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Interdisciplinary Pain Rehabilitation Programs: Evidence and Clinical Real-World Results

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Abstract

Chronic pain conditions are influenced by and interact with physical, psychological, social, and contextual factors. These conditions are associated with psychological distress, poor health, sick leave, and high socio-economic costs. Therefore, modern clinical practice applies a biopsychosocial (BPS) framework. Interdisciplinary pain rehabilitation programs (IPRPs) for chronic pain distinguish themselves as well-coordinated complex interventions. This chapter describes the contents of such programs. We will briefly review the evidence for IPRPs and discuss problems when evaluating these complex interventions. Furthermore, we will report practice-based results from a large Swedish pain registry—the Swedish Quality Registry for Pain Rehabilitation (SQRP). The SQRP collects data from a relevant special clinical department in Sweden—i.e., real-life outcomes will be depicted. Characteristics of patients that benefit the most from IPRPs will be described and discussed. The indications for IPRPs will also be presented. Finally, we will discuss how to improve rehabilitation for chronic pain patients.

Keywords: complex, chronic pain, interdisciplinary, multimodal, outcome, rehabilitation

1. Introduction

Today, there is no controversy about considering acute and chronic pain based on a foundation of neurobiology influenced by and interacting with biological, psychological, and social/contextual factors [1–3]. Hence, modern clinical practice applies a biopsychosocial (BPS) framework in assessments and treatments [4, 5]. This approach is the result of developments that have occurred over the past 70 years.

Units dedicated to treat pain were developed in the USA based on physicians' experiences with chronic pain in soldiers during and after World War Two. During this period, surgeons and anaesthesiologists attempted to alleviate both chronic and acute pain mainly using blockades and local anaesthesia [6]. Later, this type of unit expanded into Europe and Sweden. The first multidisciplinary pain clinic opened in the 1960s as a development of the pain clinic founded by John Bonica in the 1950s at the University of Washington in Seattle (USA) [7]. Bonica realised that patients with complex pain problems were not helped by single specialties, and during the 1950s he

brought neurosurgeons, psychiatrists, and anaesthesiologists to his clinic. In 1959, Wilbert Fordyce, a psychologist hired by the Department of Physical Medicine and Rehabilitation at the same hospital, became interested in applying behavioural strategies in the assessments and treatments of chronic pain. Their collaboration led to the incorporation of psychologists in pain clinics and later other health care providers trained in different but related areas [6]. Bonica also led an international initiative that resulted in the formation of an association of researchers and clinicians dedicated to the understanding and treatment of pain (International Association for the Study of Pain, IASP).

In 1982, Fordyce's psychological program and Bonica's pain clinic merged under the direction of John Loeser [6]. Under this new arrangement, patients were evaluated and treated by teams, and the BPS model started to be used in pain programs. These early programs had to deal with medication problems and addiction, so inpatient treatment became the standard. During the 1970s, the number of multidisciplinary pain clinics following the example of Seattle's clinic grew in the USA and later in Australia, New Zealand, and Europe. During the 1980s, psychologists began to add cognitive treatment strategies to the programs, which opened up treatment to a broader mix of patients. By 1990, cognitive-behavioural pain management programs were widespread and became the golden standard of care. During the 1980s and the 1990s, many studies focused on interdisciplinary pain programs (IPRPs), and new theories were launched [6, 8, 9].

The positive development in the USA slowed down at the beginning of 2000, and most units offering IPRPs closed their operations in the following decade, except for units in the Department of Veterans Affairs (VA). The Commission for the Accreditation of Rehabilitation Facilities (CARF) offers a specific set of standards that emphasise the interdisciplinary setting and the BPS model for the treatment of chronic pain. As the CARF standards remained focused on the BPS framework, the number of accredited programs illustrates the development in the USA. In 1998, there were 205 accredited chronic pain programs in the USA. By 2004, the number decreased to 125, 11 of which were VA programs [6]. These programs, excluding the VA IPRPs, decreased to 63 in 2010, 53 in 2015, and 32 in 2020 (Carolan Terrence, CARF, personal communication). However, outside the USA, the development has gone in the opposite direction. By the end of 1990 outside the USA, fewer than five tertiary pain units with CARF accredited pain programs were in operation; however, by 2021, this number had increased to 140 (CARF, personal communication). According to many reports, the decline in the USA was due to opioid use as a medication for chronic pain, but this approach, as the result of the opioid pandemic, is currently being replaced by initiatives to re-start IPRP.

