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Implementation and costs of guideline-based biopsychosocial management of low back pain

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Abstract

Background: This mixed-methods dissertation examined the implementation and costs of guideline-based biopsychosocial (BPS) management of low back pain (LBP) in Finnish occupational health primary care (OHPC). A multifaceted implementation strategy was used, combining training and booster sessions with materials, clinical champions, and outreach visits. We aimed to 1) evaluate the quality of LBP management by applying predefined criteria to physiotherapists' documentation; 2) analyze the effects of the intervention on OHPC resource utilization and work absenteeism compared to usual care; 3) examine how capabilities, opportunities, and motivation influence the implementation of guideline-based BPS management of LBP, as perceived by occupational healthcare professionals and 4) tailor a shortened version of The Determinants of Implementation Behavior Questionnaire (DIBQ) to multiprofessional rehabilitation context and cross-culturally adapt a Finnish language version.

Methods: The cluster-randomized trial (ISRCTN11875357) included six national OHPC providers, with 27 units randomized into intervention and control arms. In the intervention arm, physiotherapists and physicians received targeted 3-to-7-day training in guideline-based BPS management in 2017 and 2018, while the control arm continued usual care.

Study I evaluated the quality of LBP care from physiotherapists' first-visit documentation using predefined quality criteria applied to electronic patient records. In total, 98 records documented by 28 physiotherapists from intervention and controls arms were analyzed.

Study II analyzed healthcare utilization and LBP-related sick leave data collected from electronic patient records over a one-year follow-up for 232 patients in the intervention arm and 80 control arm patients. Costs were estimated using linear mixed models by multiplying unit costs (in euros) by each type of OHPC resource use including visits to physicians, physiotherapists, nurses, imaging and sick leave.

In Study III, focus group interviews (n=12) were conducted one year after the educational intervention. with physicians, physiotherapists and nurses (n=51) treating patients with LBP in occupational healthcare teams. The data were analyzed using deductive and inductive content analysis informed by the Capability, Opportunity, Motivation, Behavior (COM-B) model.

In Study IV, the cross-cultural translation of English DIBQ to Finnish was followed by a two-round Delphi survey involving experts in multiprofessional rehabilitation including physicians, physiotherapists, occupational therapists, psychologists, nursing scientists, social scientists. Altogether, 25 experts participated in Round 1,

and 21 in Round 2. Participants rated the importance of each DIBQ item for inclusion in the final scale on a 5-point Likert scale (1 = Strongly Disagree, 5 = Strongly Agree). Consensus to include an item was defined as a mean score of at least 4 by ≥75% of Delphi participants. Open-ended comments were analyzed inductively. Item- and scale-level content validities were assessed using the content validity index.

Results: Training in guideline-based BPS management was associated with more frequent documentation of behaviors aligned with high-quality LBP care at physiotherapists' first visit in OHPC compared to usual care.

The multiprofessional training intervention shifted care from physician-led management toward a multiprofessional, physiotherapist-driven model without increasing total costs over 12 months (€-1908, 95% CI €-6734–2919).

Facilitators of implementation were mainly related to increased capability and motivation. Participants reported improved confidence on their own and the teams' capabilities on treating more challenging patients in OHPC, enhanced communication skills, a broader understanding of the multidimensional nature of LBP, and a strengthened professional role. Barriers were related to opportunities at the organizational and system levels, including limited time and resources, unclear care pathways, inconsistent team agreements, and structural constraints.

In the cross-cultural adaptation process, consensus was reached after Round 2 on the inclusion of 21 items in the multiprofessional DIBQ (DIBQ-mp). The final version covers 11 Theoretical Domains Framework domains. Item-level content validity indices were at least 0.78, and the scale-level content validity index average was 0.93, indicating excellent content validity for multiprofessional rehabilitation context.

Conclusion: Although the BPS training intervention improved the quality of LBP assessment and management, influenced OHPC resource allocation, and strengthened professionals' capabilities and motivation, implementation into routine practice remained incomplete at 12-month follow-up. Complementary implementation strategies for sustained organizational support and clear care pathways should be further developed to embed BPS management in occupational health practice. The DIBQ-mp appears to be a promising tool for evaluating implementation determinants in multiprofessional guideline-based rehabilitation interventions.

Keywords: health services research, implementation science, musculoskeletal, physiotherapy, risk stratification, work ability

Popular science summary

Multidisciplinary biopsychosocial (BPS) training can improve back pain management without increasing costs. BPS training for low back pain may improve the quality of care, care, strengthen the role of physiotherapists, and support more efficient use of healthcare resources in occupational health services.

Low back pain is one of the leading causes of work disability and healthcare use among working-age adults. This dissertation examined how a BPS model of care, which considers physical, psychological, and social factors, can be implemented in Finnish occupational health primary care, and what effects the training has on care quality, costs, and professionals' practices.

In a cluster-randomized study, multidisciplinary teams across six occupational health providers received targeted training in guideline-based BPS management. Compared to usual care, this approach improved the quality of physiotherapists' assessments and documentation, particularly in identifying psychosocial factors and applying risk-based management strategies.

The intervention shifted care from a physician-led model toward a more physiotherapist-driven, multiprofessional approach. Over one year, patients in the BPS group had fewer physician visits and more physiotherapy visits, while overall costs did not increase. This suggests that care can be reorganized more efficiently without additional costs.

Following the training, professionals reported increased confidence in their and their team's ability to manage more complex patients, improved communication skills, and a broader understanding of low back pain. However, challenges remained. Limited time, resource constraints, unclear care pathways, and inconsistent organizational practices hindered full implementation in routine clinical work.

To support future implementation efforts, the study also developed a shortened, multiprofessional version of the Determinants of Implementation Behavior Questionnaire, the DIBQ-mp. This tool

helps identify barriers and facilitators of implementation in rehabilitative contexts.

Overall, the findings indicate that while training can improve professionals' skills and influence care practices, it is not sufficient on its own. Sustainable implementation of BPS care requires organizational support, clear care pathways, and effective teamwork to ensure early identification and support of patients at increased risk of work disability and persistent disabling pain.

The results suggest that guideline-based BPS training has the potential to improve care processes for patients with low back pain, while highlighting the need for organizational and system-level changes.

Populärvetenskaplig sammanfattning

Tvärprofessionell biopsykosocial (BPS) utbildning kan förbättra vården för ryggbesvär utan ökade kostnaderna. BPS utbildning för ländryggssmärta kan förbättra vårdkvaliteten, stärka fysioterapeuters roll och bidra till en mer effektiv användning av hälso- och sjukvårdens resurser inom företagshälsovårdens primärvård.

Ländryggssmärta är en av de vanligaste orsakerna till arbetsrelaterad funktionsnedsättning och vårdkonsumtion bland personer i arbetsför ålder. Denna avhandling undersökte hur en BPS vårdmodell, som beaktar fysiska, psykologiska och sociala faktorer, kan implementeras i finländsk företagshälsovård, samt vilka effekter utbildningen har på vårdkvalitet, kostnader och professionellas arbetssätt.

I en klusterrandomiserad studie vid sex företagshälsovårdsorganisationer fick multiprofessionella team riktad utbildning i riktlinjebaserad BPS-handläggning. Jämfört med sedvanlig vård förbättrade detta arbetssätt kvaliteten i fysioterapeuters bedömningar och dokumentation, särskilt när det gäller att identifiera psykosociala faktorer och tillämpa riskbaserade behandlingsstrategier.

Interventionen bidrog också till en förskjutning från en läkarledd modell till en mer fysioterapeutdriven, multiprofessionell vård. Under ett års uppföljning hade patienter i BPS-gruppen färre läkarbesök och fler fysioterapibesök, samtidigt som de totala kostnaderna inte ökade. Detta tyder på att vården kan organiseras mer effektivt utan att ökade kostnader.

Efter utbildningen rapporterade hälso- och sjukvårdspersonal ökad tilltro till sin egen och teamets förmåga att behandla mer komplexa patienter, förbättrade kommunikationsfärdigheter samt en bredare förståelse för ländryggssmärta. Samtidigt kvarstod utmaningar. Begränsad tid, resursbrist, otydliga vårdvägar och bristande organisatorisk samordning försvårade en fullständig implementering i det dagliga kliniska arbetet.

För att stödja framtida implementeringprocesser utvecklades även en förkortad, multiprofessionell version av frågeformuläret

Determinants of Implementation Behavior Questionnaire, kallad DIBQ-mp. Verktyget hjälper till att identifiera hinder och facilitatorer för implementering i rehabiliteringssammanhang.
Sammantaget visar resultaten att även om utbildning kan förbättra klinikers kompetens och förändra vårdpraxis, är den inte tillräcklig i sig. En hållbar implementering av BPS-modellen kräver organisatoriskt stöd, tydliga vårdvägar och välkoordinerade teamarbete för att möjliggöra tidig identifiering och stöd för patienter med ökad risk för arbetsrelaterad funktionsnedsättning och långvarig smärta.
Resultaten tyder på att riktlinjebaserad BPS-utbildning har potential att förbättra vårdprocesser för patienter med ländryggssmärta, samtidigt som de belyser behovet av organisatoriska och systemrelaterade förändringar.

Yleistajuinen yhteenveto

Alaselkäkivun näyttöön perustuva biopsykososiaalinen (BPS) koulutus voi vahvistaa ammattilaisten osaamista ja edistää resurssien tehokkaampaa käyttöä työterveyshuollossa ilman kustannusten lisääntymistä. Moniammatillinen BPS koulutus voi parantaa hoidon laatua, yhtenäistää hoitokäytäntöjä sekä vahvistaa fysioterapeuttien roolia alaselkäkivun hoidossa.

Alaselkäkipu on yksi yleisimmistä työkyvyttömyyden ja terveyspalvelujen käytön syistä työikäisessä väestössä. Tässä väitöskirjassa tutkittiin, miten BPS hoitomalli, joka huomioi fyysiset, psykologiset ja sosiaaliset tekijät, voidaan ottaa käyttöön suomalaisessa työterveyshuollossa sekä millaisia vaikutuksia koulutuksella on hoidon laatuun, kustannuksiin ja ammattilaisten toimintaan.

Klusteroidussa satunnaistetussa tutkimusasetelmassa työterveyslääkärit ja työfysioterapeutit kuudelta eri työterveyshuollon palveluntuottajalta saivat koulutusta alaselkäkivun BPS hoitoon. Tutkimuksen tulokset osoittivat, että tavanomaiseen hoitoon verrattuna BPS koulutus vahvisti ammattilaisten osaamista ja hoitosuositusten mukaista toimintaa, tuotti potilasasiakirjoihin enemmän psykologisten ja sosiaalisten tekijöiden arvioinnin dokumentointia sekä työkyvyttömyysriskien systemaattisemman tunnistamisen validoituja kyselyitä hyödyntäen.

Koulutusinterventio siirsi hoidon painopistettä lääkärivetoisesta mallista kohti fysioterapeuttivetoisempaa, moniammatillista toimintaa. Vuoden seurannassa BPS-ryhmän potilailla oli vähemmän lääkärikäyntejä ja enemmän fysioterapiakäyntejä, eikä kokonaiskustannuksissa havaittu kasvua. Tämä viittaa siihen, että resursseja voidaan kohdentaa tarkoituksenmukaisemmin ilman kokonaiskustannusten kasvua.

Ammattilaiset kokivat koulutuksen jälkeen luottamuksensa vahvistuneen sekä omaan että tiimin osaamiseen haastavien alaselkäpotilaiden hoidossa. Lisäksi he kuvasivat vuorovaikutustaitojensa parantuneen ja ymmärryksensä alaselkäkivun moniulotteisuudesta laajentuneen. Haasteita kuitenkin

jäi. Ajan ja resurssien puute, epäselvät hoitopolut ja epäyhtenäiset organisaatiokäytännöt vaikeuttivat implementointia eli uuden toimintamallin käyttöönottoa arjen kliinisessä työssä.
Tulevien implementointiprosessien tueksi tutkimuksessa kehitettiin lyhennetty moniammatillinen versio Determinants of Implementation Behavior Questionnaire -kyselystä, nimeltään 'Toiminnan muutosta ohjaavat tekijät -kysely' (DIBQ-mp). Työkalu auttaa tunnistamaan implementoinnin esteitä ja edistäviä tekijöitä.
Kokonaisuutena tulokset osoittavat, että vaikka koulutus voi parantaa ammattilaisten osaamista ja muuttaa hoitokäytäntöjä, se ei yksin riitä. BPS-mallin käyttöönotto edellyttää organisatorista tukea, selkeitä hoitopolkuja ja toimivaa tiimiyhteistyötä, jotta kohonneessa työkyvyttömyyden ja haittaavan kivun pitkittymisen riskissä olevat henkilöt voidaan tunnistaa varhain ja ohjata oikea-aikaisen tuen piiriin.
Tulokset osoittavat, että näyttöön pohjautuvalla BPS-koulutuksella on potentiaalia parantaa alaselkäkipupotilaiden hoitoprosessia, mutta samanaikaisesti on tarvetta organisaatio- ja järjestelmätason muutoksille.

To my family,
for their unwavering support

"The biomedical model… leaves no room within its framework for the social, psychological, and behavioral dimensions of illness."
- Engel 1977

Preface

I began this work from a clinical question that repeatedly surfaced in occupational health physiotherapy after participating in guideline-based training in biopsychosocial management of low back pain: what could help professionals in providing better care for working-age people in a way that is both feasible in everyday practice and meaningful to patients. Over time, it became clear that the challenge is rarely the lack of evidence. More often, the difficulty lies in translating recommendations into routines and professional behavior within real-world constraints and expectations.

This doctoral thesis brings together research, development, and implementation perspectives to better understand and support guideline-based, biopsychosocial care for low back pain. The overall aim is to examine the implementation and costs of biopsychosocial care in Finnish occupational health primary care. Implementation research -based models and frameworks provide the theoretical foundation for this mixed-methods study.

The thesis consists of four studies that approach the topic from complementary angles, ranging from cross-cultural adaptation and translation process to implementation evaluation. Together, the studies contribute to a practical understanding of how to move from evidence to routine practice in occupational health settings, while maintaining patient-centred care and attention to work ability.

In this thesis the results are presented in micro, meso, macro and meta levels. Micro represents the individual level, meso the team and organizational level, macro the wider health system and policy level, and meta the broader societal, cultural, and paradigm level.

My hope is that this work will be useful to clinicians, educators, and decision-makers who aim to reduce the burden of low back pain by strengthening the everyday delivery of evidence-based care.

Nokia, MAY 2026

Maija Paukkunen

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I feel very fortunate to have been accepted as a PhD student at Linköping University. The opportunity to study implementation science through doctoral-level courses has been pivotal for my development as a researcher. From the start, I felt warmly welcomed by the BetterBack research team, Maria Fors, Karin Schröder, Paul Enthoven, Yvonne Lindbäck, and Marlene Dufvenberg. Thank you for your generosity, encouragement, and friendship.

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This work required close collaboration with many people. I am deeply grateful to all co-authors and collaborators across the studies for your

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I wish to thank the participating occupational healthcare units for their collaboration, all the patients for taking the time to complete questionnaires, and all the physiotherapists, physicians and nurses for their commitment. Your effort made this research possible, and without you, this work would not have led to the understanding and learning it has brought.

Without financial support, my doctoral studies would not have been possible. I gratefully acknowledge the foundations that enabled me to focus on my research, the Finnish Work Environment Fund, the Finnish Cultural Foundation, the Finnish Association for the Study on Pain, the Finnish Association of Physiotherapists, the Juhani Aho Foundation for Medical Research, Avohoidon tutkimussäätiö and the Sirpa Ritala Fund at The Finnish Spinal Health Association.

Finally, my family has been my greatest source of strength and encouragement. Peppi, my teenager, you have the whole world in front of you. I am proud of you, and I look forward to supporting your path in every way I can. To my extended family, Elena and Mikael, you are both talented and dear young people, and it has been a privilege to follow your journeys. To relatives and friends, thank you for the many joyful moments we have shared. I am deeply grateful to have you in my life.

To my parents, you have faced many hardships, and you taught me and my two brothers, Markus and Mikko, resilience. You taught us that letting something happen is different from making it happen, this is the essence of ‘sisu’.

Jaro, my love, thank you for every day, and for walking beside me through both good times and difficult times. You have taught me how to dream.

List of papers

I. Paukkunen M, Öberg B, Karppinen J, Ala-Mursula L, Ryynänen K, Holopainen R, Abbott A. Where is the patient in the records? Evaluating physiotherapists' first visit in occupational health primary care pathway for low back pain. *BMJ Open Quality. 2026;15:e003900. Published open access under the CC BY licence.*

II. Paukkunen M, Karppinen J, Öberg B, Ala-Mursula L, Heikkala E, Ryynänen K, Holopainen R, Booth S, Booth N, Abbott A. Cost analysis comparing guideline-oriented biopsychosocial management to usual care for low-back pain: a cluster-randomized trial in occupational health primary care. *Scandinavian Journal of Work, Environment & Health* 2025;51(3):201-213. *Published open access under the CC BY license.*

III. Paukkunen M, Holopainen R, Öberg B, Ala-Mursula L, Karppinen J, Elo S, Abbott A. Capabilities, opportunities and motivations in implementing guideline-oriented biopsychosocial low back pain management: perceptions of occupational healthcare professionals after an educational intervention. *BMC Health Services Research*. 2025; 25:1153. *Published open access under the CC BY license.*

IV. Paukkunen M, Ala-Mursula L, Öberg B, Karppinen J, Sjögren T, Riska H, Nikander R, Abbott A. Measuring the determinants of implementation behavior in multiprofessional rehabilitation. *European Journal of Physical and Rehabilitation Medicine*. 2023; 59(4):488-501. *Published open access under the CC BY–NC-ND 4.0 license.*

Contributions

As the first author of the original publications, the author of this dissertation was responsible for conceptualizing, choosing the methodological approaches and designing the studies together with the supervisors. The author prepared and collected the data across all studies and was responsible for conducting the statistical and qualitative analyses, with methodological and analytical support from the co-authors where appropriate. In Study III, the author conducted and transcribed all focus group interviews and carried out the primary qualitative analysis.

The author drafted all manuscripts during the writing process. All co-authors contributed to the interpretation of the findings and provided substantial comments during the revision process, helping to refine the analyses, strengthen the scientific content, and improve the structure and clarity of the manuscripts. All authors reviewed and approved the final versions of the publications.

Related articles

Karppinen J, Simula AS, Holopainen R, Lausmaa M, Remes J, Paukkunen M, Ussing K, Booth N, Ryynänen K, Koski T, Abbott A, Öberg B, Linton S, Smith A, O'Sullivan P, Malmivaara A. Evaluation of training in guideline-oriented biopsychosocial management of low back pain in occupational health services: Protocol of a cluster randomized trial. Health science reports. 2021; 4(1):e251.

Ryynänen K, Oura P, Simula AS, Holopainen R, Paukkunen M, Lausmaa M, Remes J, Booth N, Malmivaara A, Karppinen J. Effectiveness of training in guideline-oriented biopsychosocial management of low-back pain in occupational health services: a cluster randomized controlled trial. Scand J Work Environ Health 2021;47(5), 367-376.

International conference presentations

International Scientific Conference on the Prevention of Work-Related Musculoskeletal Disorders (PREMUS), Tübingen, Germany, 11.9.2025. Oral presentation.

International Forum for Back and Neck Pain Research in Primary Care, Davos, Switzerland, 26.6.2025. Poster presentation.

International Back and Neck Pain Research Forum, Groningen, Holland, 31.8.2023. Oral and poster presentations.

European Implementation Event, Basel, Switzerland, 9.6.2023. Oral presentation.

Abbreviations

BPS	Biopsychosocial
COM-B	Capability, Opportunity, Motivation, Behavior model
CI	Confidence interval
CVI	Content validity index
DEPS	Depression Scale
DIBQ	The Determinants of Implementation Behavior Questionnaire
DIBQ-mp	The multiprofessional version of the Determinants of Implementation Behavior Questionnaire
EPR	Electronic patient records
EQ-5D	European Quality of Life Questionnaire– 5 Dimensions
FABQ	Fear Avoidance Beliefs Questionnaire
ICF	International Classification of Functioning, Disability and Health
IQR	Interquartile range
LBP	Low back pain
MRI	Magnetic resonance imaging
ODI	Oswestry Disability Index
OHPC	Occupational health primary care
SBT	Start Back Tool
SD	Standard deviation
TDF	Theoretical Domains Framework
ÖMPSQ-SF	The short form of the Örebro Musculoskeletal Pain Screening Questionnaire

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Chapter 1

Introduction

Low back pain (LBP) is highly prevalent and the leading cause of disability worldwide across all age groups[1,2]. Current understanding conceptualizes LBP as a complex condition in which biological, psychological, and social factors interact to shape both the experience of pain and associated disability[3].

Most adults experience LBP at some point, and it is a common cause of sickness absence in the working-age population[3]. Prognosis is generally favorable, and most acute episodes tend to improve within a few weeks without specific intervention, although recurrence is common[1,4,5]. However, some LBP patients develop persistent pain lasting more than three months, creating a disproportionate burden for individuals, workplaces, and healthcare systems. This underscores the need for efficient interventions targeted to patients at an increased risk of persistent pain and disability[5].

In Nordic countries, musculoskeletal disorders account for a substantial share of healthcare use and work disability[6]. In Finland, 16 percent of physician appointments in outpatient primary care are musculoskeletal-related, with LBP being the most common musculoskeletal complaint[7]. Musculoskeletal disorders account for approximately one third of new disability pensions awarded, and they form a substantial group of occupational diseases[8,9]. In 2023, musculoskeletal disorders -related sickness allowance costs accounted for 27.1 percent of all sickness allowances paid by the Social Insurance Institution of Finland[10]. These data demonstrate a clear need for better support to prevent prolonged work disability.

The burden of musculoskeletal disorders is unevenly distributed in the population and regions. Prevalence increases with age and is higher among women than men[1,6]. The Finnish Musculoskeletal Disorder Index, part of the National Health Index, shows regional differences in age- and sex-standardized musculoskeletal morbidity have persisted at up to twofold level from 2010 to 2022[11]. Socioeconomic gradients are also consistent: those in higher

socioeconomic positions have the lowest burden, regardless of whether socioeconomic position is measured by education or income [6,11-13]. Occupations associated with lower education or lower income are often more physically demanding[14], and these groups are also more likely to accumulate adverse lifestyle factors and comorbidities associated with risk of pain[15-17]. Income disparities may also influence whether individuals have resources to access and use services supporting care and rehabilitation. This highlights the importance of better identification of patients with accumulated risk factors.

Although musculoskeletal disorders account for a large share of global rehabilitation need[18], and generate major healthcare and societal costs, musculoskeletal care, including LBP management, remains inconsistent and often misaligned with evidence-based recommendations[19,20]. This is partly driven by low value care, such as unnecessary imaging, opioid prescribing and related harms, premature surgical referrals, and prolonged work disability, despite national guidelines consistently discourage these practices[3,21]. In Finnish occupational healthcare, only around one third of patients with an musculoskeletal related diagnosis receive guidance from an occupational health physiotherapist[22]. Overall, the evidence-to-practice gap remains substantial, reinforcing the need to improve both the access to and quality of musculoskeletal disorders management[23].

Low back pain

LBP is a symptom - not a disease - and can result from several different known or unknown causes. It is defined as pain located between the lower margins of the ribs and the inferior gluteal folds, and it is often accompanied by pain radiating into one or both lower limbs [3,21]. For over 90% of people presenting with LBP, no specific or serious cause can be identified[3] and the condition is therefore described as non-specific or 'benign'.

LBP is often classified by duration as acute (less than 6 weeks), subacute (6 to 12 weeks), or chronic (more than 12 weeks). However, this time-based scheme fits poorly with the fluctuating course of LBP

and unclear phase boundaries[24]. Because the label 'chronic' may also carry a nocebo effect[25] many sources now use a simpler distinction between acute (less than 6 weeks) and persistent (more than 12 weeks) LBP[26,27].

In non-persistent cases, the greatest improvement in pain and disability typically occurs during the first six weeks[5]. Within three months, around one third of patients recover, whereas the remaining two thirds report some degree of pain at one year[28]. This pattern is consistent with the recurrent nature of LBP[29]. Symptoms become persistent in about 20 to 30 percent of cases, and persistence is associated with a lower likelihood of full recovery[3,5,24].

Historically, imaging was expected to identify the origin of pain and guide correction of underlying damage. Current understanding recognizes pain as a broader biopsychosocial (BPS) phenomenon, shaped by factors such as prior concepts of pain, mood, physical activity habits, arousal, sleep, nutrition, nutrition, beliefs, social context, immunological and genetics factors, epigenetics, and central nervous system sensitization[3,30]. Accordingly, LBP is no longer viewed solely through a biomedical lens but is increasingly understood within a BPS framework that recognizes dynamic interactions between tissue-related factors and psychological and social influences[3,26,31]. Consistent with this shift, most clinical guidelines emphasize staying active, avoiding routine spine imaging, identifying and addressing physical and psychosocial risk factors, and supporting self-management[32-34].

Degenerative findings are common on magnetic resonance imaging (MRI) even among asymptomatic individuals[35]. The presence or extent of imaging findings do not explain pain intensity or disability it causes [3], nor do they predict future LBP[36]. Consequently, the clinical relevance of imaging findings cannot be determined in isolation for an individual patient. Importantly, early MRI increases the likelihood of further investigations, injections, and surgery regardless of the imaging findings and symptom severity[35]. Imaging may also be associated with higher medical costs, increased healthcare utilization and more absence from work[37]. Despite this, clinicians and patients may still seek a structural explanation for LBP.

Importantly, how imaging results are communicated to patients matters. Patients with acute LBP who received factual MRI explanations reported greater pain and disability and more negative perceptions than those given a reassuring, age-related interpretation of the findings[38]. Imaging findings should therefore be explained in a reassuring manner, framed in relation to patient's age, and symptoms, and clinical examination, to reduce potential harms[3].

Principally, red flags must be assessed in every patient, including features such as night pain, fever and unexplained weight loss that may indicate serious spinal pathology[3]. Clinical assessment should include spinal flexion, extension and lateral flexion, as well as functional movements and tasks the patient reports as painful, feared, or limiting, such as sit-to-stand, walking, bending and lifting. People with non-specific LBP often move more slowly and may show protective muscle guarding[39]. Physical assessment helps identify directional patterns of pain provocation, functional capacity, and the extent of protective guarding, and provides a baseline for monitoring change over time[40,41]. For suspected lumbosacral radicular pain or neurological deficits, a lower-limb neurological examination is warranted, including straight leg raise (SLR) and crossed SLR, gait assessment (including screening of foot drop), with attention to whether signs and symptoms are congruent[42]. Hip examination should also be performed to rule out hip-related pathology.

Predictors

The etiological mechanisms underlying LBP remain poorly understood, although evidence on prognostic factors has increased in recent years. Predictors of persistent, disabling LBP include genetic predisposition, symptom- and lifestyle-related factors, comorbidities, and social (including occupational) and psychological factors[3]. These factors may contribute to both the onset of LBP and its persistence.

No cost-effective or widely available preventive LBP interventions have yet been developed[26], therefore early identification of risk factors is important for secondary prevention. A systematic review including 10,842 patients found that fear-avoidance and catastrophizing,

greater baseline disability, psychiatric comorbidity, and poorer general health were the strongest predictors of persistent disabling LBP at one-year[43]. An umbrella review of seven systematic reviews similarly identified five consistent predictors of poor long-term outcomes: higher pain intensity and disability, emotional distress, negative recovery expectations and high physical work demand[44]. In a 9-year follow-up study of more than 48,000 patients, non-pain-related predictors of persistent pain included poor sleep, feeling 'fed-up', tiredness, stressful life events and obesity (Body Mass Index (BMI)>30)[16]. While sedentary behavior was not a key predictor in that study, a follow-up analysis in the same dataset reported that sitting more than six hours per day predicted the development of persistent LBP, suggesting that replacing sedentary time with physical activity may reduce risk[45].

Overall, demographic, socioeconomic, and occupational factors appear to contribute less to predicting persistence than psychological distress, general health, and lifestyle factors[16,43,44]. Risk of persistence varies across individuals, and fortunately many prognostic factors are modifiable and can be addressed through treatment and rehabilitation. Clinical guidelines therefore recommend that clinicians identify and address psychosocial risk factors to reduce the risk of persistent LBP[3].

Risk stratification

Risk factors for persistent pain are already present at the first healthcare contact[46], yet psychosocial assessment has been perceived challenging in routine practice[47,48] and even experienced clinicians have limited ability to identify patients at increased risk[49]. To support early identification, brief screening questionnaires have been developed. The most widely used tools in LBP are the STarT Back Tool (SBT) and the short form of the Örebro Musculoskeletal Pain Screening Questionnaire (ÖMPSQ-SF). Both can help identify patients with clinically relevant psychosocial features and therefore an increased likelihood of delayed recovery[50,51].

The nine-item SBT was developed to identify subgroups of patients

with non-specific LBP to determine which kind of treatment each patient would benefit[49,51] (Appendix 1). It allocates patients to different treatment pathways based on their prognosis (low, medium, or high risk of poor outcome), i.e. risk-stratified care planning. Risk stratified care guides treatment planning both on the amount and the content of treatment. It allows direction of resources for those patients that are at increased risk of developing persistent, disabling LBP, and avoiding overtreatment of those patients that will improve in any case[49].

The ten-item ÖMPSQ-SF is applicable for a musculoskeletal pain and is particularly useful for identifying risk of prolonged sickness absence[52] (Appendix 2). It focuses on psychosocial risk factors linked to persistent pain, such as depressive symptoms and fear-avoidance beliefs and can therefore help identify workers at elevated risk of work disability[50]. After psychosocial factors have been identified, care should be tailored to individual needs by linking pain understanding, treatment content, and goals to the patient's everyday life and lived experience[46,49]. According to the Council for Choices in Health Care in Finland recommendation, when persistent or recurrent LBP threatens functioning and work ability, a rehabilitation plan should be developed with a BPS assessment of the patient's life situation, at the latest within six weeks from symptom onset[53].

Systematic use of risk screening and stratification has been shown to significantly decrease LBP-related disability, reduce time off work and lower costs, likely through better targeting of limited healthcare resources[49]. Use of these tools at the first visit can help identify patients who may require more comprehensive support and guidance early on[46].

A US cohort study[54] examined predictors of the transition from acute to persistent LBP at six months, focusing on SBT risk classification (high vs low) and early exposure to non-evidence-based care. Among 5,233 primary care patients, 32 percent developed persistent LBP. Medical records were used to assess care during the first three weeks after the initial visit. Non-evidence-based pharmacological management included opioids, antidepressants without depression, systemic glucocorticoids, or benzodiazepines.

Any spinal imaging and any specialist consultation within the first three weeks were also classified as non-evidence-based. Exposure to one non-evidence-based intervention was associated with higher odds of persistence (adjusted odds ratio 1.39). Corresponding adjusted odds ratios for exposure to two or three such interventions were 1.88 and 2.16, respectively, compared with no exposure[54]. In the same study[54], smoking, obesity, severe symptom presentation, and diagnosed depression or anxiety also increased persistence. High-risk classification on the SBT more than doubled the odds of chronicity[54]. This is consistent with broader evidence that predictors of persistent, disabling LBP include genetic susceptibility, symptom severity and widespread symptoms, lifestyle-related factors, multimorbidity, social determinants, and psychological factors[3], and with Finnish population-based findings showing that depressive and anxiety symptoms and fear-avoidance beliefs were particularly prominent in the high-risk group[55].

A meta-analysis suggested that an SBT-based stratified care model is cost-effective[56]. However, evidence also indicates that the real-world effectiveness of stratified care can be limited when screening tools are not used, risk-matched treatment pathways are not referred to, delivery of psychologically informed physiotherapy is unknown and when clinician training is insufficient[57-59]. Screening tools should therefore be viewed as decision support rather than stand-alone solutions. With adequate training, clinicians can use them to quickly flag relevant clinical factors (such as pain intensity, disability, and sleep disruption) and psychological factors (such as stress, anxiety, mood, pain beliefs, and fear avoidance) that warrant deeper exploration in the clinical interview and integration into shared decision making and treatment planning, once specific pathology has been excluded.

Biopsychosocial approach

The BPS model was developed to broaden the biomedical view of illness by integrating biological, psychological, and social determinants of health and recovery[60]. The BPS model emphasizes

the importance of taking account individual's inner (subjective) experience within his/her life context[60]. Engel proposed that, to truly understand a patient's illness, it was not sufficient to simply focus on the pathophysiology of the disorder. Social context and psychosocial factors that might have contributed to the illness, or influenced the exacerbation and maintenance of the clinical problem, are important for any healthcare provider to consider[61]. In 2005, a multidimensional biopsychosocially oriented approach to assessment and management of LBP was proposed[62]. The BPS approach focuses on personalized pain education, fear reduction, functional activation and supporting healthy lifestyle behaviors when serious pathology has been ruled out[23,48]. Moderate-quality evidence from primary healthcare supports that BPS interventions probably are more effective than education or advice alone for reducing disability and pain in the short, medium, and long term among patients with LBP[63]. However, findings have been inconsistent across studies and implementation strategies to support professionals in delivering BPS care have varied widely[64-67].

Many high-quality clinical practice guidelines emphasize patient-centered care, including effective communication in musculoskeletal pain management[23]. People with persistent LBP often hold unhelpful beliefs about pain and its consequences. Common misconceptions are that pain signals damage that must be fixed[68], back should be protected[69], and painful movements should be avoided[70,71]. Many of these beliefs may be reinforced during healthcare encounters[68]. Such beliefs can contribute to catastrophizing, fear of movement, avoidance and distress[70,72]. Patients report impacts on daily functioning, work, intimacy, and social and physical participation alongside worries about job loss and financial insecurity. This burden is linked to depression and a loss of identity[70].

People with persistent pain highlight the need for their experience to be acknowledged and validated, and they value a strong therapeutic alliance, and shared decision making[73]. Validation is an important communication strategy in persistent pain care[74]. It conveys understanding and acceptance of a person's experiences, feelings, actions, and worries[75,76] and is a key component of clinician–patient interaction influencing clinical outcomes. In a Finnish study,

physiotherapists' validating responses increased and invalidating responses decreased from pre- to post-training after a brief BPS training[77].

A substantial placebo effect can be achieved without medication, through communication, non-verbal cues, and therapeutic actions alone[78]. A systematic review indicates that cognitive reassurance, for example, explanations and education that directly addresses the person's concerns, is more effective than empathy alone for reducing concerns, improving symptoms and reducing healthcare use[79]. Conversely, warning about potential harm can increase the risk of harm and reduce benefit. Communication that enhances safety is particularly helpful when patients' concerns are first acknowledged[80].

Patients also emphasize the need for a diagnosis or an explanation for their symptoms, and support for self-management, including safe use of medicines[81]. They want understandable information about possible causes, prognosis, future disability and implications for work, alongside advice on triggers, how to manage pain and flare-ups, and prevention[73]. This information should be delivered consistently, using clear language and appropriate tone. When patients cannot obtain an explanation or feel their concerns are dismissed, frustration increases[82]. People with persistent LBP may also experience iatrogenic distress and disability following clinician encounters[70]. Clinicians should first screen for indicators of specific pathology. In the absence of such findings, they should assess relevant risk factors to establish a clear management plan. Throughout, communication should convey empathy, active listening, and validation, and avoid stigmatizing language. Higher quality clinician-patient communication is associated with better outcomes, and greater clinician empathy predicts better outcomes in LBP regardless of the treatment type[83,84].

Clinicians' beliefs influence both communication and treatment choices[85]. If a clinician's understanding of pain is predominantly biomedical, care may be less likely to align with guidelines that prioritize non-pharmacological management and incorporate psychosocial factors[86], for example, fear-avoidance behavior and work-related stressors[30,87]. Therefore, BPS interventions often

incorporate structured assessment tools and evidence-based patient education resources which may slightly improve practice outcomes and patient health outcomes[88]. Australian professor Mark Hancock has created a patient education booklet, which is based on BPS model, to support giving right and equal information from professionals to patients and delivering evidence-based information about disadvantages of imaging[89]. The booklet 'Understanding low back pain' provides evidence-based information, a BPS explanation for symptoms, reminds the professional of the guideline-consistent management, supports clinical decision-making, and facilitates patient-clinician interaction (Appendix 3). The booklet has been translated and validated in Finnish[90]. A brief 30-min training session of physicians and physiotherapists combined with booklet use in clinical practice reduced unnecessary imaging and decreased LBP-related sick leave days in Finnish primary care[91].

Guideline-based non-pharmacological management

When selecting interventions, clinicians should weigh the likely benefits and harms for the patient, resource availability (for example trained professionals), financial and time costs, and patient preferences[92].

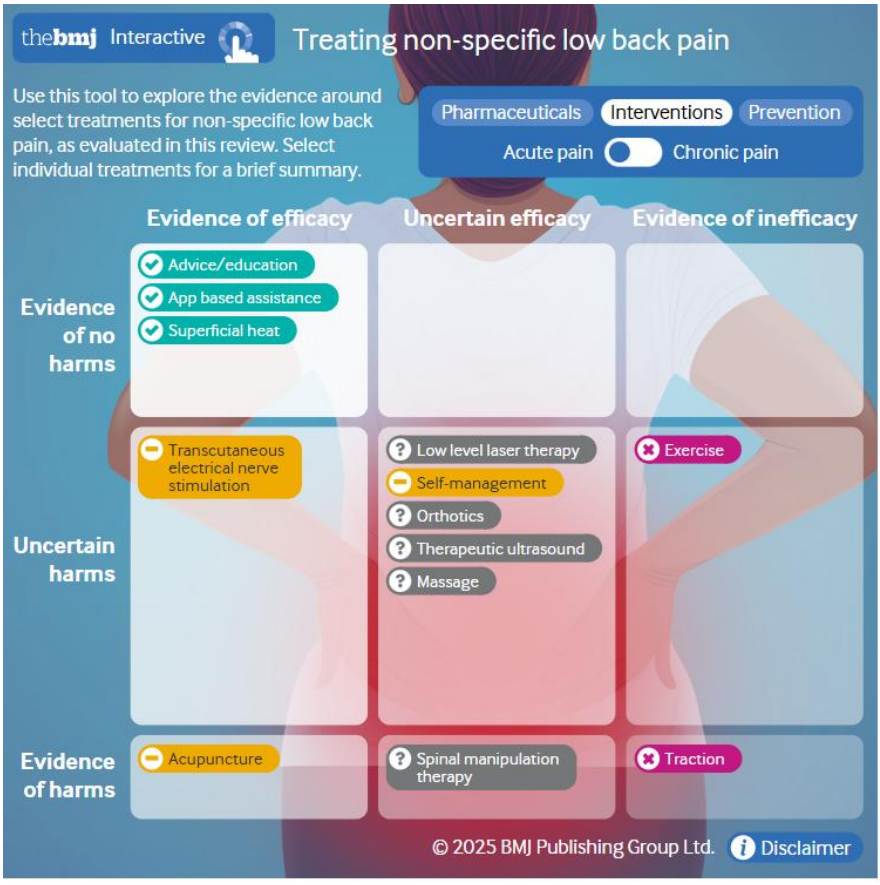

Figure 1. Treatment of acute low back pain[92]

For acute LBP, advice and education and superficial heat have moderate-certainty evidence indicating a favorable benefit to harm balance[92] (Figure 1). Benefits are likely small for advice and education and vary for superficial heat[92]. When comparing advice to stay active to rest, activity probably reduces pain intensity slightly and improves function slightly for patients with acute LBP[93].

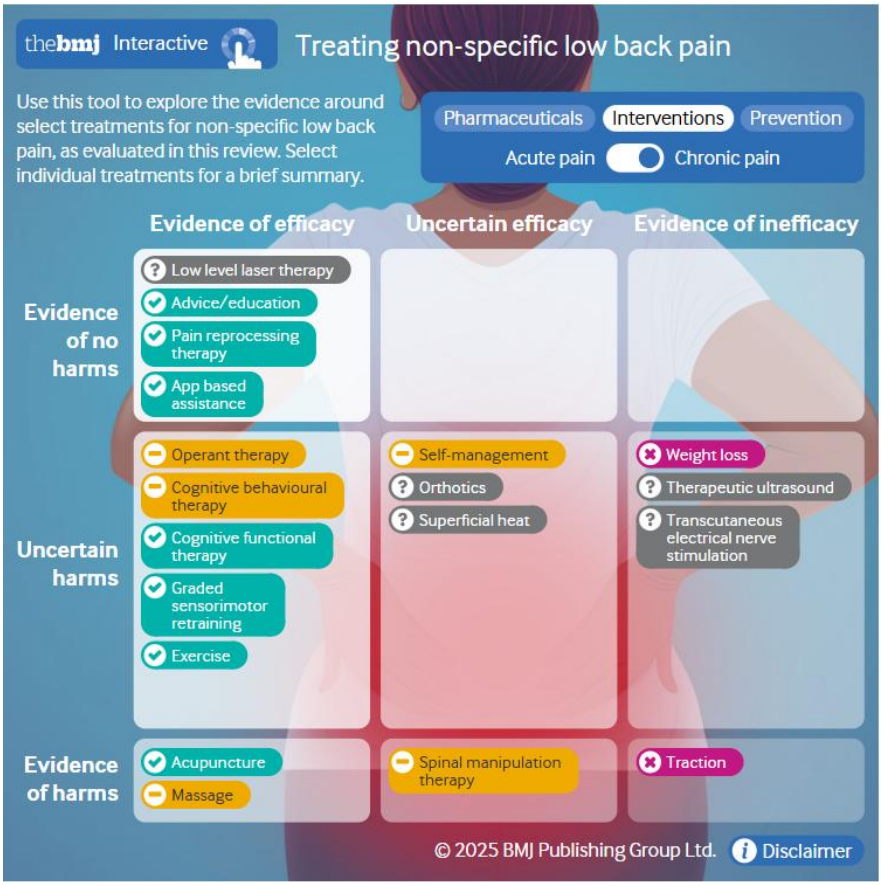

Figure 2. Treatment of persistent low back pain[92]

For persistent LBP, advice and education, exercise, integrated physical and cognitive therapies, and psychological therapies all show a favorable benefit to harm balance[92] (Figure 2). Benefits are likely small for advice and education and psychological therapies, and moderate for exercise and integrated physical and cognitive therapies[92,93]. Exercise therapies probably reduce pain intensity, and improve function slightly for people with persistent LBP, compared to no treatment/usual care[93]. Multidisciplinary therapies probably reduce pain intensity and improve function slightly and psychological therapies probably reduce pain intensity slightly but probably make no difference to function for people with persistent LBP compared to usual care[93].

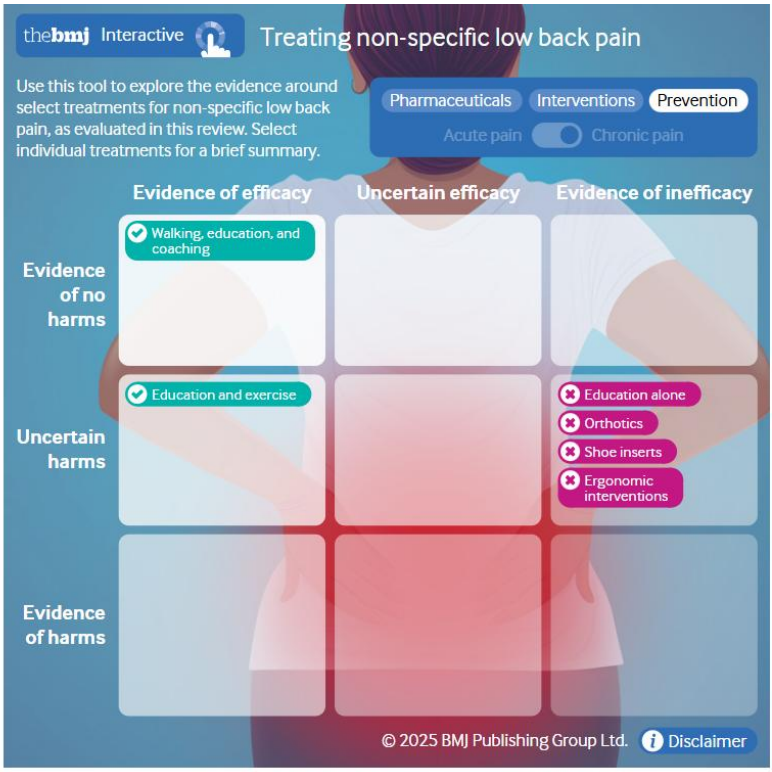

Figure 3. Prevention of low back pain[92]

For prevention, interventions combining exercise and education or health coaching have moderate-certainty evidence of favorable effects[92] (Figure 3). Compared with minimal intervention, ergonomic interventions have low to very low certainty evidence suggesting no reduction in the risk of an LBP episode[92].

Implementing evidence-based care

Healthcare research has traditionally focused on whether an intervention is effective. Effectiveness refers to improvements in clients' well-being, health, functioning, or quality of life achieved through healthcare and social services (e.g. symptom improvement). Common client-reported measures capture health, functioning,

patient experience, or service satisfaction. Cost-effectiveness describes the relationship between outcomes and costs, by comparing client-relevant outcomes with per-patient resource use. At the core of effectiveness research is the question of how, with limited resources, we can best achieve outcomes that are meaningful to clients.

Improving the quality and effectiveness of care can be done through developing evidence-based clinical practice guidelines that support decision making[94]. Clinical practice guidelines (or clinical guidelines) are "*statements that include recommendations intended to optimize patient care that are informed by a systematic review of evidence and an assessment of the benefits and harms of alternative care options*"[95]. They aim to guide decision making, care pathways, and the allocation of healthcare resources, and to reduce unwarranted variation in care[95]. Cost pressures further increase the need to reduce low-value care. Guidelines also support shared decision making with patients and consistent communication to stakeholders regarding care practices[96].

Randomized trials have repeatedly concluded that clinical practice guidelines alone are not sufficient to change treatment practices[97]. Many physiotherapists do not consistently follow evidence-based guidelines in management of musculoskeletal disorders. For example, an Australian study reported that only 54 percent of physiotherapists selected guideline-recommended interventions, while 43 percent used non-recommended interventions, and 81 percent used interventions with unknown effects[19].

A substantial amount of non-evidence-based, so called low-value care is still offered, and it may even be harmful to patients[26,54]. It has been proposed that 60% of healthcare being evidence-based i.e. care that aligns reasonably well with current best evidence and 30% being waste or low-value care including unnecessary tests or treatments, duplication, inefficient processes, and care that provides little or no patient benefit. Approximately 10% of the care produces iatrogenic harm, including preventable complications, medication errors and other forms of adverse events[98]. Classic studies indicate that it takes 17–20 years to get clinical innovations into practice; moreover, fewer than 50% of clinical innovations ever make it into general usage[99-102].

Evidence on changes in Finnish clinicians' behavior following evidence-based training remains limited.

One definition of implementation is "*a specified set of activities designed to put into practice and activity or program of known dimensions*"[103]. A foundational requirement of implementation is that poorly designed or ineffective solutions should not be implemented. Evidence-based effective intervention, active implementation support and enabling contexts (adequate social, economic, and societal support) are needed to increase the likelihood of success and to ensure societally meaningful outcome i.e that patients receive evidence-based care (Figure 4).

Figure 4. Conditions for success in translating evidence into practice[103]

Implementation research

The field of implementation science emerged from Rogers' Diffusion of Innovations (1962), which conceptualized the spread, or diffusion, of innovations as a social process with multiple determinants beyond the evidence of the innovation itself[104]. Implementation research *'…is the scientific study of methods to promote the systematic uptake of research findings and other evidence-based practices into routine practice, and hence to improve the quality and effectiveness of health services. It includes the study of influences on healthcare professional and organisational behaviour.'*[105]. For that reason the goal of implementation science is not to establish the health impact of a clinical innovation, but rather to identify the factors that affect the uptake and routine use of evidence-based practices[106]. Behavior change is often required across multiple levels of the implementation chain, including clinicians, supervisors, administration, and organizational leadership[107]. Consequently, improving practice

requires a broad understanding of prerequisites for change and the barriers that may impede it. Barriers and facilitators may relate to the intervention, the professionals who use it, healthcare organizations and research structures, the individuals receiving care, or the wider societal context [108]. Implementation research can help to clarify how, and under what conditions, behavior changes occur, whether through shifts in attitudes, environmental restructuring, or social influence[108].

The continuing education of healthcare professionals should be based on best available knowledge. Implementation research examines how evidence-based practices are adopted, delivered, and sustained across professional and organizational contexts, and why an intervention succeeds in one setting but not in another[109]. This requires attention to the context in which care is delivered and to how evidence is adapted to fit that context[110], including identifying determinants influencing uptake[111], and monitoring and supporting implementation over time. Context is defined as *'a multi-dimensional construct encompassing micro, meso and macro level determinants that are pre-existing, dynamic and emergent throughout the implementation process. These factors are inextricably intertwined, incorporating multi-level concepts such as culture, leadership and the availability of resources.'*[112]

Implementation research draws on frameworks, theories, models, and measurement tools that are used to (a) describe and guide the process of translating research into practice, (b) explain factors influencing implementation outcomes, and (c) evaluate implementation[113]. Birken et al. (2017) have identified >100 theoretical models used in dissemination and implementation science, although implementation research is a relatively young and rapidly evolving field[108,114,115]. Multidisciplinary and methodological pluralism are core strengths, because no single discipline or method is sufficient for addressing complex challenges such as adopting, tailoring and sustaining effective practices. Implementation processes can also be demanding and difficult to measure[109,116,117], which has driven the development of multiple approaches to understand healthcare professionals' behavior change and to evaluate implementation efforts and outcomes[108,113]. Many implementation

frameworks, models and theories also reflect an interdependent, multi-level system perspective on research use in healthcare.

Implementation as a planned and systematic process follows a structure of 1) planning (defining clear goals for the desired change), 2) assessing (identifying problems and gaps in the current performance), 3) analyzing target group and context (identifying local facilitators, barriers and practical conditions), 4) selecting strategies for change (match strategies to identified barriers), 5) integrating into routines (embed change into normal practice) and 6) evaluating and revising (monitoring of indicators and adjusting)[118]. There are no 'magic bullets' for improving the healthcare quality, but there are a range of interventions available that, when used as intended, could lead to improvements in practice and patient outcomes[119].

Capability, Opportunity, Motivation model of Behavior

The COM-B (Capability, Opportunity, Motivation, Behavior) model is an evaluation framework grounded in psychological theory of behavior change[120]. It provides a structured way to identify what influences a target behavior, and what must change to achieve the desired outcome[120]. COM-B proposes that behavior occurs when an individual has the (i) capability, both physical and psychological, (ii) opportunity, both physical and social, and (iii) motivation that makes the behavior more likely than competing alternatives (Figure 5).

In practice, it is essential to have the necessary skills, and enabling environment that allows behavior (time and resources), and social conditions that support the behavior as a normal and valued way of working. Most importantly, one must be convinced that it is worthwhile and prioritize it when required[120]. Capability, opportunity, and motivation interact to generate behavior, and motivation is considered a central driving force of behavior change [120]. For example, receiving knowledge by participating in an evidence-based education is typically insufficient to change behavior[121,122].