Both evidence and clinical practice guided the development of how to face the problem of chronic pain—from viewing chronic pain as a symptom of underlying causes to viewing chronic pain as a dysfunction (i.e., from a biomedical approach to a biopsychosocial approach). Therefore, treatments have evolved from monodisciplinary to multidisciplinary treatments and from multidisciplinary treatments to interdisciplinary programs.

During the 1970s and 1980s, the novel approaches to chronic pain developed slowly in Sweden. As new methods and treatments were developed, national guidelines for chronic pain treatment were warranted. In 1994, an expert group formed by the Swedish National Board of Health and Welfare summarised the recommendations for treatment of chronic pain based on the International Association for the Study of Pain (IASP) guidelines and available evidence at the time. In 2006 and 2010, two

compilations of evidence for chronic pain treatments, commissioned by the Swedish Agency for Health Technology Assessment and Assessment of Social Services (SBU; see below), confirmed the conclusions of the 1994 report about appropriate methods and lack of evidence for methods still being used. In the 2006 and 2010 reports, one method was singled out as an evidence-based approach, the IPRP. These reports contributed to a governmental decision to financially support the development of IPRPs throughout Sweden. During this period, a registry for pain rehabilitation was formed through an initiative of the professions with the aim to analyse outcomes of pain rehabilitation. The registry with the support of the affiliated units and the national organisation of county councils (SKL) developed into a national quality registry that included all tertiary pain rehabilitation units as well as units operating at the primary care level.

2. Indications for IPRP

In clinical practise, patients with complex chronic pain conditions with difficulties coping with their condition in daily life are referred to an IPRP. These patients' ability to cope with their pain can be compromised by co-morbidities and/or their work situation. Often, these patients have tried monodisciplinary interventions and/or pharmacological treatments without marked improvements. The Swedish guidelines regarding indications for IPRP, which have been approved by several authorities and professional organisations, recommend that IPRP be offered to chronic pain patients with complex clinical presentations and when monodisciplinary interventions have not been effective [10].

In 2011, the IASP stated in the Declaration Montreal that 'access to pain management is a fundamental human right' [11]. This humanitarian approach is important; however, availability to IPRP is scarce, as mentioned above, in several parts of the world, and chronic pain is common in the general population—approximately 20% of the European and North American population has a significant chronic pain condition [12, 13]. In addition, as many patients with chronic pain rarely seek health care services, these patients seem to have adapted to their pain condition to lead lives with minor consequences to their function and well-being. This needs to be considered as IPRP is costly interventions in the short run and patients need to be fully invested in the process and very possibly have a sense of urgency to benefit from treatment and be motivated to engage in behavioural and cognitive change. The motivation to behavioural and cognitive change is fundamental as an indication for IPRP. For IPRP to be used with an ethical and humanitarian perspective, it needs to prioritise individuals who suffer from substantial consequences of their chronic pain condition regarding function, social, and/or psychological well-being.

3. Basic contents of IPRP

The idea of treating chronic diseases with a broader approach than the biomedical approach was first launched by Engel in a biopsychosocial (BPS) model for the treatment of diseases, especially chronic diseases [14]. The model emphasises the mutual interactions between biological, psychological, and experiential or social factors that impact people's perceptions of their overall health. This model lies at the core of the multidisciplinary and interdisciplinary approaches to the treatment of chronic pain.

Similarities and differences between these approaches are described in detail elsewhere [7]. Although both rely on the BPS model, they differ regarding whether the goals of the professionals are integrated, whether professionals work collaboratively in teams, and whether their treatments are provided simultaneously or sequentially [9, 15]. The interdisciplinary treatment, which is based on the BPS approach [1], is the standard treatment used in IPRPs. According to IASP, interdisciplinary treatment is a:

Multimodal treatment provided by a multidisciplinary team collaborating in assessment and treatment using a shared biopsychosocial model and goals.

For example: the prescription of an anti-depressant by a physician alongside exercise treatment from a physiotherapist, and cognitive behavioural treatment by a psychologist, all working closely together with regular team meetings (face to face or online), agreement on diagnosis, therapeutic aims and plans for treatment and review¹.

The programs usually include experts working in an integrated manner with physical, social, psychological, and medical aspects to diminish the consequences of chronic pain in these or other areas [7, 16]. The principal components of IPRP are as follows:

1. a team assessment of the chronic pain problem and its consequences;
2. the establishment of a treatment plan, including interventions by different professions with goals to be achieved during the program;
3. communication between team members and between the team, the patient, and significant others;
4. deliveries of the different synchronised interventions of IPRP;
5. evaluation of the interventions;
6. documentation; and
7. a discharge process, including interaction with other stakeholders.

Other researchers have also identified the same content [17]. Although the areas covered by the interdisciplinary programs are well described elsewhere, there are very few descriptions of the interventions used in clinical practice in IPRPs, usually describing the interventions used in specific centres, such as Mayo Clinic or Chicago University Hospital [16]. In Sweden, it is possible to gather information on the interventions used in clinical practice from most of the IPRPs affiliated with the Swedish National Registry. Of the 39 affiliated units, 31 were included [18]. The usual contents of IPRP described by Swedish units are as follows:

1. dialogue and education (e.g., education, training in wellness and healthy living habits, meetings with families, video feedback, and couples therapy) and

¹ From Terminology|International Association for the Study of Pain (iasp-pain.org).

- self-training (e.g., home lessons, activity diary, physical self-training, reflection time, and self-analysis);
2. activity training (activity training, graded activity training, and exposure training);
 3. meetings (conferences with patients, rehabilitation team, vocational guidance, rehabilitation coordinator, goal-setting meetings, and meetings to check goal achievement);
 4. cognitive behavioural therapy, other psychological treatments (e.g., supervised group therapy, pain or a stress coping course, psychological and social aspects, post-traumatic stress disorder (PTSD) treatment, and psychodynamic methods) and Acceptance and Commitment Therapy (ACT) (e.g., goal compass, training in ACT principles, and mindfulness);
 5. relaxation techniques; and
 6. physical exercise.

Only 14 of 31 programs reported using interventions in the workplace. All programs reported having follow-ups (1-year follow-up by mail or at the unit for completing the registry's questionnaires). Usually, extra follow-up meetings were scheduled two to three months after discharge from rehabilitation (21 of 31 units).

The optimal composition of IPRP with respect to length, contacts with therapists, and intensity are insufficiently known according to a systematic review (SR) [19] and a meta-analysis (MA) [20]. The former concluded that because dose variables were not investigated separately in the RCTs, the reviewers could not disentangle the interrelationships between dose, content, and effects of IPRP on disability, work, and quality of life. Similarly, a longitudinal study of IPRP dosage (i.e., duration) could not establish an optimal dosage [21].

4. The general and specific goals of IPRP

Generally, IPRP goals include improving important outcomes (4,5). There are several simultaneous general goals to be considered—decreased pain intensity and increased mental health; increased participation in work/studies and social life; and increased health and quality of life. These general goals are combined with the specific goals of the individual with chronic pain. Thus, goals should ideally be set at the level of the individual, the rehabilitation teams, and the socio-economic constraints. The latter is essential since IRRPs historically have been financial failures. For IRRP to prosper and receive funding, the considerable socio-economic costs of chronic pain need to be considered. Goals, such as return to work/studies and decrease in medication use, health care use, and surgery, will in the long run also benefit the individual move towards an active, independent lifestyle.

As chronic pain is a complex experience with possible adverse effects on function and social and psychological well-being, goal setting should include several aspects and involve a BPS perspective. The general goals for IPRPs are mentioned above. In addition to these goals, there is an increasing emphasis on cognitive areas that could

mediate positive changes, such as catastrophizing, acceptance of the pain condition, avoidance of activity due to unrealistic concerns about harm, and expectations of pain treatment [22].

Researchers have debated whether pain intensity aspects should be amongst the main outcomes of pain treatments included in IPRP [23–26]. Many patients consider reducing pain to be the most important aspect of treatments with respect to regaining a normal lifestyle; however, changing this view is considered an intrinsic component of IPRP. Many chronic pain patients eligible for IPRP have experienced how short-sighted attempts to control only pain intensity can lead to vicious cycles of increased physical and psychological disability and reduced quality of life. Thus, many IPRPs have largely adopted the idea of introducing acceptance as a cornerstone of the psychological component of IPRP (i.e., the willingness to experience pain as it is) and encouraging patients to set up activity-related rehabilitation goals and to risk initial pain flare-ups. This means that patients are advised against establishing pain reduction as the only or the most important goal. Paradoxically, in the long run, pain reduction is one of the more robust results of IPRP [27]. Nevertheless, in traditional CBT, a cornerstone and mainstream in IRPs, an array of strategies is presented, strategies that target the consequences of pain with non-pharmaceutical techniques for pain control.