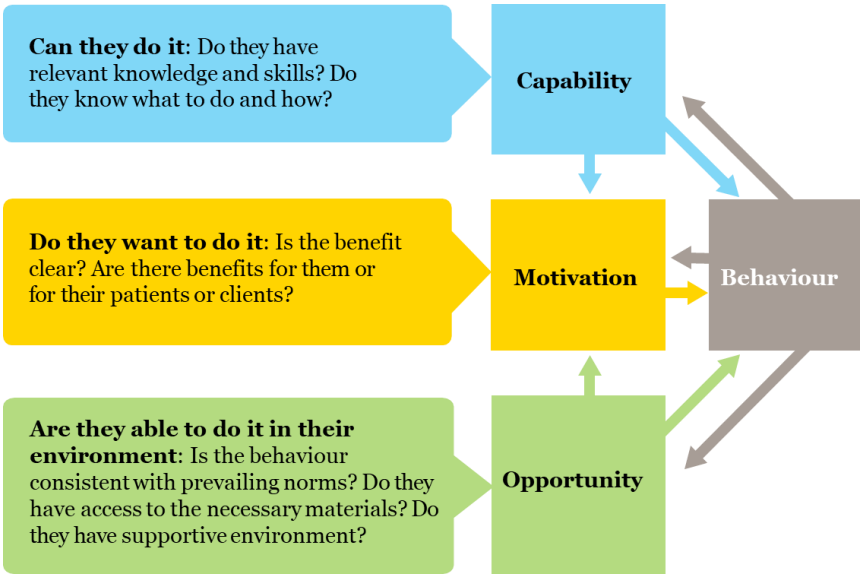

Figure 5. Capability, Opportunity, Motivation, Behavior -model[120,123].

Theoretical Domains Framework

Determinant frameworks are used to specify the types of determinants (facilitators and barriers) that influence implementation outcomes with a particular focus on what helps or prevents professionals from following guidelines, and how these barriers can be addressed. Theoretical Domains Framework (TDF) is a determinant framework that can be used to understand and explain influences on implementation outcomes and interpreting outcomes retrospectively. It was developed to identify factors influencing professionals' implementation of evidence-based recommendations [107,124]. TDF is an integrative framework synthetizing constructs from 33 behavior and behavior change theories, originally sorted into 14 domains, with 4 additional domains later added[107,124]. These domains cover key determinants of professional practice and include knowledge, skills, behavioral regulation, beliefs about capabilities, social/professional role, identity, goals, intentions, beliefs about consequences, optimism, reinforcement, emotion, social influences,

memory, attention and decision processes and environmental context and resources[107,120,123,124].

In the TDF, determinants may relate to innovation itself (innovation characteristics), the social setting (norms and support), the individual professionals (skills and self-efficacy), healthcare organizations (resources and leadership support), innovation strategies (implementation strategies), the patients or participants (attitudes) or the wider healthcare system and society[104,110,124-130]. When using TDF to study barriers and facilitators, the target behaviors should be selected and defined, specifying the functions that must change - who needs to do what differently, when, where, how and with whom. Precise behavioral specification enables more specific identification of determinants and more actionable implications for intervention design[131].

The Determinants of Implementation Behavior Questionnaire (DIBQ) was developed based on the TDF to support identifying of determinants and quantify the contribution of different TDF domains [107,124,131,132]. It was originally developed to evaluate potential determinants of healthcare professionals´ implementation behavior[133] and first tested with physiotherapists delivering physical activity interventions[132]. The original DIBQ includes 93 items covering 18 domains[132], but shorter and tailored versions have been developed for different research questions, contexts and intervention types[134]. The DIBQ instrument can be used to identify context relevant facilitators and barriers to improve and tailor the selection of implementation strategies.

Implementation strategies

Evidence based interventions are 'the what' that is being implemented (implementation object). Implementation strategies are 'the how' we attempt to get the new innovation into normal practice in clinical or community settings. Implementation strategies are defined as '*methods or techniques used to enhance the implementation, adoption and sustainability of a clinical program or practice*'[135]. Implementation strategies are often classified using frameworks such

as the Expert Recommendations for Implementing Change (ERIC) compilation, which describes discrete (single) strategies that can be combined into multifaceted approaches[136]. *Discrete* implementation strategies are a single approach or technique, such as distributing educational materials, informing local opinion leaders, revising professional roles, or using reminders (such as cues or prompts). However, the barriers involved with effectively implementing an intervention usually require the use of *multifaceted* implementation strategies that combine two or more discrete strategies[137,138]. Multifaceted implementation strategies are generally more likely to improve practice than discrete strategies with effect sizes ranging from small to moderate[139].

The effectiveness of commonly used discrete implementation strategies are described in Appendix 4. Most strategies lead to modest changes in practice, and larger changes can be expected if compliance with best practice at baseline is low[140]. Educational meetings probably produce small improvements in professional practice and patient outcomes[141], while one-off strategies are usually insufficient, and repeated, sustained approaches are more likely to change clinical practice[142]. Audit and feedback, reminders, educational outreach visits, local opinion leaders, practice facilitation and tailored strategies have generally shown small to moderate effects, with considerable heterogeneity across settings[139,143,144]. Audit and feedback probably improve professional practice, although effects vary in size. The effects are stronger when feedback is repeated, targeted and linked to clear improvement opportunities[144].

Occupational Healthcare

Under the Finnish Occupational Health Care Act (1383/2001), employers are obliged to arrange occupational healthcare for their employees. The objectives are to prevent work-related illnesses and accidents, improve work environment health and safety, maintain and improve employees' health, work ability and functioning across the working career, and support the work community[145]. The Finnish Occupational Health Services is an umbrella concept covering i. a

preventive part, statutory to be arranged, and ii. occupational health primary care (OHPC), a voluntary additional part which provides primary care level curative services alongside preventive occupational health services. It is thought that OHPC synergistically enables early detection of work-related problems and enables early prevention of work disabilities. By volume, occupational healthcare is the main primary care source for the working population in Finland. Coverage of occupational health services exceeds 90 percent of all employed people, and OHPC coverage exceeds 70 percent[10].

Finnish occupational healthcare is paid by the employer and free of charge for the employee. The costs are partly subsidized by the Social Insurance Institution of Finland to the employers[146]. This funding is collected from employers and employees through an insurance plan. Service content is detailed agreed between employers and occupational health service providers and typically planned for one to three years ahead. Occupational health services are delivered and evaluated in continuous collaboration between healthcare professionals and workplace representatives. At system level, intended outcomes include improved employee health and functional capacity, reduced work-related health risks, improved safety as well as work ability, fewer and shorter sickness absences, earlier and sustained return-to-work, reduced risk of long-term work disability and disability pension, and better functioning of work communities.

Within occupational healthcare, the services are delivered through multiprofessional teamwork, involving coordinated regular interaction that values different professional expertise across different social and healthcare disciplines (physicians, nurses, physiotherapists, psychologists, social security experts)[147,148]. Occupational health physiotherapists contribute in both preventive and curative parts of the services by evaluating musculoskeletal complaints, performing clinical and functional capacity assessments, evaluating work-relatedness of the conditions as well as aspects of work ability, providing self-management guidance and planning follow-up and recommending workplace actions and assistive devices when needed.

Preventing work disability at micro, meso and macro level

Work ability is a core rehabilitation target in working-age populations, but it is distinct from functioning. The International Classification of Functioning, Disability and Health (ICF) aims to describe the effects an illness or a disability can have on the life of an individual. In the ICF context, functioning and disability are understood as a complex, interactive and dynamic state consisting of interaction between an individual's health and features of the person and of the overall context in which the person lives[149]. In terms of eligibility for sick leave and work disability benefits in Finland, work ability is framed as functioning relative to work demands, that is, capacity to perform one's job. Besides this simplified model, definitions vary, and there are multiple conceptualizations of work ability and return-to-work models across disciplines and nations.

Return-to-work models have been grouped into biomedical and forensic, psychosocial, ecological/case-management, economic, integrative and BPS work ability models, each emphasizing different mechanisms and levers for return-to-work and disability prevention[150] (Table 1). Work ability is shaped by relationships between the individual, work tasks, the working career, the work environment, the work community, and societal structures[151-153] and many models distinguish micro-, meso-, and macro-level contexts. At micro level, work ability relates to a worker's physical, cognitive, social, demographic, educational and occupational and cultural factors. At meso level, workplace, healthcare and insurance system factors influence occupational disability and the process of return-to-work. At macro level, legislation, economic conditions, and cultural factors shape work ability and influence on duration or extent of work disability secondary to functional limitations[154]. Population characteristics such as age, health status, and employment patterns also matter[155].

BPS work ability models conceptualize work ability as multi-dimensional in relation to micro, meso and system level interaction, and interventions are often based on multiprofessional approaches.

In the earliest BPS models, the perspective focused primarily on the individual. In later developments, the role of the work organization and various meso- and macro-level factors has become more prominent. BPS models adopt a holistic perspective, emphasizing functional assessment and supporting coping and work participation even when full recovery is not achievable. The employee is viewed as an active participant in the process and, to some extent, responsible for the outcomes. Strong linkages with employer, workplace, and family are integral. Identified limitations include broad scope, and a need for more precise specification of work-related factors[150,156].

Table 1. Return-to-work models for Musculoskeletal Disorders[156-158]

Current model	Research tradition	System versus individual focus	Key determinants
Biomedical	Medicine	Individual	Medical impairment
Psychosocial	Health and rehabilitation psychology	Individual, evolving towards integration of system-based focus	Psychosocial factors, beliefs, perceptions, and expectations in return-to-work
Forensic	Forensic psychology	Individual, evolving towards recognition of system factors	Secondary gain: evolving into interaction among primary, secondary, and tertiary gains and losses
Ecological/case management	Sociology, anthropology, social, organizational, occupational health psychology, occupational health/therapy	System/system–individual interaction	Proactive system-based return-to-work policies and practices
Ergonomic	Kinesiology, psychology, engineering, occupational and physical therapy, medicine	Individual/ system interaction	Adaptation after injury
Economic	Health economics	System	Economic incentives built into the macrosystem
Biopsychosocial	Interdisciplinary/ transdisciplinary	System and individual interaction	The interaction among medical, psychosocial, and system-based factors in return-to-work

Work participation is a relevant rehabilitation outcome for many patients and is important for financial security. Eligibility for sickness absence is based on reduced functional capacity due to illness, defect, or injury rather than diagnosis alone[159]. Importantly, reduced work ability may reflect medical, physical, psychological, social, or competence-related factors, as well as organizational structures and the work environment. Therefore, work disability is often only partly attributable to disease. For example, need for sickness absence depends partly on the employee's appraisal of their ability to cope at work and by the workplace's response to the condition[160].

After work absence, exploring work modifications are oftentimes necessary. Occupational healthcare professionals are uniquely positioned within healthcare because they have access to workplaces. They understand the patient's work tasks and work demands, enabling direct collaboration with supervisors to explore occupational interventions, work modifications, flexible arrangements, part time work options, assistive devices and appropriate work equipment, and changes to the work environment. As forums for joint collaboration in these questions, both employers and occupational health services may propose occupational health meetings and, when needed, work ability assessments.

At macro level, the legislative monitoring rules related to sickness absence, including the Finnish 30–60–90 day framework: at 30 days of sick leave, the employer informs the occupational health services to enable contacting the employee, at 60 days, reimbursement for sick leave needs to be applied for and at 90 days, the occupational health physician evaluated possibilities of return-to-work together with the employee and the employer[146]. All these actions aim to prevent prolonged work disability and support return-to-work. The overarching aim is to initiate work ability support as early as possible[161].

Rationale of the thesis

LBP is a common reason for healthcare visits in working age adults and is frequently managed within OHPC in Finland. OHPC offers a strong setting for early-stage actions, including identifying individuals at increased risk of persistent disabling pain and work disability, as well as the development of active treatment and rehabilitation pathways to those at higher risk.

LBP is also one of the most common work-related conditions and poses a substantial economic burden, both in Finland and globally. As a major contributor to work disability, improving support for sustainable working careers is a clear priority. Although major clinical guidelines recommend a BPS approach for LBP management, implementation in occupational healthcare settings has remained challenging. This highlights the need for targeted training combined with evaluation of implementation processes and associated costs compared to usual care.

To date, implementation of guideline-based BPS management and stratified care has not been evaluated in Finnish OHPC. Effective implementation may enable earlier prevention, improve the efficiency of use of healthcare resource use, and strengthen work ability outcomes. In addition, there is a need for pragmatic tools to measure determinants of implementation behavior in order to support future implementation efforts and guide the selection of appropriate strategies.

This formed the rationale for our study.

Chapter 2

Aims

Overall aim

To investigate whether a targeted educational intervention in guideline-based BPS care leads to successful implementation and consequent improvement of LBP management in Finnish OHPC, using a cluster-randomized design.

Specific aims

To evaluate the quality of LBP management by applying predefined criteria to physiotherapists' documentation (Study I).

To analyze the effects of the intervention on occupational healthcare resource utilisation and work absenteeism compared to usual care 1) among all LBP patients and 2) in patient groups stratified for work disability risk according to ÖMPSQ-SF (Study II).

To examine how capabilities, opportunities, and motivation influence the implementation of guideline-based BPS management of LBP in multiprofessional teams, as perceived by occupational healthcare professionals after a targeted educational intervention (Study III).

Tailor a shortened version of 'The Determinants of Implementation Behavior Questionnaire' to multiprofessional rehabilitation context and cross-culturally adapt a Finnish language version (Study IV).

Methods

The studies I-III are based on data from a cluster RCT (ISRCTN11875357), a brief training intervention in guideline-based BPS management of LBP in OHPC. Study IV describes a cross-cultural translation and Delphi process. We use mixed-methods design, i.e. quantitative and qualitative research methods, to answer our research questions. The methods are described in more detail in the original articles I-IV. The logic model of the implementation study is presented in Figure 6.

Study setting

The study involves six nationwide OHPC providers with 27 units randomized to either an intervention (n=12) or control arm (n=15). Figure 7 presents the randomization of clusters and trial overall progression and the geographical distribution of OHPC units in the study. The units were predominantly located in urban areas. The protocol for the study is described in detail[162].

Units of Finnish major private and public OHPC companies were invited to participate. The units that consented to participate were randomized by a statistician who was not aware of the characteristics of the units into intervention or control arms using a random number generator. All the intervention units attended the same training sessions and started patient recruitment at the same time. Randomization was stratified by OHPC provider type to minimize selection bias. Within each OHPC unit randomized for training, the employer selected voluntary healthcare professionals (occupational health physiotherapists and physicians) for the training, based on their motivation and willingness to learn the BPS approach. The training was provided free of charge. The aim was that at least one physiotherapist and one physician from each unit participated. No BPS training or material were offered to any healthcare professionals of the control units, which continued to deliver their usual care.

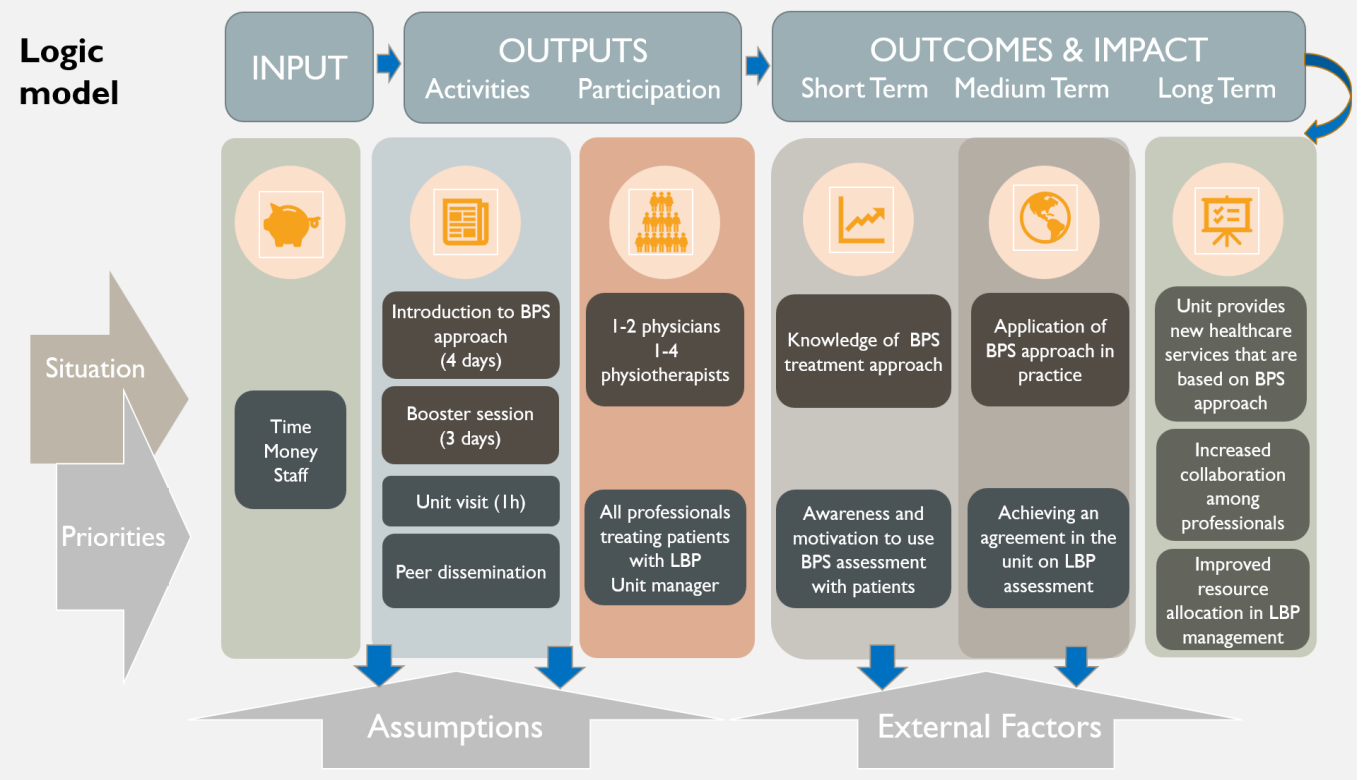

Figure 6. Logic model of the brief training intervention in guideline-based biopsychosocial (BPS) low back pain (LBP) management in occupational health primary care

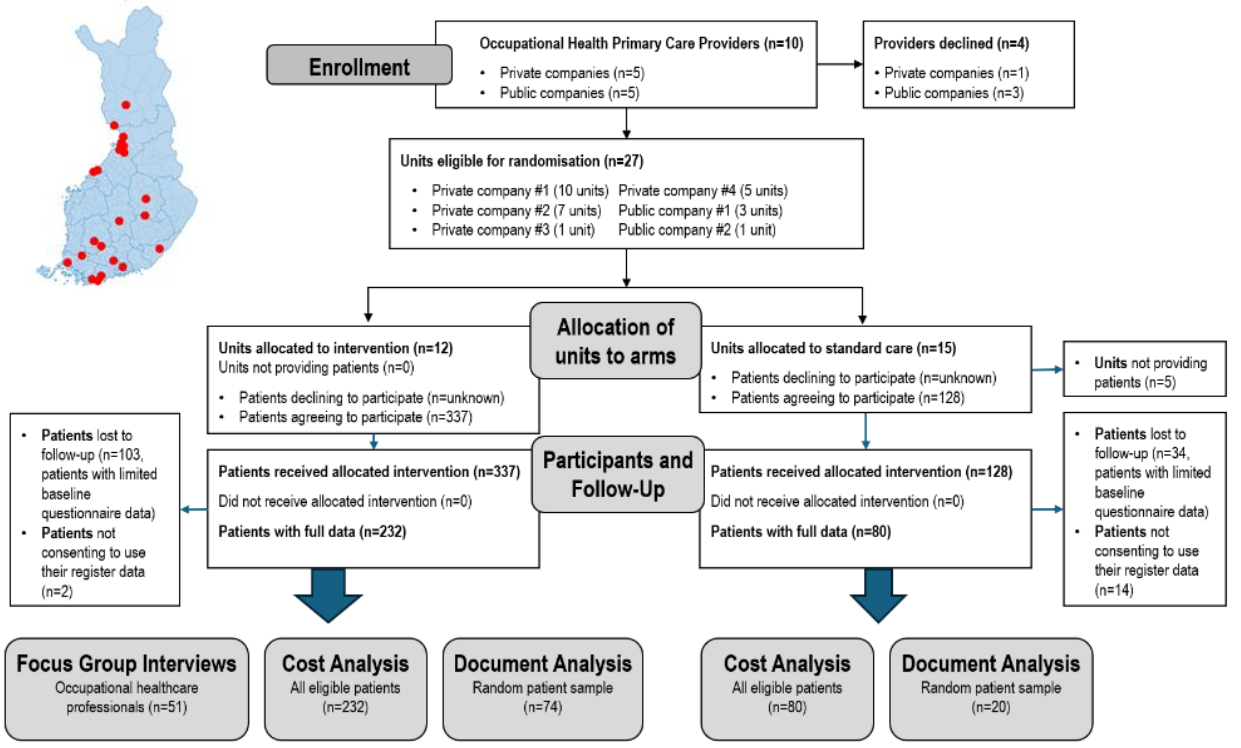

Figure 7. Flowchart of randomization of clusters

Educational intervention

Initial BPS educational intervention lasted 4 days (September 21-24, 2017) and booster training 3 days (June 3-5, 2018). Training consisted of live patient demonstrations, clinical case problem solving and role plays. The trainers were pain psychologist, Professor Steven Linton, Professor Jaro Karppinen and physiotherapist Kasper Ussing. Two experienced Finnish physiotherapists Riikka Holopainen and Mikko Lausmaa provided supervision and feedback to support the learning of professionals.

The 'clinical champions' (physiotherapists and physicians taking part in training) were encouraged to disseminate knowledge in their OHPC units to those professionals who were not involved in the BPS educational intervention. For this, they received written educational material. An online educational platform was created for the 'clinical champions', with scientific articles, videos, educational materials and a forum for questions. After the training, at least one member of the research team visited each unit. During these outreach visits, the study design was explained, and the principles of BPS management of patients with LBP were briefly reviewed. During the on-site visits, practical issues related to patient recruitment and data collection were also discussed.

Professionals were offered evidence-based tools (patient education booklet, risk stratification tools (SBT and ÖMPSQ-SF) to assess the patient and implement treatment according to the BPS guideline used in the study (Figure 8). The assessment of patients with LBP taught in the training was multidimensional, including physical (ability to function), psychological (fear of physical activity, fear-avoidance behavior, pain catastrophizing, pain-related self-esteem, depression), social (ability to work) and health-related quality of life components[23,48,163].

Professionals were encouraged to systematically use the stratification tools in evaluation of the patient's individual work disability risk profile. Stratification of patients was used as the basis of the treatment model: low-risk patients were mainly to be offered

counselling about the BPS nature of the pain, patient education, advice to stay active and advice on lifestyle factors; medium-risk patients were additionally recommended exercise therapy that improves functional capacity and more intensive physiotherapy focusing on identified risk factors; and high-risk patients received psychologically focused treatment in addition to components of medium-risk group (Figure 8). For all patients, the goal was to make the LBP understandable and to focus the guidance on observed risk factors according to the individual assessment. If necessary, the professionals could refer the patient to, for example, an occupational health psychologist. All care was provided in accordance with the existing occupational health service contracts.

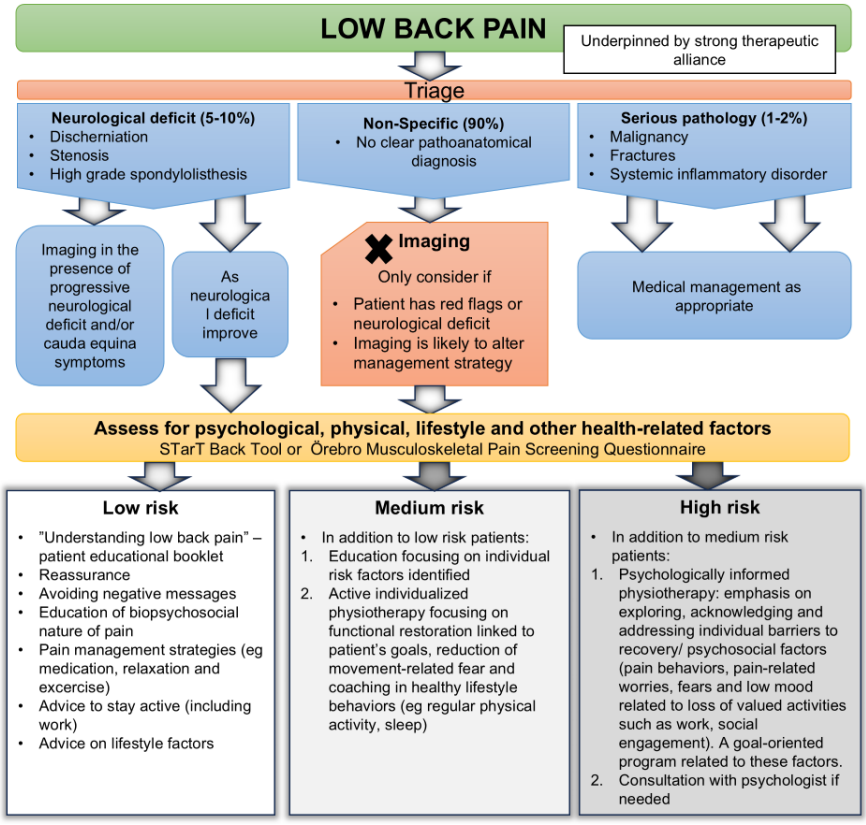

Figure 8. Biopsychosocial guideline for low back pain management used in the study

Multifaceted implementation strategy included multiprofessional BPS education targeted for 'clinical champions', booster training, educational materials, outreach visits to support dissemination to OHPC teams treating patients with LBP. The implementation object was guideline-based BPS management and stratified care in treatment of LBP.

Assumptions were that implementation of the BPS training will produce changes at both professional and organizational levels, including increased knowledge and skills, and improved motivation and attitudes toward using the BPS approach. These changes were expected to support the development and adoption of new clinical routines for LBP assessment and treatment, strengthen multiprofessional collaboration, and enable more targeted resource allocation. Ultimately, these mechanisms were assumed to contribute to more cost-effective patient care. The program theories for professional, patient and organizational perspectives are presented in Figures 9-11.

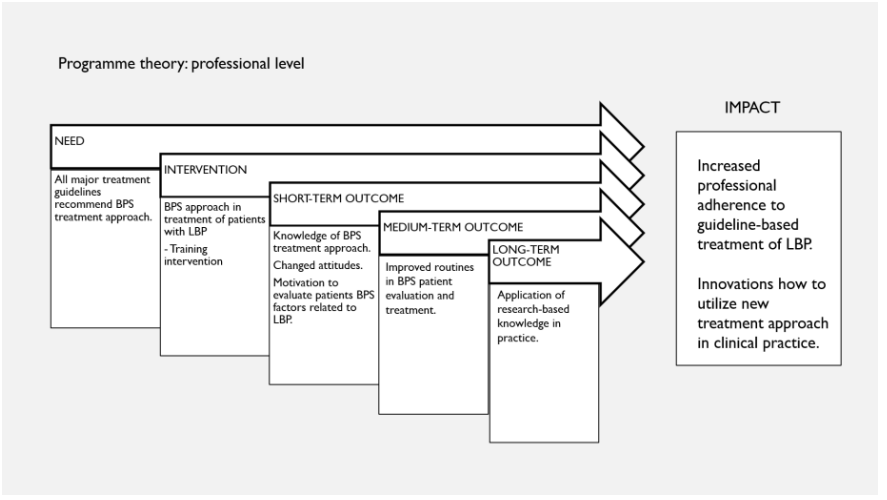

Figure 9. Programme theory: professional level (BPS= biopsychosocial; LBP= low back pain)

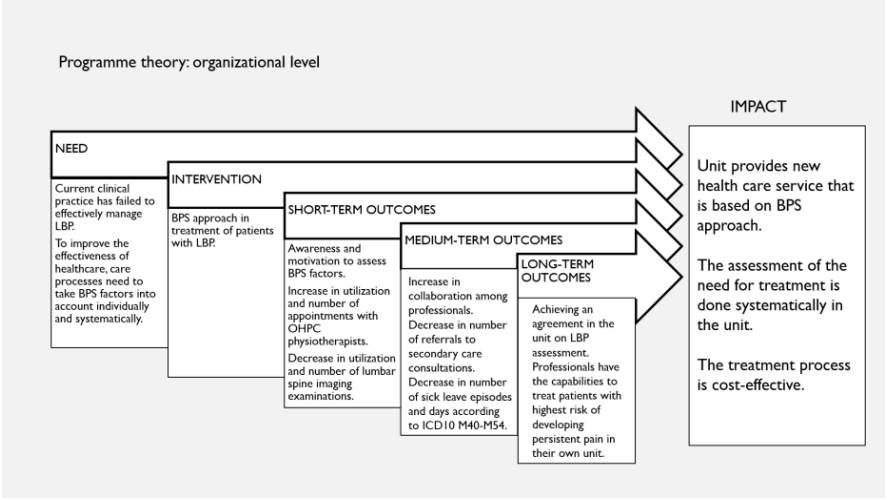

Figure 10. Programme theory: organizational level (BPS= biopsychosocial; LBP= low back pain; OHPC= occupational health primary care)

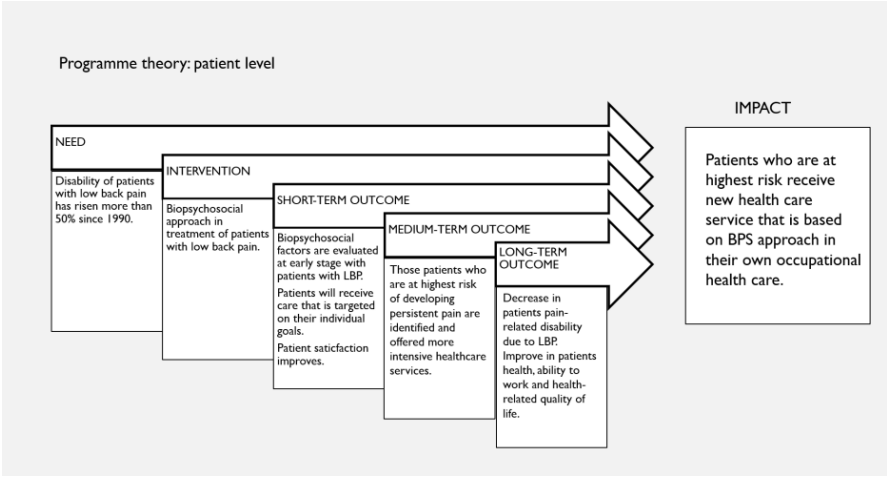

Figure 11. Programme theory: patient level (BPS= biopsychosocial; LBP= low back pain)

Study designs and data collection

We used a mixed methods design, where the Studies I-II were quantitative, the Study III was qualitative, and the Study IV integrated both qualitative and quantitative methods. Studies I, III, and IV were based on theoretical frameworks and models from implementation research[113], whereas Study II was grounded in health economics[164]. The study designs and data collection are presented in Table 2.

Table 2. Study designs and data collection (EPR= electronic patient records)

	STUDY I	**STUDY II**	**STUDY III**	**STUDY IV**
Study design and method	Quantitative study: Quality evaluation	Quantitative study: Cost analysis	Qualitative study: Content analysis	Mixed methods: Delphi study; translation and cross-cultural adaptation
Data source	Register data	Register data	Interview data	Questionnaire data
Study population	Patients with low back pain	Patients with low back pain	Focus groups of professionals	Cohort of experts
Data collection time point	Prospectively collected first physiotherapy visit from the EPRs after patient had volunteered to participate in the study.	Prospectively collected healthcare utilization from individual EPRs one year after the date of consent.	Interview data collected one year after the educational intervention, obtained with open-ended questions with a semi-structured interview guide.	Prospectively collected expert opinions using two-round Delphi process.

Participants and analysis methods

All patients aged 18–65 presenting to the involved OHPC units with nonspecific LBP with or without radicular pain were eligible. Exclusion criteria included suspicion of a serious underlying cause of LBP or requirement of urgent care[162]. Studies I and II included eligible patients 1) consenting to use their register data, 2) having complete baseline-data and 3) unit had provided opportunity to review registry data. Study III included focus groups of occupational healthcare professionals from the intervention arm. Study IV participants were a

multiprofessional cohort of experts from diverse healthcare settings and professional backgrounds in multiprofessional rehabilitation context.

Study I

Study I evaluated the quality of LBP management against predefined quality criteria. The physiotherapist first-visit after patient volunteered to participate in the study was retrieved from electronic patient records (EPRs) within the participating OHPC providers' electronic health record systems. The study type and PICO question is presented in Table 3.

Table 3. Study I type and PICO (Problem/Population, Intervention, Comparison, Outcome)

Study type	Population	Intervention and comparison	Outcomes
Secondary analysis of cluster-randomized controlled trial data; structured retrospective evaluation from electronic patient records.	Random sample of 98 electronic patient records from working-age patients (18–65 years) with low back pain in Finnish occupational health primary care; documented by 28 physiotherapists across 16 intervention and control units.	Intervention: Physiotherapists received 4–7-day training in guideline-based biopsychosocial management. Comparison: Usual care without BPS training.	Quality of low back pain management with stepwise thresholds for different work disability risk groups.

A random sample (n=98) of EPRs were analyzed using a deductive content analysis approach and study-specific researchers' evaluation tool (Appendix 5). Each EPR was read in its entirety, after which data were collected using printed researcher's evaluation tools. The evaluation tool items were derived from the intervention protocol[162], BPS target behaviors (Figure 8)[165], multidimensional factors associated with disabling LBP[166], ICF model[149] and previous studies in LBP care[167,168]. The tool covered anamnesis (pain characteristics, functional ability, work ability, person-centered aspects), assessment (biological, psychological and social dimensions) and the alignment of treatment plans with guidelines and patient's work disability risk

(low, medium and high). Items were scored using binary approach (yes = documented, no = not documented), and a single mention in the EPR was sufficient to score an item as documented. The tool aimed to identify both the aspects physiotherapists documented, and those that were omitted, offering insight into the comprehensiveness of LBP management. Two researchers jointly reviewed each EPR. After first 10 cases, a senior researcher was consulted to further standardize interpretation. EPR access permissions were obtained from each company in accordance with local data governance procedures. Due to the sensitive nature and regulation of patient information, records were reviewed on site within each provider's system, and no printouts or full record exports were made. The EPRs were evaluated against the pre-defined quality criteria, starting from reflecting adherence to the BPS guideline (Figure 12). Although each step was considered to represent equally high-quality care, the steps were interpreted in relation to alignment with the patient's risk profile: Step II with low risk; Step III with medium risk and Step IV with high risk for work disability according to ÖMPSQ-SF.

Assessment Quality Criteria
Step I - Multidimensional assessment Criteria: All bio-psycho-social dimensions documented 1. Assessing biological, psychological and social dimensions of low back pain
Treatment Quality Criteria
Step II - Treatment aligned with low risk for work disability Criteria: ≥50% of items 1-5 are documented 1. Using risk stratification tool 2. Giving patient education 3. Advising to stay active 4. Discussing pain management strategies 5. Addressing lifestyle behaviors
Step III - Treatment aligned with medium risk for work disability Criteria: Step II criteria fulfilled, and ≥50% of items 6-7 are documented 6. Using exercise interventions 7. Reducing movement-related fear by modifying pain-related behaviors or using graded exposure.
Step IV - Treatment aligned with high risk for work disability Criteria: Step III criteria fulfilled, and at least 2 out of 3 items 8-10 are documented 8. Using behavioral interventions 9. Using work-related interventions and supporting social engagement 10. Making a goal-oriented treatment plan

Figure. 12. Quality criteria definitions for low back pain management

Study II

Study II was a cost analysis of BPS approach compared with treatment as usual[164] (Table 4). We assessed the costs of healthcare utilization and LBP-related work absence using registry-based data from the intervention and control units. Patient-level OHPC utilization was obtained from EPRs.

Table 4. Study II type and PICO (Problem/Population, Intervention, Comparison, Outcome)

Study type	Population	Intervention and comparison	Outcomes
Multicenter cluster-randomized controlled trial with cost analysis.	312 working-age patients (18–65 years) with low-back pain in Finnish occupational health primary care (232 intervention, 80 control); stratified by work disability risk (ÖMPSQ-SF).	Intervention: Guideline-based biopsychosocial management of low-back pain (12 OHPC units). Comparison: Usual care in each occupational healthcare unit (15 OHPC units)	Occupational healthcare resource utilization (physician, physiotherapist, nurse visits), imaging use (direct costs) and sick leave days and costs according to ICD-10 M40-M54 diagnoses (indirect costs).

The individual-level register-based data on healthcare use covered OHPC visits one year from the date of each patient's recruitment. The medical records were used to assess the number of face-to-face visits and remote visits to OHPC professionals (physicians, physiotherapists and nurses), the number of imaging examinations and sick leave days accrued according to ICD10 M40-M54 diagnoses within the 12-month follow-up.

We estimated costs by multiplying healthcare unit costs (in euros)[169] by each type of OHPC resource use (Appendix 6). In 2017, the Confederation of Finnish Industries estimated the cost of a sick leave day to be €350. We summarized the costs to the following categories and used them as study outcomes: visits to physicians, physiotherapists and nurses; medical imaging or other diagnostic examinations (including radiograph/ MRI/ electroneurography/ electromyoneurography); total OHPC resource use; and sick leave days due to LBP. Total costs, which included all these costs, were also calculated.

Additionally, we analyzed the differences in costs between the intervention arms in patient groups stratified for work disability risk. We used the 10-item ÖMPSQ-SF (Appendix 2)[50], which has been translated and validated in Finnish[170] as a risk stratification tool for work disability. The items of ÖMPSQ-SF are (i) the duration of pain(s), (ii) pain rating, (iii) the ability to do light work, (iv) the ability to sleep at night, (v) feelings of anxiety, (vi) feelings of depression, (vii) the perceived risk of pain becoming chronic, (viii) perceived opportunities to return to work and (ix and x) fear-avoidance beliefs. Each item was scored from 0 to 10, dividing respondents into three groups according to their total scores: (i) low (0–39 points); (ii) medium (40–49 points); and (iii) high risk (50–100 points)[50,55].

Baseline characteristics included descriptive characteristics in relation to demographics, general health, LBP and workability were surveyed at baseline[171] including age, gender, body mass index (BMI; self-reported weight per squared height kg/m2, smoking, self-rated health ((European Quality of Life Questionnaire– 5 Dimensions (EQ-5D, 0–100 visual analogue scale)[172,173], health-related quality of life using the EQ-5D-3L[172,173], Depression Scale (DEPS)[174], pain duration, the Oswestry Disability Index (ODI)[175], work ability (0–10 Numerical Rating Scale), number of sick leave days due to LBP during preceding 3 months and fear of physical activity or work (Fear-Avoidance Beliefs Questionnaire, FABQ)[176].

Limited societal and healthcare perspectives were applied in the analysis. Societal perspectives typically include estimated effects on productivity, and, in this study, sick leaves were used as an indicator of productivity costs, supplementing the healthcare perspective on the use of OHPC resources. The chosen healthcare perspective was that of an OHPC payer, since the costs of the use of OHPC over the trial follow-up were paid for by employers.

Study III

Study III was a qualitative analysis of the professionals' (n=51) perceptions of implementing BPS management of LBP to clinical practice (Table 5). Interviews were conducted one year after the BPS

training, with OHPC professionals from intervention units. A purposive sampling technique was used to choose a sample of professionals from each intervention cluster. All OHPC professionals treating patients with LBP (physicians, physiotherapists, nurses, psychologists) in the intervention cluster units were invited by their employers to participate in the interviews. The interviews took place in OHPC units or in another agreed way (e.g. Skype meeting).

Table 5. Study III type and PICo (Problem/Population, Interest, Context)

Study type	Population	Interest	Context
Qualitative study (focus group interviews); deductive and inductive content analysis using COM-B framework.	51 purposively recruited occupational healthcare professionals.	Perceptions of implementing guideline-based biopsychosocial management of low back pain after an educational intervention.	Finnish occupational health primary care, multiprofessional teams, one year after training.

We developed a semi-structured interview guide covering BPS target behaviors (Appendix 7). The participants were also encouraged to speak freely about their experiences of participating in the study and the assessment and the treatment of patients with LBP in OHPC. Interviews lasted a mean of 59 minutes (28–79), were audio/video recorded, and transcribed verbatim (word-to-word) by the first author. Field notes were taken during and after each focus group as a means of documenting the contextual information needed, but transcript validation by participants was not performed. The data consisted of 281 pages (font =Times New Roman 12, spacing = 1.5).

Professionals' perceptions were analyzed using a combination of theory-driven and data-driven content analysis (deductive-inductive), with the COM-B model (Capability, Opportunity, Motivation, Behavior)[124] as the theoretical framework. Perceived facilitators/barriers were mapped to COM-B domains for three BPS target behaviors: (A) healthcare professionals and patients form a common individual BPS understanding of LBP, (B) healthcare professionals use risk stratification tools systematically at an early stage in the assessment of patients with LBP, (C) multiprofessional collaboration targeting an individualized plan for patients with LBP.

Target behaviors were defined based on LBP guidelines, BPS recommendations, and prior research on implementation challenges [23,47,131].

The analysis process contained a preparation phase, an organizing phase, a reporting phase, and a results phase, as described by Elo and Kyngäs[177]. In the preparation phase, the participants' statements were read and re-read to gain familiarity. The unit of analysis was a set of ideas selected from the interview data. In the deductive organizing phase, we developed a two-level categorizing matrix (Figure 13), and the first author coded the data according to these categories. The original statements from the interview data were first coded using a deductive, i.e. theory-oriented, method. In Step 1, the coded statements (n=1546) were classified into three target behaviors, 14 TDF domains[107] and the COM-B model[120] and interpreted as possible facilitators of or barriers to the achieving target behaviors. We used data analysis program MAXQDA 2020 Analytics Pro to manage the data.

Next, each matrix category underwent inductive analysis. We used the principles of inductive content analysis to develop the categories in each TDF domain[177]. In Step 2, we extracted all the expressions that corresponded to the unit of analysis that addressed the research question from the data and coded them. In Step 3, we formed the subcategories by combining the coded expressions and deciding what belonged in the same categories. We named the categories using the expressions that most representatively described them. Next, the subcategories were conceptualized and abstracted into a generic category. Lastly, the identified facilitators and barriers were combined in generic category level to compare the results with previous studies and report the results. Table 6 shows an example of the analysis and categorization process.

COM-B categories	TDF domain
CAPABILITY	Knowledge
	Skills
	Memory, attention and decision processes
	Behavioral regulation
OPPORTUNITY	Social influences
	Environmental context and resources
MOTIVATION	Social/professional role and identity
	Beliefs about capabilities
	Optimism
	Beliefs about consequences
	Intentions
	Goals
	Reinforcement
	Emotion

Figure 13. Two-level categorizing matrix

Table 6. Example of deductive and inductive analyses and categorization process

Target behavior A. Professional and patient form a common individual biopsychosocial (BPS) understanding of low back pain (LBP)				
Step 1 Deductive content analysis Data reviewed for content and coded for correspondence with or exemplification of target behavior and Theoretical Domains Framework (TDF) domain		**Step 2 Inductive content analysis**	**Step 3 Inductive content analysis** Conceptualizing and abstracting into categories	
COM-B / TDF domain	Example of quotation	Open-code	Sub-category	Generic category
MOTIVATION / Social and professional role, identity Description: Interpersonal processes that can cause individuals to change their thoughts, feelings, or behaviors	*'This has somehow broadened my awareness, and I no longer pay attention to only the mechanics, instead I consider functional movements and whether there is that pain-related fear and what causes it.' (OPT, 3 days training;PC4)*	The role developed from bio to BPS	Expanding professional role, confidence and boundaries	Renewing professional identity
	'I invest quite a lot in such dialogical discussions, much more than before. Previously, it was more about advising and taking control of the situation, almost like lecturing the client. Now it's more of a biopsychosocial approach with dialogue, which is good.' (OPT, 7 days training; PC2)	The role developed from lecturing to person-centered		
	'I give a certain amount of guidance in basic things to these people with acute back pain, who don't seem to need the guidance of a physiotherapist at the beginning… acute pain phase self-care methods, relaxation techniques, and then walking, how to start, and gradually increase activity as the pain allows, those I always go through.' (OHP, 7 days training; PC1)	Physician starts giving BPS patient education		
	'And because we'll always refer our patients to physiotherapy whenever they are in pain, and we wait for the professionals to give them guidance and then see how rehabilitation has progressed.' (OHP, 4 days training; PC2)	Physician's passive role to follow progress of rehabilitation	Remaining in familiar professional role and within boundaries	
	'I haven't gained much from this. Because, of course, I've been a physician for such a long time.' (OHP, team member; PC2)	Familiar professional role		
	'Yes, through training, I'd say that it has somewhat changed the entire patient interaction from my side, trying to understand the client's own thoughts and what the client themselves sees as causing their issues.' (OHP, 7 days; PC1)	Changing approach to encountering all patients	Developing identity as a professional	
	'I guess I listen more and then the treatment is more individualized. And it produces results. I'm still learning in my old age. This dialogue approach applies even in the company of friends.' (OPT, 7 days training; PC2)	Utilizing validation skills in their personal life		

By using deductive–inductive content analysis described by Elo & Kyngäs[177], we were able to monitor the progress towards the goals of the training intervention and assess how the training may have influenced on professionals´ conceptions of the treatment of patients with LBP. By applying deductive content analysis using TDF we were able to identify barriers and facilitators to implementation[107,131]. Deductive analysis allowed us to perform hypothesis testing with implementation theory (determinants framework) and to compare the results with key findings of previous data studies. Inductive content analysis provided explanation of the aspects of implementation and understanding what influences implementation outcomes moving from specific observations to broader generalizations.

The combination of theory-oriented and data-driven approaches provided richer understanding of professionals´ experiences of facilitators and barriers of applying specific BPS behaviors and multiprofessionalism in terms of clinical practice. Furthermore, the deductive framework was used as a 'set of concepts', rather than as a rigid categorization scheme, and the inductive component was essential to ensure that participants' own meanings remained in the foreground. A deductive–inductive content analysis does not constrain a study to a single philosophy of science; it is a methodological choice that can be situated within different paradigms depending on the nature of the research aim and what is taken to count as knowledge[178]. Our overall aim was to generate practically useful understanding to support implementation, including development of practices, training, care pathways, and implementation strategies. Accordingly, the study was informed by critical realist perspective[179].

Ontologically, we assumed that implementation-related phenomena were real, while expressions were shaped through situated actions, practices, and contexts, resulting in a multifaceted and context-dependent reality. Within this overall stance, the qualitative analysis was guided by constructivist epistemology. Knowledge was understood as co-produced through focus group discussions i.e. through interaction between participants (e.g.,

elaboration, and collective sense-making). The data were therefore treated as situated, socially negotiated narratives shaped by professional roles, organizational contexts, and prevailing discourses around BPS management of LBP. Analysis focused on how participants constructed meaning and justified implementation in everyday practice, rather than treating statements as direct reports of an objective reality. Meanings were developed through iterative reading, constant comparison within and across groups, and reflexive consideration of how the analytic framework and our pre-understandings as researchers influenced coding and interpretation.

The first author is a physiotherapist researcher with prior training in delivering the BPS approach, which informed her understanding of implementation processes in this context. The study was performed with a multiprofessional, experienced research group. All authors had the opportunity to participate in discussions, provide feedback, and agree on the final categories. Reflexivity was addressed throughout the study by acknowledging how the researchers' professional backgrounds and prior experiences could shape attention, interpretation, and analytic decisions.

In the summary section of the dissertation, the findings of the original qualitative study are presented using a multilevel synthesis. Rather than reporting the results under the three original target behaviors, the original qualitative categories are unpacked and reorganized across micro-, meso-, and macro-levels. This approach was used to support cross-study synthesis and to provide a more integrated understanding of the determinants influencing implementation at different levels.

Study IV

Study IV applied a mixed-method design in two phases (Table 7). Translation of the original English DIBQ and cross-cultural adaptation to Finnish (phase 1); and it's tailoring through content validity assessment and adaptation by an expert group (consisting of 25 experts) into a multiprofessional rehabilitation context version, DIBQ-mp (phase 2).

Table 7. Study IV type and PICO (Problem/Population, Intervention, Comparison, Outcome)

Study type	Population	Intervention and comparison	Outcomes
Cross-cultural translation and adaptation - a Delphi study.	25 Finnish experts representing of diverse settings and contexts in health, social welfare and education (researchers, educators, organizational leaders, practitioners and policymakers); 21 completed Round 2.	Cross-cultural adaptation of the Determinants of Implementation Behavior Questionnaire (DIBQ) into Finnish followed by a two-round Delphi process to tailor a shortened multiprofessional rehabilitation version (DIBQ-mp); no comparison group.	Consensus on included items; number of retained domains and items; Item-level Content Validity Index; Scale-level Content Validity Index.

The translation process was performed according to stages 1-4 described in Beaton protocol[180] and followed by a 2-round Delphi procedure[181-184] (Figure 14). The Delphi process consisted of two iterative rounds of ratings using an online survey and pre-tests before and after each round the results were compared with previously tailored Swedish version, DIBQ-t[134]. The research questions in the Delphi process were "which factors are the most critical in multiprofessional rehabilitation implementation, implying the question, which DIBQ domains and items thus cannot be left out of the shorter version of the questionnaire?". The Delphi study was conducted online, using Webropol, over a three-month period to provide sufficient time to gather data and aggregate group responses. Requirements for expertise for Delphi experts were 1) knowledge and experience with multiprofessional rehabilitation and/or evidence-based healthcare research implementation in the Finnish healthcare system; 2) capacity and willingness to participate; 3) sufficient time to participate in the Delphi-process.

The qualitative data from survey comments within items, domains and the free-text sections were analyzed by using inductive content analysis to classify the comments in favor of exclusion, inclusion or modification before potential inclusion to the shortened version[185,186]. Initially the participants' statements were read and re-read by the first author to gain familiarity. Subsequently, meaningful units of analysis (core sentences and words) were selected. Each meaningful unit was

condensed and labelled with a code using qualitative data analysis program MAXQDA 2020 Analytics Pro. The codes were sorted and grouped into subcategories and categories in discussion among the authors. Analysis of the comments was also used to guide the modifications and considerations of the importance and suitability of the items for the multiprofessional rehabilitation context. An item could be included even if quantitatively rated below threshold if qualitative assessment captured important issues in relation to the targeted context[187].