The process of goal setting is vital and fundamental both for the individual and the team as goal setting has been shown to promote greater behavioural change across a wide range of behaviours [28]. At the individual level, a thorough assessment that is communicated to the patient and a collaborative goal-setting process will increase engagement and adherence to treatment. In addition, the rehabilitation team will benefit from formulating common goals for treatment, reviewing results, and improving plans to stay engaged and to be flexible. The latter should constitute an important goal for the team as role models for patients. Often, the goal is to attain goals that are SMART—i.e., Specified, Measurable, Attractive, Realistic, and Time-limited [29, 30]. However, possibly the most important quality for goals is to be personalised and agreed upon by the patient. The team should strive for a collaborative approach but must always bear in mind that the patient is in a more vulnerable position and might easily give in to goals that might, for example, not feel relevant or feel too demanding. Motivational Interviewing (MI) can be used to discover a patient's motivation for a specific goal when a patient finds it difficult to specify goals. Patients are often more focused on avoiding unpleasant experiences and frequently the main wish of the patient is to be free of pain. As such, the goal-setting can constitute an acceptance of intervention as it models how to focus on the attainable and let go of the difficult to achieve a goal—i.e., pain relief.

Nevertheless, the SMART model for goal setting has lately been challenged by Acceptance and Commitment Therapy (ACT), the third wave CBT. ACT, which has increasingly been introduced in IRRP, emphasises identifying important values and not primarily setting specified, time-limited goals. However, the SMART model can be used as a step towards identifying important values.

5. Consensus approaches to identify relevant domains and variables in IPRPs

The variety of interventions used at most IPRPs in a single country [18] is in itself a challenge when it comes to measuring the outcomes of IPRPs delivered in clinical

settings. Nevertheless, the areas addressed correspond to the areas proposed by the BPS model. In addition to the variety of interventions within IPRPs, many tools have been used both by researchers and clinicians to assess patients and to measure IPRP outcomes. Two well-known initiatives to bring consensus into the areas of evaluating clinical trials, including IPRP are the Initiative on Methods, Measurement, and Pain Assessment in Clinical Trials (IMMPACT) [4, 31] and the validation and application of a patient-relevant core set of outcome domains to assess multimodal PAIN therapy (VAPAIN) initiatives (**Table 1**) [32].

IMMPACT identifies relevant outcome domains for clinical studies and proposes reliable measurement tools for the study of treatments of chronic pain, including all possible modalities and approaches. IMMPACT has resulted in several studies evaluating clinical treatments. VAPAIN specifically targets IPRPs. These initiatives have some overlapping domains that are included in clinical trials (**Table 1**). VAPAINs focused on IPRPs led to the addition of two domains considered critical when the treatment is interdisciplinary—productivity and patient satisfaction with social roles and activities. VAPAIN renamed certain domains and extended their scope (e.g., the more inclusive ‘emotional well-being’ rather than ‘emotional function’).

A different approach taken by a Canadian research group focuses on the variables of interest for health care providers and the variables of interest for patients, according to lists of parameters from the Patient-Reported Outcomes Measurement Information System (PROMIS), the International Classification of Functioning, Disability and Health (ICF), and current guidelines [33]. Here, the initiative was to identify the set of variables that are important to both providers and patients. They triangulated the ICF and the PROMIS frameworks with the perspectives (both the patients’ and clinicians’ perspectives) and found a common list of ten variables—pain interference, pain intensity, physical function, sleep disturbance, anxiety, depression, ability to participate in social roles and activities, fatigue, sleep-related impairments, and self-efficacy. The authors conclude that these variables mirror the BPS model covering the physical, psychological, and social consequences of chronic pain on an individual’s life both from the perspective of people with chronic pain and the perspective of health care providers.

IMMPACT’s domains	VAPAIN’s domains
Pain	Pain intensity and frequency
Emotional function	Emotional well-being
Physical function	Physical activity
	Productivity
	Satisfaction with social roles and activities
Self-evaluation on overall improvement and satisfaction with the intervention	Patient’s perception of achieved treatments goals
Symptom and side-effects of intervention	
Participant disposition (including participation and discontinuation of participation)	Reasons for discontinuation of treatment

Table 1.
Domains of IMMPACT and VAPAIN.