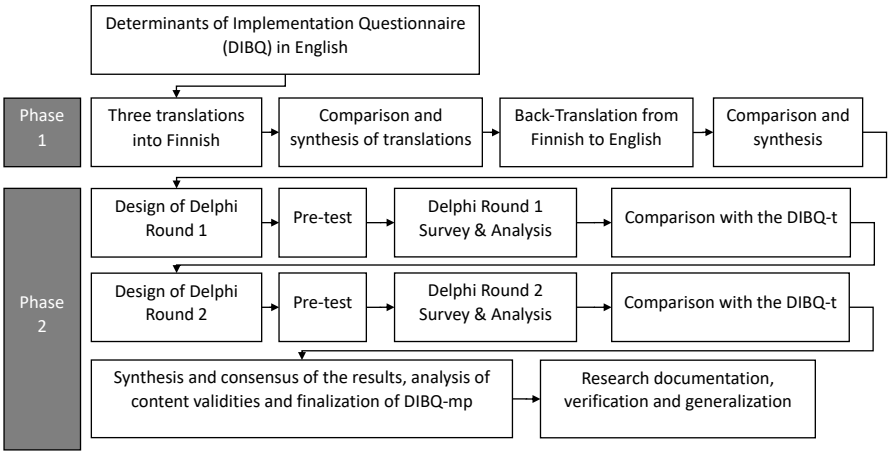

Figure 14. Cross-cultural adaptation (Phase 1) and Delphi procedure (Phase 2)

Statistical analysis

Studies I–II: Baseline characteristics were summarized using means with standard deviations (SD) for normally distributed continuous variables, medians with interquartile ranges (IQR) for non-normally distributed continuous variables, and frequencies (n) with percentages (%) for categorical variables. Differences between the intervention and control arms were assessed using independent-samples t tests, Chi-square tests, or Mann–Whitney U tests, as appropriate. Statistical significance was set at $p < 0.05$. All analyses were conducted using SPSS Statistics version 29 (IBM Corp).

Study I specific statistical methods

Evaluation tool items were analyzed descriptively using binary scoring (yes/no). Demographic outcomes were summarized as counts and proportions, and differences between arms were tested using Fisher's exact test. A power analysis based on Fisher's exact test (two-tailed, $\alpha = 0.05$, power = 0.80, allocation ratio 0.25) indicated that 99 participants (79 intervention, 20 control) were required to detect a difference in proportions (expected 0.42 vs. 0.10).

Study II specific statistical methods

Associations between trial arm and costs (overall and within ÖMPSQ-SF risk groups) were analyzed using two-level linear mixed models with fixed effects for group (intervention vs. control) and random effects for unit. Mean cost differences between arms were reported with 95% confidence intervals (CI) and p-values. Additionally, costs were compared between ÖMPSQ-SF risk groups in the total sample using the Kruskal–Wallis test. All cost variables were treated as continuous. To address skewness in cost distributions, bootstrapping with 2500 replications was applied. Both unadjusted and adjusted models were fitted; confounders were selected from baseline variables that differed statistically between arms and included duration of pain and pain-related fear for physical activity (all patients), age (ÖMPSQ-SF low-risk), general health (medium-risk), and duration of pain (high-risk).

Study IV specific statistical methods

For each Delphi round, descriptive statistics (ranges, mean ratings with SD, and percentages of agreement) were calculated for each item. Participants rated item importance as facilitators/barriers on a 5-point Likert scale (1 = strongly disagree, 2 = disagree, 3 = neither agree nor disagree, 4 = agree, 5 = strongly agree). Consensus for inclusion was defined as a mean score ≥4 by at least 75% of participants; items with agreement ≤74% were excluded or reviewed based on qualitative judgement. The second-round survey followed the same procedure. Item relevance was rated on a 5-point scale (1 = not relevant, 2 = 2 = somewhat relevant, 3 = not relevant nor relevant,

4 = quite relevant, 5 = highly relevant) and indexed using the content validity index (CVI). Ratings of 3) were excluded from item-level CVI calculations (I-CVI). For each item, the I-CVI was computed as the number of experts rating 4 or 5 divided by the number of experts. Items with I-CVI ≥0.78 were considered relevant[188].

Ethical considerations

The study was approved by the Ethics Committee of the University Hospital of Oulu, Finland (79/2017), and conducted in accordance with the Declaration of Helsinki and retrospectively registered on 13.05.2019 in the BioMed Central register (ISRCTN11875357). All intervention units (n=12) participated on voluntary basis. All participants, professionals and patients, both in the intervention and control units, took part on a voluntary basis and signed their informed consent. All personal details were replaced by identification codes so that it was impossible to recognize any individual from the data. This provided full anonymity for all the participants.

Study timeline is presented in Figure 15.

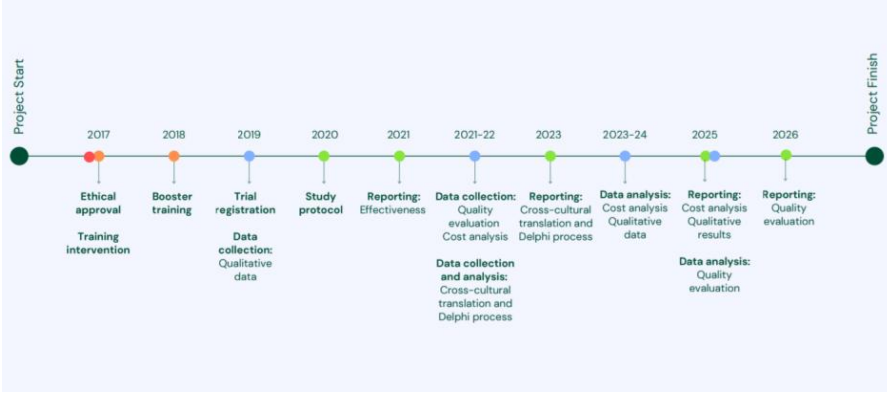

Figure 15. Project timeline

Results

This synthesis integrates the findings from studies I-IV and presents the results at the micro, meso, macro, and meta levels (Figure 16). Study I contributed to the micro-level by examining the quality of LBP management documented by physiotherapists. Study II contributed to the meso-level by describing healthcare resource use, work disability, and costs associated with different care models in OHPC. Study III contributed across the micro, meso, and macro levels by identifying barriers and facilitators to implementing a guideline-based BPS approach perceived by professionals. Study IV contributed to the meta level by tailoring a shorter multiprofessional version of the DIBQ-tool for measuring implementation determinants.

Study	Micro	Meso	Macro	Meta	Main contribution
I	•				Clinical behaviors documented
II		•			Resource use, work disability, costs
III	•	•	•		Perceived barriers and facilitators
IV				•	A tool to measure implementation determinants in multiprofessional rehabilitation

Figure 16. Conceptual model of how the studies I-IV contributed to the multi-level synthesis

Patient characteristics

Patient characteristics (total N=312) are shown in Table 8. In all, 58% were women at the age range of 21–64 years (mean 44.6 years; SD 9.4). Functional limitation was mild (median ODI 20; IQR 12-29) and quality of life moderate (median EQ-5D 0.76 (IQR 0.69-0.80). A total of 52.9% of the participants belonged to the ÖMPSQ-SF low-risk, 21.5% to the medium-risk and 25.6% to the high-risk group. Statistically significant differences between the trial arms at baseline were duration of pain and pain-related fear for physical activity.

Table 8. Baseline characteristics of participants in the trial arms. **Bolded scores denote statistical significance with P<0.05**. (EQ=EuroQol score; FABQ=Fear Avoidance Beliefs Questionnaire; IQR=interquartile range; ODI=Oswestry Disability Index; SD=standard deviation).

	Intervention (N=232)			Control (N=80)			P-value
	% (N) [a]	Mean (SD) [b]	Median (IQR) [c]	% (N) [a]	Mean (SD) [b]	Median (IQR) [c]	
Age (years)		44.6 (9.4)			45.9 (11.2)		*0.341*
Female sex	54.7 (128)			65.4 (53)			*0.092*
Body mass index (kg/m²)		27.7 (5.3)			27.3 (4.3)		*0.527*
Smoking	15.0 (35)			16.0 (13)			*0.814*
Self-rated health (1–100)			75 (65–85)			80 (65–85)	*0.327*
EQ-5D (0–1)			0.76 (0.69–0.80)			0.76 (0.69–0.80)	*0.566*
Depression Scale			4 (2–9)			4 (2–9)	*0.849*
Duration of pain							
<2 weeks	**11.1 (26)**			**19.8 (16)**			***0.017***
2–12 weeks	**32.9 (77)**			**37.0(30)**			
>3–12 months	**21.4 (50)**			**25.9 (21)**			
>12 months	**34.6 (81)**			**17.3 (14)**			
ODI (0–100)			20 (12–28)			20 (12–29)	*0.877*
Workability (0–10)			8 (6–9)			8 (6–8)	*0.542*
Sick leave days [d]		49.1 (115)			59.3 (48)		*0.116*
Sick leave days [d]			8 (4–29)			14 (4–23)	*0.572*
FABQ - work			11 (4–19)			13 (5–24)	*0.097*
FABQ - physical activity			**12 (8–14)**			**14 (9–17)**	***0.012***

[a] P-value for between-group difference from Chi square test.
[b] P-value for between-group difference from independent-samples T test.
[c] P-value for between-group difference from Mann-Whitney U test.
[d] Number of low-back pain related sick leave days during preceding 3 months to low-back pain during preceding 3 months.

Healthcare professionals and organizational participation

From each unit allocated to intervention arm at least one occupational healthcare professional, 'clinical champion', participated to the training. A total of 32 professionals attended the training (28 in 2017, 21 in 2018, and 17 at both times). 'Clinical champions' included 10 occupational health physicians and 22 occupational health physiotherapists.

Study I included EPR data from 98 clinical encounters documented by 28 physiotherapists across 16 units in five OHPC companies. Most physiotherapists were female (78.6%, n=23) with a mean age of 48.1 years (SD 8.3). Of the 19 physiotherapists in the intervention arm, 79% (n=15) had received the BPS training. Four physiotherapists were introduced to the BPS approach through peer dissemination only and documented five of the EPRs. In the control arm, EPR analysis involved 10 physiotherapists contributed, of whom one had received BPS training and had documented one EPR. The mean number of EPRs evaluated per physiotherapist was 3.8 (range 1-10) in the intervention and 2.9 (range 1-6) in the control arm.

Study III interviews of the professionals were conducted as focus group interviews (n=12). In total, 51 participants (20 physicians, 24 physiotherapists and 7 nurses) from intervention units participated in the interviews (Table 9). 11 of the participants were males and 40 females. Majority of the 'clinical champions' (n=25) participated, and their multiprofessional team members (n=26) who did not attend the educational interventions. Eventually, no psychologists participated in the interviews.

Table 9. Participants of the focus group interviews.

Unit code	Number of interviews	Participants (n)	Professions		
			OHP	OPT	OHN
PC #1	3	6	3	2	1
PC #2	4	26	10	10	6
PC #3	1	2	1	1	0
PC #4	2	9	3	6	0
PuC #2	2	8	3	5	0
Total (n)	**12**	**51**	**20**	**24**	**7**

OHP=occupational health physician; OPT=occupational health physiotherapist; OHN=occupational health nurse

Study IV Delphi participants included 25 Finnish experts from diverse settings and contexts in health, social welfare and education (researchers, educators, organizational leaders, practitioners and policymakers); 21 completed Round 2. Professions represented included physicians (specialized in occupational medicine, rehabilitation medicine, and general practice), physiotherapists (specialized in orthopedic manual therapy, musculoskeletal physiotherapy and chronic pain), occupational therapists, psychologists, psychotherapists, social psychologists, educationists, health scientists, nursing scientists and social scientists. Of the participants, half were women (52%), a third were aged from 51 to 60 years (32%), and two thirds had a doctoral level education (64%). Most often, the participants had 11 to 15 years of experience in clinical work (40%) and 16 to 20 years in academic work (32%).

Summary of the main findings of the studies I-IV across contextual levels

Figure 17 summarizes the main findings of the studies I-IV at four interconnected levels: micro, meso, macro, and meta. It groups the identified facilitators (+) and barriers (-), and results from the studies into a multilevel synthesis. It is intended to provide an overview of the multilevel nature of implementation and to illustrate how main findings from the studies complement one another.

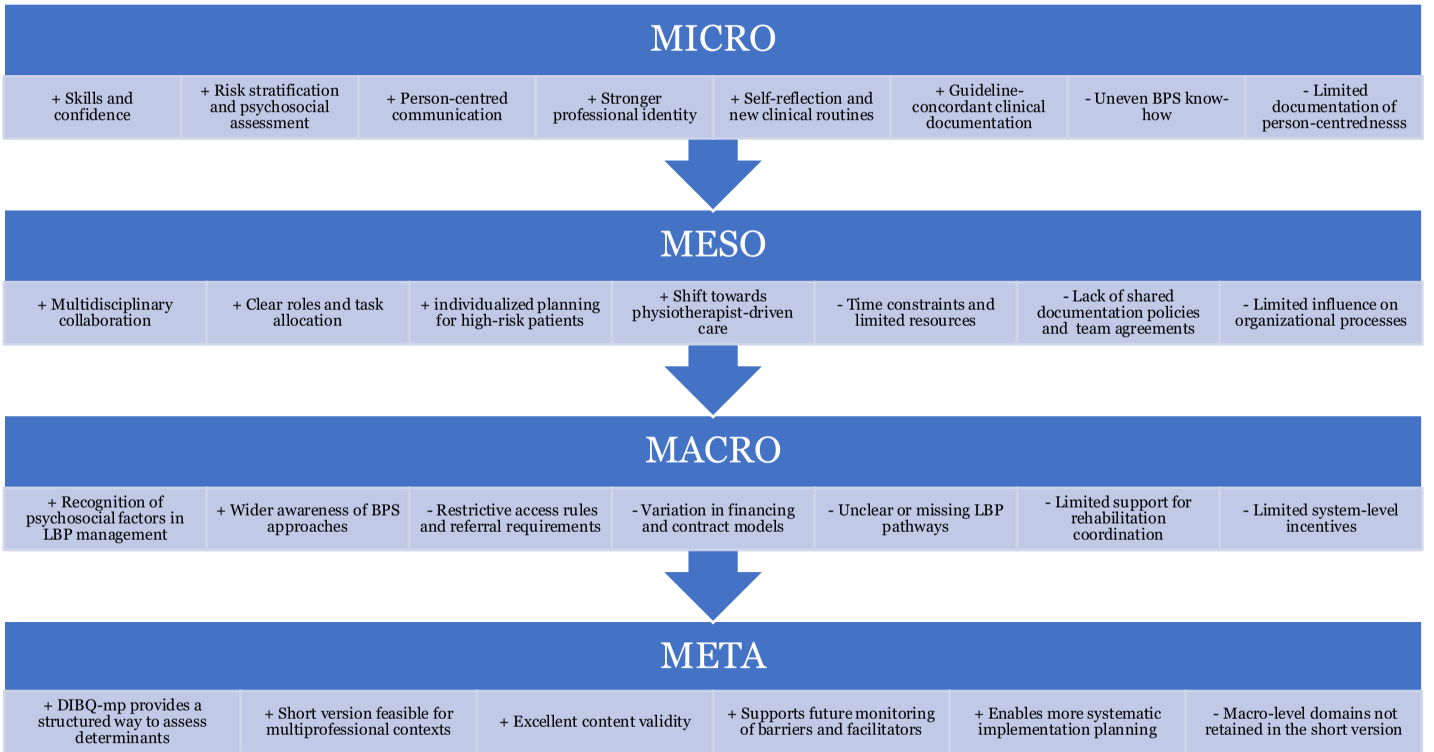

Figure 17. Summary of main findings across all studies I-IV and different levels of analysis

Micro level (Studies I & III)

Study I: Quality of LBP management

Study I showed that physiotherapists in the intervention arm more often documented clinical behaviors consistent with high quality LBP management than those in the control arm. Differences between intervention and control arms were observed in quality of anamnesis and multidimensional assessment: documentation of psychological (58.1% vs 25.0%, p=0.009), cognitive (45.9% vs 4.2%, p<0.001), social aspects (54.1% vs 29.2%, p=0.038) and pain-related functional behaviors (71.6% vs 37.5%, p=0.004). In the quality of treatment plans, differences were observed in use of risk stratification tools (73.0% vs 0%, p<0.001), advising to stay active (62.2% vs 12.5%, p<0.001), addressing healthy lifestyle behaviors (51.4% vs 16.7%, p=0.004), reducing pain-related fear by using (58.1% vs 4.2%, p<0.001), behavioral interventions (71.6% vs 4.2%, p<0.001), and in linking anamnesis, assessment, and treatment planning (36.5% vs 0%, p<0.001) (Table 10).

Quality of treatment plans in relation to work disability risk

Step II (treatment plans aligned with low risk for work disability) was met in 58.1% (n=43) of EPRs in the intervention arm, compared to 4.2% (n=1) in the control arm (p<0.001). Step III (medium risk) were met in 55.4% (n=41) of EPRs in the intervention arm, compared to 4.2% (n=1) in the control arm (p<0.001). No EPRs met Step IV (high risk) criteria. The findings suggest more guideline-concordant BPS clinical behaviors in the intervention arm. Physiotherapists in the intervention arm documented more often actions related to risk stratification and psychosocial assessments, pain education, activity support, support for lifestyle change, identification of pain-related functional behaviors and targeting those with behavioral interventions. Person-centered communication may also have been reflected in stronger alignment between assessment and treatment planning, although documentation of person-centered practices remained limited overall.

Table 10. Quality of anamnesis, assessment and treatment plans

	TOTAL n=98				
	Intervention n=74		Control n=24		P-value
	%	N	%	n	
Quality of anamnesis					
Baseline status (documented)					
Pain characteristics					
LBP history taken	86.5	64	79.2	19	*0.514*
Time Course	83.8	62	70.8	17	*0.233*
Pain Area	81.1	60	79.2	19	*1*
Pain Progression	74.3	55	79.2	19	*0.787*
Red Flags	14.9	11	8.3	2	*0.511*
Functional capacity					
Activity limitation	83.8	62	79.2	19	*0.757*
Pain-related functional behaviors	**71.6**	**53**	**37.5**	**9**	***0.004***
Workability	71.6	53	62.5	15	*0.449*
Person-centered aspects (goals, values, expectations)	36.5	27	20.8	5	*0.212*
Quality of assessment					
STEP I - Multidimensional assessment					
Biopsychosocial assessment (all dimensions documented)	36.5	27	16.7	4	*0.081*
BIOLOGICAL DIMENSION	100	74	95.8	23	*0.245*
Physical aspects	98.6	73	95.8	23	*0.432*
Health-related aspects	86.5	64	83.3	20	*0.741*
PSYCHOLOGICAL DIMENSION	**58.1**	**43**	**25**	**6**	***0.009***
Cognitive aspects	**45.9**	**34**	**4.2**	**1**	***<0.001***
Emotional aspects	43.2	32	25	6	*0.149*
SOCIAL DIMENSION	**54.1**	**40**	**29.2**	**7**	***0.038***
Social aspects	25.7	19	12.5	3	*0.262*
Work-related aspects	47.3	35	25	6	*0.061*
Quality of treatment plans					
FIRST-LINE TREATMENTS					
STEP II - Treatment aligned with low risk for work disability					
Using risk stratification tool	**73**	**54**	**0**	**0**	***<0.001***
Information or education about pain	**32.2**	**32**	**16.7**	**4**	***0.027***
Advising on return-to-activities	64.9	48	41.7	10	*0.057*
Advice to stay active	**62.2**	**46**	**12.5**	**3**	***<0.001***
Advice to avoid physical activities	**4.1**	**3**	**33.3**	**8**	***<0.001***
Pain management strategies	58.1	43	45.8	11	*0.349*
Addressing healthy lifestyle behaviors	**51.4**	**38**	**16.7**	**4**	***0.004***
STEP III - Treatment aligned with medium risk for work disability					
Using exercise (therapeutic or patient preference)	93.2	69	100	24	*0.33*
Reducing pain related fear	**58.1**	**43**	**4.2**	**1**	***<0.001***
STEP IV - Treatment aligned with high risk for work disability					
Behavioral intervention	**71.6**	**53**	**4.2**	**1**	***<0.001***
Work-related activities	33.8	25	37.5	9	*0.807*
Goal-oriented treatment plan					
Treatment plan	93.2	69	91.7	22	*1*
Clear link between anamnesis, assessment and treatment plan	**36.5**	**27**	**0**	**0**	***<0.001***
Treatment goal	89.2	66	87.5	21	*1*
SECOND-LINE TREATMENTS					
Passive treatment modalities used or advised to	44.6	33	66.7	16	*0.099*

Study III: Micro-level implementation determinants

At the micro level, professionals described that educational intervention improved their individual skills and awareness, strengthened person-centered communication, including validation and reassurance, and supported more comprehensive patient assessment with clearer action plans. The use of risk stratification tools was perceived to contribute to earlier recognition of relevant risk factors and facilitate the use of physiotherapy and multiprofessional rehabilitation planning. Professionals also described a shift toward more holistic pain management, greater integration of functional goals into occupational health physiotherapy, and increased confidence in imaging rationalization and treatment decision-making. In addition, self-reflection was seen to support the development of new clinical routines, while a renewed professional identity, a stronger therapeutic alliance, and greater professional satisfaction and confidence when managing LBP patients were perceived as important facilitators. Emotional reactions, such as concern or anxiety, were also perceived to be linked to a deeper awareness of the complexity of BPS management.

At the same time, several individual-level barriers remained. Participants reported uneven or superficial BPS know-how, feeling insufficiently prepared to manage complex BPS cases, and varying ability to identify psychosocial profiles and use risk stratification tools appropriately. Some described practical memory- and decision-making-related barriers, such as forgetting how to use or score the tools, whereas others perceived the tools as too complex or too psychologically oriented. Their use was therefore often selective rather than systematic. Intentions to apply the approach were also influenced by perceived usefulness and time constraints, which sometimes led professionals to consciously prioritize other aspects of care. Although initial resistance to change was reported, this was perceived to diminish as positive patient outcomes emerged. Generic categories from the original Study III describing capabilities and motivations at the micro level are presented in Figure 18.

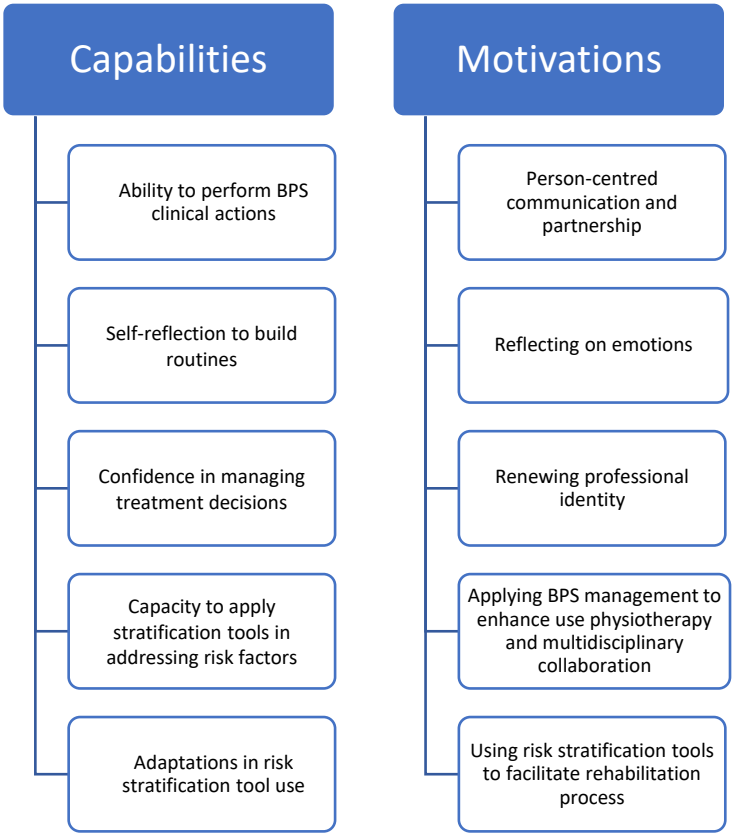

Figure 18. Generic categories related to professionals' capabilities and motivations at the micro level

Meso level (Studies II & III)

Study II: Cost analysis

Study II evaluated OHPC resource use, work disability, and costs. Although it did not directly measure meso-level determinants, the findings suggested changes in the team and service level in the delivery of care. Compared with the control arm, the intervention arm accrued more physiotherapist visits and fewer physician visits during the one-year follow-up, indicating a shift toward a more physiotherapist-driven model of care without substantial differences in total costs (Figure 19). The median number of physician visits was

1 (IQR 0-3) in the intervention arm and 2 (IQR 1-4) in the control arm, whereas the median number of physiotherapist visits was 2 (IQR 1-3) and 1 (IQR 0-2), respectively. Work disability outcomes showed a similar pattern. The median number of sick leave days was 0 (IQR 0-5) in the intervention arm and 1 (IQR 2-5) in the control arm. 64.7% of patients in the intervention arm had no sick leave during follow-up compared with 50% in the control arm. However, some patients in both arms had prolonged sick leave throughout the one-year follow-up.

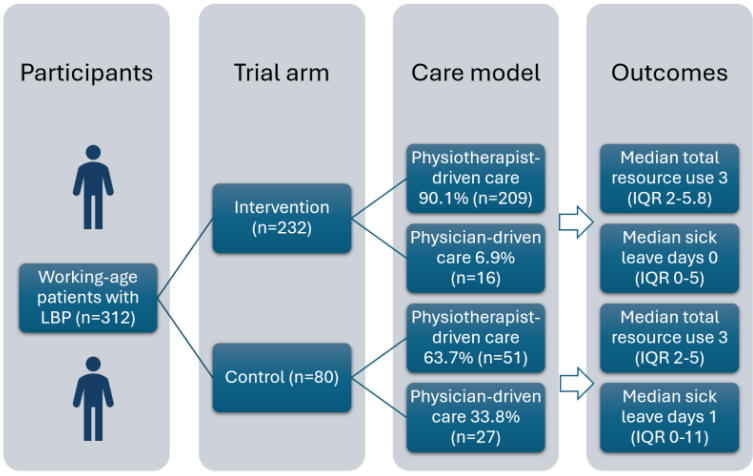

Figure 19. Occupational health primary care model, resource use and sick leaves in the intervention and control arms during 12-month follow-up (LBP= low back pain; IQR=interquartile range)

The intervention arm was associated with lower mean costs for physician visits than the control arm (mean difference €-43, 95% CI €-82 to €-3; p=0.034) and higher mean costs for physiotherapist visits (mean difference €55, 95% CI €26 to €84; p<0.001) (Table 11). No statistically significant between-group differences were observed in nurse visits, imaging costs, total OHPC resource use, sick leave costs, or total costs. Additional sensitivity analysis with estimated training costs included is presented in Appendix 8.

Table 11. Adjusted comparison of mean costs by trial arm for the total study sample. The mean difference presents the intervention effect. Negative mean difference indicates lower costs, and positive mean difference indicates higher costs for the intervention arm.

Outcome	Median cost (IQR) per patient		Adjusted mean difference (95% CI) [a]
	Intervention (n=232)	Control (n=80)	
Physician visits [b]	66 (0-167)	101 (66-256)	-43 (-82 - -3)
Physiotherapist visits [b]	148 (74-222)	74 (0-148)	55 (26 - 84)
Nurse visits [b]	0 (0-0)	0 (0-0)	-2 (-7 - 3)
Imaging due to LBP (X-ray/MRI/ENG/ENMG) [b]	0 (0-0)	0 (0-0)	-5 (-27 - 18)
OHPC resource use [b]	€222 (IQR €148–392)	€222 (IQR €134–372)	€12 (95% CI €-51 - €75)
Sick leaves (€350/day) [b]	€0 (IQR €0–1750)	€350 (IQR €0–3850)	€-1916 (95% CI €-6715 - €2883)
Total costs [b]	€257 (IQR €148–2094)	€807 (IQR €183–4172)	€-1908 (95% CI €-6734 - €2919)

CI= confidence interval: LBP= low back pain; X-ray= radiograph; MRI= magnetic resonance imaging; ENG= electroneurography; ENMG= electromyoneurography; IQR= interquartile range; OHPC= occupational health primary care

[a] bootstrapped (2500 replications)

[b] linear mixed model with covariate adjustment for pain duration and FABQ-Physical activity

When stratified by ÖMPSQ-SF risk groups, the intervention arm was associated with higher mean physiotherapist visit costs in the low-risk group (mean difference €49, 95% CI €11 to €88; p=0.012) and in the medium-risk group (mean difference €52, 95% CI €0 to €104; p=0.049) (Table 12). No statistically significant differences were observed in the high-risk group. Although median total costs and sick leave costs were descriptively lower in the intervention arm than in the control arm across the total sample and particularly in the high-risk group, the adjusted mean differences were not statistically significant. The Figures 20-22 shows the use of OHPC resource and sick leave days (minimum, maximum, median and percentiles) in the trial arms stratified by ÖMPSQ-SF risk groups.

Table 12. Adjusted comparison of mean costs by trial arm stratified by short form of Örebro Musculoskeletal Pain Screening Questionnaire (ÖMPSQ-SF) risk groups. The mean difference presents the intervention effect. Negative mean difference indicates lower costs, and positive mean difference indicates higher costs for the intervention arm.

Patient group	Sources of costs (see Appendix 6)	Median (IQR) estimated cost (€)		Mean difference [a] (95% confidence interval)	*P*-value [a]
		Intervention	Control		
Low risk	Physician visits [b]	66 (0-101)	66 (66-199)	-46 (-98 – 5)	*0.075*
n=165	Physiotherapist visits [b]	148 (74-222)	74 (0-148)	49 (11 - 88)	***0.012***
	Nurse visits [b]	0 (0-0)	0 (0-0)	-1 (-7 - 6)	*0.840*
	Imaging due to LBP (X-ray/ MRI/ ENG/ENMG) [b]	0 (0-0)	0 (0-0)	15 (-17 - 48)	*0.354*
	OHPC resource use [b]	214 (140-315)	214 (74-338)	23 (-63 - 109)	*0.591*
	Sick leaves (€350/day) [b]	0 (0-700)	0 (0-1488)	580 (-2481 - 3640)	*0.709*
	Total costs [b]	222 (148-840)	232 (130-1725)	616 (-2497 - 3728)	*0.697*
Medium	Physician visits [c]	66 (0-198)	132 (66-198)	-60 (-145- 24)	*0.160*
risk n=67	Physiotherapist visits [c]	148 (109-222)	74 (0-204)	52 (0 - 104)	***0.049***
	Nurse visits [c]	0 (0-0)	0 (0-0)	-5 (-13 - 3)	*0.254*
	Imaging due to LBP (X-ray/ MRI/ ENG/ENMG) [c]	0 (0-0)	0 (0-0)	-3 (-42 - 37)	*0.877*
	OHPC resource use [c]	222 (148-413)	257 (134-363)	-1 (-117 - 115)	*0.990*
	Sick leaves (€350/day) [c]	0 (0-2450)	525 (0-4025)	-3100 (-13720 - 7520)	*0.562*
	Total costs [c]	411 (148-413)	749 (227-4205)	-3088 (-13736 - 7560)	*0.564*
High risk	Physician visits [d]	132 (66-253)	198 (93-299)	-26 (-112 - 59)	*0.541*
n=80	Physiotherapist visits [d]	148 (74-257)	37 (0-222)	57 (-10 - 123)	*0.094*
	Nurse visits [d]	0 (0-0)	0 (0-0)	-1 (-11 - 10)	*0.883*
	Imaging due to LBP (X-ray/ MRI/ ENG/ENMG) [d]	0 (0-0)	0 (0-27)	-43 (-90 - 4)	*0.072*
	OHPC resource use [d]	284 (179-558)	315 (186-622)	7 (-131 - 145)	*0.921*
	Sick leaves (€350/day) [d]	875 (0-8663)	2450 (525-17763)	-1413 (-15119 - 12292)	*0.838*
	Total costs [d]	1196 (199-9096)	2801 (942-18220)	-1406 (-15165 - 12352)	*0.839*

IQR= interquartile range; LBP = low back pain; X-ray = radiograph; MRI = magnetic resonance imaging; ENG = electroneurography; ENMG = electromyoneurography; OHPC = occupational health primary care

[a] bootstrapped (2500 replications)

[b] linear mixed model with adjustment for age

[c] linear mixed model with adjustment for general health

[d] linear mixed model with adjustment for pain duration

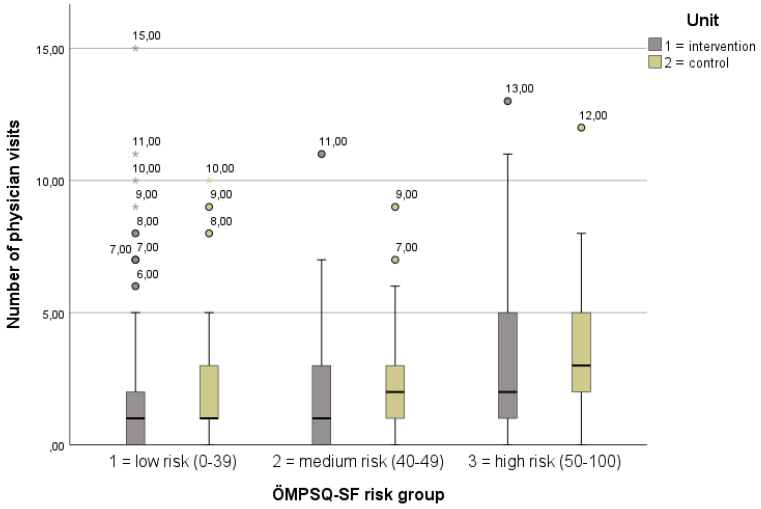

Figure 20. The number of occupational health physician visits in trial arms, stratified by short form of Örebro Musculoskeletal Pain Screening Questionnaire (ÖMPSQ-SF).

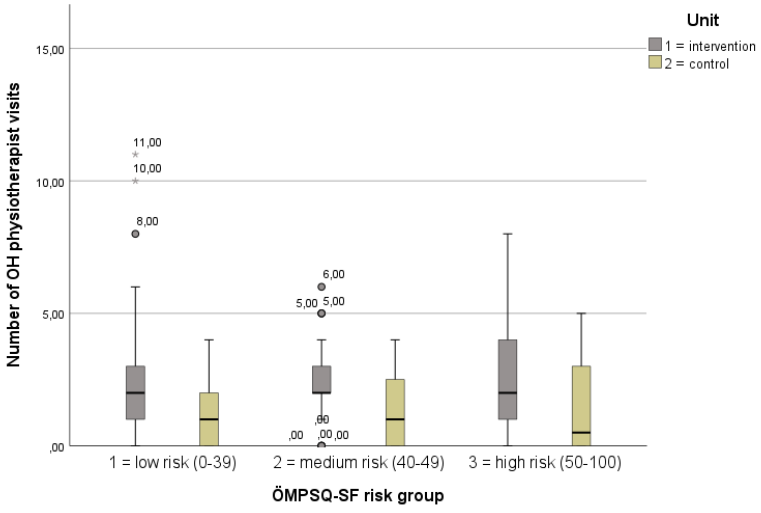

Figure 21. The number of occupational health (OH) physiotherapist visits in trial arms, stratified by short form of Örebro Musculoskeletal Pain Screening Questionnaire (ÖMPSQ-SF).

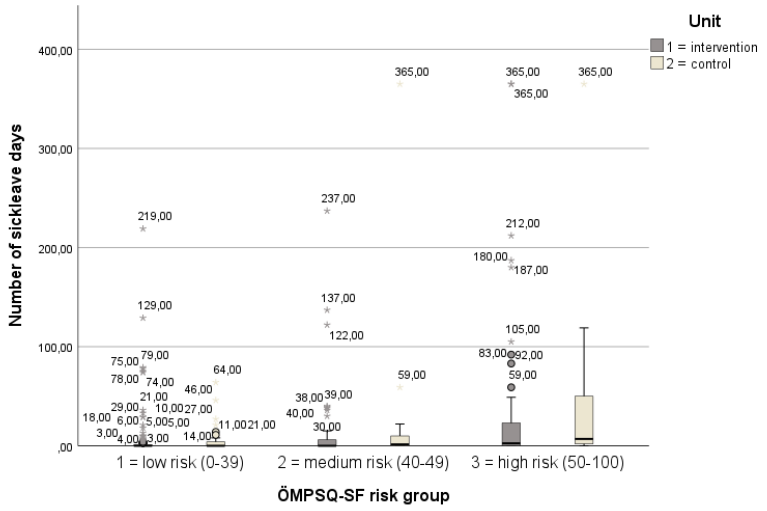

Figure 22. The number of sick leave days in trial arms stratified by short form of Örebro Musculoskeletal Pain Screening Questionnaire (ÖMPSQ-SF).

The cost analysis further suggested that reorganizing care toward multiprofessional physiotherapist-driven model was feasible in OHPC. Although no substantial between-group differences were observed in total costs, the gradient between low-risk and high-risk patients was less steep in the intervention arm than in the control arm. Compared with the low-risk group, total costs for patients in the high-risk group were more than five-fold higher in the BPS arm [€1196 (IQR €199-9096); versus €222 (IQR €148-840)], whereas in the control arm the difference was as high as twelve-fold [€2801 (IQR €942-18220); versus €232 (130-1725), respectively]. This finding highlights the importance of early identification and more targeted care pathways for patients at higher risk of work disability.

Study III: Meso-level implementation determinants

At the meso level, perceived facilitators included timely access to BPS-trained physiotherapists, allocation of extra time for the first LBP visit, case management for high-risk patients, digital risk stratification questionnaires, and monitoring of referrals, imaging, and costs. These organizational arrangements were perceived to support the feasibility of BPS-oriented practice in everyday OHPC.

Implementation was also influenced by the social and collaborative context of OHPC. Increased multiprofessional collaboration, regular interprofessional meetings, clear roles and task allocation, local peer support, stability in teamwork, and shared agreements on the use of risk stratification questionnaires were perceived as facilitating adoption of the BPS approach. In contrast, implementation was perceived as more difficult when multiprofessional collaboration was reduced mainly to EPR notes or when team support was weak.

In addition, implementation was shaped by organizational policies, pathway clarity, and the extent to which the BPS approach aligned with broader OHPC goals. Facilitators included individualized planning for high-risk patients within multiprofessional teams and alignment with organizational aims such as reducing work disability, supporting remaining functional ability, and tailoring interventions according to functional and work ability needs. Barriers included time constraints, limited resources, staff shortages, long waiting times, high staff turnover, unclear or non-existent LBP pathways, lack of team-level agreements and documentation policies, rigid practices in large OHPC organizations, and limited opportunities for professionals to influence organizational processes and policies. Together, these barriers made sustained uptake of the BPS-oriented practice more difficult in multiprofessional OHPC teams. Figure 23 presents the original Study III generic categories related to organizational and team-based opportunities, motivations and shared direction at meso level.

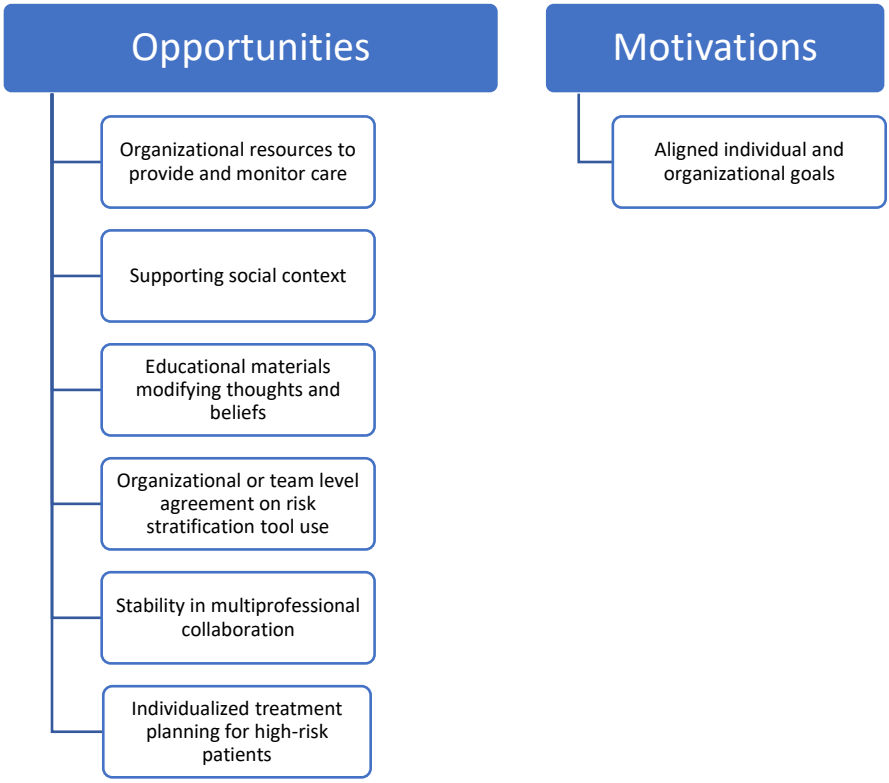

Figure 23. Generic categories related to organizational and team-level determinants of implementation at the meso level

Macro level (Study III)

Study III: Macro-level implementation determinants

At the macro level, perceived facilitators included external expectations to consider psychosocial elements in LBP management, particularly from specialists who expected structured psychosocial assessment before consultations or insurance-related work ability assessments. In addition, media was perceived to raise awareness of psychosocial factors and influence both patient and colleague expectations, thereby creating wider support for a BPS management of LBP.

At the same time, several system-level barriers were identified. These included policy-related restrictions, such as limits on the number of occupational health physiotherapy visits and referral requirements at the time of the study that reduced access to physiotherapists, and the lack of incentives or reimbursement for structured team meetings. Unequal opportunities between patients and units were also perceived to arise from variation in OHPC contract models. In addition, patient self-pay imaging and patient preferences for disability benefits rather than return-to-work were described as external pressures that could conflict with guideline-based BPS management.

Implementation was also hindered by cross-system pathway gaps and limited policy-level support for rehabilitation. Participants described unclear or non-existent LBP care pathways between OHPC and other parts of the healthcare system, as well as a lack of early-stage rehabilitation supports, such as bureaucratic obstacles related to use of partial sick leave. Together, these factors suggested that sustained implementation of the BPS approach was influenced not only by local team and organizational conditions, but also by wider system-level structures, incentives, and expectations. Figure 24 presents the original Study III generic categories related to system-level determinants of implementation at macro level.

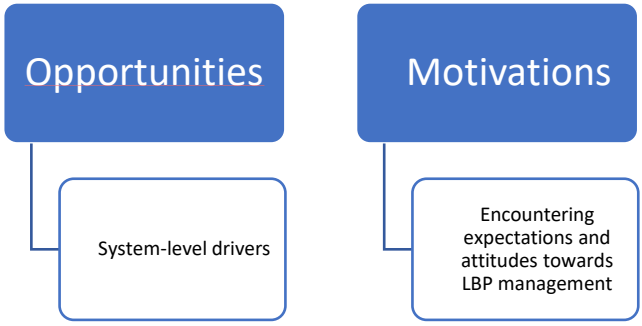

Figure 24. Generic categories related to system-level determinants of implementation at macro level

Meta level (Study IV)

Study IV: Measuring implementation determinants

Study IV contributed a meta-level perspective by examining how implementation determinants can be measured in a multiprofessional rehabilitation context. The findings showed that the multiprofessional version of the Determinants of Implementation Behavior Questionnaire, DIBQ-mp, had excellent content validity and could be used to assess barriers and facilitators relevant to the implementation of guideline-based interventions. The full version covered 18 TDF domains and 93 items, whereas the shorter version included 11 domains and 21 items and was considered feasible for use in multiprofessional rehabilitative contexts.

The retained domains reflected determinants considered pragmatic and relevant to the implementation in everyday clinical setting. These included micro-level domains such as knowledge, skills, beliefs about capabilities, beliefs about consequences, intentions, and behavioral regulation, as well as meso-level domains related to organization, innovation strategy, social influences, and innovation characteristics. In particular, the expert panel emphasized organizational resources and managerial support, training and implementation materials, workflow fit, team norms, and peer support. Overall, meso-level determinants were considered more decisive for implementation than either macro-level system factors or individual psychological profiles, such as optimism, emotions, and goals, as these were considered less pragmatic. Macro-level domains were also excluded from the shorter version because system-level conditions were viewed as relatively stable in Finland. However, these domains remain conceptually important and may be added in future studies when system-level information is needed. Table 13 presents the final tailored DIBQ-mp with item- and scale-level content validities. The translated and context adapted tool can be used to quantify the facilitators and barriers in future implementation processes. The Finnish DIBQ-mp (Toiminnan muutosta ohjaavat tekijät -kysely) is presented in Appendix 9.

Table 13. The final multiprofessional version of the Determinants of Implementation Behavior Questionnaire (DIBQ-mp)

Domain and construct	Item	I-CVI
KNOWLEDGE		
Knowledge	I know how to deliver [guideline-based intervention/procedure].	1.00
Role clarity	Objectives of [guideline-based intervention/procedure] and my role in this are clearly defined for me.	1.00
SKILLS		
Skills	I have been trained in delivering [guideline-based intervention/procedure].	0.78
	I have the skills to deliver [guideline-based intervention/procedure].	0.96
BELIEFS ABOUT CAPABILITIES		
Self-efficacy	I am confident that I can deliver [guideline-based intervention/procedure]	0.95
Perceived behavioral control	For me, delivering [guideline-based intervention/procedure] is (very difficult – very easy).	0.90
BELIEFS ABOUT CONSEQUENCES		
Attitude	For me, delivering [guideline-based intervention/procedure] is (not useful at all – very useful).	1.00
Outcome expectancies	If I deliver [guideline-based intervention/procedure] following the guidelines, this will strengthen the collaboration with professionals with whom I deliver [guideline-based intervention/procedure].	0.88
INTENTIONS		
Intentions	How strong is your intention to deliver [guideline-based intervention/procedure] in the next three months? (not strong – very strong)	0.86
INNOVATION		
Innovation characteristics	It is possible to tailor [guideline-based intervention/procedure] to patients´/clients´/rehabilitees´/participants' needs?	0.91
	[Guideline-based intervention/procedure] is compatible with daily practice.	0.91
ORGANIZATION		
Organizational resources and support	In the organization I work, all necessary resources are available to deliver [guideline-based intervention/procedure].	0.95
	I can count on support from the management of the organization I work in, when things get tough around delivering [guideline-based intervention/procedure].	1.00

PATIENT/CLIENT		
Patient/client characteristics	Patients/Clients/Rehabilitees/Participants consider participation in [guideline-based intervention/procedure] meaningful.	0.88
	Patients/Clients/Rehabilitees/Participants of [guideline-based intervention/procedure] are positive about [guideline-based intervention/procedure].	0.92
INNOVATION STRATEGY		
Innovation strategies	[Implementing organization] provides professionals with a training to deliver [guideline-based intervention/procedure].	0.95
	[Implementing organization] provides sufficient intervention instructions and materials.	0.90
	[Implementing organization] provides assistance to professionals with delivering [guideline-based intervention/procedure].	0.92
SOCIAL INFLUENCES		
Descriptive norm	Professionals with whom I deliver [guideline-based intervention/procedure] deliver [guideline-based intervention/procedure] following the guidelines.	0.95
Social support	I can count on support from professionals with whom I deliver [guideline-based intervention/procedure] when things get tough around delivering [guideline-based intervention/procedure].	0.96
BEHAVIORAL REGULATION		
Action planning	I have a clear plan of how I will deliver [guideline-based intervention/procedure].	1.00
		S-CVI/Ave 0.93
I-CVI = Item-level content validity index; S-CVI/Ave = scale-level content validity index, averaging method		

Discussion

Main findings

Overall aim of this doctoral research was to investigate whether a targeted educational intervention in guideline-based BPS care leads to successful implementation and consequent improvement of LBP management in Finnish OHPC, using a cluster-randomized design. The findings showed that such an intervention can influence both resource allocation and the quality of LBP management compared with usual care. Improvements were observed at the micro level in clinicians' skills and guideline-concordant behaviors, and at the meso level in the organization of care and task allocation. However, important barriers remained, particularly in organizational processes, care pathways, and broader system structures. In addition, this dissertation contributed by tailoring a feasible and content-valid tool for measuring implementation determinants in multiprofessional rehabilitative contexts.

The findings indicate that successful implementation of BPS management depends not only on professional learning but also on sustained organizational support, clear care pathways, and implementation strategies that extend beyond individual training to the team and system levels. The findings show how implementation is shaped by what enabled or constrained changes in professional behavior (micro level), or in organizations (meso level), what system structures supported or limited change (macro level) and how implementation determinants can be assessed to better target future strategies (meta level). These findings align with the broader implementation literature showing that to evidence-based care requires change across the whole implementation chain, including healthcare professionals, supervisors, leaders, administrators, patients, and caregivers, who need to adopt new practices, discontinue existing ones, or both[107,189]. Individual professionals or local champions may facilitate progress, but their influence remains limited if the surrounding structures do not support new ways of

working. This is consistent with Ng et al., who mapped barriers and enablers to the COM-B and TDF frameworks and concluded that adoption of BPS pain care requires coordinated action from multiple stakeholder groups across micro, meso, and macro levels[190]. In their conceptual model, opportunity, that is, the possibilities provided by the environment, is given a particularly central role. They also identify several relevant stakeholder groups, including healthcare professionals, educators, guideline developers, supervisors and policymakers.

Micro level

At the micro level, the findings indicate that targeted BPS training can strengthen clinicians' knowledge, skills and confidence in their and their teams' capabilities on treating patients with differing risk profiles. These changes were also reflected in more guideline-concordant BPS behaviors in documentation. However, they were not yet fully embedded into routine practice. In Study I, physiotherapists in the intervention arm more often documented psychosocial dimensions, use of risk stratification, behavioral strategies and advice to stay active, yet person-centered elements, such as patient's goals, values, resources or treatment expectations, were rarely documented. Study III further suggests that clinicians perceived improved confidence, shared understanding and communication skills, but also reported difficulties remembering and applying BPS tools consistently in daily routines.

Thus, the main micro-level challenge was not only whether clinicians accepted BPS principles, but whether they had sufficient practical support to enact them repeatedly in patient encounters. This supports behavior change literature emphasizing instruction, behavioral practice, feedback and cues or prompts as mechanisms for translating capability into sustained clinical behavior[190-194]. The interpretation is consistent with previous literature showing that clinicians' adoption of a BPS approach is influenced by their knowledge, skills, beliefs, communication abilities, and time constraints[191]. It also reflects a broader challenge in LBP care: the BPS model is often applied narrowly, with emphasis on biological and

cognitive-behavioral aspects, while social, cultural, relational, and institutional dimensions receive less attention[195].

Primary care BPS interventions for persistent LBP have been shown to likely reduce pain and disability compared with education or advice alone, and that interventions with a clear focus on psychosocial factors, such as pain understanding, unhelpful thoughts, coping styles, and goal setting, appear most promising[63]. This is consistent with national and international LBP guidelines, which recommend a BPS approach, physical activity, attention to psychosocial factors, and avoidance of low-value care such as unnecessary imaging and other non-recommended interventions[27,196-198]. Yet, adherence to these principles remains partial in routine practice, and low-value care for LBP continues to be a widespread international problem[19,199].

At the same time, sufficient delivery of BPS elements seems to require more than brief training: van Erp et al. noted that physiotherapists often received only short training programs, and that delivery was more adequate when training was supported by manuals, supervision, and practical resources[63]. Similarly, interdisciplinary pain training can improve BPS knowledge, attitudes, and guideline-adherent recommendations up to 6 months after training, but improved knowledge and attitudes do not necessarily confirm sustained clinical behavior change, and persistent biomedical beliefs may remain even after training[200-202]. Thus, training may initiate improved skills, but sustained implementation requires also a shared and sufficiently comprehensive understanding of what BPS care means in practice, for example instruction on how to perform a behavior and having a chance for behavioral practice/rehearsal[190]. It is important to systematically consider whose behavior needs to change at the workplace and how[120], and also how work practices may need to change within the occupational health team.

The documentation findings of Study I are important in this respect. Documentation improved as a marker of guideline-concordant BPS behavior, but documentation remains as a proxy for actual clinical behavior, and proxy measures do not always fully correspond with directly observed practice[192]. Thus, although the

observed changes are encouraging, they cannot confirm that trained clinicians consistently delivered care according to BPS principles in every patient encounter. Previous research has also shown that clinicians may not deliver interventions according to their intended principles even after training, and that maintaining new practices over time is challenging because professionals may gradually revert to established routines when reinforcement is lacking[203,204].

Taken together, the main micro-level challenge was not whether behavior change could begin after training, but whether it could be sustained, generalized, and integrated into routine care. Future implementation efforts in occupational health should move beyond education towards multicomponent support structures, such as mentoring, workflow redesign, decision support, reminders, and feedback mechanisms. This aligns with thinking on the 'future pain clinician', which emphasizes that psychologically informed and person-centered care requires a broader set of competencies than knowledge alone, and that these competencies need ongoing support in practice[142,193,204].

Meso level

At the meso level, implementation depended on organizational support and team processes. The findings suggest that the implementation of guideline-based BPS care was shaped not only by individual professionals' capabilities, but also by how care was organized, supported, and coordinated within OHPC. Study II showed that the intervention shifted resource use towards more multiprofessional, physiotherapist-driven care without substantially increasing total costs. This suggests that implementation may enable redistribution of tasks and resources rather than simply adding workload or expenditure. This is particularly relevant in OHPC, where costs are closely monitored.

Risk stratification, work ability support and return-to-work coordination require clear roles, agreed pathways and coordinated multiprofessional input. However, Study III showed that embedding of BPS care remained constrained by meso-level barriers. These included unclear care pathways, insufficient time and resources, staff

turnover, limited time for multidisciplinary reflection, lack of team agreement, restricted access to BPS-trained physiotherapists and difficulties in integrating BPS tools into everyday routines. In the absence of organizational support and structured pathways, high-risk patients were often managed without coordinated team-based processes.

This interpretation is consistent with broader implementation literature showing that education alone is rarely sufficient to produce durable change. Implementation strategies are highly context-dependent, and change is more likely to become routine when supported by organizational capability, workflow redesign, facilitation, feedback, digital prompts and locally agreed procedures[139,143]. Ng et al. similarly emphasize that BPS implementation depends on opportunity factors such as resourcing, infrastructure, multidisciplinary networks, aligned messages between professional and work processes compatible with evidence-based care[190,191].

The findings are also consistent with evidence that implementation success depends on the work community and organizational routines. Practice facilitation, which supports teams in workflow change, problem-solving and data use, has shown positive effects in primary care settings, suggesting that implementation is strengthened when change is actively supported at team and service level rather than left to individual clinicians[143].

From the perspective of BPS-oriented LBP care in OHPC, many implementation barriers are inherently meso-level organizational conditions that individual professionals can influence only partially. Therefore, future strategies should include meso-level supports such as organizational readiness assessment, leadership engagement, facilitation, audit and feedback, workflow redesign and digital decision support[139,143,205].

Taken together, the meso-level findings indicate that successful implementation of BPS care requires organizational capacity to translate individual learning into collective practice. In this study, the intervention appeared to support a more appropriate redistribution of care towards multiprofessional, physiotherapist-led management,

but long-term embedding was limited by weaknesses in organizational support, team processes and care pathway structures. This is consistent with the IMPaCT Back study, showing that reorganizing pathways and task allocation can improve care delivery without necessarily increasing costs: implementing stratified care in primary care was associated with improved patient outcomes and reduced time off work, demonstrating how pathway redesign and role redistribution can matter at least as much as individual clinician training[206].

Macro level

At the macro level, system-level structures can enable or constrain implementation. Beyond local teams and organizations, the implementation of guideline-based BPS care was shaped by wider system-level structures, including referral policies, reimbursement arrangements, contract variation, occupational health - primary care – rehabilitation pathway gaps, and expectations from insurers, specialists, employers and patients. In OHPC, these structures influence which contacts, work ability assessments, follow-up activities, workplace collaboration and multiprofessional services are practically possible. Improving LBP management and preventing work disability is therefore not only a matter of local clinical implementation, but also a system-level issue: reducing low-value care and reallocating resources towards evidence-based practices require supportive incentives, structures, and documentation systems.

The broader LBP literature strongly supports this interpretation. Buchbinder et al. argue that reducing low-value LBP care requires action not only at clinician level, but also in funding, policy, service design, and public and professional expectations[199]. Similarly, Ng et al. qualitative evidence synthesis showed that adoption of a BPS approach is influenced also by policy, funding, service provision, referral processes, organizational regulations and prevailing biomedical culture[191]. These factors are particularly relevant in OHPC, where service contracts and reimbursement structures may either support or limit the time, roles and collaboration required.

The findings of this doctoral research align with this interpretation. Study III showed that full adoption of BPS management had not been achieved one year after implementation, partly because organizational and system-level opportunity factors were perceived to limit continuity of care, especially for patients at increased risk for work disability. This suggests that even when professionals are motivated and trained, implementation may remain partial if the surrounding service system does not support the desired model of care.

Risk-stratified care illustrates this macro-level challenge. George et al. state that although risk-stratified care has shown promise, particularly in the original STarT Back trial, later trials across LBP and other musculoskeletal pain conditions have often failed to demonstrate superior effectiveness compared with usual care [57]. This was also reflected in our cluster-randomized trial: brief BPS training did not improve patients' functional capacity at the 1-year follow-up[171]. Importantly, this does not necessarily mean that risk-stratified care is ineffective as a concept, but rather that its real-world implementation is challenging. Reported barriers, such as limited use of screening tools, insufficient referral uptake, incomplete uptake of training and uncertainty about whether psychologically informed physiotherapy was delivered as intended, indicate that risk stratification requires more than introducing a screening instrument. It requires aligned pathways, reimbursement logic, professional roles and monitoring systems that make targeted care feasible[57].

In the same direction, de-implementation evidence from primary care suggests that single strategies are usually weak, whereas multifaceted approaches, especially provider education combined with audit and feedback, can reduce low-value care with moderate-certainty evidence[207]. This combination was associated with a relative reduction of about 23% in desired low-value care, while more complex packages that also included patient education showed potentially larger but less certain effects[207]. This logic is directly relevant to LBP care, where low-value diagnostics, non-evidence-based treatments, and fragmented pathways remain system-sensitive problems.

In Finland, the statutory basis of occupational healthcare and the Decree on Good Occupational Healthcare Practice create both an obligation and an opportunity to organize care systematically[145]. However, legislation alone does not guarantee that reimbursement models, contracts or service structures support multiprofessional BPS implementation in routine practice. Taken together, the macro-level findings suggest that successful implementation of BPS care requires system conditions that support evidence-based resource allocation and de-implementation of low-value care. Future implementation therefore requires attention not only to clinicians and organizations, but also to the policy, payer and service structures that determine whether guideline-concordant care can be delivered consistently.

Meta level

At the meta level, measuring implementation determinants support future implementation. In addition to examining implementation outcomes across micro, meso, and macro levels, this dissertation contributed by tailoring a practical tool for measuring implementation determinants in a multiprofessional rehabilitation context. The DIBQ-mp in study IV was reduced from 93 items across 18 domains to a pragmatic 21-item version covering 11 TDF domains considered most relevant to multiprofessional rehabilitation. The tool showed excellent content validity and was considered suitable for different Finnish social and healthcare settings. The DIBQ-mp can support future implementation planning by helping identify determinants related, for example, to knowledge, skills, beliefs, innovation, organization, social influences and behavioral regulation. In OHPC, such measurements may help move implementation support from general education towards more targeted strategies.

This also aligns with broader literature on psychologically informed care. Ballengee et al. conclude that psychologically informed physical therapy has evidence of benefit in selected patient groups, but pragmatic trials have shown less consistent effects, partly because of implementation challenges[208]. Their proposed implementation roadmap emphasizes moving beyond efficacy trials towards hybrid effectiveness-implementation designs, where clinical outcomes,

implementation outcomes, contextual barriers and facilitators, and sustainability are evaluated together[208].

Reflection on implementation strategies

Our implementation strategy followed a multifaceted design, with education as the dominant mechanism targeting capability and motivation. Initial training was reinforced through booster sessions, while opportunity was supported through materials, clinical champions, and outreach visits. Although multifaceted implementation strategies are generally more likely to improve practice than single, the effectiveness of implementation strategies depends less on the number of components and more on how well strategies are targeted, active, and integrated to address the determinants of practice change[139,140,209]. Multifaceted strategies may target multiple determinants simultaneously. This is important because implementation barriers are rarely single domain (such as knowledge (capability); beliefs (motivation); workflow, time, resources (opportunity); and system constraints. Single strategies typically target only one domain, and multifaceted strategies can address capability, opportunity and motivation together.

Our findings are consistent with broader implementation evidence showing that educational strategies typically produce modest improvements in care processes, while effects on patient outcomes are smaller and less consistent, especially when implementation relies on a single component or time-limited implementation strategy[139,141,142]. In LBP-specific implementation literature, one-off or single-component implementation efforts have largely been unsuccessful, whereas sustained and repeated strategies have been more likely to improve clinical practice[142]. Simpson et al. show that training physical therapists to deliver individualized BPS interventions for musculoskeletal pain has often been insufficiently reported and variably implemented[66]. Brief, mainly didactic, training is unlikely to support the paradigm shift and behavioral change required for competent BPS practice. More robust training approaches included experiential learning, supervision, feedback, post-training mentoring,

competency assessment, and fidelity monitoring[66]. This aligns with the findings of this doctoral research, suggesting that future implementation strategies should include also structured referral pathways, documentation support, ongoing mentoring, and organizational strategies that enable professionals to deliver BPS care as intended in routine practice.

Boaz et al. concluded that the effects of implementation strategies are highly context-dependent, and the field should move away from searching for one universally effective strategy towards building context-sensitive combinations of strategies[139]. Tailored implementation strategies are frequently recommended to improve healthcare professionals' practice and despite the increase in the number of new studies identified, the update of Cochrane review concludes that tailored implementation strategies probably result in a slight improvement in professional practice[210]. It is not yet clear how best to tailor interventions and therefore not clear what the effect of an optimally tailored intervention would be and no single optimal method for tailoring has been established. Several frameworks can guide tailoring: Theory informed approaches including COM-B /Behavior Change Wheel, TDF, Diffusion of innovations, as well as Pragmatic or commonsense approaches[211]. This theory-informed tailoring fits well with the use of DIBQ-mp in future studies.

To successfully implement innovations, organizations are suggested to involve stakeholders from multiple organizational levels[103,110,212], apply a variety of implementation strategies tailored to local context, leverage existing enablers, and address barriers to change[126]. Unfortunately, not all organizations have the capacity for conducting change on their own; many lack infrastructure support, necessary resources, or knowledge and understanding of change processes[110]. In this study, the lack of opportunity to support organizations in these changes was reflected in the findings.

Evidence from stratified LBP care suggests that patient-level benefits are most plausible when screening is linked to matched treatment pathways, professional training, role redesign and implementation support[49,206]. However, successful implementation does not always transfer to patient-level outcomes. Vice versa, the lack

of an intervention effect can be due entirely or in part to the implementation. If there is poor reach into the population, low engagement, or poor fidelity, the overall impact will inherently be low as well [64]. Therefore, future implementation should not rely on education-led strategies alone but combine training with meso- and macro-level supports, including workflow redesign, prompts and screening questionnaires integrated in EPR systems, structured care pathways, audit and feedback, facilitation, leadership engagement and mechanisms for monitoring fidelity. This is particularly relevant for BPS-oriented LBP care, where the desired behaviors, such as risk stratification, psychosocial assessment, person-centered goal setting, work ability support and coordinated follow-up, are complex and distributed across professionals and service structures.

Contribution of the dissertation

The contribution of this dissertation is not that it identifies entirely new barriers to BPS implementation, but that it shows how known implementation challenges interact in the specific context of Finnish OHPC. First, international evidence on implementing BPS models for LBP in OHPC is more limited than in general primary care. This dissertation adds cluster-randomized evidence on how targeted training was reflected in physiotherapists documented clinical behavior, multiprofessional resource use and costs, and perceived implementation determinants across micro, meso, and macro levels.

Second, the finding that capability and motivation improved while opportunity-related barriers remained dominant provides a concrete COM-B-based explanation for why education alone was insufficient[120]. While the intervention supported changes in knowledge, confidence and documented practice, sustained implementation depended on whether organizational routines, care pathways, digital systems, and resources enabled these behaviors in routine care.

Third, the DIBQ-mp extends the measurements in implementation research by offering a pragmatic tool for monitoring determinants in multiprofessional rehabilitation contexts. This facilitates tailored

implementation planning, in which strategies are selected based on identified barriers and facilitators rather than applied as generic education[211].

Fourth, the 12-month real-world follow-up indicates that BPS implementation may be initiated at professional level but remain only partially embedded in practice when organizational and system-level support is insufficient. This finding is consistent with prior evidence suggesting that implementation effects are often modest and strongly influenced by contextual factors and organizational capability[139].

Methodological considerations

A major strength of this doctoral research is the use of complementary methods across quantitative and qualitative designs. The cluster-randomized trial enabled evaluation under routine care conditions across nationwide OHPC providers and multiple clinical units, supporting the external validity[164]. The use of EPR and registry-based data allowed assessment of real-world resource use, sick leave, and documented clinical behaviors without additional burden to patients or professionals[164,213-215].

Another strength is the multilevel perspective on implementation evaluation. In Study I, retrospective EPR analysis enabled evaluation of actual clinical documentation using predefined quality criteria. The use of two independent assessors with consensus procedures strengthened credibility and reproducibility[216]. In Study II, registry-based data enabled comparison of guideline-based BPS care with usual occupational health practice in real-world conditions. Study III examined barriers and facilitators one year after the intervention using focus group interviews. The combination of deductive analysis informed by COM-B-model and the inductive content analysis, together with triangulation with implementation theory, strengthened trustworthiness[177]. The qualitative sample was large and multidisciplinary, including 51 participants across 12 focus groups, providing diverse perspectives. Purposive sampling enabled inclusion of information-rich participants with relevant experience on the implementation process and willingness to participate[217-219]. Rather

than relying on saturation, sample adequacy can be interpreted through the concept of information power, whereby the most relevant information the sample holds, the fewer participants are required[220,221]. Given the focused study aim and specificity of the sample, the qualitative dataset can be considered sufficiently informative. Study IV further strengthened the thesis by developing a pragmatic cross-culturally adapted version of the DIBQ for multiprofessional rehabilitation (DIBQ-mp), using Delphi methodology. The process combined quantitative consensus ratings with qualitative assessment and involved experts from diverse professional backgrounds from different parts of Finland, supporting content validity and applicability[180,181,188,222].

The intervention itself represented a novel application of a guideline-based BPS model within OHPC and, to our knowledge, was the first effort to implement such a model in Finnish OHPC practice. The multiprofessional training of physicians and physiotherapists may have fostered shared understanding, clarified professional roles, and facilitated the development of more coordinated care processes. In addition, this type of training with patient case demonstrations may improve awareness of how to apply evidence-based treatment approaches across professional groups and thereby help the reduction of the use of non-evidence-based practices in LBP management.

Several limitations should be acknowledged. First, documentation was used as a proxy for clinical behavior, meaning that Study I reflects documented rather than all delivered care[194,223]. Narrative records required interpretation, and the evaluation and scoring captured the presence rather than the depth or adequacy of documentation. Variation in EPR systems, incomplete records, and limited contextual information such as time constraints, patient preferences, and shared decision-making may have influenced the findings[224-228].

Second, cost analysis was affected by baseline imbalances and potential selection bias, as recruitment was lower in the control arm. Training costs were not included in the primary analysis, although sensitivity analyses suggested that adding training costs did not substantially change the findings (Appendix 8). In addition, the analysis did not include healthcare resource use outside OHPC,

sickness absence due to other diagnoses, and presenteeism, limiting conclusions from a broader societal perspective.

Third, the implementation strategy was multifaceted but education driven. It consisted of initial training supported by booster sessions, with complementary elements such as materials, clinical champions, and outreach visits. The relatively short duration and limited long-term support may have constrained sustained behavior change, particularly given that implementation of BPS care requires changes in professional roles, team routines and processes, and organizational structures[65,142,229-232].

Qualitative data are subject to potential response biases, particular in focus group settings. Power dynamics within multiprofessional teams may have influenced the expression of views, and not all perspectives may have been equally represented. While individual interviews could have reduced this risk, focus groups enabled exploration of shared experiences and team-level processes, which remain underexplored in this context. Importantly, interview data cannot verify actual clinical behavior or identify missing competencies. Observational methods, such as video-recorded consultations evaluated with validated tools, could have provided complementary insights into clinical practice. However, video-recordings cannot demonstrate the professionals' perceptions of facilitators and barriers to adoption and multiprofessional collaboration.

Finally, the DIBQ-mp reflects expert consensus within the Finnish multiprofessional rehabilitation context. Its generalizability to other healthcare systems requires further evaluation. Additionally, some deviations from the original protocol should be noted[162]. Professional self-reported questionnaires were not used, and certain cost components, such as spine surgery, prescription reimbursements, and visits to publicly provided healthcare were not fully captured in national healthcare registers. Furthermore, variability in organizational contexts, including ongoing structural changes, uneven participation in training, and limited exposure to booster sessions, may have influenced implementation outcomes.

Conclusions

Specific conclusions

Training in a guideline-based BPS approach was associated with more frequent documentation of behaviors aligned with high-quality LBP management. Physiotherapists who received BPS training consistently assessed psychological and social dimensions of LBP, used risk stratification, and implemented behavioral strategies. However, the overall quality of LBP management varied, and person-centered aspects such as goals, values, resources and expectations, as well as the link between assessment and treatment planning, remained insufficiently documented. (Study I)

Brief BPS training may support a shift in OHPC resource use from solely physician-driven care to multiprofessional, physiotherapist-driven care for management of patients with LBP in differing risk groups of work disability without a substantial increase in total costs. (Study II)

OHPC professionals perceived micro-level capabilities and motivations mainly as facilitators of the implementation of guideline-based BPS management of LBP in multiprofessional teams. Barriers were perceived mainly in opportunities, especially at meso and macro levels. These findings suggest that future implementation efforts should place greater emphasis on organizational and system-level strategies. (Study III)

A cross-cultural translation and adaptation process resulted a Finnish translation and a tailored tool, DIBQ-mp, for quantifying the facilitators and barriers in future implementation processes. The short version emphasizes pragmatic micro- and meso-level determinants and was shown to be feasible for multiprofessional rehabilitative contexts. (Study IV)

Overall conclusion

Despite improvements in the quality of LBP assessment and treatment, OHPC resource allocation and professionals' individual capabilities and motivations, integration of BPS management into routine practice remained incomplete at 12-month follow-up. These findings indicate that the multifaceted implementation strategy with a primary emphasis on education was insufficient to achieve sustained implementation. Complementary implementation strategies are needed to support consistent quality, documentation, and long-term use of BPS management. Embedding BPS management of LBP into routine OHPC practice requires sustained organizational support, clear structures and care pathways, and implementation strategies that extend beyond individual training to team and system levels.

Clinical implications

The findings of this doctoral research have several practical implications for the implementation of guideline-based BPS care in OHPC.

- Interaction between professional groups is important for implementation of BPS approach and risk stratification. Training should therefore be delivered multiprofessionally, and preferably to occupational healthcare teams, so that the educational setting mirrors everyday clinical practice. When professionals learn together in roles similar to those in routine practice, this may strengthen shared understanding, clarify responsibilities, and support the adoption of more coordinated processes for supporting work ability.
- Early identification of patients with increased risk for work disability, who may need broader support, is important. For high-risk patients, workplace collaboration should be acknowledged. If clinical judgment, risk assessment, or work ability evaluation indicates that work-related factors are relevant, collaboration with the workplace should be initiated early rather than only after problems have become prolonged.
- Care pathways for patients with differing risk groups should be clarified and strengthened. High-risk patients often require more comprehensive assessment, timely access to appropriate professionals, and coordinated follow-up. Occupational healthcare teams should therefore agree on responsibilities and the division of tasks, while ensuring sufficient time and resources for guideline-concordant BPS assessment and treatment.
- Leaders and managers should be actively engaged in implementation. Organizational commitment is needed to support documentation practices, clarify care processes, and enable the use of digital systems that facilitate risk stratification, care planning, follow-up, and monitoring.
- Implementation should be monitored systematically. Practical tools such as the DIBQ-mp may help identify barriers and

facilitators over time and guide efforts needed at both individual and organizational levels.

- Further development of task allocation could support more appropriate use of resources in musculoskeletal care. Musculoskeletal disorders may be managed more effectively through better use of occupational health physiotherapists' expertise. In the future, especially if shortages in primary care physicians persist, physiotherapists may have an increasingly important role in the management of substantial groups of individuals with LBP.

Future research implications

Based on this thesis, several important questions remain. Future research should determine which combinations of implementation strategies are sufficient to sustain behavior change in occupational healthcare, which determinants are most influential across professions and organizations, and under what conditions changes in documented and perceived practice translate into implementation fidelity and improved patient outcomes. Further work is also needed to clarify how risk-stratified, multiprofessional care pathways for high-risk patients should be organized, how organizational and digital infrastructures can better support implementation, and whether tools such as the DIBQ-mp can be used to guide more precisely tailored implementation strategies in routine care.

This doctoral research provides an important foundation for future studies on the implementation of guideline-based BPS care in OHPC. Overall, the trial design can be considered closer to a Hybrid Type 1 study design, in which the primary focus was on clinical and service outcomes, while implementation was examined as a secondary aim. However, future research should move beyond this approach.

- Given the existing evidence supporting BPS-oriented LBP care, future studies could more explicitly adopt Hybrid Type 2 or Type 3 designs, with greater emphasis on testing implementation strategies and evaluating their effects on both implementation and patient-related outcomes[233-235]. The present findings therefore offer a strong basis for designing future hybrid studies in which a more refined implementation strategy can be tested.
- Future research should particularly focus on strengthening the organizational and practical conditions that support implementation.
    - Digital documentation systems and decision-support tools should be examined as potential facilitators of implementation, especially in supporting risk stratification, care planning, follow-up, and more consistent documentation of BPS-oriented care.

    - Implementation readiness should be assessed at both individual and organizational levels. This includes evaluating professionals' baseline competence, as well as organizational readiness and leadership support, and capacities such as available resources. Such assessments could help make local adaptations and tailor implementation strategies more effective.
    - Future interventions may benefit from more systematic mentoring, competence evaluation after the training, and other forms of ongoing support to strengthen long-term adoption.
- Involve patients more actively in the design, refinement, and evaluation of both care pathways and implementation strategies. Patient involvement could improve the relevance, acceptability, and feasibility of interventions, and help ensure that implementation efforts align with the needs and preferences of those receiving care.

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Appendices

Appendix 1. STarT Back Tool[51]

The Keele STarT Back Screening Tool

Patient name: _____ Date: _____

Thinking about the **last 2 weeks** tick your response to the following questions:

		Disagree 0	Agree 1
1	My back pain has **spread down my leg(s)** at some time in the last 2 weeks	☐	☐
2	I have had pain in the **shoulder** or **neck** at some time in the last 2 weeks	☐	☐
3	I have only **walked short distances** because of my back pain	☐	☐
4	In the last 2 weeks, I have **dressed more slowly** than usual because of back pain	☐	☐
5	It's not really safe for a person with a condition like mine to be physically active	☐	☐
6	**Worrying thoughts** have been going through my mind a lot of the time	☐	☐
7	I feel that **my back pain is terrible** and **it's never going to get any better**	☐	☐
8	In general I have **not enjoyed** all the things I used to enjoy	☐	☐

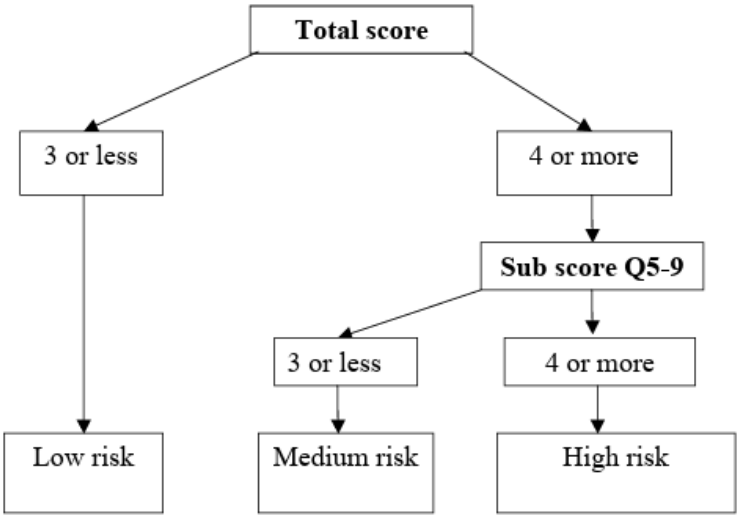
9. Overall, how **bothersome** has your back pain been in the **last 2 weeks**?

Not at all	Slightly	Moderately	Very much	Extremely
☐ 0	☐ 0	☐ 0	☐ 1	☐ 1

Total score (all 9): _____ **Sub Score (Q5-9):**_____

Funded by Arthritis Research UK

The STarT Back Tool Scoring System



Funded by Arthritis Research UK

Appendix 2. The short form of the Örebro Musculoskeletal Pain Screening Questionnaire[50]

Name_____Date_____

1. How long have you had your current pain problem? Tick (√) one.

0-1 weeks [1] □ 1-2 weeks [2] □ 3-4 weeks [3] □ 4-5 weeks [4] □ 6-8 weeks [5] □
9-11 weeks [6] □ 3-6 months [7] □ 6-9 months [8] □ 9-12 months [9] □ over 1 year [10] □

2. How would you rate the pain that you have had during the past week? Circle one.

0 1 2 3 4 5 6 7 8 9 10
No pain *Pain as bad as it could be*

Please circle the one number which best describes your current ability to participate in each of these activities.

3. I can do light work for an hour.

0 1 2 3 4 5 6 7 8 9 10
Can't do it because of the pain problem *Can do it without pain being a problem*

4. I can sleep at night.

0 1 2 3 4 5 6 7 8 9 10
Can't do it because of the pain problem *Can do it without pain being a problem*

5. How tense or anxious have you felt in the past week? Circle one.

0 1 2 3 4 5 6 7 8 9 10
Absolutely calm and relaxed *As tense and anxious as I've ever felt*

6. How much have you been bothered by feeling depressed in the past week? Circle one.

0	1	2	3	4	5	6	7	8	9	10
Not at all										*Extremely*

7. In your view, how large is the risk that your current pain may become persistent?

0	1	2	3	4	5	6	7	8	9	10
No risk										*Very large risk*

8. In your estimation, what are the chances you will be working your normal duties in 3 months

0	1	2	3	4	5	6	7	8	9	10
No chance										*Very Large Chance*

Here are some of the things which other people have told us about their pain. For each statement, please circle one number from 0-10 to say how much physical activities, such as bending, lifting, walking, or driving affect your pain.

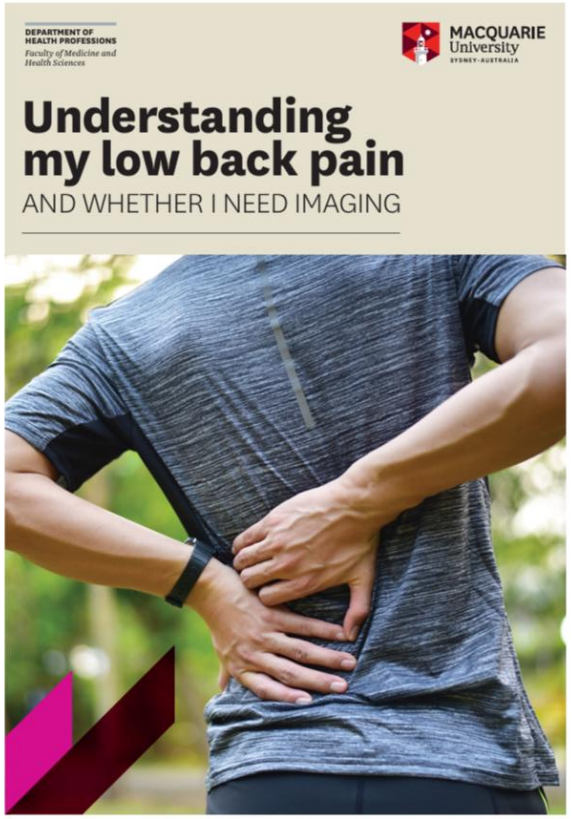
9. An increase in pain is an indication that I should stop what I'm doing until the pain decreases.

0	1	2	3	4	5	6	7	8	9	10
Completely disagree										*Completely agree*

10. I should not do my normal work with my present pain.

0	1	2	3	4	5	6	7	8	9	10
Completely disagree										*Completely agree*

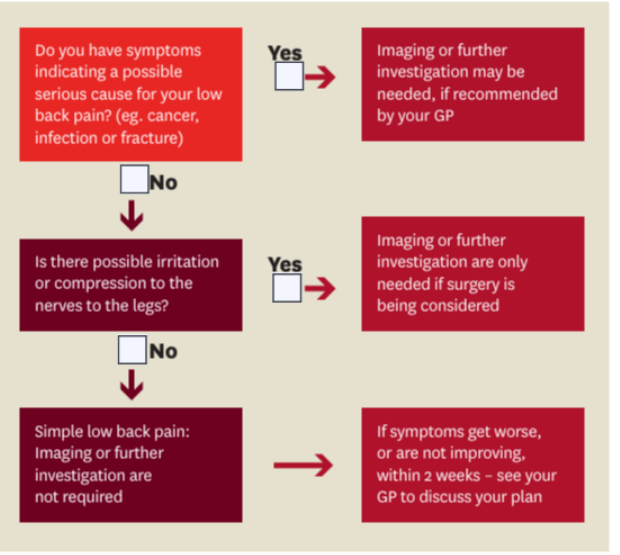
Appendix 3. Patient education booklet[89]



Do I need imaging or further investigations?

Imaging or further investigations don't usually help low back pain. Your GP can show you whether you need further investigations based on the flowchart below:

Name: _____



All about low back pain

WHAT IS CAUSING MY LOW BACK PAIN?

Common causes of low back pain include minor soft tissue injuries such as muscle spasm or joint sprain.

Less than 1 in 100 people with low back pain have a serious cause for their pain (eg, fracture, cancer, infection or inflammatory arthritis).

These conditions are usually obvious and your GP will take a clinical history and perform an assessment to 'check' for them.

I HAVE STRONG PAIN – DOESN'T THIS MEAN A BAD INJURY HAS OCCURRED?

No – lots of research shows that strong pain does not equal a bad injury.

Many people experience a lot of pain. This does not mean there is any damage in their back.

Some factors that can change the pain you feel include your mood and stress levels, your sleep quality and your lifestyle and general fitness levels.

HOW COMMON IS SIMPLE LOW BACK PAIN?

It is common and often reoccurs.

Four out of five people will get low back pain at some time in their life. Half of these will go on to get further episodes of back pain throughout their life.

Recurrence is common and does not mean that there is greater reason for concern.

WHAT IS SIMPLE LOW BACK PAIN?

Low back pain, where **no indication of a serious cause can be found.**

Pain may be mild or very strong, but it **typically improves a lot over the first couple of weeks.**

There may also be pain into the legs. **As the back gets better, the leg pain usually improves too.**

Why isn't imaging needed?

Imaging (eg, x-rays, CTs or MRI scans) doesn't usually **help find the cause of pain.**

The **treatment and speed of recovery** for most cases of back pain **is the same whether imaging is used or not.**

WON'T IMAGING SHOW WHAT IS CAUSING MY LOW BACK PAIN?

No - the underlying cause of back pain **cannot** usually be seen on imaging.

Imaging can help diagnose serious causes of low back pain - but, these are very rare and your GP will check for signs of them.

I KNOW OTHER PEOPLE WHO FOUND 'CHANGES' ON IMAGING OF THEIR BACK – WHAT IF I HAVE THESE 'CHANGES' TOO?

Many 'changes' can be seen on imaging, but it is unknown if they are causing your pain.

Most of the 'changes' seen on imaging are normal and more common the older you get.

Even people **without back pain** commonly have imaging 'changes'. For example, 6 out of 10 middle aged people without back pain have changes on imaging such as disc bulges or degeneration.

WHY SHOULDN'T I GET IMAGING 'JUST IN CASE'?

Unnecessary imaging has some **risks:**

- **Radiation** exposure (for x-ray and CT) can **increase the risk of cancer.** Less radiation is better
- It can **cost you money** and is **time consuming**
- **Changes on imaging are often seen and may cause stress, anxiety and worry,** even though they are usually unimportant
- Imaging has been associated with **worse patient outcomes** and an increase in **unnecessary surgery**

What can I do to help decrease my low back pain?

The best thing you can do is to **stay as active** as possible.

HOW WILL ACTIVITY HELP MY LOW BACK PAIN?

Activity keeps the back mobile, flexible and strong. **Movement, even if it causes temporary mild pain, is good for your back.**

Research shows that bed rest or prolonged inactivity can delay recovery.

WHAT EXERCISES CAN I DO WHEN I HAVE LOW BACK PAIN?

Any exercise you enjoy can help decrease your pain and get you moving.

Some suggestions include:

- **Gentle stretches or exercises** (such as Tai Chi or Yoga)
- Aerobic exercises like **walking or swimming**

You can also ask your GP for some safe exercises and stretches if you are unsure.

IS THERE ANYTHING ELSE I CAN DO?

- Try to stay positive and take steps towards a healthier lifestyle.
- When you feel stressed, angry or worried your pain might feel worse. Managing these feelings might help your low back pain.
- Lifestyle factors may also be associated with low back pain. You might find it helpful to address poor sleep patterns and consider changes to diet, alcohol intake and smoking.

MY BACK HURTS – HOW CAN I STAY ACTIVE?

You may need to take things a bit easier for a few days, but **you also need to get back into your normal activities as soon as possible.**

Normal activities include your regular work, household and recreational activities.

Staying active is safe with simple low back pain – even if there is some pain.

Pain with movement does not mean you are doing any damage to your back.

What is my low back pain management plan?

THE FOLLOWING SUGGESTIONS MAY HELP REDUCE YOUR PAIN AND INCREASE YOUR RECOVERY:

- Take it easy for the first day or two after the pain starts if needed, then start getting back into your normal daily activities as soon as possible.
- Try to avoid staying in one position for a prolonged time.
- Try some gentle exercise such as walking, swimming or stretching.

POSSIBLE PAIN-RELIEF STRATEGIES RECOMMENDED BY YOUR GP:

- ☐ Pain-relief medications: _____
- ☐ Heat
- ☐ Referral to a physiotherapist / chiropractor / osteopath / other _____

OTHER SUGGESTIONS FROM YOUR GP (EG. SPECIFIC EXERCISES, STRESS RELIEF, SLEEP STRATEGIES ETC.)

What should I do next?

☐ Please come back in _____ for a review

☐ Please come back if your pain is not improving after _____ weeks

☐ As long as your pain is improving you do not need to return for a review

WHEN SHOULD I RETURN FOR FURTHER MEDICAL ADVICE?

Occasionally low back pain does not improve or symptoms may change.

CONTACT YOUR HEALTH CARE PRACTITIONER IF YOU HAVE ANY OF THE FOLLOWING SYMPTOMS:

1. Difficulty passing or controlling urine or stool
2. Numbness around your back passage or genitals or in both legs
3. Unsteadiness on your feet
4. Pain which gets worse rather than better over several weeks
5. Feeling generally unwell with your low back pain (for example: fever or unexplained weight loss)

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Where can I find more information about low back pain?

There are a number of resources on the internet you can access to get quality information about the diagnosis and treatment of low back pain. Some suggested online resources include:

Low back pain information; South Australia Health; Government of South Australia
sahealth.sa.gov.au/lowbackpain

10 things you need to know about low back pain; NPS MedicineWise
tinyurl.com/NPS-LBP-10

Low back pain video; Evans Health Lab
evanshealthlab.com/low-back-pain-video/

Imaging explained; NPS MedicineWise
tinyurl.com/NPS-Imaging

ACKNOWLEDGEMENTS

The following information sources were used in the development of this booklet:

- Burton K, Klaber Moffett J, Main C, Roland M, Waddell G, The Back Book 2nd Edition (2002), The Stationary Office, England
- National Health and Medical Research Council: Acute Low Back Pain
- Orthopaedic Spinal Services, SA Health: Advice for Managing Low Back Pain
- Orthopaedic Spinal Services, SA Health: Scans and Low Back Pain
- NPS MedicineWise: Back Pain Choices

CRICOS Provider 00002J

The English version is available at:
https://www.mq.edu.au/__data/assets/pdf_file/0016/1311046/digital-booklet.pdf

The Finnish version is available at:
https://www.terveyskirjasto.fi/xmedia/dlk/dlk00326_alaselkakipuopas.pdf

Appendix 4. Effectiveness of discrete implementation strategies

Strategy (ERIC) [136]	Description (ERIC) [136]	Expected impact
STRATEGIES TO TRAIN SITE STAFF AND CLINICIANS		
Conduct educational meetings	Hold meetings targeted toward different stakeholder groups (e.g providers, administrators, other organizational stakeholders, and community patient /consumer, and family stakeholders) to teach them about the clinical innovation.	Small improvements in practice and patient outcomes 7% points (95% CI 6.62-6.97%) increase in compliance with target EBP care [144]
Develop educational material	Develop and format manual, toolkits, and other supporting materials in ways that make it easier for stakeholders to learn how to deliver the clinical innovation.	*Indirect* [209] Printed educational materials 4 percentage points improvement in clinical practice [88]
Conduct ongoing training	Plan for and conduct training in the clinical innovation in an ongoing way.	*Inconclusive* [209]
STRATEGIES TO PROVIDE INTERACTIVE ASSISTANCE AND SITE SUPPORT		
Audit and provide feedback	Collect and summarize clinical performance data over a specified time period and give it to clinicians and administrators to monitor, evaluate, and modify provider behavior.	Small to moderate improvement in professional practice (a median absolute increase of 4.3 percentage points (IQR 0.5% to 16%) in target EBP use [144] *Supportive* [209]
Practice facilitation	A multifaceted process of enabling and supporting individuals, groups, and organizations in their efforts to adopt and incorporate clinical innovations into routine practices.	*Supportive* [209] Improves guideline uptake in primary care [143]
Conduct cyclical small tests of change	Implement changes in a cyclical fashion (ie, test, assess, repeat) using small tests of change before taking changes systemwide.	*Indirectly supportive only* [209]

Assess and redesign workflows	A system-level strategy that involves observing and mapping current work processes and planning for desired work processes and identifying changes necessary to accommodate, encourage, or incentivize use of the clinical innovation as designed.	*Moderately supportive* [209]
Centralize technical assistance	Develop and use a centralized system to deliver technical assistance focused on implementation issues.	*Limited supportive* [209]
Facilitate collaborative learning environment	Assembling a group of providers or provider organizations that is asked to collaborate (virtually or in person) to foster a learning environment to improve implementation of the clinical innovation.	*Moderately supportive* [209]
STRATEGIES TO TAILOR, ITERATE AND ADAPT TO CONTEXT		
Tailor strategies	Tailor the implementation strategies to address barriers and leverage facilitators that were identified through earlier data collection.	Small to moderate benefit [210] *Inconclusive* [209]
Promote adaptability within the EBP	Identify the ways a clinical innovation can be tailored to meet local needs and clarify which elements of the innovation must be maintained to preserve fidelity.	*Supportive* [209]
Purposefully reexamine and adjust the implementation	Monitor progress and adjust effective practices and implementation strategies to continuously improve the quality of care.	*Inconclusive* [209]
STRATEGIES TO PREPARE SITES FOR IMPLEMENTATION		
Assess for readiness and identify barriers and facilitators	Assess various aspects of an organization to determine its degree of readiness to implement, barriers that may impede implementation, and strengths that can be used in the implementation effort.	*Indirectly supportive only* [209]
Develop an implementation blueprint	Develop a formal implementation blueprint that includes all goals and strategies, including the following 1) aim/purpose of the implementation; 2) the scope of the change; 3) timeframe and milestones; and 4) appropriate performance/progress measures.	*Inconclusive* [209]

Develop and organize quality monitoring systems	Develop and organize systems and procedures that monitor clinical processes and/or outcomes, and implementation outcomes) that are often specific to the innovation being implemented.	*Inconclusive* [209]
STRATEGIES TO SUPPORT CLINICIAN PRACTICE CHANGE		
Remind clinicians	Develop reminder systems designed to help clinicians recall information and/or prompt them to use the clinical innovation.	*Moderately supportive* [209]
Clinical decision support tools	A variety of tools and resources that are made available to clinicians to enhance clinical decision-making and improve quality of care	*Supportive* [209] Computerized decision support systems 5.8% point (95%CI 4.0-7.6%) increase in compliance with target EBP practice [236]
Conduct local consensus discussion	Include local providers and other stakeholders in discussions that address whether the chosen problem is important and whether the clinical innovation to address it is appropriate.	*Inconclusive* [209]
Develop and organize quality monitoring systems	Developing, testing, and introducing into quality monitoring systems the right inputs such as the appropriate language, protocols, algorithms, standards, and types of measures (of processes, patient and consumer outcomes, and implementation outcomes) that are often specific to the innovation being implemented.	*Inconclusive* [209]
STRATEGIES TO MOBILIZE SITE STAFF FOR IMPLEMENTATION		
Organize clinician implementation team meetings	Develop and support teams of clinicians who are implementing the innovation and give them protected time to reflect on the implementation effort, share lessons learned, and support one another's learning.	*Inconclusive* [209]
Identify and prepare champions	Identify and prepare individuals who dedicate themselves to supporting, marketing, and driving through an implementation, overcoming indifference or resistance that the intervention may provoke in an organization.	*Inconclusive* [209]

Inform local opinion leaders	Inform providers identified by colleagues as opinion leaders or "educationally influential" about the clinical innovation in the hopes that they will influence colleagues to adopt it	Local opinion leaders: a median 10.8% absolute improvement in compliance with desired EBP use [237]
Recruit, designate, and train site staff for leadership	Recruit, designate, and train leaders for the change effort.	*Inconclusive* [209]
OTHER STRATEGIES		
Prepare patients /consumers to be active participants	Prepare consumers to be active in their care, to ask questions, and specifically to inquire about care guidelines, the evidence behind clinical decisions, or available evidence-supported treatments.	*Supportive* [209]
Utilize financial strategies (incentives)		Benefit not possible to evaluate due to possible underutilization in implementation research [209]

EBP= evidence-based practice

Appendix 5. Full researchers' evaluation tool

Researcher's evaluation tool to examine physiotherapists' clinical practice in light of their electronic patient record (EPR) documentation.
The tool was developed for study-specific purposes. The instruction was to mark "Yes" if any mention of the item/dimension in question in the EPR was found, "No" if it was not documented at all. Orange shadings further visualize the agreed scorings for the dimensions of assessment and treatment quality criteria.

NAME OF THE UNIT:	PATIENT ID:	Gender: 1 Male / 2 Female / 3 Other
Name of the PT:	Date of patient recruitment:	Age:
Date of PT visit:	Date of control check-ups:	o Visit at clinic o Remote
ANAMNESIS		
BASELINE STATUS		
Occupation:	Physical workload: o Light o Medium o Heavy	
Work situation: Working: o Full-time o Part-time / Not working: o Short-term sick leave o Long-term sick leave (<2 weeks)		
Current work modifications:		
LBP diagnosis ICD10:	ICP2-code:	1 Non-specific / 2 Specific
Comorbidities:		Number of comorbidities:
PAIN CHARACTERISTICS	**Patient´s LBP history taken** [162]	**o Yes o No**
	Time course: 1 Acute / 2 Subacute / 3 Recurrent / 4 Persistent / 5 NA	
	Pain area: 1 Localized / 2 Widespread / 3 NA	
	Progression: 1 Improving / 2 Stable / 3 Deteriorating / 4 NA	
	Number of relapses:	Time of relapses:
	Red flags documented	o Yes o No
PERSON-CENTERED ASPECTS	**Person-centered aspects identified** [162]	**o Yes o No**
	Patient´s values documented	o Yes o No
	Patient´s resources documented	o Yes o No
	Patient´s treatment expectations documented	o Yes o No
	Patient´s goals documented	o Yes o No
FUNCTIONAL CAPACITY	**Functional capacity documented** [162]	**o Yes o No**
	Pain-related functional behaviors identified*	o Yes o No
	Activity limitation documented	o Yes o No
WORKABILITY	**Workability documented** [162]	**o Yes o No**
ASSESSMENT		
STEP I - Multidimensional assessment		
Cross X all types of assessments documented		Notes of the evaluation
BIOLOGICAL	**PHYSICAL ASSESSMENT**	o Yes o No

	o Physical examination* [162]	
	o Range of motions	
	o Provocative spinal movement directions* [162]	
	o Gait	
	o Posture	
	o Motor control	
	o Patient specific functions* [162]	
	o Pain-related physical behaviors* [162]	
	o Autonomic arousal* [162]	
	o Muscle strength	
	o Muscle activation	
	o Physical loading demands [162]	
	o Tissue hypersensitivity [162]	
	o Relationship between physical aspects and pain responses [162]	
	o Other:	
	HEALTH-RELATED ASPECTS	o Yes o No
	o Activity and/or sedentary lifestyle [162]	
	o Weight / Obesity [162]	
	o Smoking habits [162]	
	o Nutrition	
	o Sleep deficit [162]	
	o General condition [162]	
	o Pain medication	
	o Psychotropic drugs	
	o Alcohol abuse	
	o Other:	
PSYCHOLOGICAL	**COGNITIVE ASPECTS [162]**	o Yes o No
	o Pain-related worries	
	o Coping	
	o Pain catastrophizing	
	o Hypervigilance	
	o Relationship between cognitive stressors and pain responses	
	o Other:	
	EMOTIONAL ASPECTS [162]	o Yes o No
	o Distress	
	o Low mood	
	o Fear of physical activity or re-injury	
	o Anxiety feelings	
	o Relationship between emotional stressors and pain responses	
	o Other:	

SOCIAL	**SOCIAL ASPECTS** [162]	o Yes o No
	o Life stress events	
	o Social support at home	
	o Socio-economic factors	
	o Social isolation	
	o Cultural factors	
	o Several visits to various practitioners	
	o Complaints or seeking compensation	
	o Relationship between social stressors and pain responses	
	o Other:	
	WORK-RELATED ASPECTS [162]	o Yes o No
	o Workplace issues	
	o Work modifications	
	o Self-perceived ability to work	
	o Fear of not coping with work demands	
	o Work community support	
	o Relationship between work stressors and pain responses	
	o Other:	
TREATMENT		
FIRSTLINE TREATMENTS		
STEP II -Treatment aligned with low risk for work disability		
Use of a risk stratification tool [162]		o Yes o No
o SBT (score_____)	o ÖMPSQ-SF (score _____)	o Other:
Information / education on pain [162]		o Yes o No
Discussion of imaging / use of patient educational booklet 'Understanding my low back pain' [162]		o Yes o No
Advice on return-to-activities (incl. work) [162]		o Yes o No
o Advice to stay active and/or return to normal physical activities		o Advice to avoid physical activities
Pain management strategies [162]		o Yes o No
Addressing healthy lifestyle behaviors [162]		o Yes o No
o Sleep hygiene	o Regular physical activity [162]	o Relaxation / Stress reduction [162]
o Dietary advice	o Substance abandonment	o Other:

STEP III - Treatment aligned with medium risk for work disability		
Use of exercise [162]		o Yes o No
Physical activity based on patient preference and accessibility [162]		o Yes o No
Therapeutic exercise [167]		o Yes o No
o Postural training [167]	o Muscle strengthening training [167]	o Range of movement training [167]
o Postural control training [167]	o Muscle endurance training [167]	o Pelvic floor training [167]
o Core exercise [167]	o Cardiovascular training [167]	o Balance training [167]
o Relaxation training [167]	o Other:	
Reducing pain related fear of movement [162]		o Yes o No
Graded exposure to patient-specific functions / threatening activities* [162]		o Yes o No
Modifying pain-related functional behaviors* [162]		o Yes o No
STEP IV - Treatment aligned with high risk for work disability		
Planned behavioral strategies		o Yes o No
o Psychologically informed care [162]	o Cognitive functional therapy [166]	o Psychophysical physiotherapy
o Mindfulness	o Supportive conversation	o Other:
Relapse plan [162]		o Yes o No
Planned work-related activities		o Yes o No
o Contact with supervisor during visit		o Work modifications[162]
o Keep contact with work during sick leave		o Activity pacing
o Information /education on work-related activities		o Physical activities at work
o Recommendation for assistive devices		o Other:
Goal-oriented treatment plan [162]		o Yes o No
Treatment Plan	Treatment plan [162]	o Yes o No
	o Clear link between anamnesis, assessment and treatment plan	
	Notes of the evaluation	
Treatment Goal	Treatment goal [162]	o Yes o No
	o Short-term	o Long-term
	Goal based on:	
	o Collaboration between therapist and patient [162]	
	o Activities related to patient´s valued goals [162]	
	o Physiotherapists´ examination	
	o General level LBP rehabilitation	
	o Other:	
	Notes of the evaluation	
SECOND LINE TREATMENTS		
MANUAL THERAPY (used or advised to)		
o Joint mobilization [167]	o Stretching [167]	o Traction [167]
o Joint manipulation [167]	o Nerve mobilization [167]	o Fascia mobilization / manipulation [167]
o Massage [167]	o Trigger point pressure [167]	o Other:

PHYSICAL MODALITIES (used or advised to)		
o Heat [167]	o Orthosis [167]	o Taping [167]
o Acupuncture [167]	o TENS [167]	o Other:

Notes of the evaluation

EPR = electronic patient records; ICD10 = International Classification of Diseases, 10th Revision; ICPC2 = International Classification of Primary Care, 2nd edition; ID = identifier; LBP = low back pain; NA = not assessed; PT = physiotherapist; SBT = STarT Back Tool; TENS = transcutaneous electronic nerve stimulation; ÖMPSQ-SF = Örebro Musculoskeletal Pain Screening Questionnaire, short-form

*Documenting patients perceived **pain-related functional behaviors** i.e. communicative or overprotective behaviors such as avoidance of activities
Performing **physical examination** e.g. neurological examination, sit-to-stand, bending, squatting
Assessing **provocative spinal movements** i.e. directional pain responses
Assessing **patient specific functions** i.e. activities the person was unable to perform or found them difficult
Observing **pain-related physical behaviors** i.e. slow guarded movement, avoidance, breath holding, propping with hands, limping, compulsive stretching or use of braces
Observing **autonomic arousal** e.g. rapid superficial breathing, sweating, agitation
Performing **graded exposure** to patient-specific functions / threatening activities i.e. guiding pain and movement control strategies to build confidence for people to re-engage in valued activities [166]
Modifying pain-related functional behaviors i.e. identifying and practicing alternative ways to do activities and letting go of unhelpful protective habits e.g. moving very cautiously, avoiding activities, holding breath, using compensatory upper limb support to offload during tasks, limping, repetitive stretching to control symptoms and relying on braces or overusing external supports when not needed.