6. How to evaluate the complex IPRP intervention

There is a need to develop clinically applicable, standardised, and accepted ways to evaluate IPRP. IPRP is a complex intervention with several general goals (see above) and is delivered by an interdisciplinary team of professionals in close collaboration with the patient and considering the patient’s specific goals. This is entirely different from a pharmacological intervention, which aims to alter a biochemical process to decrease pain intensity (**Figure 1**). In fact, an IPRP tries to influence several levels, including the behaviours of the patient with chronic pain. Hence, in clinical practice, there are several outcomes and to make things, even more, complicated the important goals for the individual patients may differ. Due to these circumstances, the concept of one or two primary outcomes and a few secondary outcomes applied in pharmacological randomised controlled trials (RCTs) do not reflect the complexity of IPRP. In a systematic review (SR) by SBU, the included RCTs on average had nine outcome variables and the variables were seldom divided into primary and secondary outcomes [23].

The evaluation of complex interventions, such as IPRP is not clear-cut [34]. Clinically applicable, standardised, and accepted ways to evaluate the multiple outcomes of IPRP in individual patients clinically and in trials, SRs/meta-analysis (MAs) and observational studies are lacking. If the changes in outcomes are intercorrelated (they often are, see below), it may be problematic to evaluate the outcome measures separately as sometimes is done [35]. In contrast, SBU defined a positive outcome of an RCT when the *majority of outcomes* were significantly better for the control intervention [23, 36]. Another approach was chosen by a group of reviewers [37]. They predetermined *primary* and *secondary outcomes* and what was necessary to classify an intervention as positive before reviewing the RCTs. Recently, we suggested how simultaneous goals can be handled using scores from Principal Component Analysis (PCA) in RCTs and observational studies [27]. For fibromyalgia, OMERACT² and

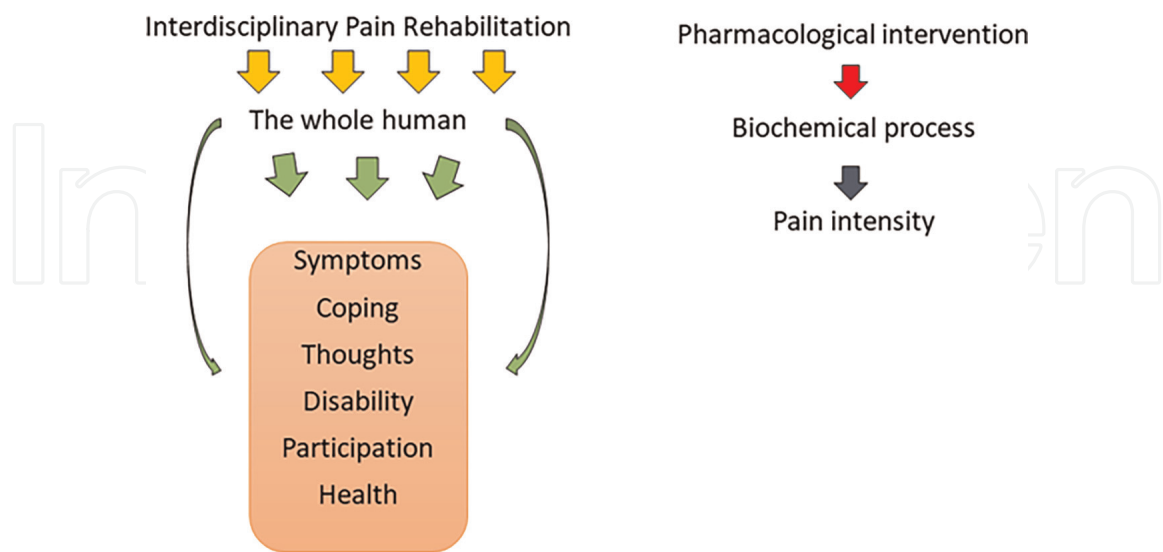


Figure 1.
The complexity of IPRP versus a pharmacological intervention.

² An international, informally-organized network initiated in 1992 aimed at improving outcome measurement in rheumatology.

others have suggested preliminary responder criteria based on several variables [38–40]. A similar approach that defines a total improvement variable based on the dichotomizing six variables was used by Grimby-Ekman et al. [41].