Assessment Quality Criteria

Step I - Multidimensional assessment

Criteria: All bio-psycho-social dimensions documented

Assessing biological, psychological and social dimensions of low back pain

Treatment Quality Criteria

Step II - Treatment aligned with low risk for work disability

Criteria: ≥50% of items 1-5 are documented

1. Using risk stratification tool
2. Giving patient education
3. Advising to stay active
4. Discussing pain management strategies
5. Addressing lifestyle behaviors

Step III - Treatment aligned with medium risk for work disability

Criteria: Step II criteria fulfilled, and ≥50% of items 6-7 are documented

6. Using exercise interventions
7. Reducing movement-related fear by modifying pain-related behaviors or using graded exposure.

Step IV - Treatment aligned with high risk for work disability

Criteria: Step III criteria fulfilled, and at least 2 out of 3 items 8-10 are documented

8. Using behavioral interventions
9. Using work-related interventions and supporting social engagement
10. Making a goal-oriented treatment plan

Appendix 6. Occupational healthcare unit costs in 2017

Resource	Time (minutes)	Cost (€)
Physician visit [a]	15-20	66
Remote physician visit [a]	15-20	35
Physiotherapists visit [a]	45-60	74
Remote physiotherapists visit [a]	15-30	35
Nurse visit [a]	15-20	32
Magnetic resonance imaging (MRI) [a]		337
Radiograph (X-ray) [a]		106
Electroneuromyography (ENMG) [a]		106
Electroneurography (ENG) [a]		106
Cost estimate of sick leave day [b]		350

[a] Unit cost in 2017 [169]

[b] Estimated by the Confederation of Finnish Industries in 2017

Appendix 7. The interview guide

Semi-structured interview guide for focus group interviews in occupational health service (OHS) units. The interviewer explains the study purpose, the process and the rules for the focus group interview.

Introduction of participants (name, occupation).

Question 1. Can you tell me about your perceptions of the educational intervention on biopsychosocial (BPS) approach and whether the training has influenced professionals' actions when working with patients with low back pain (LBP)?

After this, the conversation may flow freely. The participants are asked to tell more and encouraged to share their experiences of participating in the study and the assessment and the treatment of patients with LBP in OHS using following questions:

Can you tell me more about…?
What do you think it is because of?
Previously you said that…
Can you explain how you mean

Question 2. Can you tell me about your perceptions on

- the respective (interviewed) OHS unit
- multidisciplinary collaboration

Question 3. Can you explain, how you mean by the BPS approach?

Question 4. What have been possible facilitators of implementation?

Question 5. What barriers to implementation have you experienced?

Question 6. Can you tell me about how have the professionals that participated in the BPS training implemented the information from the training in your team and the OHS unit?

Question 7. How many professionals actively use the BPS approach in your OHS unit? Could you define what it means for different professional groups?

Question 8. Could you tell me about the treatment pathways for different risk groups of patients with LBP – especially for patients with high risk of prolonged disability?

Question 9. Are screening tools used systematically in your OHS unit?

Question 10. In your experience, has educational intervention influenced on processes in your OHS unit?

- imaging practices in the unit
- the sick leave practices in the unit
- the referrals to secondary care

Question 11. Can you tell me about your experiences of interacting with patients?

Appendix 8. Additional sensitivity analysis with estimated training costs included.

Patient group	Sources of costs (see Appendix 6)	Median (IQR) estimated cost (€)		Mean difference [a] (95% confidence interval)	*P*-value [a]
		Intervention [c]	Control		
Total n=312	OHPC resource use [b]	348 (274-518)	222 (134-372)	138 (246 - 350)	*<0.001*
	Sick leaves (€350/day) [b]	126 (126-1876)	350 (0-3850)	-1790 (-9189 - 2967)	*0.591*
	Total costs [b]	383 (274-2221)	807 (183-4172)	-1782 (-9498 - 3128)	*0.590*

OHPC = Occupational health primary care; IQR = interquartile range; FABQ Fear Avoidance Beliefs Questionnaire

[a] bootstrapped (2500 replications)

[b] linear mixed model with covariate adjustment for pain duration and FABQ-Physical activity

[c] a one-time investment of €29222 of providing the training is included in the analysis (€126 per patient recruited from the intervention arm).

The costs of receiving the training were calculated according to the following estimates: Ten physicians spent average of 24.6 hours in the training costing €51/hour. Twenty-two physiotherapists spent average of 33.3 hours in the training costing €18/hour. The median monthly salary of physicians in 2017 was €7800, as estimated by the Finnish Medical Association. The median monthly salary of physiotherapists in 2017 was €2800, as estimated by the Finnish Association of Occupational Health Physiotherapists. The cost of participating in the training was 25722. Adding this to the costs of training (€3500) is a one-time investment of €29222, equivalent to €126 per patient recruited in the intervention arm.

Appendix 9. The Finnish version of the final DIBQ-mp.

Toiminnan muutosta ohjaavat tekijät -kysely

Toiminnan muutosta ohjaavat tekijät -kysely sovellettuna moniammatilliseen kuntoutuskontekstiin. Kysely kartoittaa ammattilaisten kokemuksia mm. tietoihin, taitoihin, käyttäytymiseen, asenteisiin ja toimintakulttuuriin liittyen, jotka voivat joko edistää tai estää näyttöön pohjautuvan suosituksen mukaisen hoidon toteuttamista. Kyselyn taustateorioina ovat Teoreettisten aihealueiden viitekehys (Theoretical Domains Framework) ja Käyttäytymisen muutospyörä (Behavioural Change Wheel). Vastausvaihtoehtoina käytetään 7-portaista Likertin asteikkoa. Kussakin kohdassa käytetään tarkasteltavan suosituksen nimeä [Näyttöön pohjautuvan toimintamallin] sijaan.

Osa-alue	Kysymys
TIEDOT	
Tiedot	Tiedän, miten [Näyttöön pohjautuvaa toimintamallia] toteutetaan
Tehtävien selkeys	[Näyttöön pohjautuvan toimintamallin] tavoitteet ja osuuteni niissä on selkeästi määritelty minulle
TAIDOT	
Taidot	Minut on koulutettu toteuttamaan [Näyttöön pohjautuvaa toimintamallia]
	Minulla on taidot toteuttaa [Näyttöön pohjautuvaa toimintamallia]
OMIA KYKYJÄ KOSKEVAT KÄSITYKSET	
Minäpystyvyys	Olen varma, että osaan toteuttaa [Näyttöön pohjautuvaa toimintamallia]
Koettu toteutuksen osaaminen	Minulle [Näyttöön pohjautuvan toimintamallin] toteuttaminen on erittäin vaikeaa - erittäin helppoa
KÄSITYKSET TOIMINNAN VAIKUTUKSISTA	
Asenne	Mielestäni [Näyttöön pohjautuvan toimintamallin] toteuttaminen on (erittäin hyödytöntä - erittäin hyödyllistä)
Tulosodotukset	Jos toteutan [Näyttöön pohjautuvaa toimintamallia] suositusten mukaisesti, se vahvistaa yhteistyötä [Näyttöön pohjautuvaa toimintamallia] toteuttavien ammattilaisten kanssa
AIKOMUKSET	
Aikomukset	Kuinka vahva on aikomuksesi toteuttaa [Näyttöön pohjautuvaa toimintamallia] seuraavan 3 kuukauden kuluessa (erittäin vähäinen – erittäin vahva)
UUSI TOIMINTAMALLI	
Uuden toimintamallin ominaisuudet	[Näyttöön pohjautuva toimintamalli] on mahdollista räätälöidä potilaiden/asiakkaiden/kuntoutujien/osallistujien tarpeiden mukaisesti
	[Näyttöön pohjautuva toimintamalli] sopii päivittäiseen asiakastyöhön

TYÖPAIKKA	
Työpaikan resurssit ja tuki	Työpaikallani on kaikki tarvittavat resurssit käytettävissä [Näyttöön pohjautuvan toimintamallin] toteuttamiseen
	Voin luottaa työpaikkani johdon tukeen, kun [Näyttöön pohjautuvan toimintamallin] toteuttamisessa ilmaantuu ongelmia
POTILAS / ASIAKAS	
Potilaan / asiakkaan käsitykset	Potilaat/asiakkaat/kuntoutujat/osallistujat kokevat [Näyttöön pohjautuvan toimintamallin] merkityksellisenä
	[Näyttöön pohjautuvan toimintamallin] potilaat/asiakkaat/kuntoutujat/osallistujat suhtautuvat myönteisesti [Näyttöön pohjautuvaan toimintamalliin]
TOIMEENPANOON LIITTYVÄT KÄYTÄNNÖT	
Toimeenpanoon liittyvät käytännöt	[Toimeenpaneva taho] tarjoaa ammattilaisille koulutusta [Näyttöön pohjautuvan toimintamallin] toteuttamiseen
	[Toimeenpaneva taho] tarjoaa riittävästi käyttöä tukevaa materiaalia [Näyttöön pohjautuvan toimintamallin] toteuttamiseen
	[Toimeenpaneva taho] tarjoaa tukea ammattilaisille [Näyttöön pohjautuvan toimintamallin] toteuttamiseen
SOSIAALISEN YMPÄRISTÖN VAIKUTUKSET	
Toiminnan vakiintuneisuus	Ammattilaiset, joiden kanssa toteutan [Näyttöön pohjautuvaa toimintamallia], toteuttavat [Näyttöön pohjautuvaa toimintamallia] suositusten mukaisesti
Sosiaalinen tuki	Voin luottaa, että saan tukea ammattilaisilta, joiden kanssa toteutan [Näyttöön pohjautuvaa toimintamallia], kun sen toteuttamisessa ilmaantuu ongelmia
OMAN TOIMINNAN OHJAUS	
Oman toiminnan suunnittelu	Minulla on selkeä suunnitelma, kuinka aion toteuttaa [Näyttöön pohjautuvaa toimintamallia]

Vastausvaihtoehtoina käytetään 7-portaista Likertin asteikkoa:
1= Täysin eri mieltä, 2= Eri mieltä, 3= Jokseenkin eri mieltä, 4= Ei samaa eikä eri mieltä, 5= Jokseenkin samaa mieltä, 6= Samaa mieltä, 7 = Täysin samaa mieltä

1= Erittäin vaikeaa, 2= Vaikeaa, 3= Jokseenkin vaikeaa, 4= Ei vaikeaa eikä helppoa, 5= Jokseenkin helppoa, 6= Helppoa, 7= Erittäin helppoa

1= Erittäin hyödytöntä, 2= Hyödytöntä, 3= Jokseenkin hyödytöntä, 4= Ei hyödytöntä eikä hyödyllistä, 5= Jokseenkin hyödyllistä, 6= Hyödyllistä, 7= Erittäin hyödyllistä

1= Erittäin vähäinen, 2= Vähäinen, 3= Jokseenkin vähäinen, 4= Ei vähäinen eikä vahva, 5= Jokseenkin vahva, 6= Vahva, 7= Erittäin vahva

PAPER I

BMJ Open Quality

Where is the patient in the records? Evaluating physiotherapists' first visit in occupational health primary care pathway for low back pain

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ABSTRACT

Background Clinical guidelines recommend a biopsychosocial approach to low back pain (LBP) management, with physiotherapists playing a key role in occupational health primary care (OHPC). However, little is known about how their clinical behaviours at the first visit align with guideline-oriented biopsychosocial principles. Therefore, we evaluated LBP management quality in OHPC by applying predefined criteria to physiotherapists' documentation.

Methods Based on a cluster-randomised implementation study data (ISRCTN11875357) we analysed 98 electronic patient records (EPRs) documented by 28 physiotherapists across diverse OHPC units. The intervention arm had received 3–7 days of biopsychosocial training. A stratified random sample of EPRs from individuals with LBP was reviewed using a structured researcher's evaluation tool. Each item was scored dichotomously (yes/no) and evaluated against predefined quality criteria with stepwise thresholds for different work disability risk groups.

Results Step I, multidimensional biopsychosocial assessment of LBP, was documented in fewer than half of the records (36.5% in the intervention vs 16.7% in the control arm, p=0.081). The biological dimension was well documented in both arms (100% vs 95.8%, p=0.245), while psychological (58.1% vs 25%, p=0.009) and social (54.1% vs 29.2%, p=0.038) dimensions were more frequently documented in the intervention arm.

Step II quality criteria (low-risk patients) were met in 58.1% of intervention versus 4.2% of control records (p<0.001), and step III (medium-risk) in 55.4% versus 4.2% (p<0.001). No EPRs met step IV (high-risk) quality criteria.

The intervention arm more often documented psychosocial assessments, risk stratification, behavioural strategies and advice to stay active. Person-centredness (ie, goals, values, resources, expectations) was rarely documented (36.5% vs 0%, p<0.001).

Conclusion Training in guideline-oriented biopsychosocial approach was associated with more frequent documentation of behaviours aligned with high-quality LBP management. However, overall quality varied, and person-centred aspects remained underreported. Complementary implementation strategies are required to ensure consistent delivery and documentation of biopsychosocial clinical practice in OHPC.

WHAT IS ALREADY KNOWN ON THIS TOPIC

⇒ Low back pain (LBP) is a leading cause of work disability, and occupational health physiotherapists play a key role in its early management. Documentation in electronic patient records (EPRs) reflects delivered care, but no structured evaluation of LBP management quality has been undertaken in this context.

WHAT THIS STUDY ADDS

⇒ This study shows that physiotherapists who had received biopsychosocial (BPS) training more consistently assessed psychological and social dimensions of LBP, applied risk stratification and implemented behavioural strategies, while person-centredness and linkage between assessment and treatment planning remained insufficiently documented.

HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE OR POLICY

⇒ The study highlights the need for complementary implementation strategies (e.g. structured templates, mentoring and EPR integration to ensure consistent delivery and documentation of BPS dimensions of LBP in occupational health primary care.

⇒ The study provides direction for the development of standardised minimum datasets and adoption of BPS quality indicators as benchmarks for developing national standards in LBP management.

INTRODUCTION

Low back pain (LBP) is the leading cause of disability worldwide[1] and a common reason for work absence.[2] Current understanding recognises LBP as a complex condition influenced by biological, psychological and social factors, all of which influence pain experience and related disability.[1] Although biopsychosocial (BPS) management is recommended in clinical guidelines, its implementation in occupational health primary care (OHPC) remains limited.[3]

The BPS approach integrates multidimensional assessment and management.

The biological dimension targets functional ability (eg, promoting activity, lifestyle changes, short-term pharmacological treatment if necessary). The psychological dimension addresses maladaptive beliefs, reducing fear-avoidance behaviour and psychologically informed intervention, when needed. The social dimension includes, for example, work demands. BPS principles include patient involvement, shared decision-making and interdisciplinary collaboration.[4–6] Risk stratification tools such as the Start Back Tool (SBT)[7 8] and Örebro Musculoskeletal Pain Screening Questionnaire (ÖMPSQ)[9] and its short version ÖMPSQ short-form (SF)[10–12] are recommended to identify individuals at higher risk for prolonged LBP-related disability and tailor care accordingly.[7 13] Also, early dialogue with the workplace is critical to support work participation.[14] However, there is little consensus on what data should be routinely collected in OHPC.[15] Currently, electronic patient record (EPR) documentation in work-related musculoskeletal disorders is inconsistent, and no standardised data content requirements exist internationally.[16]

Quality improvement frameworks such as the Plan-Do-Study-Act (PDSA) cycle provide a structured way to implement and evaluate changes in care delivery.[17] We have previously reported the 'plan' and 'do' phases of the PDSA cycle, evaluating effectiveness,[18] costs[19] and professionals' experiences[20] of care after a BPS training programme for the assessment and management of LBP versus usual care. The current 'study' phase uses EPR data to evaluate whether physiotherapists' documentation reflects BPS principles following training. The findings will inform the subsequent 'act' phase to further advance quality improvement actions. In this context, it is essential to assess observable clinical behaviours, because changing knowledge or attitudes does not always translate into behaviour change.[21–23] Therefore, it is important to evaluate whether clinical BPS target behaviours, for example, early risk stratification, goal-oriented planning and person-centredness,[20] are visible in documentation. Routinely collected EPRs may provide a pragmatic source of real-world evidence for evaluating care processes and can be used to measure quality of care.[16 24–26] In sum, our aim was to evaluate the quality of LBP management by applying predefined criteria to physiotherapists' documentation. We hypothesised that the quality of EPRs documented by physiotherapists who had received training in guideline-oriented BPS management would more frequently align with these criteria compared with physiotherapists without such training.

METHODS

Study design, setting and participants

This study is a secondary analysis of physiotherapists' EPR data from a two-arm cluster randomised controlled trial (ISRCTN11875357), described in detail elsewhere.[18 27] Shortly, Finnish occupational health services include statutory preventive activities and, where contracted, OHPC implying primary care level curative care provided by multidisciplinary teams comprising physicians, nurses, physiotherapists and psychologists.[28]

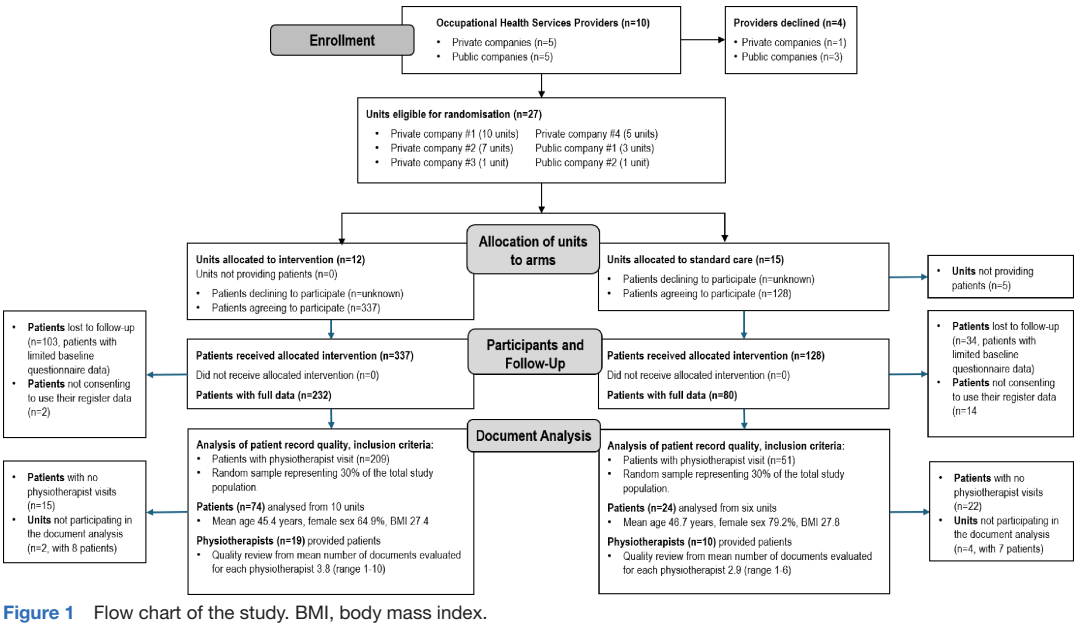

Figure 1 Flow chart of the study. BMI, body mass index.

Six companies providing OHPC (27 units) across Finland participated (figure 1). Units were randomised to intervention or control arms. Between September 2017 and December 2018, physiotherapists and physicians examined eligible patients aged 18–65 years with LBP with or without radicular pain. Exclusion criteria included suspected serious pathology or urgent need for care.[18] A 30% random sample of EPRs (n=98) was drawn from patients with complete baseline data, consent for register data and at least one physiotherapy visit. Additionally, OHPC providers' permission for data collection was needed. Random sampling was performed by an independent researcher to ensure proportional representation from the trial arms. Researchers evaluating EPR data, the data abstractors, were blinded to allocation to arms.

Intervention

The BPS training programme (4-day initial, 3-day booster) included live patient demonstrations, problem solving and role-play.[27 29] Trainers included experts in pain psychology, rehabilitation medicine and physiotherapy. Participating physiotherapists and physicians disseminated knowledge to their multidisciplinary teams'. Two experienced physiotherapists tutored the study sites.

The participating physiotherapists were trained to apply BPS assessment, use risk stratification tools (SBT, ÖMPSQ-SF) and tailor care to the level of disability risk (low, medium, high). For all patients, the goal was to make the LBP understandable and to focus on modifiable factors according to the individual assessment. Instructions on documentation were not included in the training. Online supplemental figure 1 outlines the BPS guideline used in the training.

The control arm received no such training. The basic education of the use of the BPS approach in assessment and treatment of LBP has been mostly limited.

Document analysis

An evaluation tool was specifically developed to enable systematic exploratory EPR review to evaluate the quality of physiotherapists' first visit in OHPC pathway for LBP. Items were derived from the intervention protocol,[27] clinical BPS target behaviours[20] (online supplemental figure 1), multidimensional factors associated with disabling LBP,[29] International Classification of Functioning, Disability and Health model[30] and quality index study in LBP care.[31] The three-page tool covered anamnesis (pain characteristics, functional ability, work ability, person-centred aspects), dimensions of assessment (biological, psychological and social) and assessment, whether the documented first-line and second-line treatments aligned with guidelines as well as the low-risk, medium-risk and high-risk profiles. Items were scored using a binary approach (yes=documented, no=not documented) and a single mention in the EPR was sufficient to score an item as documented. The evaluation tool aimed to identify both the aspects physiotherapists documented and those that were omitted, offering insight into the comprehensiveness of LBP management. The detailed description of the evaluation tool and its components is presented in online supplemental table 1.

Definition of quality criteria for studying the impact of the intervention

The assessment and treatment quality were evaluated using predefined stepwise criteria, starting from reflecting adherence to BPS guideline, *step I* (figure 2). Although each step was considered to represent equally high-quality care, the steps were interpreted in relation to appropriate alignment with the patient's risk group: *step II* treatment with low risk; *step III* treatment with medium risk and *step IV* treatment with high risk for work disability according to ÖMPSQ-SF.

Assessment Quality Criteria
Step I - Multidimensional assessment Criteria: All bio-psycho-social dimensions documented 1. Assessing biological, psychological and social dimensions of low back pain
Treatment Quality Criteria
Step II - Treatment aligned with low-risk for work disability Criteria: ≥50% of items 1-5 are documented 1. Using risk stratification questionnaire 2. Giving patient education 3. Advising to stay active 4. Discussing pain management strategies 5. Addressing lifestyle behaviours
Step III - Treatment aligned with medium-risk for work disability Criteria: Step II criteria fulfilled, and ≥50% of items 6-7 are documented 6. Using exercise interventions 7. Reducing movement-related fear by modifying pain-related behaviours or using graded exposure.
Step IV - Treatment aligned with high-risk for work disability Criteria: Step III criteria fulfilled, and at least 2 out of 3 items 8-10 are documented 8. Using psychologically informed interventions 9. Using work-related interventions and supporting social engagement 10. Making a goal-oriented treatment plan

Figure 2 Quality criteria definitions for low back pain management.

Data collection

Data abstraction using the evaluation tool was performed by three researcher pairs (MP and KR, MP and JH, MP and IT) who reviewed the first physiotherapy visit EPR after patient consent. Each EPR was read in full and analysed deductively, using printed evaluation tools. Two researchers jointly reviewed each record and completed the tool by consensus. Discrepancies were resolved through discussion, with a third researcher (JK) consulted when needed. After the first 10 cases, the completed evaluation tools, open questions and uncertainties were reviewed with JK to ensure consistency and clarify interpretations. Altogether, JK was consulted on three occasions for consensus.

Data abstraction was performed by researchers with 10-year to 30-year clinical experience. MP and IT are occupational health physiotherapists. KR and JH are occupational physicians, and KR and JK are specialists in Physical and Rehabilitation Medicine. MP and JK contributed to BPS training but had no affiliation with participating OHPC companies. JH, IT and KR were not involved in training and worked in different companies.

Baseline characteristics

Characteristics of participating physiotherapists included gender, age, workplace, number of days participating to BPS training and number of EPRs in the sample. Baseline patient data included demographics, general health, LBP characteristics, functional status and work ability as described previously[18] including age, gender, body mass index (BMI, self-reported weight per squared height kg/m^2), smoking, self-rated health (EuroQol 5 dimensions (EQ–5D), 0–100 Visual Analogue Scale), health-related quality of life using the EuroQol 5 dimensions 3 levels (EQ-5D-3L), the Depression Scale, pain duration, the Oswestry Disability Index (ODI), work ability (0–10 Numerical Rating Scale), number of sick leave days due to LBP over the preceding 3 months and fear of physical activity or work (Fear-Avoidance Beliefs Questionnaire).

Statistical analysis

Baseline characteristics are presented as means with SD, medians with IQRs and proportions (%) and counts. The statistical significance of the differences between intervention and control arms was estimated using the independent-samples t-test, χ^2 or Mann-Whitney U tests, as appropriate.

Evaluation tool items were analysed descriptively using binary scoring (yes/no). Demographic outcomes were summarised as counts and proportions. Differences between arms were tested using Fisher's exact test. Analyses were conducted using SPSS statistics, V.29 (IBM Corp). A power analysis using Fisher's exact test (two-tailed, α=0.05, power=0.80, allocation ratio 0.25) indicated that 99 participants (79 in intervention arm, 20 in control arm) were needed to detect a difference in proportions (expected 0.42 vs 0.10).

RESULTS

EPR data from 98 clinical encounters documented by 28 physiotherapists across 16 OHPC units in five companies were included in the analysis. The majority of physiotherapists were female (78.6%, n=23) with a mean age of 48.1 years (SD 8.3). Of the 19 physiotherapists in the intervention arm, 79% (n=15) had received the BPS training. Four physiotherapists were introduced to the BPS approach through peer dissemination only and had documented five of the EPRs. In the control arm, EPR analysis involved 10 physiotherapists contributed, of whom one had received BPS training and had documented one EPR. The mean number of EPRs evaluated per physiotherapist was 3.8 (range 1–10) in the intervention and 2.9 (range 1–6) in the control arm.

The patient baseline characteristics (n=98) are presented in table 1. The mean age was 45.6 years (SD 9.7), and 68.4% (n=67) were female. Functional limitation was mild 43.9% (n=43) or moderate 45.9% (n=45) according to the ODI. The median EQ-5D index was 0.79 (0.75–0.86). Based on the ÖMPSQ-SF, 41.8% (n=41) of patients were classified to low-risk, 25.5% (n=25) to medium-risk and 32.7% (n=32) to high-risk group. There were no statistically significant differences in baseline characteristics between the intervention (n=74) and control (n=24) arms.

Quality of anamnesis

Pain characteristics, that is, LBP history taking, functional capacity and *work ability* were well documented across both arms. *Pain-related functional behaviours* (ie, communicative or overprotective behaviours such as avoidance of activities) were more frequently documented in the intervention arm (71.6% vs 37.5%, p=0.004). The *triage* process (ie, the screening for red flags) was not systematically documented. *Person-centred aspects,* such as patient's goals, values, resources and treatment expectations, were documented rarely overall (table 2a).

Quality of assessment

Step I, documentation addressing all BPS dimensions was found in fewer than half of the EPRs overall (36.5% vs 16.7%, p=0.081, online supplemental figure 2). Biological dimensions were well documented in both arms. Psychological (58.1% vs 25%, p=0.009) and social (54.1% vs 29.2%, p=0.038) dimensions were recorded more frequently in the intervention arm.

Biological dimensions

Physical aspects were documented for nearly all EPRs in the intervention and control arms (95–98%). These typically included performing physical examination (eg, neurological examination, sit-to-stand, bending, squatting), evaluation of range of motions and identification of provocative spinal movements (ie, directional pain responses). Documentation of physical loading demands, such as occupational, ergonomic, sports or leisure-related activities, was observed in 47–62% of EPRs, with no difference between

Table 1 Sample baseline characteristics

	Total n=98		
	Intervention n=74	Control n=24	P value
General health-related			
Age* (years)	45.4 (9.8)	46.7 (9.7)	0.571
Female sex†	64.9 (48)	79.2 (19)	0.190
Body mass index* (kg/m^2)	27.4 (4.6)	27.8 (4.3)	0.672
Smoking†	18.9 (14)	16.7 (4)	0.804
Self-rated health status‡ (1–100)	70 (59–85)	73 (65–85)	0.238
EQ5D (0–1)‡	0.79 (0.74–0.86)	0.79 (0.75–0.86)	0.912
DEPS score ‡	7 (2–11)	6.2 (1–8.75)	0.360
LBP-related			
Duration of pain			
<2 weeks†	6.8 (5)	16.7 (4)	0.349
2–11 weeks †	36.5 (27)	29.2 (7)	
>3–12 months †	16.2 (12)	25.0 (6)	
>12 months†	40.5 (30)	29.2 (7)	
Work ability-related			
Work ability ‡ (0–10)	7 (6—8)	6.8 (6–8.75)	0.721
Number of sick leave days due to LBP during preceding 3 months †	48.6 (36)	45.8 (11)	0.221
Number of sick leave days due to LBP during preceding 3 months ‡	7 (3–32.5)	20 (10.5–26)	0.267
Pain-related fear (FABQ)-Work ‡	14.4 (5–22)	13.3 (1.5–22.25)	0.602
Pain-related fear (FABQ)-Physical activity ‡	12 (9–16)	11 (7–16)	0.557
Drug prescriptions †	74.3 (55)	83.3 (20)	0.421
Non-psychotropic drug prescriptions†	67.6 (50)	83.3 (20)	0.195
Psychotropic drug prescriptions†	43.8 (32)	47.8 (11)	0.812
Comorbidities			
Number of comorbidities*	0.81 (1.04)	0.58 (1.1)	0.469
Hypertension†	16.2 (12)	12.5 (3)	0.756
Depression†	16.2 (12)	8.3 (2)	0.507
Migraine†	10.8 (8)	4.2 (1)	0.446
Hypothyroidism†	9.5 (7)	4.2 (1)	0.675
Asthma†	6.8 (5)	8.3 (2)	1
Diabetes†	5.4 (4)	8.3 (2)	0.633
Sleep apnoea†	6.8 (5)	4.2 (1)	1
Obesity†	4.1 (3)	12.5 (3)	0.155

*Mean (SD), p value for between-group difference from independent-samples t-test.
†Percentage (frequency), p value for between-group difference from χ^2 test.
‡Median (IQR), p value for between-group difference from Mann-Whitney U test.
DEPS, Depression Scale; EQ-5D, EuroQol 5 Dimensions 3 Levels score; FABQ, Fear Avoidance Beliefs Questionnaire; LBP, low back pain.

arms. Assessment of patient specific functions (ie, activities the person was unable to perform or found difficult) was more frequently documented in the intervention arm (37.8% vs 12.5%, p=0.023). Likewise, observations of pain-related physical behaviours (ie, slow guarded movement, avoidance, breath holding, propping with hands, limping, compulsive stretching or use of braces) were documented more often in the intervention arm (37.8% vs 12.5%, p=0.023). Other physical aspects, such as gait, motor control, muscle strength and observation of autonomic arousal (eg, rapid superficial breathing, sweating, agitation), were documented rarely.

Health-related aspects were most recorded as general activity levels. In contrast, documentation of smoking, nutrition or substance use was rare. Sleep disturbances,

Table 2 Quality of anamnesis and assessment

	Total n=98				
	Intervention n=74		Control n=24		
	%	N	%	n	P value
(a) Quality of anamnesis					
Baseline status (documented)					
Pain characteristics					
LBP history taken	86.5	64	79.2	19	0.514
Time course	83.8	62	70.8	17	0.233
Acute	10.8	8	8.3	2	1
Subacute	5.4	4	4.2	1	1
Recurrent	29.7	22	25	6	0.797
Persistent	37.8	28	33.3	8	0.809
Pain area	81.1	60	79.2	19	1
Localised	33.8	25	26	6	0.462
Widespread	47.3	35	54.2	13	0.641
Pain progression	74.3	55	79.2	19	0.787
Improving	18.9	14	50	12	0.006
Stable	14.9	11	8.3	2	0.511
Deteriorating	40.5	30	20.8	5	0.092
Red flags	14.9	11	8.3	2	0.511
Functional capacity					
Activity limitation	83.8	62	79.2	19	0.757
Pain-related functional behaviours	**71.6**	**53**	**37.5**	**9**	**0.004**
Workability	71.6	53	62.5	15	0.449
Person-centred aspects	36.5	27	20.8	5	0.212
Patient's goals	25.7	19	8.3	2	0.09
Patient's values	13.5	10	0	0	0.113
Patient's resources	16.2	12	12.5	3	1
Patient's treatment expectations	6.8	5	0	0	0.33
(b) Quality of assessment					
Step I: multidimensional assessment					
Biopsychosocial assessment (all dimensions documented)	36.5	27	16.7	4	0.081
Biological dimension (physical and health-related aspects)	100	74	95.8	23	0.245
Physical aspects	98.6	73	95.8	23	0.432
Physical examination	68.9	51	79.2	19	0.439
Range of motions	81.1	60	91.7	22	0.343
Provocative spinal movement directions	64.9	48	70.8	17	0.63
Gait	13.5	10	16.7	4	0.741
Posture	39.2	29	45.8	11	0.636
Motor control	10.8	8	8.3	2	1
Patient specific functions	**37.8**	**28**	**12.5**	**3**	**0.023**
Pain-related physical behaviours	**37.8**	**28**	**12.5**	**3**	**0.023**
Autonomic arousal	6.8	5	4.2	1	1
Muscle strength	17.6	13	16.7	4	1
Muscle activation	5.4	4	4.2	1	1
Physical loading demands	47.3	35	62.5	15	0.243

Continued

Table 2 Continued

	Total n=98				
	Intervention n=74		Control n=24		
	%	N	%	n	P value
Work	27	20	45.8	11	0.128
Free time	1.4	1	0	0	1
Tissue hypersensitivity	44.6	33	41.7	10	1
Other physical tests	27	20	41.7	10	0.207
Health-related aspects	86.5	64	83.3	20	0.741
Activity	70.3	52	66.7	16	0.801
Weight/obesity	8.1	6	16.7	4	0.254
Smoking	0	0	4.2	1	0.245
Alcohol abuse	0	0	0	0	
Nutrition	2.7	2	0	0	1
Sleep deficit	41.9	31	33.3	8	0.484
General condition	40.5	30	37.5	9	1
Pain medication	47.3	35	45.8	11	1
Psychological dimension (cognitive and emotional aspects)	**58.1**	**43**	**25**	**6**	**0.009**
Cognitive aspects	**45.9**	**34**	**4.2**	**1**	**<0.001**
Pain-related worries	**21.6**	**16**	**0**	**0**	**0.01**
Coping	**29.7**	**22**	**4.2**	**1**	**0.011**
Pain catastrophising	5.4	4	0	0	0.569
Hypervigilance	9.5	7	0	0	0.189
Emotional aspects	43.2	32	25	6	0.149
Distress	12.2	9	12.5	3	1
Low mood	9.5	7	0	0	0.189
Fear of physical activity	**31.1**	**23**	**8.3**	**2**	**0.031**
Anxiety	6.8	5	8.3	2	1
Social dimension (social and work-related aspects)	**54.1**	**40**	**29.2**	**7**	**0.038**
Social aspects	25.7	19	12.5	3	0.262
Life-stress events	10.8	8	8.3	2	1
Social support at home	4.1	3	4.2	1	1
Socioeconomic challenges	1.4	1	4.2	1	0.432
Social isolation	4.1	3	4.2	1	1
Cultural background	0	0	0	0	
Visits to several practitioners	9.5	7	0	0	0.189
Complaints seeking	1.4	1	0	0	1
Work-related aspects	47.3	35	25	6	0.061
Workplace issues	10.8	8	12.5	3	1
Work modifications	14.9	11	12.5	3	1
Self-perceived ability to work	**25.7**	**19**	**4.2**	**1**	**0.022**
Fear of not coping with work demands	5.4	4	0	0	0.569
Work community support	6.8	5	0	0	0.33

Bolded values indicate statistically significant difference ($p < 0.05$)
LBP, low back pain.

general condition and pain medication use were noted in under half of EPRs.

Psychological dimensions

Cognitive aspects (eg, worry, coping, catastrophising, hypervigilance) were documented more often in the intervention arm (45.9% vs 4.2% (p=0.001). *Emotional aspects* were also more frequently documented, including fear of physical activity (31.1% vs 8.3%, p=0.031).

Social dimensions

Social aspects (eg, life stressors, social support, socioeconomic challenges, social isolation, cultural background, complaints-seeking behaviours, multiple consultations) were infrequently documented (25.7% vs 12.5%, p=0.262). *Work-related aspects* (eg, workplace issues, work modifications, perceived ability to work, fear of not coping with work demands, support from work community) were more often addressed in the intervention arm, including perceived work ability (25.7% vs 4.2%, p=0.022). Table 2b details the assessment quality.

Quality of treatment plans

First-line treatments

Step II: treatment aligned with low risk for work disability

Risk stratification was documented only in the intervention arm (73% vs 0%, p<0.001). *Pain education* and *advice to stay active* were documented more often (32.2% vs 16.7%, p=0.027 and 62.2% vs 12.5%, p<0.001, respectively). Conversely, advice to avoid activity, such as warnings against bending the back, was documented more often in the control arm (4.1% vs 33.3%, p<0.001). *Addressing healthy lifestyle behaviours,* mainly guiding regular physical activities, was more often documented in the intervention arm (41.9% vs 16.7%, p=0.029) while stress reduction, sleep hygiene, substance abandonment and dietary advice were rarely documented. *Pain management strategies* were documented in about half of EPRs.

Step III: treatment aligned with medium risk for work disability

Although *therapeutic exercise* was well documented in both arms, the content differed notably. Relaxation and breathing exercises were documented five times more often in the intervention arm (79.7% vs 29.2%, p<0.001). In contrast, postural training (4.1 vs 20.8, p=0.02), postural control training (10.8% vs 33.3%, p=0.022), core exercise (14.9% vs 54.2%, p<0.001) and McKenzie were more frequently documented in the control arm (5.4% vs 20.8%, p=0.037). Muscle strengthening and mobility exercises were documented in 25–42% of cases. Exercise modalities, such as functional restoration, Pilates, muscle endurance, cardiovascular, pelvic floor and balance training, were rarely documented overall.

Interventions targeting pain-related fear, such as modifying pain-related behaviour (identifying and practising alternative ways to perform activities and letting go of unhelpful protective habits, eg, guarded movement, avoidance, breath holding, offloading with upper limb support, limping, repetitive stretching and unnecessarily using braces or external supports) and graded exposure to perceived difficult or threatening activities (ie, guiding pain and movement control strategies to build confidence for people to re-engage in valued activities[32]), were more frequently documented in the intervention arm. They were recorded in over half of EPRs (58.1% vs 4.2%, p<0.001), a 14-fold difference.

Step IV: treatment aligned with high risk for work disability

Planned *work-related activities* were documented at similar rates at the first visit (33.8% vs 37.5%, p=0.807). These included ergonomics education, work modifications, assistive devices, lifting techniques, activity pacing and promoting physical activity at work. No documentation was found on direct supervisor contact during the visit, or advice to maintain workplace contact during sick leave. *Behavioural interventions,* for example, psychologically informed physiotherapy, were more common in the intervention arm (71.6% vs 4.2%, p<0.001). Relapse planning was rare in the physiotherapist's first-visit documentation. *Treatment goals* were documented in the majority of EPRs (89.2% overall).

Link between the anamnesis, assessment and treatment planning: the EPRs were also evaluated for the presence of patient-identified individual aspects and whether the treatment plan reflected these. Specifically, it was evaluated whether issues identified during the patient interview, such as sleep difficulties, depressive symptoms or pain exacerbation by specific postures or movements, were addressed in the goal setting and treatment plan. A clear trackable, documented alignment between recognising the issue (anamnesis), assessing patient-specific problem and translating into personalised treatment planning was found in only 36.5% of the intervention arm cases and in none of the control arm (p<0.001).

Second-line treatments: passive treatment modalities were documented for 45% of EPRs in the intervention arm, and 67% in the control arm, although this difference was not statistically significant. Reported modalities included stretching, nerve mobilisation and massage. However, the use of traction (4.1% vs 20.8%, p=0.02) and passive orthoses (0% vs 12.5%, p=0.013) was more frequently documented in the control arm. Taping, fascia mobilisation and referrals to manual therapies were reported only for a small proportion. Table 3 summarises the treatment quality.

Quality of stepwise treatment in relation to disability risk

Step II (treatment aligned with low risk for work disability) was met in 58.1% (n=43) of EPRs in the intervention arm, compared with 4.2% (n=1) in the control arm (p<0.001). *Step III* (medium-risk) was met in 55.4% (n=41) of EPRs in the intervention arm, compared with 4.2% (n=1) in the control arm (p<0.001). No EPRs met *step IV* (high-risk) criteria.

When analysed by risk groups, 53.3% (n=16) of low-risk patients in the intervention arm met *step II* (low-risk) criteria, and 50.0% (n=15) *step III* (medium-risk) criteria.

Table 3 Quality of treatment plans

	Total n=98				
	Intervention n=74		Control n=24		
	%	N	%	N	P value
First-line treatments					
Step II: treatment aligned with low-risk					
Use of risk stratification tool	**73**	**54**	**0**	**0**	**<0.001**
ÖMPSQ-SF scores	**40.5**	**30**	**0**	**0**	**<0.001**
SBT scores	**48.6**	**36**	**0**	**0**	**<0.001**
Both ÖMPSQ-SF and SBT scores	**24.3**	**18**	**0**	**0**	**<0.001**
Information or education about pain	**32.2**	**32**	**16.7**	**4**	**0.027**
Discussion on imaging	14.9	11	4.2	1	0.283
Advice on return-to-activities	64.9	48	41.7	10	0.057
Advice to stay active	**62.2**	**46**	**12.5**	**3**	**<0.001**
Advice to avoid physical activities	**4.1**	**3**	**33.3**	**8**	**<0.001**
Pain management strategies	58.1	43	45.8	11	0.349
Addressing healthy lifestyle behaviours	**51.4**	**38**	**16.7**	**4**	**0.004**
Sleep hygiene	4.1	3	8.3	2	0.593
Dietary advice	2.7	2	0	0	1
Regular physical activity	**41.9**	**31**	**16.7**	**4**	**0.029**
Substance abandonment	0	0	0	0	
Relaxation or stress reduction	21.6	16	8.3	2	0.225
Step III: treatment aligned with medium-risk					
Use of exercise (therapeutic or patient preference)	93.2	69	100	24	0.33
Physical activity based on patient preference	40.5	30	25	6	0.225
Therapeutic exercise	93.2	69	100	24	0.33
Postural training	**4.1**	**3**	**20.8**	**5**	**0.02**
Postural control training	**10.8**	**8**	**33.3**	**8**	**0.022**
Core exercise or spiral stabilisation	**14.9**	**11**	**54.2**	**13**	**<0.001**
Relaxation or breathing	**79.7**	**59**	**29.2**	**7**	**<0.001**
Muscle strengthening	41.9	31	29.2	7	0.338
Muscle endurance training	2.7	2	0	0	1
Cardiovascular training	2.7	2	0	0	1
Range of movement training	32.4	24	25	6	0.614
Pelvic floor	2.7	2	0	0	1
Balance training	1.4	1	0	0	1
Other	27	20	45.8	11	0.128
Functional restoration	4.1	3	16.7	4	0.059
McKenzie	**5.4**	**4**	**20.8**	**5**	**0.037**
Pilates	6.8	5	8.3	2	1
Reducing pain-related fear	**58.1**	**43**	**4.2**	**1**	**<0.001**
Graded exposure	**47.3**	**35**	**4.2**	**1**	**<0.001**
Modifying pain-related behaviours	**52.7**	**39**	**4.2**	**1**	**<0.001**
Step IV: treatment aligned with high-risk					
Behavioural intervention	**71.6**	**53**	**4.2**	**1**	**<0.001**
Psychologically informed physiotherapy	**73**	**54**	**4.2**	**1**	**<0.001**
Relapse plan	6.8	5	4.2	1	1

Continued

Table 3 Continued

	Total n=98				
	Intervention n=74		Control n=24		
	%	N	%	N	P value
Work-related activities	33.8	25	37.5	9	0.807
Information or education on ergonomics	16.2	12	19.2	7	0.233
Work modifications	6.8	5	8.3	2	1
Contact with supervisor during visit	0	0	0	0	
Keep contact with work during sick leave	0	0	0	0	
Recommendation for assistive devices	6.8	5	16.7	4	0.216
Lifting instructions	5.4	4	12.5	3	0.357
Activity pacing	9.5	7	20.8	5	0.16
Physical activities at work	8.1	6	4.2	1	1
Goal-oriented treatment plan					
Treatment plan	93.2	69	91.7	22	1
Clear link between anamnesis, assessment and treatment plan	**36.5**	**27**	**0**	**0**	**<0.001**
Treatment goal	89.2	66	87.5	21	1
Short term	70.3	52	83.3	20	0.289
Long term	27	20	25	6	1
Second-line treatments					
Passive treatment modalities used or advised to	44.6	33	66.7	16	0.099
Joint mobilisation or foam roller	1.4	1	4.2	1	0.432
Joint manipulation	1.4	1	0	0	1
Massage	5.4	4	12.5	3	0.357
Stretching	33.8	25	41.7	10	0.625
Nerve mobilisation	9.5	7	8.3	2	1
Trigger point pressure	0	0	0	0	
Traction	**4.1**	**3**	**20.8**	**5**	**0.02**
Fascia mobilisation	4.1	3	12.5	3	0.155
Heat	0	0	0	0	
Acupuncture	0	0	0	0	
Orthosis	**0**	**0**	**12.5**	**3**	**0.013**
TENS	0	0	0	0	
Taping	5.4	4	4.2	1	1

Bolded values indicate statistically significant difference ($p < 0.05$)
ÖMPSQ-SF, Örebro Musculoskeletal Pain Screening Questionnaire, short form; SBT, Start Back Tool; TENS, transcutaneous electronic nerve stimulation.

In the control arm, no EPRs met *step II* (low-risk) criteria ($p<0.001$).

Of medium-risk patients, 55.6% (n=10) in the intervention arm met *step II* (low-risk) criteria and 50.0% (n=9) *step III* (medium-risk) criteria. In the control arm, 14.3% (n=1) met *step II* (low-risk) criteria and *step III* (medium-risk) criteria ($p=0.006$).

Of high-risk patients, 65.4% (n=17) in the intervention arm met *step II* (low-risk) criteria *and step III* (medium-risk) criteria. In contrast, 7.7% (n=1) of EPRs in the control arm met these criteria ($p=0.001$).

Sensitivity analyses

A sensitivity analysis was performed, excluding patients (n=5) in the intervention group whose physiotherapists received education via peer dissemination; this did not change findings. Similarly, results remained consistent when one patient from the control arm whose physiotherapist had participated in the BPS training was excluded.

DISCUSSION

The aim of this study was to evaluate the quality of physiotherapists' LBP management by applying predefined criteria to their EPR documentation and to examine whether their documented clinical behaviours aligned with a guideline-oriented BPS approach. Physiotherapists in the intervention arm more consistently assessed psychological and social dimensions, applied risk stratification and implemented behavioural strategies. However, person-centred aspects were infrequently documented. A clear link between anamnesis, assessment and treatment planning was documented in only one-third of the intervention arm and was absent in the control arm, indicating that treatment planning did not always reflect patient-identified goals and expectations. These results show that although documentation in the intervention arm more often aligned with BPS target behaviours, implementation was partial, underscoring the challenges of translating professional training into consistent clinical behaviours and documentation.

EPRs support informed decision-making and continuity of care.[33 34] They also safeguard patients' rights, protect healthcare professionals legally and support quality, safety and continuous learning.[34–36] Although red flag assessment is critical at the first visit, it was rarely documented, possibly reflecting physiotherapy referral pathways and access to national Patient Data Repository. Reassuringly, however, biological dimensions were well covered in the first visits examined in this study. Since 2022, physiotherapists in Finland have served as potential first-contact professionals, underscoring the need to further strengthen first-visit documentation.

OHPC physiotherapists have the potential to positively influence work disability rates, given their access to information on workplace culture, modifications and job demands.[16 37] While a comprehensive multidimensional assessment and treatment (steps I–III) require considerable time already at the first visit, in OHPC it remains essential to assess the relation between symptoms, work demands and the need for work-related interventions.

Previous research suggests that self-reported clinical behaviours may be overestimated compared with observed behaviours and that physiotherapists should increase their focus on psychosocial factors in practice.[22] In OHPC, a study on nurses found gaps in the systematic documentation and follow-up of psychosocial stressors, and responses to detected risks were often inadequate.[38] We observed similar shortcomings: even when psychosocial issues (such as low mood, fear of activity or workplace stressors) were documented, follow-up plans rarely aligned with the patient's stated concerns and needs.

EPR templates vary across companies.[34] Most templates in the study included standard sections: consultation, chief complaint (reason for arrival), anamnesis, status and plan. Previous work suggests that loose EPR structures are not well suited for documenting work ability in OHPC.[34] Consistent with this, we identified gaps in documentation of planned work-related activities. However, our analysis was restricted only to first-visit records. Previous research has also identified poor quality of physiotherapy outcome registration as a barrier to reusing routinely collected data for research purposes.[24 39 40] A core set of data elements has been proposed for musculoskeletal therapists in OHPC, including health status, pain characteristics, psychosocial and work-related aspects and treatment interventions. As these are potentially predictive of work-related musculoskeletal disorders, there is a need to develop standardised minimum datasets tailored to physiotherapists and physicians in OHPC to support value-based musculoskeletal care.[16] This aligns directly with the rationale of our study. The structured evaluation tool we applied covered the proposed core content, adding clinical reasoning, functional capacity, work ability and person-centred elements to support informed clinical decision-making and continuity of care. The tool was developed by the research team for retrospective analysis; it was not available for the participating physiotherapists nor included in the BPS training. We found differences between the arms. Our findings suggest an association between having received specific BPS training and more multidimensional structured documentation, as without such training essential BPS dimensions remained undocumented in the control arm.

This study has several strengths. The design allowed for evaluating care in routine OHPC settings without disrupting workflows. Retrospective use of EPRs provided insights into real-world practice, enhancing external validity. Using existing documentation imposed no additional burden on patients or professionals and reduced biases associated with direct observation or interviews. Documentation is legally required in Finland to be completed immediately after the clinical encounter, which enhances accuracy and reliability. The retrospective design enabled timely access to mandated documentation without interfering with patient care. Because registry data are generated independently of research activities, they provide an authentic reflection of clinical behaviour. The cluster-randomised sampling approach ensured representation of the broader Finnish working population and inclusion of individuals across all risk groups supports generalisability. The study complied with ethical and legal requirements, including the General Data Protection Regulation, national data protection legislation[41–45] and ethical approvals. The EPRs contained rich clinical detail, including assessments, treatment decisions, follow-up plans and referrals to multidisciplinary services, providing a comprehensive view of physiotherapy. Two researchers at each time extracted and evaluated the data using a structured evaluation tool, with discrepancies resolved through seeking consensus with a third researcher, strengthening inter-rater reliability and credibility. Predefined quality criteria ensured standardised evaluation, enhancing transparency and reproducibility.