Because evaluations of several outcomes often raise an issue of multiple comparisons, Bonferroni corrections may be recommended [42, 43]. This is a conservative approach when the number of tests increases and can reduce the chances to detect real treatment effects [42, 44, 45]. Moreover, such corrections are intended for corrections of *independent* comparisons [44]; however, this situation is not present when evaluating the outcomes of IPRPs. Hierarchical or ‘gatekeeping’ procedures that do not require adjustment for multiplicity have been presented [43], but a natural hierarchy of outcomes must be present. Outcomes may be combined into a single composite outcome [46], but this may be problematic with respect to missing values for different variables and when the components of the composite endpoint are measured on different scales such as non-commensurate outcomes [46]. Multivariate methods that can handle non-commensurate outcomes in one analysis have been presented [46]. In studies from the Swedish Quality Registry for Pain Rehabilitation (SQRP, reported below), advanced multivariate methods such as PCA and Orthogonal Partial Least Square regression have been applied and can handle non-commensurate outcomes in one analysis.

7. Evidence according to systematic reviews

The available SRs and MAs indicate that IPRP is an evidence-based intervention. **Table 2** lists and briefly describes the results of available SRs and MAs based on only RCTs according to Dragioti et al.’s [47] search strategy.

SRs and MAs using several simultaneous outcomes report positive outcomes for IPRP for chronic pain conditions [23, 35–37, 48, 49, 52, 53, 55]. Studies using overall assessments of outcomes and therefore considering that IPRP is a complex intervention agree that IPRP has positive outcomes with moderate to strong evidence [23, 36, 37]. There is no consensus regarding the duration of the effects after IPRP (follow-up time) [23, 35–37, 48, 52–55]. When outcome variables are evaluated independently, the outcomes associated with positive effects differ across studies [50, 53, 56–58]. Articles reporting results for fibromyalgia separately reported positive outcomes for IPRP. However, both evidence levels and follow-up periods (short, medium, or long term) differed [23, 36, 37, 52, 58]. The conclusions regarding the effects of IPRP on vocational variables, such as return to work (RTW) and sick leave were heterogenous according to these reviews [23, 35, 36, 48–51].

The authors of these reviews identify several problems and limitations. Most SRs report that there is heterogeneity in study settings, interventions, and control groups. It is difficult to compare the patient groups included in the identified RCTs since there is no internationally accepted way to describe the patient groups. In addition, the number of comorbidities and duration of sick leave can differ, and external factors, such as the social security situation can differ considerably across studies from different countries and years. Some of the variables suggested by IMMPACT and VAPAIN can be useful for the development of a standardised set of variables that can be used to describe chronic pain patient cohorts [4, 31, 32]. Moreover, because there is no internationally accepted definition of IPRP, authors of SRs and MAs must create their own operational definitions to identify the relevant RCTs. In the quality assessments of RCTs, the issue of blinding might be problematic, and IPRP studies may be

First author, year, and reference	Type	Patients	No. of RCTs*	Main results and comments
Nielson 2001 [48]	SR	CP with separate analysis for CLBP, FM, and other	21	<ul style="list-style-type: none">• IPRP is effective in CLBP conditions in intermediate to long-term – moderate evidence.• Contradictory for RTW in CLBP.• IPRP is effective in other pain conditions in the short to intermediate term – moderate evidence.
Guzman 2002 [49]	SR +MA	CLBP	10	<ul style="list-style-type: none">• Strong evidence that IPRP improved function compared with inpatient or outpatient non-multidisciplinary treatments.• Contradictory for vocational outcomes (RTW) in CLBP.
SBU 2006 [23]	SR	CP with separate analysis for FM	46	<ul style="list-style-type: none">• Strong evidence that IPRP in long term has better overall results in CP than less intensive interventions.• Strong evidence that IPRP is associated with positive effects upon RTW and sick leave in long term.• Moderate evidence that IPRP in long term has better overall results in FM than less intensive interventions.
van Geen 2007 [50]	SR	CLBP	10	<ul style="list-style-type: none">• A positive effect of IPRP on work participation and quality of life in the long term.• No long-term effects on pain and functional status.
Scascighini 2008 [37]	SR	CP with separate analyses for CBLP and FM	36	<ul style="list-style-type: none">• Compared to non-multidisciplinary control, moderate evidence of higher effectiveness for IPRP.• Compared to no treatment or TAU, strong evidence of higher effectiveness for IPRP in CP; for CBLP and FM, moderate evidence.• No evidence that a special kind, duration, or setting of IPRP was superior to any of the other study regimens.
Norlund 2009 [51]	SR +MA	CLBP	7	<ul style="list-style-type: none">• For the Scandinavian studies (n=5), the effects on RTW had clinical relevance.
Häuser 2009 [52]	SR +MA	FM	9	<ul style="list-style-type: none">• Strong evidence that IPRP has beneficial short-term effects on the key symptoms of FM.• Strong evidence that the positive effects on key symptoms decline with time.
SBU 2010 [36]	SR	CP with separate analyses for CLBP and FM		<p>Partial update of 2006 SBU**</p> <ul style="list-style-type: none">• Moderate evidence that IPRP in the long term has better overall results in chronic back pain (neck, shoulder, and low back together) than less intensive interventions.• Moderate evidence that IPRP in the long term has better overall results in CBLP than less intensive interventions.• Lack of studies for only chronic neck and shoulder pain.• Moderate evidence that IPRP in the long term has better overall results in generalised pain (FM) than less intensive interventions.