An inherent limitation is that not all aspects of care may have been recorded, while documentation was used

as a proxy for physiotherapists' behaviour. Thus, findings reflect documented rather than all delivered care.[22 46] Mapping narrative EPRs to predefined criteria required interpretation, introducing the possibility of misjudgement, although a structured evaluation tool was used. Moreover, our scoring approach captured only the presence, not the depth nor adequacy of the documentation. Some EPRs were inconsistently detailed or incomplete, which may have influenced accuracy.[16 25 47–50] Contextual factors influencing treatment decisions and continuity of care, such as patient preferences, time constraints or availability of multidisciplinary staff, were generally absent. Important aspects of treatment quality, such as shared decision-making, were seldom recorded in detail.[51] Variation in EPR systems across providers may have introduced heterogeneity unrelated to clinical practice.[34 52] No pilot study was undertaken in this secondary analysis of trial data. Some dual roles of researchers may have exposed them to observer bias in EPR abstraction and interpretation, despite efforts to standardise the extraction procedure and apply predefined criteria. To minimise this risk, those involved in the BPS training were not affiliated with OHPC providers, and those employed by participating companies were not involved in the training. Finally, the number of EPR cases (98) was slightly below the calculated size (99 participants required, 79 from intervention, 20 from control arm to detect statistically significant between-group differences), which may have affected statistical power. Transferability to other countries and healthcare systems may be limited by differences in financing, professional scope of practice and documentation infrastructure.

The scope of Finnish employer-funded OHPC differs from general primary care by its close connections to preventive occupational health services including professional consultations, health check-ups and workplace collaboration.[28 53] Even in OHPC, physiotherapists assess musculoskeletal complaints through clinical examination and functional capacity assessments, evaluate work-relatedness and work ability, provide self-management advice, including exercise guidance and plan follow-up and workplace actions. These role expectations may support more consistent documentation in domains aligned with OHPC processes, whereas other guideline-recommended elements may be documented less systematically if they are not embedded in local workflows, reflected in EPR templates or emphasised during training.

Implications for healthcare professionals, managers, policy makers and information technologists

Our study provides concrete direction for the 'act' phase of the PDSA cycle. First, physiotherapists seem to need additional support to translate BPS principles into clinical behaviours and individualised treatment plans, and including specific training on documentation practices and competency assessment would add to the BPS education.[54] Second, follow-up mentoring and case-based learning might reinforce the integration of psychological and social dimensions in care, particularly for individuals with higher risk scores.[55] Third, structured EPRs with BPS target behaviours based on competency checklist as quality indicators could serve as benchmarks for developing national standards in LBP assessment and management. Fourth, integrating patient-reported outcomes and feedback mechanisms would help align care with patient priorities. Structured templates, checklists and EPR prompts could support consistent and systematic documentation of BPS dimensions.

Implications for researchers

Future research should examine how structured documentation tools, decision-support systems or dialogue-support templates facilitate more consistent and comprehensive implementation of BPS approach. The impact of integrating documentation practices into training, alongside different forms of follow-up support, should be further explored. It would also be valuable to examine whether, and how, adoption of a BPS approach differs in new vs continuous patient-physiotherapist relationships. Furthermore, competency assessment and fidelity testing based on real-life observations should be performed to assess delivery quality in addition to proxy measures. Longitudinal studies are needed to establish whether improved documentation quality translates into better care processes and patient outcomes. Finally, as artificial intelligence (AI) is increasingly used for quality evaluation, documentation must be structured to ensure reliable evaluation. AI scribe applications are in the early adoption phase and may improve documentation efficiency, but also introduce errors of omission, fabrication or substitution. Risks related to privacy and data security must be acknowledged.[56]

CONCLUSIONS

Training in guideline-oriented BPS approach was associated with more frequent documentation of target behaviours consistent with high-quality LBP management. Physiotherapists in the intervention arm more consistently assessed psychological and social dimensions, applied risk stratification and implemented behavioural strategies. However, systematic documentation of psychological and social dimensions, person-centredness and linkage between assessment and treatment planning remained insufficient. These findings underscore the need for complementary implementation strategies to strengthen the consistent delivery and documentation of BPS assessment and management in routine OHPC practice.

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PAPER II

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Cost analysis comparing guideline-oriented biopsychosocial management to usual care for low-back pain: a cluster-randomized trial in occupational health primary care

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Objectives This study aimed to investigate the effect of a brief training intervention for occupational health services (OHS) professionals on multiprofessional resource utilization and the costs of biopsychosocial management of patients with low-back pain (LBP) compared to usual care among all participants and those in work disability-based risk groups.

Methods OHS utilization and back-related sick leave data were collected from electronic patient records over one-year follow-up comparing 232 patients in the intervention arm and 80 control-arm patients, stratified for risk of work disability based on the Örebro Musculoskeletal Pain Screening Questionnaire. We estimated costs using linear mixed models by multiplying unit costs (in euros) by each type of OHS resource use (visits to physicians, physiotherapists, nurses, use of imaging) and the number of sick leaves. Estimated mean cost differences with confidence intervals (CI) were reported using bootstrapping to deal with skewed cost data.

Results The median number of visits to physicians and physiotherapists in the intervention versus control arms was 1 [interquartile range (IQR) 0–3] and 2 (IQR 1–4) versus 2 (IQR 1–3) and 1 (IQR 0–2), respectively. The intervention arm accrued lower physician costs (€-43, 95% CI €-82– -3, P=0.034) and higher physiotherapist costs (€55, 95% CI €26–84, P<0.001) compared to the control arm. There was no statistically significant difference in average total costs between the arms (€-1908, 95% CI €-6734–2919). In the low- and medium-risk groups of work disability, physiotherapist costs were higher in the intervention than control arm, but no statistically significant differences were observed between the arms in the total resource utilization or sickness absence costs.

Conclusions Brief biopsychosocial training may support shifting OHS resources towards multiprofessional physiotherapist-driven care, instead of solely physician-driven care, for management of patients with LBP in differing risk groups of work disability with no substantial differences in total costs.

Key terms health services research; implementation research; occupational health service; pain; resource; return to work; risk stratification; screening; workability; Örebro Musculoskeletal Pain Screening Questionnaire.

Low-back pain (LBP) is one of the most common work-related conditions and can be quite costly (1–4). Therefore, identifying a mix of services that are both effective and cost-effective is of great importance in modern occupational healthcare. Most patients with new episodes of LBP recover quickly, however recurrence is common and, for a small proportion, LBP becomes persistent and disabling (5). Long periods of sickness absence predict disability pensions, but even relatively short sickness absences can be predictive of disability (6). In a registry-based real-world study, the prevalence of chronic LBP in 2011–2017 was 2.7% in specialized

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care settings and 5.8% in combined specialized and primary care in Finland. Importantly, the specialized care patients had lower socioeconomic status, employment rates and disposable income levels and higher likelihood of comorbidities compared to their matched population-based controls (7). These findings highlight the need for more comprehensive strategies to mitigate disability from LBP.

In recent years, multiple tools have been developed for the prediction of work disability risk among patients with musculoskeletal pain. One of these is the validated Örebro Musculoskeletal Pain Screening Questionnaire (ÖMPSQ) (8), which was found to have "acceptable" performance for prediction of disability outcomes but "excellent" performance concerning absenteeism (9). A 10-item short form of the ÖMPSQ (ÖMPSQ-SF) extracted from the 25-item full version (10) was found to be "good" in predicting work disability (11). In a population-based cohort, the high-risk group according to ÖMPSQ-SF had 7.5-times higher number of sick leave days and 16.1-times higher odds of disability pension over a 2-year follow-up compared to the low-risk subgroup (11). Importantly, a stratified approach, with more focus on high-risk patients, has been found to be effective in reducing long-term disability among patients with musculoskeletal pain (12).

The occupational health services (OHS) provide an excellent context for developing multiprofessional collaboration by being oriented towards workability support, well connected to workplaces, and in close partnership with different stakeholders. Under the Finnish Occupational Healthcare Act, all employers must provide OHS to their employees to foster safety and health and prevent work disability. In addition, most employers voluntarily purchase primary healthcare services and sometimes specialist consultations from the OHS, as agreed in the varying contracts between the OHS providers and the employers. In 2021, 90.1% of the Finland's employed workforce (1.98 million people) were covered by preventive OHS and further 90% of those had also access to occupational health (OH) primary care services (13).

While all major guidelines on the management of LBP recommend a biopsychosocial (BPS) management approach (14), the training for OH professionals to use this approach has not been widely available. Previously, we have reported the clinical effectiveness of a brief training intervention for OH professionals in implementation of guideline-oriented and risk stratified BPS management of LBP in a cluster-randomized study with 1-year follow-up (15, 16). In the trial, we observed no clinically relevant differences between the patient-reported outcome measures of the patients recruited by the healthcare practitioner trained in BPS management of LBP and those of the patients recruited through usual OHS over one-year follow-up (15). In the present study, we have proceeded to conduct an economic evaluation (17) of the aforementioned trial (15). Specifically, we have investigated the effects on multiprofessional resource utilization and associated costs to employers (i) among all LBP patients and (ii) in patient groups stratified for work disability risk according to ÖMPSQ-SF.

Methods

Study setting and participants

The OHS are important providers of primary care in Finland, delivering services of OH physicians, nurses, physiotherapists, and psychologists. At the time of this study, the latter two were available according to OH physicians' and nurses' referrals, but, since 2022, OH physiotherapists have also been first-contact clinicians.

As detailed previously (15), a total of 27 OHS units from six different private and publicly funded companies participated in the study. For each participating company, the units were randomized to either an intervention or to a control arm. BPS training for OH physicians and physiotherapists lasted 3–7 days, depending on the professional. A total of 28 professionals attended the initial training in 2017, 21 in 2018, and 17 at both times, while 32 professionals attended at least one of the trainings. The brief training (4 days in the initial training in September 2017 and 3 days in the booster training in June 2018, in total 44 hours) intervention for OH professionals in implementing guideline-oriented stratified BPS management was held by world-leading experts in LBP management (16). The extensiveness of the training was similar to conventional continuing education workshops for professionals and feasible to accomplish. In the supplementary material (www.sjweh.fi/article/4212), figure S1 presents the infographic of guideline-based BPS patient management of LBP for which the professionals in the intervention arm received training. The training included presentations, discussion, and practical training with patient demonstrations about clinical assessment, clinical reasoning, therapeutic alliance, pain behaviors, fear-avoidance, imaging, communication skills and key management principles (16). Professionals working in the control arm were not exposed to the BPS training and were therefore expected to treat patients as usual.

The professionals in both the intervention and control arms recruited the patients for the study from 25 September 2017 to 1 December 2018. We included all patients aged 18–65 with LBP with or without radicular pain. Exclusion criteria were suspicion of a serious underlying cause of LBP and need for urgent care (15).

Analyses are based on the data of 312 patients (232

in the intervention and 80 in the control arm) who responded to the electronic questionnaire and provided written informed consent to participate and for their register data to be accessed. The intervention arm included 12 OHS units. Of the original 15 control units, patients were recruited from 10 OHS units. Figure 1 presents the CONSORT flow diagram for the cluster-randomized controlled trial.

The ethics committee of the Northern Ostrobothnia Hospital District has approved the research (79/2017), which was conducted according to the Declaration of Helsinki and retrospectively registered in the BioMed Central register (ISRCTN11875357). The only deviation from the protocol emerged from denied access to national register data on work disabilities due to changes in data regulations beyond our control. The University of Oulu was the registrar of the study (16).

OHS visits, imaging, and back-related sick leave days

Patient-level data on OH primary care utilization was extracted from electronic patient records (EPR). Data were collected retrospectively from individual EPR one year after the date of consent obtaining the number of face-to-face visits and remote visits to OH professionals (physicians, physiotherapists and nurses) and the associated ICD-10 M40-M54 diagnoses. Physicians included the specialist OH physicians and physicians without specialization in OH but working in OH primary care. We excluded all general medical examinations, mandatory occupational safety examinations, telephone calls for booking appointments or prescription renewals and group sessions.

Multiprofessional physiotherapist-driven care was coded as a variable, based on records, to show at least one physiotherapist visit in addition to at least one visit to a physician or a nurse in OHS. The number of imaging examinations and number of sick leave days accrued according to ICD10 M40-M54 diagnoses within the 12-month follow-up were extracted from the EPR.

Costs

Limited societal and healthcare perspectives were applied in our analysis. Societal perspectives typically include estimated effects on productivity and, in this study, sick leaves were used as an indicator of productivity costs, supplementing our healthcare perspective on the use of OHS resources. The chosen healthcare perspective is that of an OHS payer since employers

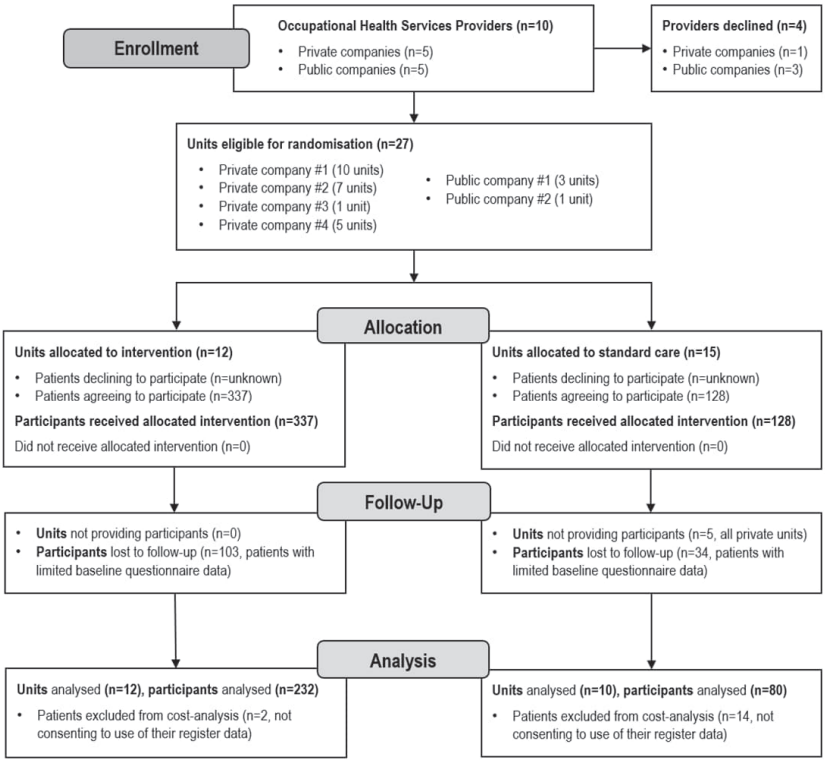

Figure 1. Flow chart of the phases of the cluster randomized controlled trial used in the cost analysis.

paid the costs of the use of OHS over the trial follow-up. Employers can later apply for partial (50–60%) reimbursements from KELA, the social insurance institution. In Finland, employers pay all costs for the 1–10 first sick leave days, thereafter they receive partial reimbursement if they continue paying wages during later part- or full-time sick leave.

We estimated OHS costs by multiplying healthcare unit costs (in euros) (18) by each type of OHS resource use (supplementary table S1). In 2017, the Confederation of Finnish Industries estimated the cost of a sick leave day to be €350. We summarized the costs to the following categories and used them as study outcomes: visits to physicians, physiotherapists and nurses; medical imaging or other diagnostic examinations [including radiograph (X-ray)/magnetic resonance imaging (MRI)/electroneurography (ENG)/electromyoneurography (ENMG)]; total OHS resource use; and sick leave days due to LBP.

Total costs, which included all these costs, were also calculated. All cost variables were treated as continuous.

In our trial, the OHS service providers did not pay for the BPS training intervention and participants could attend without fees during their normal working hours. In additional sensitivity analysis, we estimated the direct cost of the initial training to be €2500 and the direct cost of the booster training to be €1000, based on the trainers' salaries for the time used. Unfortunately, we were only able to estimate these associated indirect productivity costs for employers because we did not have access to data on the participants' salaries or other potential expenses, such as travel costs. A one-time investment of €29 222 for delivering the training was included in the additional analysis, equivalent to €126 per patient recruited from the intervention arm. This calculation also includes estimates of professionals' salaries for the time spent attending the training.

Work disability risk according to the Örebro Musculoskeletal Pain Screening Questionnaire - Short Form

We used the 10-item ÖMPSQ-SF (supplementary figure S2) (10), which has been translated and validated in Finnish (19) as a risk stratification tool for work disability. The items of ÖMPSQ-SF include: (i) the duration of pain(s), (ii) pain rating, (iii) the ability to do light work, (iv) the ability to sleep at night, (v) feelings of anxiety, (vi) feelings of depression, (vii) the perceived risk of pain becoming chronic, (viii) perceived opportunities to return to work and (ix and x) fear-avoidance beliefs. Each item is scored 0–10, and respondents are divided into three groups according to their total scores: (i) low (0–39 points); (ii) medium (40–49 points); and (iii) high risk (50–100 points) (10, 20).

Baseline characteristics

Descriptive characteristics in relation to demographics, general health, LBP and workability were surveyed at baseline (15) including age, gender, body mass index (BMI, self-reported weight per squared height kg/m^2), smoking, self-rated health (EuroQol (EQ)-5D, 0–100 visual analogue scale), health-related quality of life using the EQ-5D-3L, the Depression Scale (DEPS), pain duration, the Oswestry Disability Index (ODI), workability (0–10 numerical rating scale), number of sick leave days due to LBP during preceding three months and fear of physical activity or work (Fear-Avoidance Beliefs Questionnaire, FABQ).

Statistical methods

The distribution of included variables was described using means with standard deviations (SD) for normally distributed continuous/count variables, medians with interquartile ranges (IQR) for non-normally distributed continuous/count variables and using frequencies (N) with percentages (%) for categorical variables. The statistical significance of the differences between intervention and control groups was estimated using the independent-samples T test, Chi-square and Mann-Whitney U tests, as appropriate, in the total study sample and within the ÖMPSQ-SF risk groups. As a supplementary analysis, we compared costs between ÖMPSQ-SF risk groups in the total sample and estimated the statistical significance of potential differences using Kruskal-Wallis test. P-values <0.05 were considered statistically significant.

Two-level linear mixed models, with fixed effects for group (intervention versus control) and random effects for unit, were used to analyze the associations between trial arms and costs among all LBP patients and within ÖMPSQ-SF risk groups. Mean differences in the costs between the trial arms were reported with accompanying confidence intervals (CI) and associated P-values. Bootstrapping with 2500 replications was used to attempt to deal with skewness in the distribution of costs. Analyses included unadjusted and adjusted models, and confounders for each model were selected from baseline variables based on a statistically significant difference in the distribution between trial arms and were as follows: duration of pain and pain-related fear for physical activity for all patients, age for ÖMPSQ-SF low-risk group, general health for medium-risk group, and duration of pain for high-risk group. Statistical analyses were conducted using SPSS Statistics version 29 (IBM Corp, Armonk, NY, USA).

Results

Patient characteristics (total N=312) are shown in table 1a. In all, 58% were women and the age range was 21–64 years. A total of 52.9% of the participants belonged to the ÖMPSQ-SF low-risk, 21.5% to the medium-risk and 25.6% to the high-risk group. Statistically significant differences between the trial arms in the ÖMPSQ-SF groups at baseline are shown in tables 1b–d.

OHS visits, resource use, and sick leave days

During the one-year follow-up, the median number of visits to physicians was 1 (IQR 0–3) in the intervention arm and 2 (IQR 1–4) in the control arm, while the median number of physiotherapist visits was 2 (IQR 1–3) and 1 (IQR 0–2), respectively (table 2a). In the intervention arm, 90.1% (N=209) received multiprofessional physiotherapist-driven care compared to 63.7% (N=51) in the control arm (P<0.001; table 2b). In the high-, medium- and low-risk groups use of multiprofessional physiotherapist-driven care was higher in the intervention arm (89.7% versus 91.4% versus 89.7%, respectively) than the control arm (50% versus 65% versus 71.1%, respectively; table 2b).

Both physician and physiotherapist were seen in total in 158 cases including 122 (52.6%) patients in the intervention arm, and 36 (45.0%) in the control arm, respectively. All three (physician, nurse and physiotherapist) were seen in 18 cases including 13 (5.6%) patients in the intervention arm and 5 (6.3%) of patients in the control arm, respectively. The number and percentage of patients having contact only with a physician was 15 (6.5%) in the intervention arm and 22 (27.5%) in the control arm, while 1 person (1.3%) had contact with a nurse in the control arm (P<0.001).

The median number of sick leave days in the intervention arm was 0 (IQR 0–5) and 1 (IQR 0–11) in the control arm. In the intervention arm, 64.7% of patients had no sick leave due to LBP over the 1-year follow-up period compared to 50% in the control arm. Figure 2 shows the use of OHS resources and sick leave days (minimum, maximum, median and percentiles) in the trial arms stratified by ÖMPSQ-SF risk groups.

Costs

Table 3 presents the main results of the study in the trial arms for the total study sample and stratified for the ÖMPSQ-SF risk groups. The median cost of all OHS resource use was €222 (IQR €144–389) per patient in both the control and intervention arms. The intervention arm accrued significantly lower costs for physician visits (adjusted mean difference: €-43, 95% CI €-82–-3) but higher costs for physiotherapist visits (€55, €26–84) compared with the control arm. Total costs did not differ statistically significantly between the arms €-1908 (€-6734–2919). Supplementary table S2 presents a comparison of total costs between trial arms including the estimated training costs.

In the low- and medium-risk groups, physiotherapist costs were higher in the intervention than control arm (adjusted mean difference €49, 95% CI €11–88 in the low-risk group, and €52, 95% CI €0–104 in the medium-risk group). Sickness absence costs seemed to be lower in the intervention arm among patients with medium- and high-risk of work disability but not statistically significantly compared to the control arm. Supplementary table S3 presents the unadjusted associations between trial arms and estimated costs.

The analysis comparing visits, sick leave days, total estimated OHS resource use and costs between the ÖMPSQ-SF risk groups in the total sample combining intervention and control arms is shown in supplementary table S4. The median number of OHS visits and days on sick leave differed statistically significantly between the groups. For example, the median number of days on sick leave were higher in the high- and medium-risk ÖMPSQ-SF groups [5 (IQR 0–34) and 0 (IQR 0–7) days, respectively] than in the low-risk group [0 (IQR 0–3) days].

There were also statistically significant differences in the OHS resource utilization and sick leave costs between the ÖMPSQ-SF risk groups. For instance, compared to the low-risk group, the total costs for patients in the high-risk group were more than five-fold higher with intervention arm [€1196 (IQR €199-9096); versus €222 (IQR €148-840)] and as much as twelve-fold higher in the control arm [€2801 (IQR €942-18220); versus €232 (130-1725), respectively].

Discussion

The current study was, to our knowledge, the first to evaluate subsequent changes in OHS resource use and costs after implementing a guideline-based BPS model for managing patients with LBP in the OH primary care setting. The study suggests that a brief BPS training intervention for OH professionals may help to shift OHS resources towards multiprofessional physiotherapist-driven care, instead of solely physician-driven care, without significant differences in total costs. Stratification according to ÖMPSQ-SF risk groups showed that in the low- and medium-risk groups of work disability, physiotherapist costs were higher in the intervention than control arm, but no statistically significant differences were observed between the arms either in the average total resource utilization or the sickness absence costs.

Table 1a. Baseline characteristics of participants in the trial arms. **Bolded scores denote statistical significance with P<0.05**. [EQ=EuroQol score; FABQ=Fear Avoidance Beliefs Questionnaire; IQR=interquartile range; ODI=Oswestry Disability Index; SD=standard deviation].

	Total (N=312)						
	Intervention (N=232)			Control (N=80)			P-value
	% (N) [a]	Mean (SD) [b]	Median (IQR) [c]	% (N) [a]	Mean (SD) [b]	Median (IQR) [c]	
General health							
Age (years)		44.6 (9.4)			45.9 (11.2)		0.341
Female sex	54.7 (128)			65.4 (53)			0.092
Body mass index (kg/m²)		27.7 (5.3)			27.3 (4.3)		0.527
Smoking	15.0 (35)			16.0 (13)			0.814
Self-rated health (1–100)			75 (65–85)			80 (65–85)	0.327
EQ-5D (0–1)			0.76 (0.69–0.80)			0.76 (0.69–0.80)	0.566
Depression Scale			4 (2–9)			4 (2–9)	0.849
Low-back pain-related							
Duration of pain							
<2 weeks	**11.1 (26)**			**19.8 (16)**			**0.017**
2–12 weeks	**32.9 (77)**			**37.0 (30)**			
>3–12 months	**21.4 (50)**			**25.9 (21)**			
>12 months	**34.6 (81)**			**17.3 (14)**			
ODI (0–100)			20 (12–28)			20 (12–29)	0.877
Workability							
Workability (0–10)			8 (6—9)			8 (6–8)	0.542
Sick leave days [d]		49.1 (115)			59.3 (48)		0.116
Sick leave days [d]			8 (4–29)			14 (4–23)	0.572
FABQ - work			11 (4–19)			13 (5–24)	0.097
FABQ - physical activity			**12 (8–14)**			**14 (9–17)**	**0.012**

[a] P-value for between-group difference from Chi square test.
[b] P-value for between-group difference from independent-samples T test.
[c] P-value for between-group difference from Mann-Whitney U test.
[d] Number of low-back pain related sick leave days during preceding 3 months to low-back pain during preceding 3 months.

Table 1b. Baseline characteristics of participants in the trial arms stratified by low-risk work disability groups based on the short form of Örebro Musculoskeletal Pain Screening Questionnaire (ÖMPSQ-SF). **Bolded scores denote statistical significance with P<0.05**. [EQ=EuroQol score; FABQ=Fear Avoidance Beliefs Questionnaire; IQR=interquartile range; ODI=Oswestry Disability Index; SD=standard deviation].

	Low-risk (N=165)						
	Intervention (N=127)			Control (N=38)			P-value
	% (N) [a]	Mean (SD) [b]	Median (IQR) [c]	% (N) [a]	Mean (SD) [b]	Median (IQR) [c]	
General health							
Age (years)		**43.7 (9.4)**			**45.0 (12.5)**		**<0.001**
Female sex	55.9 (71)			60.5 (23)			0.614
Body mass index (kg/m²)		26.9 (5.1)			26.8 (4.3)		0.742
Smoking	14.2 (18)			15.8 (6)			0.804
Self-rated health (1–100)			80 (75–90)			85 (79–90)	0.513
EQ-5D (0–1)			0.86 (0.80–0.86)			0.86 (0.80–0.86)	0.469
Depression Scale			3 (1–4)			3 (1–5)	0.942
Low-back pain-related							
Duration of pain							
<2 weeks	18.1 (23)			31.6 (12)			0.115
2–12 weeks	40.2 (51)			36.8 (14)			
>3–12 months	19.7 (25)			23.7 (9)			
>12 months	22 (28)			7.9 (3)			
ODI (0–100)			12 (8–18)			12 (6–16)	0.313
Workability							
Workability (0–10)			8 (8–9)			8 (7.8–9)	0.173
Sick leave days [d]	44.9 (57)			47.4 (18)			0.787
Sick leave [d]			7 (3–14)			10.5 (3–25.5)	0.482
FABQ - work			8 (2–14)			10.5 (1–21)	0.181
FABQ - physical activity			9 (6–13)			11 (5.5–16)	0.208

[a] P-value for between-group difference from Chi square test.
[b] P-value for between-group difference from independent-samples T test.
[c] P-value for between-group difference from Mann-Whitney U test.
[d] Number of low-back pain related sick leave days during preceding 3 months.

Table 1c. Baseline characteristics of participants in the trial arms stratified by medium-risk work disability groups based on the short form of Örebro Musculoskeletal Pain Screening Questionnaire (ÖMPSQ-SF). **Bolded scores denote statistical significance with P<0.05**. [EQ=EuroQol score; FABQ=Fear Avoidance Beliefs Questionnaire; IQR=interquartile range; ODI=Oswestry Disability Index; SD=standard deviation].

	Medium-risk (N=67)						
	Intervention (N=47)			Control (N=20)			P-value
	% (N) [a]	Mean (SD) [b]	Median (IQR) [c]	% (N) [a]	Mean (SD) [b]	Median (IQR) [c]	
General health							
Age (years)		44.1 (10.1)			48.8 (9.1)		0.378
Female sex	48.9 (23)			70 (14)			0.113
Body mass index (kg/m^2)		28.6 (4.9)			27.4 (4.7)		0.609
Smoking	14.9 (7)			10 (2)			0.591
Self-rated health (1–100)			**70 (60–80)**			**80 (71–85)**	**0.020**
EQ-5D (0–1)			0.79 (0.75–0.80)			0.82 (0.76–0.86)	0.052
Depression Scale			7 (4-11)			6 (2.3–8)	0.346
Low-back pain-related							
Duration of pain							
<2 weeks	2.1 (1)			15 (3)			0.091
2–12 weeks	34.0 (16)			25 (5)			
>3–12 months	21.3 (10)			35 (7)			
>12 months	42.6 20)			25 (5)			
ODI (0–100)			24 (18–28)			21 (16.5–29)	0.611
Workability							
Workability (0–10)			7 (6–8)			7.5 (6–8)	0.199
Sick leave days [d]	46.8 (22)			65 (13)			0.173
Sick leave [d]			7 (4.8–24.3)			15 (7–24.5)	0.088
FABQ - work			12 (6–20)			15.5 (3–24)	0.597
FABQ - physical activity			12 (9–14)			13 (9.8–15.8)	0.151

[a] P-value for between-group difference from Chi square test.
[b] P-value for between-group difference from independent-samples T test.
[c] P-value for between-group difference from Mann-Whitney U test.
[d] Number of low-back pain related sick leave days during preceding 3 months.

Table 1d. Baseline characteristics of participants in the trial arms stratified by high-risk work disability groups based on the short form of Örebro Musculoskeletal Pain Screening Questionnaire (ÖMPSQ-SF). **Bolded scores denote statistical significance with P<0.05**. [EQ=EuroQol score; FABQ=Fear Avoidance Beliefs Questionnaire; IQR=interquartile range; ODI=Oswestry Disability Index; SD=standard deviation].

	High-risk (N=80)						
	Intervention (N=58)			Control (N=22)			P-value
	% (N) [a]	Mean (SD) [b]	Median (IQR) [c]	% (N) [a]	Mean (SD) [b]	Median (IQR) [c]	
General health							
Age (years)		46.6 (8.8)			44.7 (10.6)		0.171
Female sex	58.6 (34)			68.2 (15)			0.433
Body mass index (kg/m^2)		28.9 (5.9)			28.2 (4.0)		0.080
Smoking	22.7 (5)			21.1 (4)			0.575
Self-rated health (1–100)			60 (50–70)			65 (56–70)	0.241
EQ-5D (0–1)			0.70 (0.69–0.78)			0.70 (0.65–0.76)	0.325
Depression Scale			10 (5–15)			9 (4.5–19)	0.953
Low-back pain-related							
Duration of pain							
<2 weeks	**0 (0)**			**4.5 (1)**			**0.014**
2–12 weeks	**17.2 (10)**			**45.5 (10)**			
>3–12 months	**25.9 (15)**			**22.7 (5)**			
>12 months	**56.9 (33)**			**27.3 (6)**			
ODI (0–100)			31 (25.5–44)			31 (27.5–40.5)	0.783
Workability							
Workability (0–10)			6 (3–7)			6 (4–7.25)	0.458
Sick leave days [d]	62.1 (36)			72.7 (52)			0.372
Sick leave [d]			28 (7–75)			12 (5.5–24)	0.947
FABQ - work			19 (10–26)			20.5 (10.8–28.3)	0.779
FABQ - physical activity			14 (12–17.3)			17 (14–20)	0.114

[a] P-value for between-group difference from Chi square test.
[b] P-value for between-group difference from independent-samples T test.
[c] P-value for between-group difference from Mann-Whitney U test.
[d] Number of low-back pain related sick leave days during preceding 3 months.

Table 2a. Occupational health service (OSH) visits and sick leaves in the trial arms during 1-year follow-up, stratified by short form of Örebro Musculoskeletal Pain Screening Questionnaire (ÖMPSQ-SF) risk groups for work disability. [IQR=interquartile range].

	Total		Low risk		Medium risk		High risk	
	Intervention (N=232)	Control (N=80)	Intervention (N=127)	Control (N=38)	Intervention (N=47)	Control (N=20)	Intervention (N=58)	Control (N=22)
	Median (IQR)	Median (IQR)	Median (IQR)	Median (IQR)	Median (IQR)	Median (IQR)	Median (IQR)	Median (IQR)
All physician visits	1 (0–3)	2 (1–4)	1 (0–2)	1 (1–3.3)	1 (0–3)	2 (1–3)	2 (1–5)	3 (1.8–5)
Specialist physician in OH	1 (0–2)	1 (0–3)	1 (0–2)	1 (0–2)	1 (0–3)	1.5 (1–3)	2 (0.8–3)	1.0 (0–4)
Physician without specialization in OH	0 (0–0)	0 (0–0)	0 (0–0)	0 (0–0)	0 (0–0)	0 (0–0)	0 (0–0)	0 (0–1)
Remote physician visits	0 (0–1)	0 (0–1)	0 (0–0)	0 (0–0)	0 (0–1)	0 (0–1)	1 (0–1.3)	0 (0–1)
All OH physiotherapist visits	2 (1–3)	1 (0–2)	2 (1–3)	1 (0–2)	2 (2–3)	1 (0–2.8)	2 (1–4)	0.5 (0–3)
Remote OH physiotherapist visits	0 (0–1)	0 (0–0)	0 (0–1)	0 (0–0)	0 (0–1)	0 (0–0)	0 (0–1)	0 (0–0)
OH nurse visits	0 (0–0)	0 (0–0)	0 (0–0)	0 (0–0)	0 (0–0)	0 (0–0)	0 (0–0)	0 (0–0)
Total OH service resource use	3 (2–5.8)	3 (2–5)	3 (2–5)	3 (1.8–5)	3 (2–6)	3.5 (2–5.8)	5 (3–8)	4.5 (2.8–7.3)
Number of sick leave days	0 (0–5)	1 (0–11)	0 (0–2)	0 (0–4.3)	0 (0–7)	1.5 (0–11.5)	2.5 (0–24.8)	7 (1.5–50.8)

Table 2b. Occupational health service (OHS) resource use in the trial arms during 1-year follow-up, stratified by short form of Örebro Musculoskeletal Pain Screening Questionnaire (ÖMPSQ-SF) risk groups for work disability. [HCP=healthcare professional].

	Total			Low risk			Medium risk			High risk		
	Intervention (N=232)	Control (N=80)	P-value	Intervention (N=127)	Control (N=38)	P-value	Intervention (N=47)	Control (N=20)	P-value	Intervention (N=58)	Control (N=22)	P-value
	% (N) [a]	% (N) [a]		% (N) [a]	% (N) [a]		% (N) [a]	% (N) [a]		% (N) [a]	% (N) [a]	
Multiprofessional physiotherapist-driven care	90.1 (209)	63.7 (51)	<0.001	89.7 (114)	71.1 (27)	<0.001	91.4 (43)	65.0 (13)	0.003	89.7 (52)	50.0 (11)	<0.001
Physiotherapist and physician or nurse visits	82.8 (196)	57.5 (46)	<0.001	85.8 (109)	65.8 (25)	0.006	85.1 (40)	55.0 (11)	0.008	81.0 (47)	45.5 (10)	0.002
Physiotherapist and physician and nurse visits	5.6 (13)	6.3 (5)	0.858	3.9 (5)	5.3 (2)	0.744	6.4 (3)	10.0 (2)	0.599	8.6 (5)	4.5 (1)	0.513
Physician-driven care	6.9 (16)	33.8 (27)	<0.001	7.9 (10)	28.9 (11)	<0.001	4.3 (2)	30.0 (6)	0.003	6.9 (4)	45.5 (10)	<0.001
Physician and nurse visits	0.4 (1)	6.3 (5)	0.001	0	7.8 (3)	0.001	2.1 (1)	5 (1)	0.527	0	4.5 (1)	0.102
Physician visits only	6.5 (15)	27.5 (22)	<0.001	7.9 (10)	21.0 (8)	0.022	2.1 (1)	25.0 (5)	0.003	6.9 (4)	40.9 (9)	<0.001
Nurse visits only	0	1.3 (1)	0.088	0	0		0	0		0	4.5 (1)	0.102
No visits to HCP after recruitment	3.0 (7)	1.3 (1)	0.388	2.4 (3)	0	0.339	4.3 (2)	5.0 (1)	0.893	3.4 (2)	0	0.378
Total percentages (frequencies)	100 (232)	100 (80)		100 (127)	100 (38)		100 (47)	100 (20)		100 (58)	100 (22)	

[a] P-value for between-group difference from Chi square test.

Higher use of physiotherapist resources in the LBP management might imply that patients receive more concrete guidance on self-care and exercises for functional restoration, advice to cope with pain, and encouragement for staying active and returning to work. For patients with LBP, the approximate length of one visit with an OH physician is 15–20 minutes versus 60 minutes with an OH physiotherapist (supplementary table S1). This may provide an added opportunity for learning and getting support also on the BPS aspects of their conditions. In terms of OHS resource use, a shift towards more physiotherapist-driven care for patients with LBP could increase the availability of physician resources for other prioritized patient groups in OHS.

There is a paucity of research on the resource use in the OHS among patients with LBP, and due to the diversity of national systems, the generalizability and applicability of results is limited internationally. A recent Finnish study (N=87 468) examined the use of OHS by diagnosis category showing that patients diagnosed with musculoskeletal disorders (MSD) or/and mental disorders (MD) differed from other workers in their use of OHS and cost of sick leaves. The most common MSD diagnosis was LBP (M40–54), diagnosed in 71% of patients (N=9557) where approximately half also had MD. Up to 30% of patients with MSD had not used the services of an OH physiotherapist at all during the 3-year follow-up period. Employees diagnosed with both MSD and MD accounted for 73% of costs (21). The average OHS cost per patient with LBP in 2017 was nearly two-fold higher with the combination of LBP and MD (Dr. M. Lahelma, personal communication 13.12.2023). In our study, the total costs were five-fold higher with BPS care (€1196 versus €222) and as much as twelve-fold higher under conventional care (€2801 versus €232) for the patients with high risk of work disability compared to those with low risk. Given that

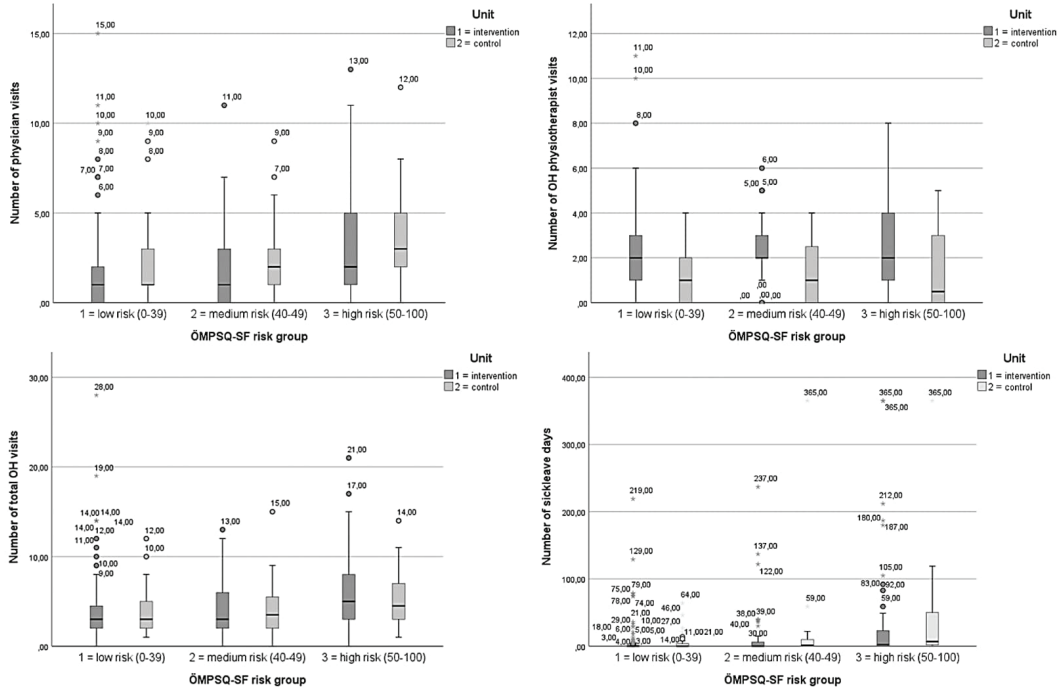

Figure 2. The occupational health services resource use and number of sick leave days in the trial arms, stratified by short form of Örebro Musculoskeletal Pain Screening Questionnaire (ÖMPSQ-SF risk groups). [OH=occupational health].

the ÖMPSQ-SF pays attention to BPS factors, the patients with high risk of work disability in our cohort might have similarly complex and manifold needs to the population diagnosed with MSD and MD in the abovementioned study. The high-risk patients clearly represent a group with need of a broad multiprofessional care to avoid disability.

Extending working careers has become an important objective in aging societies (22), and, thus, identifying patients with an increased risk of work disability at early stage and providing targeted care is crucial. A systematic review demonstrated that a stratified care approach based on STarT Back Tool for patients with LBP provides substantial clinical and health-related cost benefits in the medium- and high-risk subgroups compared with physiotherapy without stratification in primary care (23, 24). Our study supports the findings concerning stratification and encourages the use of ÖMPSQ-SF in the OHS setting to aid decision-making concerning rational allocation of healthcare resources for different subgroups of LBP patients.

Furthermore, our approach combines both work disability risk stratification and BPS management. In the Finnish context, even the Finnish Ministry for Social Affairs and Health recently recommended that BPS rehabilitation for prolonged or recurrent LBP should be routinely offered in the publicly funded health services (25). The recommendation does not specify the roles of the different HCP, but our study suggests that a BPS model can be implemented in the form of multiprofessional physiotherapist-driven care in both public and private OHS (26). Previous studies from the primary care settings have also reported that having a physiotherapist as the primary assessor for patients with MSD appears to be as cost-effective as physician-driven usual care (27–29).

The role of an OHS in LBP management is to assess the patient's workability in relation to their work circumstances and ensure that the necessary support and rehabilitation measures are taken. In Finland, workability support for LBP patients includes services provided by the OH physician (eg, consultations, medical examination and treatment, workability assessment, prescriptions of partial and full sick leave), rehabilitative support provided by OH physiotherapist (eg, counselling and advice on self-care methods for pain management, functional restoration interventions), and workplace activities by both professions as agreed upon and planned

Table 3. Adjusted comparison of mean costs by trial arm for the total study sample and stratified by short form of Örebro Musculoskeletal Pain Screening Questionnaire (ÖMPSQ-SF) risk groups. The mean difference presents the intervention effect. Negative mean difference indicates lower costs and positive mean difference indicates higher costs for the intervention arm. [LBP=low back pain; X-ray=radiograph; MRI=magnetic resonance imaging; ENG=electroneurography; ENMG=electromyoneurography; OHS=occupational health service].

Patient group	Sources of costs (see supplement table 1)	Median (IQR) estimated cost (€)		Mean difference [a] (95% confidence interval)	P-value [a]
		Intervention	Control		
Total (N=312)	Physician visits [b]	66 (0–167)	101 (66–256)	-43 (-82—3)	0.034
	Physiotherapist visits [b]	148 (74–222)	74 (0–148)	55 (26–84)	<0.001
	Nurse visits [b]	0 (0–0)	0 (0–0)	-2 (-7–3)	0.451
	Imaging due to LBP (X-ray/ MRI/ ENG/ENMG) [c]	0 (0–0)	0 (0–0)	-5 (-27–18)	0.682
	OHS resource use [b]	222 (148–392)	222 (134–372)	12 (-51–75)	0.714
	Sick leaves (€350/day) [b]	0 (0–1750)	350 (0–3850)	-1916 (-6715–2883)	0.430
	Total costs [b]	257 (148–2094)	807 (183–4172)	-1908 (-6734–2919)	0.435
Low risk (N=165)	Physician visits [c]	66 (0–101)	66 (66–199)	-46 (-98 – 5)	0.075
	Physiotherapist visits [c]	148 (74–222)	74 (0–148)	49 (11–88)	0.012
	Nurse visits [c]	0 (0–0)	0 (0–0)	-1 (-7–6)	0.840
	Imaging due to LBP (X-ray/ MRI/ ENG/ENMG) [c]	0 (0–0)	0 (0–0)	15 (-17–48)	0.354
	OHS resource use [c]	214 (140–315)	214 (74–338)	23 (-63–109)	0.591
	Sick leaves (€350/day) [c]	0 (0–700)	0 (0–1488)	580 (-2481–3640)	0.709
	Total costs [c]	222 (148–840)	232 (130–1725)	616 (-2497–3728)	0.697
Medium risk (N=67)	Physician visits [d]	66 (0–198)	132 (66–198)	-60 (-145- 24)	0.160
	Physiotherapist visits [d]	148 (109–222)	74 (0–204)	52 (0–104)	0.049
	Nurse visits [d]	0 (0–0)	0 (0–0)	-5 (-13–3)	0.254
	Imaging due to LBP (X-ray/ MRI/ ENG/ENMG) [c]	0 (0–0)	0 (0–0)	-3 (-42–37)	0.877
	OHS resource use [d]	222 (148–413)	257 (134–363)	-1 (-117–115)	0.990
	Sick leaves (€350/day) [d]	0 (0–2450)	525 (0–4025)	-3100 (-13720–7520)	0.562
	Total costs [d]	411 (148–413)	749 (227–4205)	-3088 (-13736–7560)	0.564
High risk (N=80)	Physician visits [e]	132 (66–253)	198 (93–299)	-26 (-112–59)	0.541
	Physiotherapist visits [e]	148 (74–257)	37 (0–222)	57 (-10–123)	0.094
	Nurse visits [e]	0 (0–0)	0 (0–0)	-1 (-11–10)	0.883
	Imaging due to LBP (X-ray/ MRI/ ENG/ENMG) [c]	0 (0–0)	0 (0–27)	-43 (-90–4)	0.072
	OHS resource use [e]	284 (179–558)	315 (186–622)	7 (-131–145)	0.921
	Sick leaves (€350/day) [e]	875 (0–8663)	2450 (525–17763)	-1413 (-15119–12292)	0.838
	Total costs [e]	1196 (199–9096)	2801 (942–18220)	-1406 (-15165–12352)	0.839

[a] Bootstrapped (2500 replications).
[b] Linear mixed model with covariate adjustment for pain duration and FABQ-Physical activity.
[c] Linear mixed model with adjustment for age.
[d] Linear mixed model with adjustment for general health.
[e] Linear mixed model with adjustment for pain duration.

with the workplace (eg, OH collaborative negotiations, workplace assessments and recommendations of work modifications) (30, 31). The widest possible use of different forms of workability support should be directed at patients with elevated risk of work disability, yet 6.9% of high-risk patients in the intervention arm and 45.5% in the control arm received physician-driven single-professional care (P=<0.001). Instead of the previous physician-only or physician-to-physiotherapist practice model, a physiotherapist-only, physiotherapist-to-physician – in case of 'red flags' or a more challenging pain problem – or a more multiprofessional approach, including also a nurse, psychologist or social worker according to the needs, could be implemented in OHS.

The strength of our study is that the cost analysis is conducted on the basis of a cluster randomized controlled trial. This design also offers an opportunity to evaluate the OHS resource use and costs under real world conditions, with recruited patients representative of typical clinical caseloads, a comparison of the intervention with current OHS practice, and follow-up under routine conditions (32). The study involved key nationwide OHS organizations with 27 separate OHS units. Objective data from individual EPR provided complete information on the OHS resource use, based on the mandatory registration of visits and sick leaves for a specific patient group of public health relevance. The limited number of exclusion criteria enhances the generalizability of the results from an OHS setting to a wider primary healthcare context. However, our study population presented with relatively mild risk pattern for work disability, which warrants consideration in terms of generalizability.

Our study has some limitations as well. Patients in the intervention and control arms differed at baseline in terms of age, general health, and pain duration, especially in the ÖMPSQ-SF risk groups. However, we attempted to control for these observed imbalances in the primary analyses. Although the approximate total number of clients served by the units was slightly over 150 000 in both trial arms, substantially less participants were recruited in the control versus intervention arm. In the control arm, approximately 1 per 1250 clients served gave consent to participate, compared to 1 per 450 in the

intervention arm, which indicates recruitment was likely affected by selection bias (33, 34). Moreover, 34% of intervention arm patients' pain lasted >12 months compared to 17% in the control arm (15). A critical factor affecting the completion of the study was the slow pace of patient recruitment. This occurred despite our effort to design the inclusion and exclusion criteria as pragmatic and simple as possible, aiming to minimize the workload for professionals within the participating OHS units. The training intervention was free of direct costs to the OHS providers and participants. It is easy to think of the intervention as a form of voluntary continuous education typically provided by OH employers to their employees, which could also be considered as an investment of time for better care, which is why we did not include training costs in the main analysis. The training costs can be seen as a one-time investment for better division of work and well-being at work. Nevertheless, training costs are a relevant issue for wider implementation, and we also undertook an additional sensitivity analysis by adding an artificially high cost per patient to cover the estimated costs of training (supplementary table S2). The cost of training on a per-patient basis would likely be much lower, as training would also be likely to contribute to the care many future patients. Even when using an upper-end estimate of €126 per patient, our base-case findings were not altered to any substantial extent.

In this study, we did not have access to records of OHS resource use or sickness absence for diagnoses other than LBP. We could not evaluate either the role of presenteeism or the KELA reimbursements provided to employers. We assume that these factors impacted both study arms equally. If any impacts were present, they likely contributed to cost reductions for employers. Additionally, the use of partial sick leave likely reduced costs, but this was not common in our data, with partial sick leave being prescribed for only 3.8% (N=9) and 2.5% (N=2) of patients in the intervention and control groups, respectively. It is important to note that the association of LBP and MD and their combination is linked to more frequent use of healthcare resources (21, 35) and work disability (3, 36, 37). Even though trial-based analyses often have limitations, the study provided tools for professionals to identify BPS risk factors for disability and to prioritize the use of OHS resources optimally based on individual needs. Partly due to regulatory problems outside our control and incertitude caused by selection biases in this cluster-randomized trial, we were not able to obtain sufficient data to conduct a full economic evaluation in a sufficiently robust manner. Therefore, we combined estimated healthcare-payer and sick-leave costs to form a cost analysis from a limited societal perspective, thus providing useful new evidence comparing some of the costs associated with usual care to those of a guideline-oriented BPS approach to management of LBP.

The evaluation and treatment process of guideline-based BPS management (supplementary figure S1) took into account the multidimensional nature of LBP (38). The percentage of trained physiotherapists was 44% but the respective coverage for physicians was only 2% (analysis not shown). This is a limitation for implementation of the BPS model in the intervention units. However, the training participants were urged to use and champion the BPS model to guide and support colleagues. The BPS model of care may be more easily implemented in the future since the intervention has now been tested in a real clinical OHS setting (39, 40).

Importantly, our previous study serving as the platform of the present study was designed to enhance a new approach to pain management in the OH primary care setting. In the future, an agile subgrouping of patients could be useful in the implementation of patient-centered treatment pathways. Reorganizing LBP management in OH primary care could help to manage physician workload and promote a more efficient use of OHS resources. As the high-risk patients might have multiple risk factors for work disability, their OHS care should be carefully planned and coordinated, including the continuity of multiprofessional BPS care and return-to-work coordination.