First author, year, and reference	Type	Patients	No. of RCTs*	Main results and comments
				<ul style="list-style-type: none">• Low evidence that IPRP improves RTW/sick leave compared to less intensive interventions.
van Middelkoop 2011 [53]	SR +MA	CLBP	83	<ul style="list-style-type: none">• IPRP was found to reduce pain intensity and disability at short-term follow-up compared to no treatment/WLC.• There was moderate evidence for not finding an effect on disability and long-term outcomes.
Kamper 2014 [35]	SR +MA	CBLP	41	<ul style="list-style-type: none">• IPRP is more effective than TAU (moderate evidence) and physical treatments (low-quality evidence) in decreasing pain and disability in long term.• For work outcomes, IPRP was more effective than physical treatment but not more effective than TAU.
Gianola 2018 [54]	SR +MA	CBLP	22	Partial reanalyses of Kamper et al.'s review [35] using minimal important differences units (MIDs). Using this approach, they concluded that IPRP led to improvements in an appreciable number of patients in the short- and medium-term after IPRP. In the long term, IPRP probably had little or no benefit for most patients.
Casey 2020 [55]	SR +MA	CP	27	<ul style="list-style-type: none">• For pain intensity and disability, IPRP the effects (low-quality evidence) were better than active physical interventions at the short-term and long-term but not the medium-term follow-up.
Martinez-Calderon 2020 [56]	SR +MA	CP	60	<p>Investigates the outcome pain self-efficacy.</p> <ul style="list-style-type: none">• IPRP improved pain self-efficacy with small effects at the short-term, medium-term, and long-term follow-up (low-quality evidence).
Martinez-Calderon 2020 [57]	SR	CLBP	61	<p>Investigates outcomes of fear.</p> <ul style="list-style-type: none">• IPRP reduced kinesiophobia (moderate evidence).• IPRP altered fear-avoidance beliefs (very low evidence).
Martinez-Calderon 2021 [58]	SR	FM	12	<p>Investigates the outcome of pain-related fear.</p> <ul style="list-style-type: none">• IPRP reduced kinesiophobia (very low evidence).

*Not all RCTs may be used for the analyses of IPRP outcomes.

**Note that GRADE was used in the 2010 SBU report but not in the 2006 SBU report.

SR = Systematic Review with narrative synthesis of data; MA = Meta-Analysis; RCT = Randomised Controlled Trial; IPRP = Interdisciplinary Pain Rehabilitation; CLBP = chronic low back pain; FM = fibromyalgia; CP = non-specific chronic pain conditions; TAU = treatment as usual; and WLC = waiting list controls.

Table 2.
Brief conclusions from Systematic Reviews (SR) and Meta-Analyses (MA) of IPRP identified using Dragioti et al.'s search strategy [47].

classified with lower quality since it is impossible to blind IPRP for patients. Different results in the reviews might also depend on the specific criteria for inclusion and the fact that parts of reviews are based on judgements of researchers.

8. Why registry studies?

The results from RCTs, SRs, and MAs must be confirmed in real-life consecutive flow of patients in clinical settings. Direct clinical application of the results from RCTs is not suitable in all situations as these studies might be associated with bias and the patients investigated in RCTs might not represent real-world patients (i.e., insufficient external validity) [59]. Hence, the results from RCTs and SRs must be confirmed in real-life settings, for example, using registry data. This methodology is labelled *practice-based evidence (PBE)* and has been applied in rehabilitation research [60]. An increasing interest in such clinical registries is noted and the International Association for the Study of Pain (IASP) has a special interest group (Pain Registries SIG), which is designed to further increase the interest for evaluating real-world data.