Concluding remarks

With no substantial difference in total costs, brief BPS training may help LBP patients with differing risks of work disability by shifting OHS resources from solely physician- to multiprofessional physiotherapist-driven care. Implementation research is needed to further analyze the use of stratification by work disability risk, with pre-defined criteria for defining adherence to the intended model of LBP care.

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PAPER III

BMC Health Services Research

RESEARCH Open Access

Capabilities, opportunities and motivations in implementing guideline-oriented biopsychosocial low back pain management: perceptions of occupational healthcare professionals after an educational intervention

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Abstract

Background We explored Finnish occupational healthcare professionals' (HCP) perceptions of biopsychosocial (BPS) low back pain (LBP) management after an educational intervention.

Methods We conducted twelve group interviews of 51 physicians, physiotherapists and nurses from intervention units in a cluster randomized controlled trial (ISRCTN11875357). We used deductive and inductive content analysis to examine the data, and the Capability-Opportunity-Motivation-Behaviour (COM-B) model to identify the facilitators of and barriers to changes in three target behaviours: (A) forming a common BPS-based understanding with patients, (B) systematically using risk stratification tools, and (C) multidisciplinary collaboration in individualized care planning.

Results Facilitators and barriers were categorized into the following COM-B domains. Most of the facilitators were in the *Capability* and *Motivation* domains: increased confidence regarding managing treatment decisions, improved therapeutic alliance and renewed professional identity. Significant system-level barriers were mostly in the *Opportunity* domain: time constraints, limited resources and unclear treatment pathways. The HCPs reported improved individual skills and awareness after the training, but varying organizational policies and lacking incentives hindered the adoption of BPS methods in multidisciplinary teams. Initial resistance to change decreased as positive patient outcomes emerged. The perceived benefits were increased multidisciplinary collaboration and a shift toward holistic pain management. Those who embraced BPS management reported greater professional satisfaction and confidence when handling LBP patients.

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Conclusions To effectively implement BPS management in occupational health services, organizational and system-level barriers must be addressed and HCPs' skills and motivation enhanced. For sustained support through policy initiatives and reinforced multidisciplinary collaboration, future strategies should integrate BPS practices into routine workflows.

Trial registration The trial was retrospectively registered on 13.05.2019 ISRCTN11875357.

Keywords Implementation, Occupational health services, Musculoskeletal, Qualitative, Primary care, Multiprofessional

Introduction

Clinical guidelines recommend the biopsychosocial (BPS) approach for managing disabling low back pain (LBP) [1–5]. BPS management emphasizes personalized pain education, fear reduction, functional activation and the adoption of healthy lifestyle behaviours for patients for whom serious pathology has been ruled out. The intensity of the intervention should be tailored to the patient's individual needs [6–8]. BPS interventions have produced inconsistent results. Implementing them in clinical practice has been challenging [9, 10] and optimal implementation strategies for multidisciplinary healthcare services remain unknown [11–14]. Research in the context of occupational health services (OHS) is scarce, and this highlights a crucial gap and the need for further development.

Randomized trials have repeatedly concluded that publishing clinical guidelines alone is not enough to change treatment practices [15]. Merely changing the perceptions of individual healthcare professionals (HCPs) and enhancing their professional skills through training does not necessarily lead in adopting new behaviours [16–18]. Previously identified barriers to using BPS management on LBP patients include a lack of knowledge, time constraints, traditional expectations of the physiotherapist's role, lack of confidence and inadequate training in how to deliver BPS interventions [10, 19–22]. Implementation strategies for helping HCPs adopt BPS interventions have varied widely [11, 12, 23, 24].

A Cochrane systematic review [25] found that although multidisciplinary BPS management reduced pain and disability in persistent LBP cases, it had no similar benefits for work-related outcomes. Given that managing prolonged LBP requires a person-centred and often multidisciplinary approach, interprofessional education is essential for improving communication, clinical decision-making and care delivery [25–27]. However, research on the barriers to and facilitators of HCPs' behavioural change in a multidisciplinary OHS setting remains limited [28–30]. This study thus addresses a critical research gap by exploring whether multidisciplinary education is perceived as an effective strategy for supporting the implementation of BPS management in OHS.

Theoretical frameworks and models based on implementation science can help us understand HCPs' behavioural changes, evaluate implementation efforts, and identify the factors that affect implementation outcomes [26]. The COM-B (Capability, Opportunity, Motivation, Behavior) model of behaviour and the Theoretical Domains Framework (TDF) are widely used in implementation studies [31, 32]. COM-B serves as an evaluation framework for identifying the factors that influence target behaviours, and determining what needs to change to achieve the desired outcome [31]. TDF, as a determinant framework, identifies the barriers to and facilitators of implementing evidence-based behaviours [32, 33].

This study was part of a research programme involving a two-arm cluster randomized controlled trial that investigated the effectiveness, costs and implementation of guideline-oriented BPS management of LBP in comparison to routine care in Finnish OHS [34]. The intervention aimed to address the multidimensional nature of LBP and to promote a new approach to pain management in the OHS setting. The BPS training successfully shifted OHS resource use from physician-driven care (unimodal) to multidisciplinary physiotherapist-driven care (multimodal, covering more aspects of BPS) without substantial differences in total costs [35]. However, it did not significantly reduce the primary outcome of LBP-related disability during a one-year follow up [36]. To understand these results more deeply, theory-oriented and data-driven analysis approaches need to be combined. For example, implementation research frameworks can help determine HCPs' perceptions of the facilitators of and barriers to implementing specific BPS behaviours and multidisciplinary collaboration in clinical practice.

The multifaceted implementation strategy included targeted multidisciplinary education of 'clinical champions' (participating physicians and physiotherapists), booster training, educational materials, outreach visits and dissemination to colleagues. The implementation object was guideline-oriented BPS management and stratified care in treatment of LBP. Target behaviours were defined on the basis of LBP guidelines, BPS recommendations, and prior research on implementation challenges [6, 10, 37].

The aim of this study was to explore how the components of the COM-B model – (1) capabilities, (2)

opportunities and (3) motivation – influence the implementation of guideline-oriented BPS management of LBP in multidisciplinary OHS teams, as perceived by HCPs after a targeted educational intervention. More specifically, the study aimed to identify the barriers to and facilitators of three key BPS target behaviours: (A) HCPs and patients forming a common BPS understanding of LBP, (B) HCPs use risk stratification tools systematically at an early stage in the assessment of patients with LBP and (C) Multidisciplinary collaboration targeting an individualized plan for patients with LBP.

Materials and methods

Study design

The study participants were HCPs from the intervention units of a cluster randomized clinical trial (ISRCTN11875357). The trial was retrospectively registered on 13.05.2019. The physicians and physiotherapists (clinical champions)of the intervention arm received four days of training (in 2017) and three days of booster training (in 2018). The research protocol is published elsewhere [34].

The training emphasized a person-centred BPS approach with validating patient-professional interaction in LBP management, such as reassurance and avoiding negative messages [27]. The main risk stratification tools were the STarT Back Tool [38, 39], and the short form of the Örebro Musculoskeletal Pain Screening Questionnaire [40], which can be used to identify patients with clinically relevant psychosocial features that may delay their recovery [41–43]. A cut-off score is used to identify high-risk, moderate-risk and low-risk patient groups to enable targeted care [38, 40]. Fig. 1 shows the BPS guideline used in the study. Appendix 1 and the study protocol contain a detailed description of the educational interventions [34].

In each OHS unit of the intervention arm, the employer selected voluntary physiotherapists and physicians for training, based on their motivation and willingness to participate in an educational intervention on the BPS approach. From each OHS unit allocated to the intervention arm, at least one physician and one physiotherapist participated. The clinical champions ($n = 28$ in the initial training and $n = 21$ in the booster training; 17 HCPs participating in both sessions) from all the intervention OHS units participated in the same training intervention. The four-day training was held in September 2017 and the three-day booster training in June 2018. The clinical champions were advised to share what they learned to their OHS team members in the form of a printed educational package. To facilitate this, after the initial workshop, a research group member made outreach visits to the intervention units to provide information and to help introduce the research project to the whole workplace.

The ethics committee of the hospital district of North Ostrobothnia granted permission for the study (79/2017, 19.9.2017). The study was conducted in accordance with the Declaration of Helsinki. The University of Oulu acted as the research registrar. We followed the consolidated criteria for reporting qualitative research (COREQ) when reporting the results [44]. All personal details were replaced by identification codes to ensure the participants' full anonymity. The research team has contributed to multiple qualitative studies in the context of healthcare and professional education that have been published in peer-reviewed journals. The team acknowledges that their cultural and theoretical backgrounds may have influenced the interpretation of the data. The first author identifies as a middle-class woman, and was trained to deliver the BPS approach in physiotherapy during the previous study [45], and this informed her understanding of how to implement the BPS management of LBP. She approached the study from a constructivist approach, assuming that reality is socially constructed, and her task as a researcher was to understand and interpret socially constructed meanings.

Setting

Five nationwide OHS organizations participated in the study. Finnish OHS is a key healthcare provider for the working population, and handles both work-related and general health issues, including acute and chronic illnesses. OHS operates through collaboration between healthcare providers and workplaces, and focuses on occupational safety and maintaining work ability. This focus integrates primary care with preventive functions, meaning that work-relatedness and work ability are evaluated during appointments. The multidisciplinary OHS team, which consists of physicians, nurses, physiotherapists and psychologists, works together to deliver comprehensive care [46] through regular interaction and collaboration, and values the expertise of various HCPs [47].

We conducted focus group interviews ($n = 12$) (Table 1). All the clinical champions and their multidisciplinary OHS teams who treated LBP patients were invited by their employers to participate in the interviews. Their participation was voluntary, and they received no compensation from the research team. The OHS employers kept no record of those who refused to participate. Informed consent to participate was obtained from all the study participants.

Description of sample

The participants represented a purposive sample of HCPs ($n = 51$) working in intervention units. They were from all over Finland and worked in both private ($n = 42$) and public ($n = 8$) OHS units. Eleven of the participants were

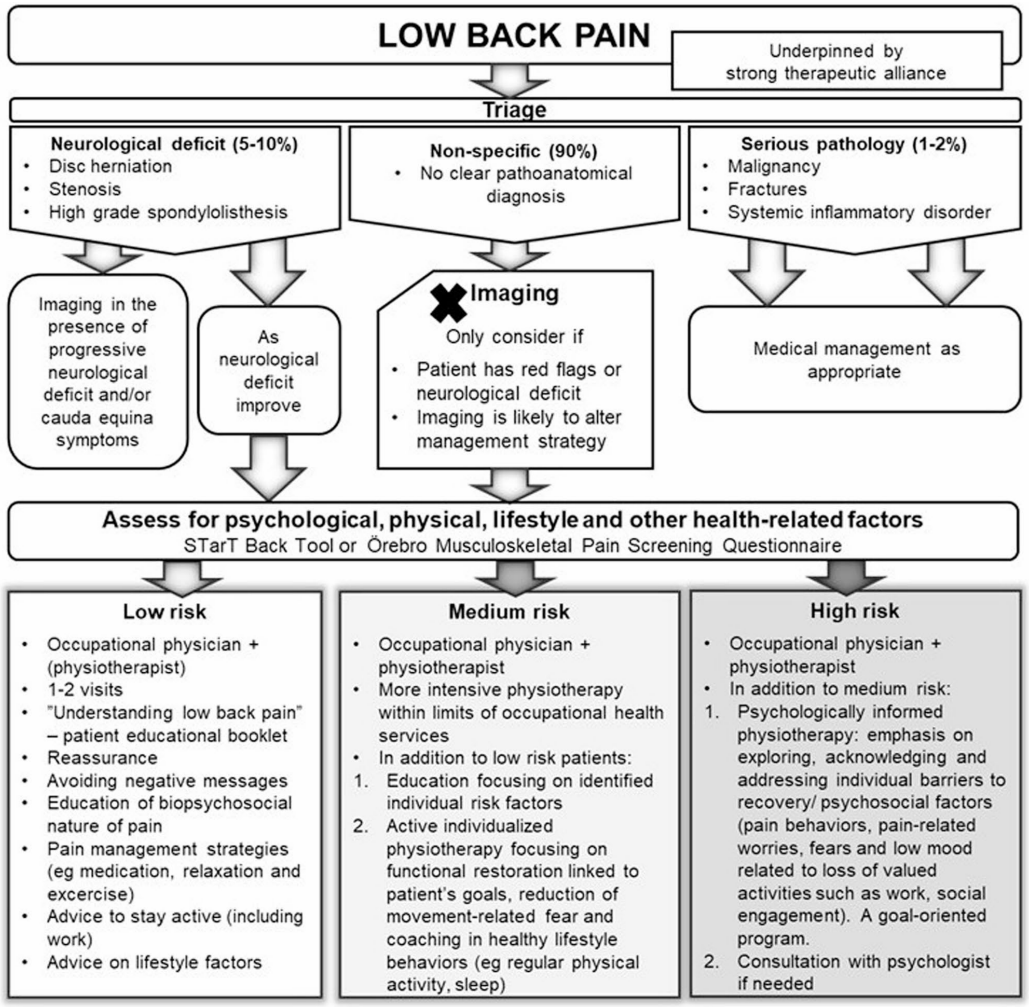

Fig. 1 Biopsychosocial management of patients with low back pain guideline used in the study

male and 40 were female. They were physicians ($n=20$), physiotherapists ($n=24$) and nurses ($n=7$). We managed to interview the majority of the clinical champions (25 of 28) and their multidisciplinary team members ($n=26$) including the head physicians, head nurses and/or head physiotherapists in each OHS company. No psychologists were interviewed.

Data collection

We created a semi-structured interview guide to cover the target behaviours of the BPS approach (Appendix 2). The participants were also encouraged to speak freely about their participation in the study and the management of LBP patients in OHS. A practice interview was conducted with a physiotherapist who was not involved in this study but had undergone BPS training. The practice interview helped us clarify and order the interview questions. The multidisciplinary OHS teams were interviewed in the spring of 2019, either in the OHS units or in some other agreed upon way (e.g. remote meeting). The interviewer (MP) had a Masters' degree in health care, was a member of the research group and worked as a physiotherapist at the time of the study. She was present during the educational interventions but was otherwise

Table 1 Focus group interviewees

Unit code	Number of focus group interviews	Number of participants	Number of occupational healthcare professionals		
			Physicians	Physiotherapists	Nurses
PC #1	3	6	3	2	1
PC #2	4	26	10	10	6
PC #3	1	2	1	1	0
PC #4	2	9	3	6	0
PuC #2	2	8	3	5	0
Total (n)	12	51	20	24	7

unknown to the participants. The interviews were conducted in Finnish. In three of the interviews, a research assistant was present to assist with the data collection by making the audio-visual recordings.

The interviews lasted 59 min on average (28–79 min). They were audio- and videorecorded and the first author transcribed them verbatim. The resulting data consisted of 281 pages (font = Times New Roman 12, spacing = 1.5). The interviewer made field notes during and after each focus group session to document the required contextual information. We did not carry out participant validation of the transcripts or repeat any interviews.

Data analysis

We combined deductive and inductive approaches for analysing the data. The analysis process contained a preparation phase, an organizing phase, a reporting phase, and a results phase, as described by Elo and Kyngäs [48]. In the preparation phase, the participants' statements were read and re-read to gain familiarity. The unit of analysis was a set of ideas selected from the focus group data and could be one sentence or several sentences. In the deductive organizing phase, we developed a two-level categorizing matrix (Appendix 3), and the first author coded the data according to these categories. The original statements from the interview data were first coded using a deductive, i.e. theory-oriented, method. In Step 1, the coded statements ($n = 1546$) were classified into three target behaviours, 14 TDF domains [32] and the COM-B model [31] and interpreted as possible facilitators of or barriers to the achieving target behaviours. We used data analysis programme MAXQDA 2020 Analytics Pro to manage the data.

Each matrix category underwent inductive analysis. MP and RH used the principles of inductive content analysis to develop the categories in each TDF domain [48]. In Step 2, we extracted all the expressions that corresponded to the unit of analysis that addressed the research question from the material and coded them. In Step 3, we formed the subcategories by combining the coded expressions and deciding what belonged in the same categories. We named the categories using the expressions that most representatively described them. Next, the subcategories were conceptualized and abstracted into a generic category. Table 2 shows an example of the analysis and categorization process. All the authors had the opportunity to participate in discussions, provide feedback and agree on the final categories. Finally, we combined the identified facilitators and barriers into a generic category for reporting the results and comparing them to those of previous studies.

Results

We identified a total of 19 TDF-related categories that represented the capabilities, opportunities and motivation for implementing guideline-oriented BPS management of LBP. The following figure presents the main and generic categories (Fig. 2).

Next, we present a detailed analysis of the study findings, focusing on the identified facilitators of (+), barriers (-) or neutrals (0) to achieving the three BPS target behaviours. Figures 3, 4 and 5 illustrate the inductive categories (generic and subcategory) under three main COM-B categories for each target behaviour. More detailed information on the main, generic and subcategories are provided in Supplementary Tables 1a–c, and quotations are presented in the Online material.

Target behaviour A

HCPs and patients form a common individual BPS understanding of LBP (Fig. 3)

1) Capabilities of HCPs to form a common individual BPS understanding of LBP with patient

Category – Ability to perform BPS clinical actions (+/-)

Facilitators: The HCPs perceived that their understanding of and skills for managing LBP patients had improved, and that they had developed a deeper understanding of the multidimensional nature of pain and of the impact of communication on patient recovery. Considering patients' life situations and recognizing pain-related fear of physical activity were seen as essential components of BPS assessment. The physiotherapists felt more confident about rationalizing the need for imaging and felt empowered to discuss issues they previously considered beyond their competence. Most of the HCPs also felt more confident about encouraging patients to use their backs.

Barriers: The multidisciplinary team members perceived their knowledge of and skills in BPS management as superficial when applied in clinical practice.

Table 2 Example of deductive and inductive analyses and categorization process

Target behaviour A. HCP and patient form a common individual BPS understanding of LBP				
Step 1 Deductive content analysis Data reviewed for content and coded for correspondence with or exemplification of target behaviour and TDF domain		**Step 2 Inductive content analysis**	**Step 3 Inductive content analysis** Conceptualizing and abstracting into categories	
COM-B/ TDF domain (description)	Example of quotation	OPEN-CODE	SUB-CATEGORY	GENERIC CATEGORY
MOTIVATION/ Social and professional role, identity (Interpersonal processes that can cause individuals to change their thoughts, feelings, or behaviours)	*'This has somehow broadened my awareness, and I no longer pay attention to only the mechanics, instead I consider functional movements and whether there is that pain-related fear and what causes it.' (OPT, 3 days training; PC4)*	Role of OPT developed from bio to BPS	Expanding professional role, confidence and boundaries	Renewing professional identity
	'I invest quite a lot in such dialogical discussion, much more than before. Previously, it was more about advising and taking control of the situation, almost like lecturing the client. Now it's more of a biopsychosocial approach with dialogue, which is good.' (OPT, 7 days training; PC2)	Role of OPT developed from lecturing to person-centred		
	'I give a certain amount of guidance in basic things to these people with acute back pain, who don't seem to need the guidance of a physiotherapist at the beginning… acute pain phase self-care methods, relaxation techniques, and then walking, how to start, and gradually increase activity as the pain allows, those I always go through '(OHP, 7 days training; PC1)	OHP starts giving BPS patient education		
	'And because we'll always refer our patients to physiotherapy whenever they are in pain, and we wait for the professionals to give them guidance and then see how rehabilitation has progressed.' (OHP, 4 days training; PC2)	Passive professional role: OHPs' role is to follow progress of rehabilitation	Remaining in familiar professional role and within boundaries	
	'I haven't gained much from this. Because, of course, I've been a physician for such a long time.' (OHP, team member; PC2)	Familiar professional role		
	'Yes, through training, I'd say that it has somewhat changed the entire patient interaction from my side, trying to understand the client's own thoughts and what the client themselves sees as causing their issues.' (OHP, 7 days training; PC1)	Changing approach to encountering all patients	Developing identity as a professional	
	'I guess I listen more and then the treatment is more individualized. And it produces results. I'm still learning in my old age. This dialogue approach applies even in the company of friends.' (OPT, 7 days training; PC2)	HCP perceives benefits of utilizing validation skills in their personal life		

COM-B Capabilities, Opportunities, Motivations, Behaviour model, *TDF* Theoretical Domains Framework, *BPS* biopsychosocial, *OHP* occupational health physician, *OPT* occupational health physiotherapist, *HCP* healthcare professional, *LBP* Low back pain

Category – Self-reflection to build routines (+/-) Facilitators: To implement new clinical behaviours, the HCPs felt that they needed to self-reflect on and be critical of their previous practices, such as recognizing invalidating communication habits and challenging themselves to actively develop new routines. Other facilitators were identifying previously missing skills and fostering patients' self-efficacy and hope. Many team members reported feeling more confident about reinforcing the importance of staying active and engaged in work after being inspired by discussions with clinical champions. The HCPs perceived that this shift was possible because they no longer feared the patient's pain and felt more confident about normalizing pain in clinical discussions and actions. This deeper understanding was reflected in patient assessments, as the HCPs reported spending more time interviewing and listening and allowing patients to express their emotions. The physiotherapists in particular reported successfully implementing multidimensional assessments during their allocated times by consciously prioritizing patient interviews over performing an extensive range of clinical tests.

Barriers: The HCPs perceived that they needed to reorganize their work to integrate BPS management as a natural part of their routine practice. However, difficulty finding alternative ways of working and a lack of time for processing new knowledge were perceived as barriers.

2) Opportunities to form a common individual BPS understanding of LBP with patient

Category – Organizational resources to provide and monitor care (+/-) Facilitators: Organizational-level directives and the monitoring of the use of resources (e.g. referrals to physiotherapists, specialized care, imaging and care-related costs) were perceived as facilitators. In one organization, BPS assessment of LBP patients was prioritized by a directive to allocate 30 min for a patient's first physicians' appointment, which allowed more time for a comprehensive assessment.

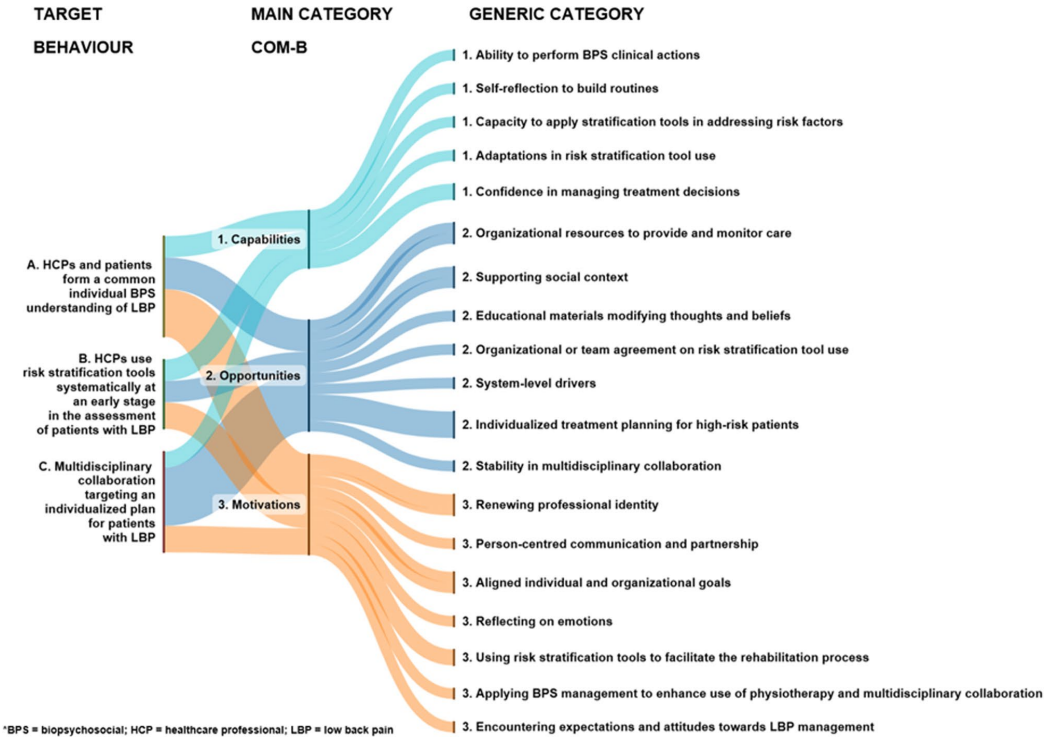

Fig. 2 Summary of capabilities, opportunities, and motivations for implementing guideline-oriented biopsychosocial management of low back pain

Barriers: Many of the physicians perceived insufficient consultation time as a barrier to conducting a multidimensional BPS assessment. They often avoided addressing complex issues if the appointment was too short to adequately help their distressed patients. When patients independently chose to pay for imaging themselves, it was perceived as difficult to establish a shared understanding of BPS management.

Category – Supporting social context (+/-) Facilitators: The HCPs perceived that they had become more responsive to patients' experiences and expectations, as well as more understanding. Patients' responses were seen as shaping HCPs' behaviours and decision-making, and many reported receiving positive feedback on the multidimensional pain explanation. They also regarded professional networks and training as essential for supporting the transition to BPS clinical behaviours.

Barriers: Lack of support from colleagues, contradictory instructions and explanations given to patients by different HCPs, and patients' negative expectations, such as a strong desire to retire, were perceived as barriers to implementation.

Category – Educational materials modifying thoughts and beliefs (+) Facilitators: Having access to educational materials that addressed beliefs, fears, understanding and self-awareness was perceived as a facilitator. These resources helped provoke changes in patients' thinking patterns, enabling them to reframe their perceptions and gain new insights. The patient education booklet was valued for its role in managing patients' fears and reducing the need for imaging. The physiotherapists found that the booklet enhanced their credibility when discussing imaging needs, which raised the threshold to referring the patient to a physician for imaging. The physiotherapists also described using resources such as Explain Pain videos and video recordings made during appointments to help patients recognize the disconnect between their thoughts and behaviours. These tools were perceived as facilitating a shared understanding between HCPs and patients.

3) Motivations to form a common individual BPS understanding of LBP with patient

Category – Renewing professional identity (+/-/0) Facilitators: These included physicians' and physiotherapists' perceptions of their expanded social and professional

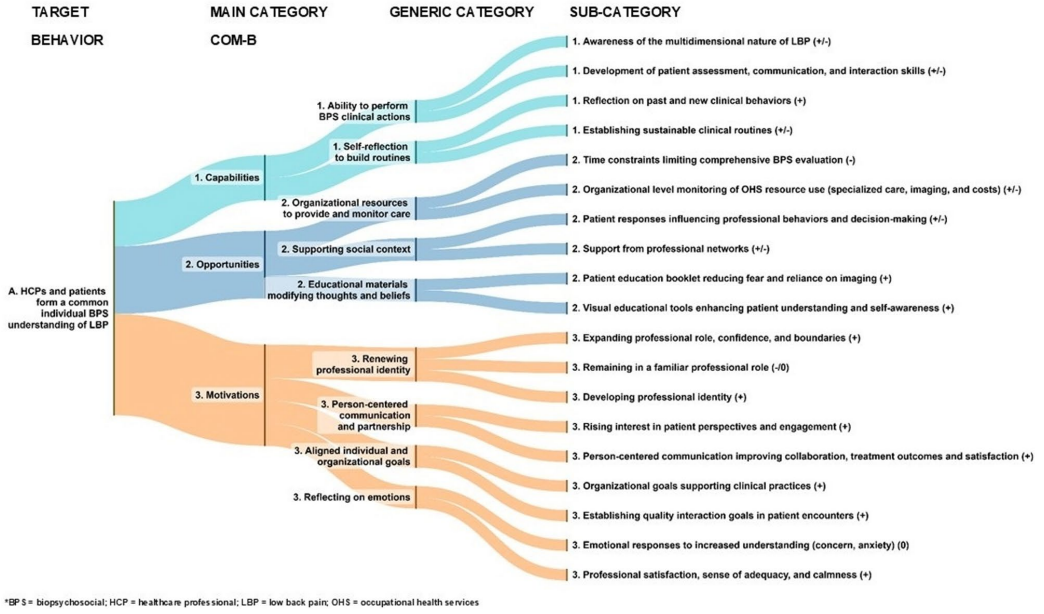

Fig. 3 Healthcare professionals and patients form a common individual biopsychosocial understanding of low back pain

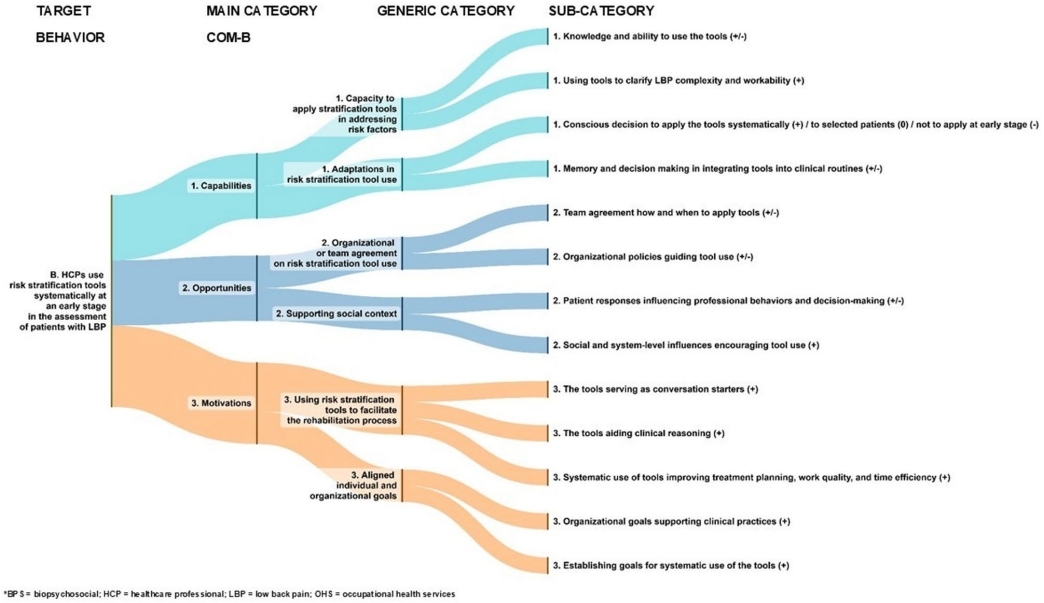

Fig. 4 Healthcare professionals systematically use risk stratification tools during patient assessment

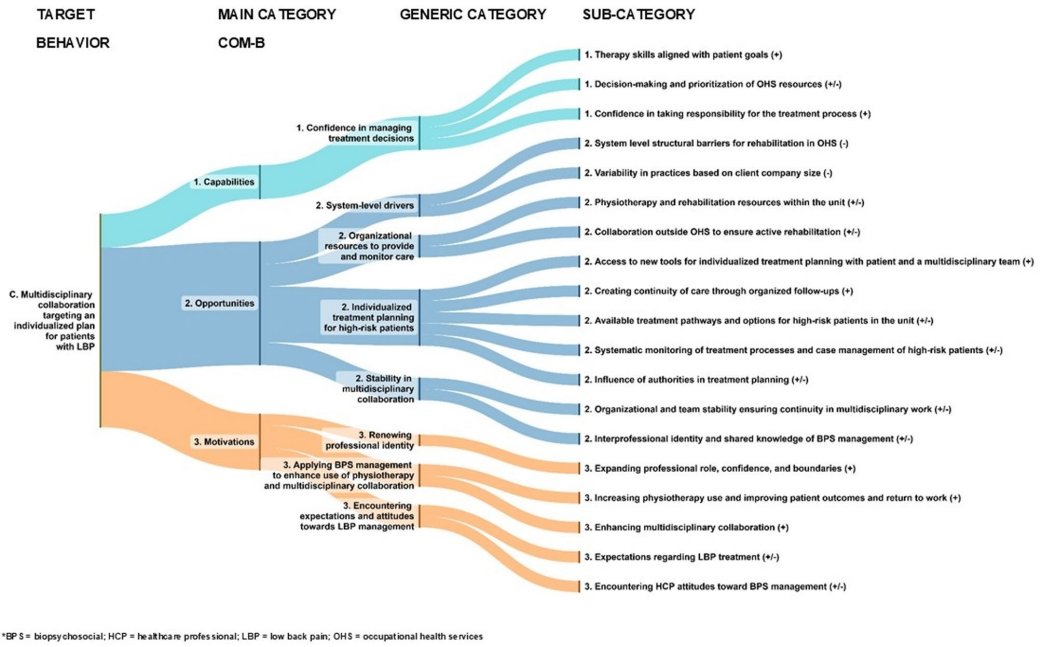

Fig. 5 Multidisciplinary collaboration targeting an individualized plan for patients with LBP

roles. Many physicians reported that they had begun guiding patients with acute LBP on self-care methods, relaxation, movement and a gradual return to activity. Some HCPs perceived that learning BPS management had completely changed their approach to patient care. The physiotherapists even reported applying these new interaction skills outside of work in their personal lives. This showed that these skills had become routine – something they naturally incorporated and benefitted from in their daily interactions.

Barriers/Neutrals: Many team members perceived that BPS management was already integrated into their professional roles. A barrier to some physicians was their perceived passive role in the rehabilitation process. Patients referred to physiotherapy expected the physiotherapists to provide the necessary guidance, whereas the physician's role was primarily to monitor the progress of rehabilitation. These physicians perceived their professional role as unchanged.

Category – Person-centred communication and partnership (+) Facilitators: Person-centred communication was perceived as improving therapeutic alliance, collaboration, treatment results and patient satisfaction. The HCPs discovered a new interest in their patients' perspective and understanding. They found that letting the patient be the storyteller was an important step for forming a common BPS-based understanding with the patient and for finding goals for meaningful rehabilitation from the patients' perspective.

Category – Aligned individual and organizational goals (+) Facilitators: The HCPs reported setting individual goals to focus on the quality of their interaction with the patient (e.g. nocebo messages, plain language, shared understanding). An organizational endeavour to apply BPS management was also perceived as facilitating its adoption on an individual level. In one organization, all the physiotherapists compared the benefits and challenges of BPS management to their normal practices. This strategy helped dismantle misconceptions and facilitated acceptance and willingness to use BPS management as the first-line treatment in OHS. In addition, recognizing that the organization's goals and current development models (work modification, care pathways and reducing sick leaves) were in line with the BPS approach encouraged managerial support of changes in clinical practices.

Category – Reflecting on emotions (+/0) Neutrals/Facilitators: The HCPs reported feeling more worried than before about patients' fear avoidance behaviour and feeling anxious when patients misunderstood them. These were categorized as neutral, because the HCPs believed this concern and anxiety was a response to their increased

understanding. Despite this, the HCPs perceived that the new way of working increased their satisfaction, feeling of adequacy and calmness during patient encounters.

Target behaviour B

HCPs use risk stratification tools systematically at an early stage in the assessment of patients with LBP (Fig. 4)

1) Capabilities for the systematic use of risk stratification tools at an early stage in the assessment of patients with LBP

Category – Capacity to apply stratification tools in addressing risk factors (+/-) Facilitators: These included an improved ability to identify patients' psychosocial profiles with the help of tools. The tools made it easier to assess and address risk factors, and reduced the complexity of pain problems or work disability.

Barriers: Some team members perceived their lack of knowledge about the stratified model of care as a barrier, which suggests that dissemination might not have been completely successful in some intervention units.

Category – Adaptations in risk stratification tool use (+/-/0) Facilitators: Some HCPs reported using risk stratification tools systematically for assessing work ability. Having a clear process for using the tools – during appointments or as homework – and documenting the scores in the electronic patient records were perceived as facilitating the tools' use in clinical practice.

Neutrals: The most common way in which the tools were used differed from their original intended purpose. Instead of systematic use, the HCPs reported typically using them for selected patient groups, such as new patients or those with persistent pain problems. The HCPs perceived the choice of a questionnaire as personal, given the wide variety of available assessment tools.

Barriers: Barriers to applying the tools as intended included HCPs' perceptions that patients needed time to build up trust before bringing up psychosocial issues in an interview. A few HCPs found the tools overly complex or felt that they focused too much on psychological aspects and considered other assessments more important. Some physicians prioritized the assessment of work ability and the need for medication over other considerations, particularly in the context of limited time resources.

2) Opportunities to systematically use risk stratification tools at an early stage in the assessment of patients with LBP

Category – Organizational or team agreement on risk stratification tool use (+/-) Facilitators: A facilitator of the systematic use of questionnaires was their availability in electronic form. Some teams perceived that discussions on tool usage and task division among professionals helped them reach clear agreements on when to use questionnaires systematically, such as in work ability assessments.

Barriers: The HCPs felt that their intention to use the tools was hindered by the lack of a mutually agreed practice at the organizational level, and their limited ability to influence organizational policies.

Category – Supporting social context (+/-) Facilitators: System-level and social pressure encouraged the HCPs to use the tools. For example, physical and rehabilitation medicine specialists required a comprehensive evaluation, also of psychosocial factors, before consultation, and insurance companies preferred work ability risk assessments to be a part of the decision-making process.

Barriers: Some HCPs perceived negative patient responses to the tools as a barrier, leading them to discontinue their use.

3) Motivations for systematically using risk stratification tools at an early stage in the assessment of patients with LBP

Category – Using risk stratification tools to facilitate the rehabilitation process (+) Facilitators: Many HCPs emphasized how the tools helped them start the rehabilitation process by aiding conversation. The physiotherapists noted that the questionnaire prompted them to consider the patient's broader life situation. The HCPs found that using the tool as intended supported clinical reasoning and enabled them to develop more individualized treatment plans. The systematic surveying of psychosocial factors was perceived as enhancing the quality of OHS care.

Category – Aligned individual and organizational goals (+) Facilitators: Many HCPs had set a goal to integrate the tools into their practice. Some organizations planned to incorporate them into their electronic system, allowing patients to complete the questionnaire before their appointment so that the results were available at the first consultation. The digitalization of risk stratification tools was seen as an opportunity to guide the direction and extensiveness of the rehabilitation process. The organization's goal of using the questionnaire for every LBP patient, along with training for professionals, was perceived as a facilitator for systematic use, even though this was not yet fully implemented.

Target behaviour C

Multidisciplinary collaboration targeting an individualized plan for patients with LBP (Fig. 5)

1) Capabilities for multidisciplinary collaboration targeting an individualized plan for patients with LBP

Category – Confidence in managing treatment decisions (+/-) Facilitators: The physiotherapists felt that the BPS training had improved their confidence in their therapy skills and in their ability to treat more challenging patients. This included integrating patients' individual goals into

treatment plans and focusing more on functional movements in daily activities. Many team members, including physicians and nurses, reported increased trust in the multidisciplinary team's capabilities. The physicians felt that they had gained confidence in taking responsibility for the treatment process and developed patience to wait for rehabilitation results. This shift resulted from a conscious decision to utilize all the multidisciplinary resources available in the unit before referring patients to specialized care or imaging.

Barriers: Some physiotherapists felt like outsiders in the multidisciplinary teams, as they were excluded from discussions and not involved in decision-making regarding the treatment and rehabilitation process of LBP patients, including the use of multidisciplinary OHS resources.

2) Opportunities for multidisciplinary collaboration targeting an individualized plan for patients with LBP

Category – System-level drivers (-) Barriers: Many HCPs reported system-level structural barriers to early-stage rehabilitation. For example, at the time of the study, Finnish OHS policy restricted patients to a maximum of three physiotherapy appointments. Variations in practices based on the size of the client companies were also seen as barriers to multidisciplinary collaboration and treatment planning. The lack of formal communication and team discussions stemmed from the absence of a payer for structured multidisciplinary meetings on patient care, a challenge particularly evident in small client companies. In contrast, the rigid practices of large organizations limited opportunities in local OHS.

Category – Organizational resources to provide and monitor care (+/-) Facilitators: Direct access to physiotherapy within one to three days and the flexibility to use physiotherapy based on patient needs were seen as facilitators.

Barriers: The perceived barriers to resources in the OHS unit included long waiting times for physiotherapy and insufficient availability of BPS-trained physiotherapists. When patient treatment required healthcare services outside of OHS, many HCPs felt they lacked personnel resources to monitor rehabilitation processes and were unable to influence the content of the rehabilitation.

Category – Individualized treatment planning for high-risk patients (+/-) Facilitators: Using risk stratification tools was perceived as a facilitator of individualized patient treatment planning in the OHS multidisciplinary team. The Patient-specific Functional Scale was also considered a valuable tool for identifying functional goals together with the patient, helping set meaningful goals for both leisure time and work. The physiotherapists viewed an authoritative physician as helpful for convincing patients of the importance of their treatment plan. The HCPs supported treatment planning by ensuring continuity of care through organized follow ups, such as phoning patients two weeks after their physiotherapist appointments so that they were not left without support. Systematic monitoring of treatment processes and sick leaves, and case management of high-risk patients were facilitated by team-agreed task allocation. In some OHS units, the HCPs had developed innovative BPS-based service models, such as multidisciplinary group rehabilitation, and rapid multidisciplinary collaboration for high-risk patients.

Barriers: The availability of care pathways for high-risk patients was perceived as varying greatly. The physiotherapists identified the lack of collaboration with psychologists for LBP patients as a barrier. Non-individualized treatment plans from orthopaedic surgeons were also considered unhelpful for BPS management. Many HCPs concluded that LBP care pathways were either unclear or non-existent.

Category – Stability in multidisciplinary collaboration (+/-) Facilitators: Stability in the organization was perceived as ensuring the continuity of multidisciplinary work. Regular interprofessional meetings ensured that knowledge transfer was not solely based on electronic patient records. Many HCPs felt that after the multidisciplinary training they more often discussed patients' situations and planned treatment processes in OHS team meetings. In some OHS units, the clinical champions developed a group identity and shared similar thoughts on how treatment should be carried out. Interprofessionally shared knowledge of how to use BPS management was perceived as facilitating sustainability, and as unifying and harmonizing care pathways.

Barriers: These included changes to job descriptions, organizational reforms, digitalization, lack of time, financial constraints, high staff turnover and short work periods. These factors were perceived as hindering multidisciplinary collaboration and implementation efforts. Some clinical champions found it difficult to disseminate BPS management within multidisciplinary OHS teams due to a disconnect between BPS training and routine teamwork. Physicians in particular found leading implementation challenging due to their limited connection to patient care, having to rely on electronic patient records for transferring knowledge, and the large size of their units, which made effective implementation difficult. A key barrier was the perception that the BPS approach should be personally internalized and embraced for successful adoption. In addition, the professionals' actions during patient encounters could not be directly monitored or controlled, which further complicated dissemination.

3) Motivations for multidisciplinary collaboration targeting an individualized plan for patients with LBP

Category – Renewing professional identity (+) Facilitators: The physiotherapists felt that their professional skills had expanded as their role in OHS was no longer limited to physical ergonomics. Many reported gaining confidence in applying their expertise more broadly in multidisciplinary collaboration. The HCPs observed positive patient experiences with BPS management in both mental and physical conditions. The physicians recognized the increased role of physiotherapists in addressing pain behaviours, fears and treatment. The patients' feedback to the HCPs revealed that they perceived physiotherapists as appropriate providers of psychological support, often finding their guidance sufficient without the need for additional psychological intervention.

Category - Applying BPS management to enhance use of physiotherapy and multidisciplinary collaboration (+) Facilitators: The HCPs perceived that using BPS management led to increased use of physiotherapy, improved patient outcomes, including return to work and less referrals to specialized care. It was also seen as enhancing multidisciplinary collaboration by promoting consultations and interprofessional referrals. The HCPs also found multidisciplinary collaboration more effective than before.

Category – Encountering expectations and attitudes towards LBP management (+/-) Facilitators: These included enthusiasm for a new approach to patients and a shared commitment to identifying their abilities and opportunities despite LBP. The physiotherapists found it helpful that patients generally expected to receive instructions and advice when they were asked about their expectations, as this made it easier to engage them in active treatment.

Barriers: The HCPs saw patients' expectations to be referred to physiotherapy for passive treatments as a barrier. Some HCPs also relied on imaging to reinforce patient commitment to rehabilitation and were sceptical of BPS-based care. Many clinical champions reported initial resistance from OHS team members, who displayed low enthusiasm, disbelief or frustration toward BPS management. However, these attitudes gradually improved as the team members observed successful patient outcomes and shared patient experiences. As a result, most HCPs expressed an interest in further BPS training for their work community.

Discussion

The aim of this study was to explore the perceptions of HCPs, including clinical champions and their multidisciplinary team members, regarding the capabilities, opportunities and motivations for implementing guideline-oriented BPS management of LBP after a targeted educational intervention. Using a combination of deductive and inductive analyses of interviews with HCPs, we identified both barriers to and facilitators of BPS management in all the COM-B model categories one year after it was first implemented. The barriers were predominantly in the opportunity domain and mainly at the organizational level, whereas the facilitators were in the capability and motivation domains.

Capability

Systematic reviews indicate [11, 49] that successful HCP behaviour change interventions typically involve face-to-face training over an extended period of one or more months, covering patient demonstrations, pragmatic tools and opportunities to practice new skills in clinical settings. The trainers' feedback also plays a critical role in reinforcing learning [11]. In the present study, multidisciplinary training was perceived as enhancing the HCPs' confidence in both their own and their multidisciplinary team's abilities to manage complex patients, creating trust in each other's capabilities and optimism that this would lead to positive outcomes for the patient.

The HCPs acknowledged that creating awareness and shared views on BPS management both within their teams and with patients was challenging. A common understanding of the multidimensional nature of pain, the use of relevant clinical tools and interprofessional roles facilitated the implementation of BPS management in OHS. The HCPs saw clinical routines that are collaboratively accepted by the multidisciplinary team as important facilitators.

The challenges of shifting from a biomedical to a BPS-based approach in LBP management are well-documented in several qualitative studies [10, 18, 19, 22, 50, 51]. Traditionally, physiotherapists focus on the somatic aspects of pain, and pay insufficient attention to the psychological and social dimensions [18, 52, 53]. Previous studies indicate that physiotherapists may avoid addressing emotionally charged topics, which can lead to invalidating communication and limiting patients' expression [54]. However, brief validation training can improve HCP communication skills [55, 56]. The findings of this study support this, as the HCPs felt that the tools helped them address BPS issues, communicate more effectively with patients, and encouraged patient expression of emotions.

Behaviour change techniques linked to the TDF [57–59] emphasize the importance of instructions, graded tasks and active problem solving, such as analysing the factors that influence behaviour and generating strategies to overcome barriers and/or increase facilitators, to enhance skills and self-efficacy. Establishing a method for

the HCPs to monitor their behaviours could also be part of a behaviour change support strategy [57–59]. In this study, memory and decision-making regarding the use of the tools in clinical routines were often perceived as barriers. These could be counteracted by defining a stimulus to cue the behaviour [57–59], such as a prompt in the electronic patient information system to design a care pathway for high-risk patients.

Opportunity

The HCPs described how multidisciplinary collaboration was strengthened by the social influence in the teams, which provided support and fostered the stability and continuity of care. One year after its implementation, BPS management of LBP, including risk stratification, had not been fully adopted in the OHS units. This may partly explain the lack of significant differences between the patient outcomes in the intervention and control arms [36].

Implementation research suggests that behaviour change occurs at the level of the work community as a whole [60] and requires shifts in perceptions, beliefs and clinical routines across individual, group and organizational levels [61, 62]. Such changes often take time, and require HCP involvement in the development of clinical procedures [61, 62] as well as teamwork availability [63]. This study reinforced these findings, as the HCPs reported limited organizational and work community-level changes.

One notable barrier was the lack of clear pathways between OHS and primary care. Previous studies have identified time constraints and remuneration issues as barriers to delivering risk-stratified care in primary care [51, 64–66]. In this study, organizational structures and resources were sometimes inadequate to ensure the continuity of care for high-risk patients. In the absence of structured care pathways, the HCPs attempted to manage them individually. The facilitators in this study included monitoring care pathways, coordinating multidisciplinary resources, and incorporating group-based treatments for high-risk patients.

Environmental contexts and available resources significantly influence HCPs' behaviour. Practical support from colleagues or staff, modifications to daily routines and social reinforcement (e.g. recognition of effort) can facilitate change [57–59]. Monitoring clinical behaviours and providing feedback could be a key task for clinical champions, and may facilitate sustainable implementation in clinics [67]. In our study, the clinical champions created opportunities for their colleagues to use BPS management by disseminating their knowledge. Open discussion on norms and agreement on clinical practices was perceived as facilitating the adoption of BPS management.

Motivation

The COM-B model [31] recognizes that motivation is a key driver of behaviour change. One qualitative study [45] reported considerable initial resistance to BPS management among Finnish physiotherapists because the approach was new and different. Learning and implementing BPS management without adequate support was perceived as challenging. In our study, the HCPs encountered both enthusiasm and resistance in their multidisciplinary teams. Attitudes towards BPS clinical behaviours were influenced by the credibility of the information sources advocating for or against its adoption. Identifying oneself as a role model when acting as a clinical champion and that one's behaviour might serve as an example to others was sometimes unclear. On the other hand, the teams with multiple trained clinical champions demonstrated greater enthusiasm and engagement, indicating that multidisciplinary training was a valuable implementation strategy for enhancing collaboration and supporting the adoption of BPS management.

Qualitative studies of physiotherapy norms have highlighted that professional identity is shaped by educational and institutional expectations, often reinforcing a biological focus on pain management [68, 69]. In our study, a *Renewing professional identity* category emerged in two target behaviours (A, C). For some, their professional role expanded to align with BPS principles, whereas for others their old roles remained the same, and they saw no difference between their current and the expected behaviours. As a behavioural change strategy, beliefs about capabilities can be enhanced through demonstration, role modelling, and providing opportunities for behavioural practice and feedback. Multidisciplinary reflection and mutual learning require dedicated time during the workday [70] the lack of which, due to organizational constraints, was identified as a major barrier in our study.

Goal setting, at both the individual and organizational level, was perceived as facilitating engagement with BPS management (A, B). Open discussions on implementation goals, with comparisons of the benefits and challenges of behaviour change, were perceived as facilitators. One participating organization adopted this strategy, and its physiotherapists found that such discussions clarified misconceptions. Although the literature identifies discussing goals and benefits as an effective strategy for supporting behaviour change [57–59, 71], reinforcement strategies may also include material incentives or rewards [57–59]. However, this study did not recognize possible reimbursements.

HCPs play a critical role in coaching, educating and empowering patients to manage their conditions independently. Empathy and validation in clinical interactions enhance patient engagement and adherence, leading to

improved patient outcomes [72–76]. Interestingly, the HCPs in this study reported strong emotional responses when reflecting on patient encounters. Some described professional satisfaction and unity within their multidisciplinary teams, but others experienced anxiety and concern as a result of their increased awareness and understanding of patient perspectives. Although self-reflection is discussed in the literature, the dual focus on emotional reflection and its connection to renewing professional identity in the context of BPS implementation may signal deeper professional and identity transformations, an area that is important to address in future implementation strategies.

Strengths and limitations of the study

The focus group interviews were conducted one year after the educational intervention and booster training, due to the requirement for extended follow-up in multidisciplinary implementation studies [70, 77, 78]. A further strength was that the implementation strategy was in line with conventional continuing education models. However, the relatively short training (3–7 days) and lack of long-term support is likely to have limited any behavioural changes. More intensive training, mentoring and organizational support could improve skills and the willingness to provide BPS care and conditions for HCPs to transfer their knowledge to clinical practice in their own OHS units and potentially even across organizations. Clinician beliefs and attitudes have most probably reflected on LBP outcomes [79] as implementation was only partially successful within one-year follow-up. Future programmes should incorporate team-scale multiprofessional training and organizational support to encourage knowledge transfer and sustainability.

Assessing the credibility of qualitative studies is challenging, as the way in which they are conducted and reported vary. This study complied with a guideline, combining deductive and inductive content analysis [48], and triangulating the findings with implementation theories. The collaboration within the research team enhanced its trustworthiness. Theoretical saturation was adequately reached during the content analysis, as the data exhibited repetition and the abstraction process could be conducted properly in line with the Elo and Kyngäs approach of combining categories, which further strengthened the study's trustworthiness. The large representative sample of 51 participants across 12 focus groups ensured diverse perspectives and analytical depth [80–82]. However, we acknowledge that the variations in group size and duration are limitations. In addition, isolating the effects of multifaceted implementation strategies from contextual factors remains challenging.

The findings of the study are transferable to Finnish OHS and similar international contexts but may not be applicable to other cultural contexts. In Finland, 90% of employees are covered by OHS [83] and all employers are mandated to provide OHS for their employees. Healthcare systems differ across countries, which influences the factors that affect the implementation of BPS management. The HCPs' participation in the intervention may have introduced response bias, as they might have emphasized positive changes or aligned their responses with study expectations. The interviews could not fully assess whether treatments were implemented as stated or intended, nor could they identify gaps in skills. In addition, power imbalances in OHS teams, particularly in dual roles (e.g. supervisor-staff) should be considered when interpreting the results [84]. We considered individual interviews, but previous studies have already primarily explored physiotherapists' perceptions and focus group studies on multidisciplinary teams in OHS remain rare.

This study highlights the importance of helping HCP transition from a biomedical to a holistic BPS approach in OHS multidisciplinary teams. Knowing the facilitators of and barriers to this process can guide tailored implementation strategies. Future studies should (1) identify the factors that most significantly influence HCPs' behaviour changes related to BPS management (2), develop strategies that reduce barriers and improve healthcare delivery at the organizational level, and (3) objectively evaluate the quality of patient assessment and the delivery of BPS management.

Conclusion

One year after BPS management was initially implemented, the identified facilitators were primarily in the capability (e.g. skills, confidence to make treatment decisions) and motivation (e.g. communication, renewing professional identity) domains, and the barriers were predominantly in the opportunity domain, mainly due to the lack of team agreement and organizational and system-level constraints. To ensure that BPS management is effective and continues in OHS, future implementation strategies should integrate BPS practices into routine workflows. Support could be sustained through policy initiatives and reinforced through multidisciplinary collaboration. The results contribute to the development of targeted and multifaceted strategies to support the integration of BPS management into practice and to promote evidence-based care in OHS.

Abbreviations

BPS	biopsychosocial
COM-B	Capability, Opportunity, Motivation, Behaviour model
COREQ	The consolidated criteria for reporting qualitative research
HCP	Healthcare professional
LBP	Low back pain
OHP	Occupational health physician
OHS	Occupational health services
OPT	Occupational health physiotherapist
TDF	Theoretical Domains Framework

Supplementary Information

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Supplementary Material 1

Supplementary Material 2

Supplementary Material 3

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Authors' contributions

MP, JK and RH conceptualized and designed the study. MP, AA, BÖ, JK, LAM and RH chose the methodological approach. MP conducted all focus group interviews, transcribed the data and performed the primary data analysis. RH contributed to interpretating the data and writing the original draft. MP, RH, AA, BÖ, JK, LAM and SE contributed to refining the interpretations, improving the structure and substantively editing and revising the final manuscript. All authors read and approved the final version. All authors have agreed both to be personally accountable for their contributions and to ensure that questions related to the accuracy or integrity of any part of the work, even ones in which the author was not personally involved, are appropriately investigated, resolved, and the resolution documented in the literature.

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Data availability

The anonymized data that support the findings of this study is provided within the manuscript and supplementary information files. Original transcipts are not openly available due to reasons of sensitivity.

Declarations

Ethics approval and consent to participate

The ethics committee of the hospital district of North Ostrobothnia granted permission for this study (79/2017, 19.9.2017). All the study participants gave their informed consent to participate.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

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Publisher's Note

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Riikka Holopainen is a musculoskeletal physiotherapist, lecturer and researcher. She completed her PhD in 2021 and the topic of her thesis, which consisted of qualitative studies, was using the biopsychosocial approach to manage musculoskeletal conditions. She currently works part-time as a clinical expert at the South Savo Wellbeing Services County in Finland, combining clinical work and developing rehabilitation practices. She is also involved in multiple research projects focusing on musculoskeletal conditions, person-centred care and communication, and implementing evidence-based care pathways. Her special interest is in qualitative and implementation research. RH also teaches these topics in continuing education workshops and is a frequently invited lecturer.

Birgitta Öberg is a Senior Professor at Linköping university. She has been responsible for the development of research on physiotherapy in Linköping for many years and was appointed Professor in 2000. She has held several board member positions in the research community, for example, in the Swedish Research Council for six years, where she also served as its chair for three years. She was Head of the Department of Medicine and Health for 13 years. BÖ is currently working in research and tutors PhD students in physiotherapy. Her area of interest is clinical research, focusing on musculoskeletal disorders and cardiovascular diseases. The studies include evaluation of interventions, risk factor prediction, clinical course, instrument and outcome development and implementation. She has tutored 25 PhD students with different professional backgrounds and has over 150 international publications.

Leena Ala-Mursula (MD) is a Professor of Occupational Health at the University of Oulu, Finland. She is a distinguished developer of education in her discipline and holds several national-level positions of trust in medical specialist training. Her research focuses on employment-related epidemiology combined with biopsychosocial and life-course models of health and on developing new understandings in occupational health.

Jaro Karppinen (MD) is a specialist and Professor of Physical and Rehabilitation Medicine at the University of Oulu (currently emeritus). He has worked as Director of Rehabilitation services in the South Karelia Wellbeing Services County since 2020. JK has been the principal investigator in many clinical studies of low back pain and sciatica. He has a wide research spectrum that covers the environmental, metabolic and genetic risk factors of musculoskeletal disorders. His current research interests are artificial intelligence-based analytics of lumbar magnetic resonance imaging, population-level rehabilitation interventions and biopsychosocial care pathways in primary healthcare for musculoskeletal disorder patients. JK has over 300 peer-reviewed scientific publications in international journals and has an H-index (scopus.com) of 67. He has been a member of the European Academy of Rehabilitation Medicine since 2012.

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PAPER IV

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ORIGINAL ARTICLE

Measuring the determinants of implementation behavior in multiprofessional rehabilitation

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ABSTRACT

BACKGROUND: The Determinants of Implementation Behavior Questionnaire (DIBQ) measures facilitators or barriers of healthcare professionals' implementation behaviors based on the current implementation research on practice and policy. The DIBQ covers 18 domains of the Theoretical Domains Framework and consists of 93 items. A previously tailored version (DIBQ-t) covering 10 domains and 28 items focuses on implementing best-practice low back pain care.
AIM: To tailor a shortened version of DIBQ to multiprofessional rehabilitation context with cross-cultural adaptation to Finnish language.
DESIGN: A two-round Delphi study.
SETTING: National-level online survey.
POPULATION: Purposively recruited experts in multiprofessional rehabilitation (N.=25).
METHODS: Cross-cultural translation of DIBQ to Finnish was followed by a two-round Delphi survey involving diverse experts in rehabilitation (physicians, physiotherapists, occupational therapists, psychologists, nursing scientists, social scientists). In total, 25 experts in Round 1, and 21 in Round 2 evaluated the importance of DIBQ items in changing professionals' implementation behavior by rating on a 5-point Likert Scale (1=Strongly Disagree, 5=Strongly Agree) of including each item in the final scale. Consensus to include an item was defined as a mean score of ≥4 by ≥75% of Delphi participants. Open comments were analyzed using inductive content analysis. Items with agreement of ≤74% were either directly excluded or reconsidered and modified depending on qualitative judgements, amended with experts' suggestions. After completing an analogous second-round, a comparison with DIBQ-t was performed. Lastly, the relevance of each item was indexed using content validity index on item-level (I-CVI) and scale-level (S-CVI/Ave).
RESULTS: After Round 1, 17 items were included and 48 excluded by consensus whereas 28 items were reconsidered, and 20 items added for Round 2. The open comments were categorized as: 1) "modifying"; 2) "supportive"; and 3) "critical". After Round 2, consensus was reached regarding all items, to include 21 items. After comparison with DIBQ-t, the final multiprofessional DIBQ (DIBQ-mp) covers 11 TDF domains and 21 items with I-CVIs of ≥0.78 and S-CVI/Ave of 0.93.
CONCLUSIONS: A Delphi study condensed a DIBQ-mp with excellent content validity for multiprofessional rehabilitation context.
CLINICAL REHABILITATION IMPACT: A potential tool for evaluating determinants in implementing evidence-based multiprofessional rehabilitation interventions.

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KEY WORDS: Rehabilitation; Implementation science; Delphi Technique; Surveys and questionnaires.

In many fields of social and health care and rehabilitation, there is a gap between what has been proven to be effective and what is practiced.[1-4] Narrowing this gap through the successful implementation of evidence-based practices depends on changing the behavior of the professionals.[3, 5] Implementation research aims to generate knowledge of strategies helping to translate research evidence to clinical practice, and to understand key factors associated with changing professionals' implementation behavior.[3, 6-10] This can be complicated, especially in the multiprofessional rehabilitation context due to heterogeneous professional roles and complex interventions.[11, 12] Multiprofessional rehabilitation involves collaborative teams or work communities consisting of professionals from different social and health care disciplines working together to deliver services.[13]

The Theoretical Domains Framework (TDF) was initially developed for implementation research to identify factors influencing professionals' behavior regarding implementation of evidence-based practice recommendations. The TDF is an integrative framework synthetizing 33 theories of behavior and behavior change, originally sorted into 14 domains, with 4 additional domains later added.[14, 15] According to the TDF, barriers and facilitators of implementation may relate to the innovation itself (*e.g.* innovation characteristics), the social setting (*e.g.* norms, support), the individual professionals (*e.g.* skills, self-efficacy), health care organizations (*e.g.* resources and support), innovation strategies (*e.g.* training), the patients or participants in treatment and rehabilitation (*e.g.* attitudes) - or health care system and society per *se*.[3, 7, 16-21]

The Determinants of Implementation Behavior Questionnaire (DIBQ) has been developed based on TDF.[14, 15, 22] It quantifies the role of TDF domains in the implementation process, so that the factors influencing implementation behavior can be identified.[23] The DIBQ was initially developed for evaluating potential determinants of health care professionals' implementation behavior[24] and it was first tested with physiotherapists in physical activity interventions.[22] The original DIBQ is extensive, including 93 items assessing 18 domains,[22] but it was successfully shortened and tailored to different research questions, contexts and intervention types.[25]

The success of strategies for implementing evidence-based procedures into health care is often overlooked, and only patient-reported outcomes or economic impacts are often examined. Clinical guideline recommendations alone do not seem to be sufficient to change treatment practices.[26] Moreover, it has been shown that dissemination of guidelines is not enough to change behavior, and thus, more active implementation strategies are needed.[26] Therefore, it is important to have feasible and valid instruments for assessing facilitators and barriers of professionals' behavior regarding implementation of theory-based interventions. In science as well as in practice and policy, there is a growing need for robust, transparent and systematic as well as rapid and pragmatic methods for supporting implementation processes. In the multiprofessional rehabilitation context, a user-friendly and context adapted tool is required for monitoring and scaling the factors influencing implementation and for enhancing the use of evidence in daily routines that are often characterized by busyness and limited resources.

The current study aimed to tailor a shortened version of DIBQ to multiprofessional rehabilitation context and cross-culturally adapt a Finnish language version.

Materials and methods

The study design is described in Figure 1. Mixed methods were used. The original DIBQ in English language was first translated and cross-culturally adapted to Finnish (phase 1); and then tailored by means of a two-round Delphi process among a purposively recruited national-level group of experts, giving both quantitative ratings allowing content validity assessments as well as qualitative written judgements regarding DIBQ items to be included into a shortened multiprofessional rehabilitation context version of the DIBQ (DIBQ-mp) (phase 2). Support for adaptation and validation of the DIBQ to multiprofessional context was given by the original developer of the questionnaire through an e-mail communication.[22] This study did not include patients, but non-identifiable health care professionals who participated as volunteers.

Translation of the English version and cross-cultural adaptation to Finnish (phase 1)

The aims of the cross-cultural translation process were to translate all items of the English version and cross-culturally adapt them to Finnish language. A forward-backward translation was completed using the 4-stage process outlined by Beaton[27] based upon the English version of the questionnaire.[22, 28] Cross-cultural adaptation is defined as "a process which looks at both language (translation) and cultural adaptation issues in the process of preparing a questionnaire for use in another setting"[27].

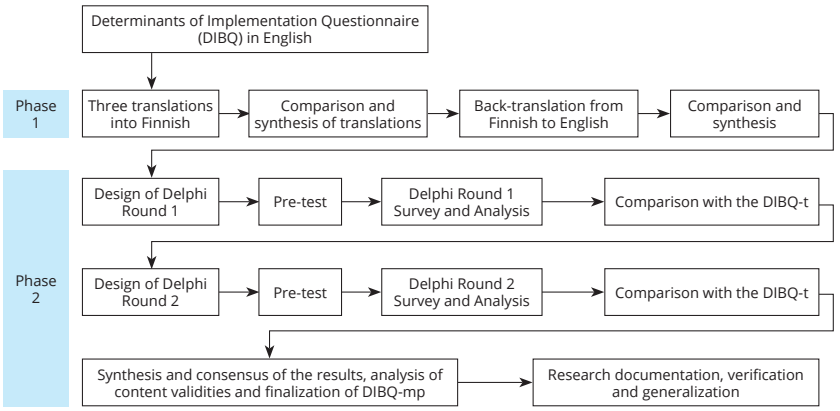

Figure 1.—Cross-cultural adaptation (phase 1) and Delphi procedure (phase 2).

Delphi procedure (phase 2)

The aim of phase 2 was to reduce the number of items and tailor DIBQ to multiprofessional rehabilitation context. The Delphi method was utilized to collect the judgments of experts in a group decision making setting to gain understanding of the items and for identification of critical factors to obtain a shorter version of the DIBQ. The research questions in the Delphi process were "which factors are the most critical in multiprofessional rehabilitation implementation, implying the question, which DIBQ domains and items thus cannot be left out of the shorter version of the questionnaire?". The study was conducted following the principles of classical Delphi.[29-31] Both qualitative and quantitative methods were used in the Delphi process. The Delphi process consisted of two iterative rounds of ratings using an online survey and pre-tests before and comparison to DIBQ-t after each round.

Prior to the Delphi rounds, pre-tests were conducted with the goal of testing and adjusting the Delphi questionnaire to improve comprehension, and to work out procedural problems. The survey was revised as the result of the pre-tests. To ensure sufficient contribution and take account of the typically high drop-out rate in Delphi-studies, the purpose of this study was to recruit 30 participants,[32] which would allow the diversity in views while accounting for expected attrition rate.[32]

A purposive sampling strategy was used to recruit a panel of experts from the authors' networks covering all health care districts, private and public sector and research and education networks in Finland. The following eligibility criteria and requirements for expertise for Delphi participants were used: 1) knowledge and experience with multiprofessional rehabilitation and/or evidence-based health care research implementation in the Finnish health care system; 2) capacity and willingness to participate; 3) sufficient time to participate in the Delphi-process.[33] Research team identified an initial group of experts with a good geographical coverage and multiprofessional diversity (including specialists in rehabilitation medicine, occupational health care, general medicine, psychology, physiotherapy, nursing sciences, occupational therapy and social sciences), and the "snowball" sampling technique was used to generate subsequent participants.[34] The Delphi study was conducted online, using Webropol, over a three-month period to provide sufficient time to gather data and aggregate group responses. Data collection took place in the period of April to June 2021.

Design of Delphi Round 1

The initial instruction of the Delphi questionnaire to Round 1 was: Please evaluate the importance of each item as a facilitator of or a barrier to changing professionals' implementation behavior. The survey was comprised of 5-point Likert scale questions with comments and free-text sections. The purpose of the first round was to: 1) rate the content and structure of each DIBQ item; 2) recommend items to be included or excluded from the multiprofessional DIBQ (DIBQ-mp); and 3) to comment on the comprehensibility, suitability and usability of the questionnaire. The descriptive comments were obtained within each domain:" Are the items understandable and clear? If no, please comment briefly". The DIBQ items as well as

new items suggested in the comments were then reconsidered and/or modified based on the ratings and remarks of the participants. Participants' age, gender, education, educational level, primary role, years of experience, and field of expertise were inquired to evaluate overall representativity/feasibility to be included in the Delphi process, but not further used in item-level considerations.

Design of Delphi Round 2

Delphi Round 2 was designed to 1) determine agreement on items revised based on results of Round 1; and 2) determine preliminary agreement of the new items generated in Round 1; 3) elicit further comments and feedback using a 5-point Likert scale and free text to state the reasoning for their rating or provide additional comments. Participants received the summary of Round 1 results and were free to review and reflect on these results as they submitted their responses and feedback in Round 2. Participants were also asked again to comment the comprehensibility of the items.

Data analysis

Descriptive statistics (ranges, means of ratings with standard deviations and percentages of agreements) for each item were calculated for Round 1 and Round 2 results. Participants rated and commented on the importance of each DIBQ item as a facilitator of or a barrier to changing professionals' implementation behavior. Consensus to include items was defined as a mean score of ≥4 on a Likert Scale (1 = Strongly Disagree, 2 = Disagree, 3 = Neither Agree nor Disagree, 4 = Agree, 5 = Strongly Agree) by at least 75% of Delphi participants. Delphi questions with a group level of agreement of 75% or higher were included and 74% or lower were either excluded or reviewed depending on qualitative judgements. A second-round survey followed the same process as the first round.

Experts were asked to rate the relevance of each item on a 5-point scale (1 = not relevant, 2 = somewhat relevant, 3 = not relevant nor relevant, 4 = quite relevant, 5 = highly relevant). The relevance of each item scored by experts was indexed using content validity index (CVI). The rating of 3 on the scale was not included in the calculation of an item-level CVI. For each item, the I-CVI was computed as the number of experts giving a rating of either 4 or 5, divided by the number of experts. An item was considered 'relevant' when scoring an item-level CVI (I-CVI) of 0.78 or more.[35]

The qualitative data from survey comments within items, domains and the free-text sections were analyzed by using inductive content analysis to classify the comments in favor of exclusion, inclusion or modification before potential inclusion to the shortened version.[36, 37] Initially the participants' statements were read and re-read by the first author to gain familiarity. Subsequently, meaningful units of analysis (core sentences and words) were selected. Each meaningful unit was condensed and labelled with a code using qualitative data analysis program MAXQDA 2020 Analytics Pro. The codes were sorted and grouped into subcategories and categories in discussion among the authors. Analysis of the comments was also used to guide the modifications and considerations of the importance and suitability of the items for the multiprofessional rehabilitation context. An item could be included even it was quantitatively rated below threshold if qualitative assessment captured important issues in relation to the targeted context.[38]

Comparison with DIBQ-t

Finally, the results of the Delphi-procedure were compared with DIBQ-t tailored versions in Danish and Swedish before synthesis of the results.[25] A comparison to previously tailored versions was done for benchmarking and comparison of the items chosen, reflecting on differences between the two versions, identifying the items that overlap in content and reflecting experiences of the use of the DIBQ-t.

Data availability

The data associated with the paper are not publicly available but are available from the corresponding author on reasonable request.

Results

Translation of the DIBQ in English and cross-cultural adaptation to Finnish (phase 1)

The forward and backward translation (steps 1-4) were performed successfully. Since the multiprofessional rehabilitation context was considered, the 'profession' in the original DIBQ was modified to relate to 'social and health care professional'. 'Action' was modified to relate to 'intervention/procedure'. 'Context' was modified to relate to 'rehabilitation'. 'Target' was modified from 'patient' to 'patient, client, participant or rehabilitee' depending on the social and health care setting.

Taxonomy in Finnish language for implementation is in its early development and there are no scientific publications on translation of TDF to Finnish language. Another

challenge in the translation was that in Finnish language the variations of multiple meanings for words often differ from the corresponding variations in English. For example, the word 'worthwhile' can refer to health-economical perspective, financial profit for professional or workplace, or more abstract personal relevance or meaningfulness from client perspective, *i.e.* is it worthwhile to the client to participate on rehabilitation with regards to costs and outcomes. The results from the expert panel review and the inductive content analysis were used to answer the questions about content validity and cross-cultural adaptation to a Finnish social and healthcare setting. The Finnish translation of DIBQ and the TDF domain titles is presented in (Supplementary Digital Material 1: Supplementary Table I).

Delphi procedure to identify factors of importance in multiprofessional rehabilitation program implementation (phase 2)

Of the invited 111 persons, 25 experts (23%) participated in the Round 1 survey. Of the participants, half were women (52%), a third were aged from 51 to 60 years (32%), and two thirds had a doctoral level education (64%). Most often, the participants had 11 to 15 years of experience in clinical work (40%) and 16 to 20 years in academic work (32%, Figure 2). All experts used both spoken and written English regularly. Many reported having several professions or professional roles. Professions represented included physicians (specialized in rehabilitation medicine, occupational medicine and general practice), physiotherapists (specialized in orthopedic manual therapy, musculoskeletal physiotherapy and chronic pain), occupational therapists, psychologists, psychotherapists, social psychologists, educationists, health scientists, nursing scientists and social scientists (Table I). The experts represented of diverse settings and contexts in health, social welfare and education – and the perspectives of scientists, researchers, educators, organizational leaders, practitioners and policymakers. The participants were representative of the invited persons' professions and positions in the Finnish rehabilitation system. The pre-test of Delphi questionnaire resulted in revisions of improving clarity of the instructions for the Delphi panellists and spelling.

Round 1

In Round 1, participants reached agreement for 65 of the 92 content questions: 17 items reached consensus to be included, and 48 items were excluded because of low ratings or qualitative assessments favouring exclusion. The domains on which items reached agreement to be included concerned 'Knowledge', 'Skills', 'Beliefs about capabilities', 'Intentions', 'Innovation', 'Organization', 'Patient', 'Innovation strategy', 'Social influences' and 'Behavioral regulation'. The domains in which all items reached agreement to be excluded were 'Social/professional role and identity', 'Optimism', and 'Goals'. Mean scores ranged from 2.4 to 4.6, and the standard deviations from 0.51 to 1.22 (Supplementary Digital Material 2: Supplementary Table II).

In reconsiderations of items, which did not reach consensus in Round 1, 48 changes were made to the questionnaire. Changes included revisions to wordings (N.=27), adding one missing item (6.2) from original 93-item DIBQ

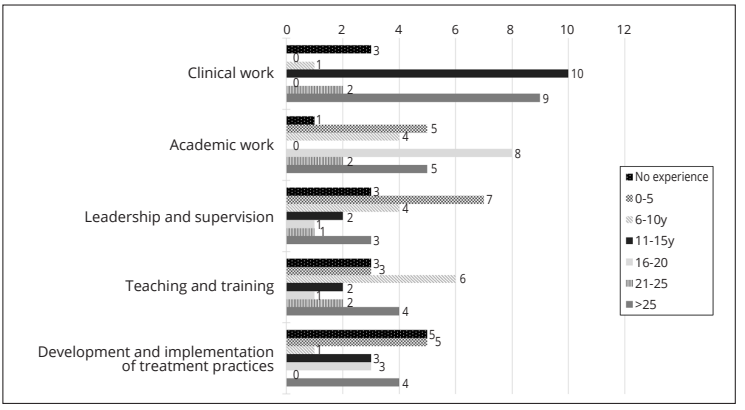

Figure 2.—Professional experience of participants.
X-axis describes the number of participants in each field and category.

TABLE I.—*Participants' field of education, primary role and field of expertise.*

Participant	Field of education	Primary role	Field of expertise
P1	Health Sciences Health Economics	Senior Planning Officer	Health economics Health technology assessment
P2	Health Sciences Occupational Therapy	Service Manager	Research and development of health care services Rehabilitation service system Management and supervision of social and health services Primary care
P3	Health Sciences Physiotherapy	Physiotherapist	Research and development of rehabilitation Research and development of health care services Education and training Biopsychosocial evaluation and treatment Direct access to physiotherapist Primary care
P4	Health Sciences Physiotherapy	Physiotherapist	Research and development of rehabilitation Education and training Biopsychosocial evaluation and treatment Direct access to physiotherapist Clinical expert: orthopedic manual therapy Rehabilitation entrepreneur
P5	Health Sciences Physiotherapy	Researcher	Education and training Clinical expert
P6	Health Sciences Physiotherapy	Educator	Research and development of rehabilitation Education and training: physiotherapy
P7	Medicine	Physician	Research and development of health care services Implementation research Management and supervision of social and health services Clinical expert Evidence-based medicine
P8	Medicine	Physician	Research and development of health care services Implementation research: clinical guidelines
P9	Medicine	PRM specialist	Research and development of health care services Research and development of occupational health care services Education and training: medical sciences Clinical expert
P10	Medicine	Specialist in neurology	Research and development of health care services Social insurance institution
P11	Medicine	Specialist in General Medicine	Research and development of health care services Implementation research Biopsychosocial evaluation and treatment Management and supervision of social and health services Primary care
P12	Music Therapy Psychotherapy	Researcher Trainer Facilitator Therapist	Research and development of rehabilitation: evaluation and effectiveness research Education and training Clinical expert
P13	Nursing Sciences	Doctoral Researcher Research Coordinator	Education and training
P14	Nursing Sciences	Educator	Education and training
P15	Psychology	Researcher, Psychotherapist	Research and development of rehabilitation Research and development of health care services Clinical expert
P16	Psychology and Educational Sciences	Senior Advisor	Multidisciplinary and customer-oriented development of social and health services Development of the cooperation structures in the social and welfare services
P17	Medicine	Researcher Physician	Research and development of rehabilitation Implementation research Rehabilitation service system Working life research Occupational health care
P18	Medicine	Chief Medical Officer PRM specialist	Research and development of rehabilitation Education and training Management and supervision of social and health services Clinical expert: secondary care
P19	Medicine	Chief Medical Officer PRM specialist	Research and development of health care services Primary care

(To be continued)

TABLE I.—*Participants' field of education, primary role and field of expertise (continues).*

Participant	Field of education	Primary role	Field of expertise
P20	Medicine	Chief Medical Officer PRM specialist	Research and development of rehabilitation Research and development of occupational health care services Rehabilitation service system
P21	Medicine	Chief Medical Officer PRM specialist	Research and development of rehabilitation Research and development of health care services Rehabilitation service system Management and supervision of social and health services Biopsychosocial evaluation and treatment Clinical expert: primary care
P22	Medicine	Researcher Chief Medical Officer PRM specialist	Research and development of rehabilitation Research and development of health care services Education and training
P23	Social, Health and Sports Sciences	Educator Project Manager Researcher	Research and development of rehabilitation: rehabilitation of the elderly Research and development of health care services Education and training
P24	Social Psychology	Executive Manager	Education and training: Social psychology, behavior change, motivational interview Associations and foundations
P25	Social Sciences	Senior Advisor	Research and development of rehabilitation Implementation research Implementation support Rehabilitation service system Management and supervision of social and health services: Self-assessment strategies Occupational health care

PRM: physical and rehabilitation medicine.

in Round 1 (N.=1) and addition of new items (N.=20). All new items were added as suggested by the experts for the Round 2.

Inductive content analysis of the feedback provided by the experts in Round 1 identified three key categories of statements that described the contents being: 1) 'modifying', 2) 'supportive' and 3) 'critical'. The total number of coded statements was 303. The statements were classified into three categories and five subcategories. 'Modifying' (N.=67) included subcategories of 'modifying the content of an existing item' (N.=47) and 'modifying the content of the domain with a new item' (N.=20). 'Supportive' included a subcategory of 'encouraging the use of an item or domain' (N.=36). 'Critical' (N.=200) included subcategories of 'critical constructive' statements reflecting of how the items are worded, presented and understood in Finnish language (N.=165) and 'exclude' statements suggesting excluding the item or domain (N.=35). Categories and subcategories were conceptualized based on the data of the research question, and iteratively developed from the coding. The results of content analysis are presented in the Table II.

In the end of Round 1, 68% (N.=17) expected the questionnaire as 'suitable' for Finnish context, 4% (N.=1) 'not suitable' and 28% (N.=7) 'could not yet say'. Half of the drop-outs (N.=4) rated the questionnaire as 'suitable' and half 'could not say'. The Delphi expert that rated the questionnaire not suitable criticized on the length, imbalance of the domains and lacking compatibility for all professional groups. On the other hand, the question categories were found to be useful in different situations, and the possibility to choose the most appropriate questions for different purposes was discussed.

Round 2

For Round 2, 84% of Round 1 participants completed the survey (N.=21). Three of the experts dropped out due to lack of time and one had volunteered to participate in Round 1 only. In total, 48 amendments to the questionnaire were proposed. In addition, four items reached consensus to be included while 44 items were excluded. Mean scores ranged from 2.9 to 4.6, with the standard deviation ranging from 0.49 to 1.22 (Supplementary Table II). Supplementary Digital Material 3 (Supplementary Table III) presents the ratings of items that are included in DIBQ-mp for Round 1 and Round 2.

In the end of Round 2, 76% (N.=16) expected the questionnaire to be 'suitable' for Finnish context and 24% (N.=5) could not yet say. Examples of responses included:

"If such a questionnaire were available, it could facilitate the implementation of the various guidelines and make it more targeted at the services." (P1)

"*The questionnaire can be used to design, adjust and provide the right kind of training for professionals, and*

TABLE II.—*Results of the content analysis of expert panel comments.*

Category (number of statements)	Subcategory (number of statements)	Example of comments	Examples of quotations	Adaptations
Modifying (67)	Modifying the content of an existing item (47)	• Context related feedback. • Improve clarity and legibility by shortening the sentences. • Content related feedback on the wording of the items.	• *"The system is shifting towards common social and health care organizations. The forms of the questions are targeted only to health care professionals."* (P17) • *"A 'participant' is not a suitable term for all interventions."* (P8) • *"Shorten "following the guidelines" out of the questions."* (P9) • *"6.9 Strange emphasis on physical activity. Rehabilitation is a learning process.* (P25) • *"18.1 The word 'automatically' does not seem appropriate here. Could it be 'naturally', which suggests that it does not require effort. Automatic rehabilitation intervention is more like robotics."* (P12) • *"14.7 The word "helpful" is challenging. It may or may not mean concrete help."* (P2)	• Modifying the items to have a multidisciplinary 'social and health care professional' perspective. • Modifying the items to refer to patient, client, participant or rehabilitee depending on the social and health care setting. • Modifying a few items by shortening out "following the guidelines". • Modifying the item 6.9 by replacing "physical activity" with "activity in the daily living". • Modifying the item 18.1 by replacing the word "automatically" with "naturally". • Modifying the items 14.7 and 11.4 with replacing "are helpful" with "are supportive and willing to provide solutions".
	Modifying the content of the domain with a new item (20)	• New questions suggested by Delphi experts.	• *"I believe that […] is achieving results"* • *"I experience positive emotions (e.g., calmness, optimism, comfort) when working in an […].* • *"I believe that I am doing relevant work in delivering […]"*	• The importance of all the proposed 20 new items were evaluated in Delphi round 2.
Critical (200)	Critical constructive (165)	• Choice of wording and phrasing in Finnish. • Imprecise sentences that should be clarified. • Understanding. • General critical statements of the questionnaire.	• *"The term intervention is not clear to everyone."* (P14) • *"The questions are formulated as if assuming that the intervention is a one-time operation that is performed and can then be considered performed (such as surgery on a single patient). I guess the intention should be for a professional to take intervention in a tool that is used constantly and over and over again with several different clients."* (P16) • *"The issue of motivation of participants is problematic because professionals should not drift into a situation where "they" accomplish something for "those" who are not motivated."* (P12) • *"It is essential to specify what is meant by an evaluation (4.9)."* (P25) • *"The question of the focus of primary health care on prevention is surprising in this context and, if it is held, it must somehow be explained (10.3). In order to have sufficient resources, primary health care should focus more on prevention ...?"* (P16) • *"13.7. I do not understand the question."* (P2) • *"This domain [Organization] is limited to thinking about a paid work model, as is the case in the original survey. But while this work is done in many other different "labour market positions" such as self-employed, it should be possible to answer similar questions from those positions as well".* (P17)	• Modifying the Finnish wording of "guideline-based intervention/procedure" to support the continuous use. • Comments were used to guide the considerations of the importance and suitability of the items 4.4 and 17.4 and changing the wording of the item 12.1 from "motivation" to "meaningfulness". • Specifying and clarifying items 4.9, 4.11, 10.3 and 13.7 for increased understanding. • The general critical comments were saved for research group for future studies.
	Exclude (35)	• Statements suggesting excluding the item or domain.	• *"14.1 is definitely useless."* (P8) • *"Slightly unclear how this relates to a particular intervention, in particular 10.3."* (P3)	• No adaptations made to items. • Comments were used to guide the considerations of the importance and suitability of the items.
Supportive (36)	Encouraging the use of the item or the domain (36)	• Confirmatory feedback on the importance of the items or the domains.	• *"Really important questions."* (P25) • *"Really important that implementation intentions are involved!"* (P24)	• No adaptations made to items. • Comments were used to guide the considerations of the importance.

supervisors will also be informed about their own role in the success of the implementation." (P13).

"The questionnaire would reveal the views of the professional delivering the intervention as well as it can explain the results of the intervention or whether it is not taking place actually in practice." (P2)

"This is a good universal questionnaire for evaluation of the implementation. If particularly interested in some aspect in addition to the core-set, such as emotions or organizational support, you may add questions related to this topic to the questionnaire." (P25)

Synthesis and consensus of the results with validity ratings

After Round 2, comparison with DIBQ-t resulted in further exclusion of four and inclusion of four items. Items were included in the synthesis based on importance for research purposes (2.1), multiprofessional work (6.7), the need of further support for professionals (4.6) and emphasis on client perspective (12.1). Items (1.3, 11.4, 14.5) were excluded due to overlapping with content. Suggested new item "I believe that I am doing relevant work in delivering [guideline-based intervention/procedure]" was excluded due to not having TDF classification. After the synthesis, the Delphi process was concluded. Figure 3 illustrates the Delphi Process Summary.

The final DIBQ-mp covers 21 items representing 11 out of 18 TDF domains: 'Knowledge', 'Skills', 'Beliefs about Capabilities', 'Beliefs about Consequences', 'Intentions', 'Innovation', 'Organisation', 'Client/Participant/Patient', 'Innovation strategy', 'Social influences' and 'Behavioral regulation'. Table III demonstrates the final multiprofes-

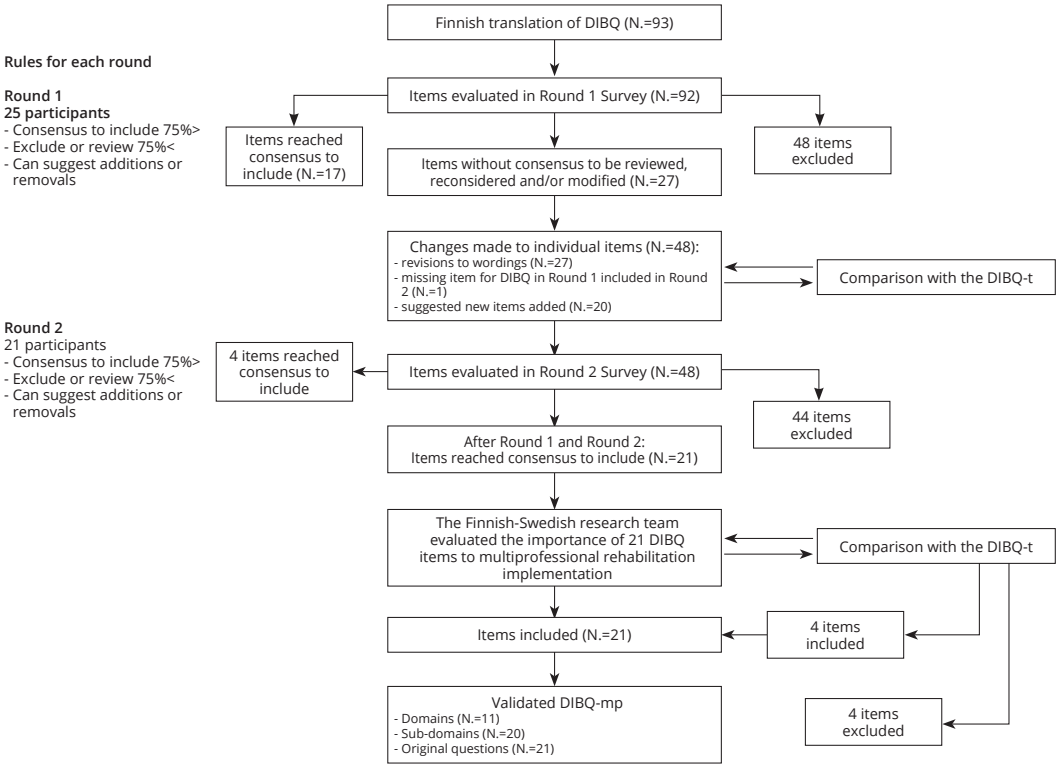

Figure 3.—The Delphi Process Summary.

TABLE III.—*The Final DIBQ-mp.*

Domain and construct	Item	Experts in agreement (N.)	Number of experts (N,)	I-CVI
Knowledge				
Knowledge	I know how to deliver [guideline-based intervention/procedure].	25	25	1.00
Role clarity	Objectives of [guideline-based intervention/procedure] and my role in this are clearly defined for me.	22	22	1.00
Skills				
Skills	I have been trained in delivering [guideline-based intervention/procedure].	18	23	0.78
	I have the skills to deliver [guideline-based intervention/procedure].	22	23	0.96
Beliefs about capabilities				
Self-efficacy	I am confident that I can deliver [guideline-based intervention/procedure]	20	21	0.95
Perceived behavioral control	For me, delivering [guideline-based intervention/procedure] is (very difficult – very easy).	18	20	0.90
Beliefs about consequences				
Attitude	For me, delivering [guideline-based intervention/procedure] is (not useful at all – very useful).	21	21	1.00
Outcome expectancies	If I deliver [guideline-based intervention/procedure] following the guidelines, this will strengthen the collaboration with professionals with whom I deliver [guideline-based intervention/procedure].	17	19	0.88
Intentions				
Intentions	How strong is your intention to deliver [guideline-based intervention/procedure] in the next three months? (not strong – very strong)	19	22	0.86
Innovation				
Innovation characteristics	It is possible to tailor [guideline-based intervention/procedure] to patients'/clients'/ rehabilitees'/participants' needs?	20	22	0.91
	[Guideline-based intervention/procedure] is compatible with daily practice.	21	23	0.91
Organization				
Organizational resources and support	In the organization I work, all necessary resources are available to deliver [guideline-based intervention/procedure].	20	21	0.95
	I can count on support from the management of the organization I work in, when things get tough around delivering [guideline-based intervention/procedure].	25	25	1.00
Patient/client				
Patient/client characteristics	Patients/Clients/Rehabilitees/Participants consider participation in [guideline-based intervention/procedure] meaningful.	14	16	0.88
	Patients/Clients/Rehabilitees/Participants of [guideline-based intervention/procedure] are positive about [guideline-based intervention/procedure].	22	24	0.92
Innovation strategy				
Innovation strategies	[Implementing organization] provides professionals with a training to deliver [guideline-based intervention/procedure].	21	22	0.95
	[Implementing organization] provides sufficient intervention instructions and materials.	19	21	0.90
	[Implementing organization] provides assistance to professionals with delivering [guideline-based intervention/procedure].	22	24	0.92
Social influences				
Descriptive norm	Professionals with whom I deliver [guideline-based intervention/procedure] deliver [guideline-based intervention/procedure] following the guidelines.	20	21	0.95
Social support	I can count on support from professionals with whom I deliver [guideline-based intervention/procedure] when things get tough around delivering [guideline-based intervention/procedure].	22	23	0.96
Behavioral regulation				
Action planning	I have a clear plan of how I will deliver [guideline-based intervention/procedure].	23	23	1.00

S-CVI/Ave 0.93
I-CVI: Item-level content validity index; S-CVI/Ave: scale-level content validity index, averaging method.

sional DIBQ (DIBQ-mp), re-translated back to English language. Supplementary Digital Material 4 (Supplementary Table IV provides the Finnish version of the final DIBQ-mp.

In the content validity assessment, all 21 of the DIBQ-mp items were indexed with CVI≥0.78 (Table III). Most items were rated CVI≥0.90 by majority of the content experts (N.=16-25) except for four items ranging from 0.78 to

0.88 (Table III). The final DIBQ-mp is composed of items that have I-CVIs of ≥0.78 and overall scale-level content validity index S-CVI/Ave 0.93 (excellent content validity: I-CVIs of ≥0.78 and an S-CVI/Ave of 0.90 or higher).[39]

Discussion

The final validated multiprofessional DIBQ, DIBQ-mp, was reduced from 93 items on 18 domains to 21 items on 11 TDF domains of most important to multiprofessional rehabilitation context: 'Knowledge', 'Skills', 'Beliefs about Capabilities', 'Beliefs about Consequences', 'Intentions', 'Innovation', 'Organisation', 'Client/Participant/Patient', 'Innovation strategy', 'Social influences' and 'Behavioral regulation'. Moreover, based on high CVI-ratings, the DIBQ-mp is suitable for different settings in Finnish social and health care in context of multiprofessional rehabilitation.

To our knowledge, other tools intended to be used for the research on implementation of multiprofessional rehabilitation interventions and procedures are not available. The previous studies have applied the DIBQ-t in evaluating the expectations of the implementation process in profession-specific interventions.[40, 41] In the Swedish study, facilitating role of most domains of DIBQ-t was reported.[41] The Danish study investigated clinician-level factors related to implementing evidence-based care for LBP patients in primary care using DIBQ-t and qualitative assessments. Personal gain, practicalities, buying-in on the program, and clinicians' attitudes toward the program were found important for implementation. Qualitative data was valuable in understanding that the participants had high competence in knowledge and skills after evidence-based training irrespective whether they implemented the intervention or not. The study indicated that training alone is insufficient for implementation.[40] DIBQ-mp version was developed for the multiprofessional rehabilitation context whereas DIBQ-t had focus on low back pain management. When DIBQ-mp was benchmarked to DIBQ-t, the determinants of implementation behaviour were same in both versions on the domain level but differed on an item-level.

The domains that were excluded from the original DIBQ related, firstly, to the individual level (micro level such as emotions and optimism), and secondly, to the system-related domains (macro-level such as professional role, and social and political context). It might reflect that the system level in Finland and in other Scandinavian countries is considered stable and allows professionals to choose interventions based on rather autonomous understandings on evidence-based guidelines instead of being strictly regulated by the authorities. Organizational level (meso-level such as organizational support) was considered more important in the local clinical context. On the individual level, the domains that were ruled out related to the psychological profiles, whereas included domains such as knowledge and skills were considered of more importance. System and individual level were potentially less influential considering barriers or facilitators of implementation behavior in multiprofessional rehabilitation context.

The purpose of the Round one Delphi was to detect the DIBQ questions that experts valued as potentially important determinants of professionals' implementation behavior and the purpose of the Round two was to condense the list. However, instead of just removing unnecessary questions, Delphi panellists suggested multiple new items to be included. Delphi participants raised up relevant themes that they felt were missing from the original DIBQ questionnaire: 1) support for multiprofessional work in rehabilitation; 2) beliefs about outcome-expectancies and meaningfulness of the work; 3) patient perspectives: expectations, values, satisfaction, recovery; 4) compatibility (is the intervention perceived as being consistent with the professional's existing values, past experiences, and needs); 5) perspectives of continuous learning, learning organization and special features of adult learning; 6) advantages from the patient's point of view; and 7) estimation of the professional's own willingness to embrace and apply, and ability to monitor the implementation (Supplementary Table II). Notably, in Round 2, none of the added items reached consensus to be included in the final DIBQ-mp.

One aspect that was not raised by Delphi panellists was which DIBQ items would capture barriers and facilitators from a health care/societal economic point of view. For example, items regarding beliefs about consequences (6.1, 6.2, 6.5), innovation (9.3), social-political context (10.2), innovation strategy (13.6) capture certain economical aspects. However, the experts prioritized the item 6.1 asking if delivering the intervention following the guidelines is "useful". This could be interpreted as capturing aspects of cost utility from the professional perspective, but for more robust coverage of cost utility, researchers would probably need to include additional items to the DIBQ-mp for their specific research purpose.

The original version of the questionnaire was developed to be applicable to any context but was first tested in a specific context. A recent Cochrane review suggests that mixed-methods studies with longer acclimatization period before evaluation of newly implemented teamwork interventions, and longer follow-up, are needed when

implementing interventions that require multiprofessional collaboration.[11] For this purpose, valid and reliable tools are necessary. A scale has been developed to measure multiprofessional (nurse-physician) collaboration[42] but there are limitations with the validity, reliability, and the extent the scale can be used with different professional groups.

Engaging clinicians in multiprofessional collaboration belongs to managers' role, starting with an evaluation of the quality of services and establishing reimbursements that support teamwork, local quality improvement and the interdisciplinary sharing of knowledge.[43] Therefore, managers need information about the relationship of professionals with other disciplines, and professionals' attitudes, beliefs and motivational factors for multiprofessional collaboration.[44, 45] We propose the use of implementation research -based questionnaire to collect data on the use of evidence in daily routines, to advance problem solving when putting evidence into practice, and to facilitate the implementation of guideline-based interventions and procedures.

The DIBQ-mp would seem most suitable for multiprofessional training of evidence-based interventions and in improving future implementation strategies. Essentially, DIBQ-mp can identify factors of importance at individual, system and organization levels. The 'Socio-political context' domain was excluded from the DIBQ-mp. The society context was seen critical to success by Delphi experts, but the important actors are context- and system-related. When aspects of information at society level is needed, items considering larger operational environment can be added to the questionnaire.

We used well-established methods in the cross-cultural adaptation and Delphi process. The strength of the Delphi method was that we were able to gather participants with different professions in rehabilitation from all parts of Finland. Good geographical coverage also provided diversity in Delphi experts' accents and wordings in different parts of the country. Finland has approximately 5.5 million inhabitants. The Finnish rehabilitation system includes practicing rehabilitation experts from the primary care, secondary care, rehabilitation entrepreneurs, associations and foundations, occupational health care, scholars of the field in universities and research institutions as well as experts acting in the funding organizations such as the national social insurance institution, earnings-related pension providers, insurance companies and State Treasury.[1] The group of experts included was representative in terms of practicing experts and educators of the Finnish rehabilitation system. A minimum panel of 15-20 experts is recommended to ensure sufficient contributions in a Delphi study,[32] and we had over 20 experts in both rounds. Also, the use of both quantifiable and qualitative measures, and especially, inclusion of a qualitative assessment can be regarded as a strength of the study. However, the use of Finnish multiprofessional experts for the Delphi process can be regarded as a limitation too as the generalizability of DIBQ-mp to other European countries and worldwide needs to be evaluated. However, the authors of the study comprise a multiprofessional group of researchers from Sweden and Finland, intensively networking internationally.

The process of translation of DIBQ involved cross-cultural translation process followed by Delphi procedure, which provided expert opinions on the comprehensiveness of the questionnaire. The cross-cultural translation included a backward translation by one professional translator, while a minimum of two professional translators is recommended to assure consistent translation.[27] However, there is controversy of the need and value of backward translation.[46, 47] It has been proposed that the inclusion of an expert panel improves the quality of the instrument, especially the face validity and content validity.[48] In addition, the qualitative assessment can maximize the attainment of semantic, idiomatic, experiential and conceptual equivalence.[49]

There are no validated quality indicators for Delphi studies. A set of four criteria has been proposed as quality indicators:[31] 1) Were criteria for participants reproducible? 2) Was the number of rounds to be performed stated? 3) Were criteria for dropping items clear? 4) Stopping criteria other than rounds specified? In this study, the recruiting strategy and criteria for participants produced the desired number of professionals with diversity of professions and convincing experience in implementation or rehabilitation system. Four Delphi participants did not attend Round 2 with a drop-out rate of 16%, which is quite low. The planned number of rounds was performed as noted in instructions to Delphi participants. The criteria for dropping items were based on consensus. In Delphi studies the definition of consensus based on percentage can range from 50-97%.[31] In this study, consensus was defined as a proportion within a range (unrestricted), *i.e.* items rated at group level of agreement of 75% or higher were included and 74% or lower were either excluded or reviewed and revised depending on qualitative judgements. The termination of the Delphi was based on *a priori* definition to run two rounds.

Limitations of the study

One of the limitations of *a priori* specification of criteria for dropping items, is that items believed to be important may

fall just below the threshold. If sufficient justification is provided, the authors may consider including these items *a posteriori*.[31] In our study, three original items with ≤74% agreement (2.1; 4.6; 12.1) were included in the final DIBQ-mp.

Implementing and changing behavior in a multiprofessional context can be even more challenging than in a profession-specific setting. The research on multiprofessional collaborative practices is still developing.[50, 51] The factors that facilitate multiprofessional collaboration are often specifically related to the operating environment (organizational and processual aspects) and relational and contextual factors of multiprofessionalism.[12]

The study presents a tool, a tailored questionnaire for multiprofessional rehabilitation implementation use, the DIBQ-mp, consisting of 21 items. DIBQ-mp can be used in evaluating determinants, either facilitators or barriers, of implementing evidence-based multiprofessional rehabilitation in clinical practice. The questionnaire can address the issues professionals encounter when implementing new evidence-based models for the benefit of patients. The specific name of the training, intervention, model, innovation or procedure is replaced for [guideline-based intervention /procedure] within each item. The DIBQ-mp with 21 items is a shorter, and more pragmatic version of the original DIBQ. Expert statements denoted that a questionnaire aimed for professionals should be kept short as a long questionnaire is more difficult to use for multiprofessional rehabilitation.

In all, the focus of the research was directed by the opinions of the Delphi participants. Therefore, the results of the study reflect the consensus opinion. The Delphi study objective was to present the results as a core set of items important in multiprofessional rehabilitation implementation. As all the DIBQ items are tailored to multiprofessional rehabilitation context (Supplementary Table II), certain domains or individual items can be added to the DIBQ-mp according to singular research purpose. The TDF is generally used to build a semi-structured interview guide. In future studies, it would be interesting to use the determinant questionnaire as a low-cost strategy to survey a large sample of professionals in different fields of multiprofessional rehabilitation.

Conclusions

We present a national-level development process of cross-culturally adapted and condensed DIBQ-mp tool. It consists of 21 items to assess determinants of professionals' implementation behavior in multiprofessional rehabilitation context, representing 11 of the initial 18 DIBQ domains.

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Conflicts of interest
The authors certify that there is no conflict of interest with any financial organization regarding the material discussed in the manuscript.

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