Most real-world observational evaluations of IPRP are based on within-group analyses over time. However, such observational studies are often associated with bias. Creating an objection-free control group in clinical practice in association with registries of IPRP is ethically, economically, and practically impossible. To date, attempts using other types of registries for creating a control group have not been successful [61]. Fortunately, methods have been developed that emulate randomisations based on observational data, which allows comparisons between interventions [62]. Target trial emulations are increasingly applied (e.g., in clinical pharmacology, oncology, cardiovascular diseases, critical care, and rheumatology) and can under appropriate circumstances give valid effect estimations compared to RCTs [63, 64]. When target trial emulations can be adequately performed, they generally yield stronger evidence than other types of observational research designs [63]. However, these are not simple methods or without limitations and biases [65–67]. Although criticised, a first attempt has been made that focuses on sick leave associated with IPRP using data from the SQRP (see below) [68]. If further research and refinements of registries covering IPRP conclude that this methodology is applicable, it would be a great advantage. It would further increase the importance of registries for improving the clinical results of IPRP and other complex interventions for patients with serious chronic pain conditions.

9. The Swedish Quality Registry for Pain Rehabilitation (SQRP) and its goals

9.1 Why a registry?

There are usually two approaches to building a registry, and both influence the architecture and content of the registry. Registries are either built to answer research questions or to provide clinical evaluations to providers at each site. SQRP was built primarily around the second approach. The initiative to start SQRP was taken within the professionals' network, the decision made by the leadership of the units delivering IPRP around 1997. Since its inception, in 1998, the registry has addressed the description of what was being offered at the clinical settings, the overall situation of the patients being admitted, and the changes reported in the included instruments at discharge and 1-year follow-up. Therefore, the SQRP has always worked very closely with the clinicians providing treatment as they are a source of knowledge to be used in the assessment of patients and the evaluation of their progress in the programs as well as describe data at the organization's level. The general goals are given in **Table 3**.

• Develop and secure the quality of care
• Compare outcomes at group level between the Swedish units
• Allow for the participating units to follow-up on their delivery of care
• Based on adequate comparisons with other units, facilitate discussions about improvement plans and practices within each unit

Table 3.
General goals of SQRP.

The registry aims to highlight data on structure, processes, and outcomes. Outcomes are retrieved at the individual, group, unit, and national levels (**Table 4**). Every year SQRP follows how the registry is used at the clinical level and promotes plans for improvements. Examples of improvement work, using measures of the registry (according to answers to the 2019 survey) are presented in **Table 5**.

9.2 Variables and instruments included in the SQRP in 2021

An overview of the variables and instruments included in the registry (2021) is presented in **Table 6**. Hence, SQRP is mainly a patient-reported registry, including mostly patient-related outcome measures (PROM data) as well as patient-related evaluation measures (PREM data). The PREM variables concern satisfaction with reception/encounter, the site information, degree of participation in the rehabilitation plan, teamwork, and family participation in the program.

<i>Structure</i>	
Type of intervention	
	<i>Only screening/pain analysis</i>
	<i>IPRP</i>
	<i>Other interventions</i>
Number of registrations	
<i>Process</i>	
Time	
Reasons for discharge	
<i>Results</i>	
Level of the individual (patient profile and reports)	
Level of the unit (group reports)	
Level of the country (yearly reports)	
	<i>Discharge</i> R 1
	<i>One-year follow-up</i> R 2
	<i>Analysis (optional)</i> R 3
	<i>Analysis (optional)</i> R 4
<i>R = Report.</i>	

Table 4.
Clinical evaluations (levels of analysis).

<ul style="list-style-type: none">• Increased patient participation in their rehab and more effective treatment schedules during follow-up
<ul style="list-style-type: none">• Increased focus on sick-leave process, contact with the workplace, and physical activity in the program
<ul style="list-style-type: none">• Shortened waiting lists
<ul style="list-style-type: none">• Increased feedback to patients by means of SQRP data which led to increased motivation to actively work towards a healthier lifestyle
<ul style="list-style-type: none">• Focused work on fear of movement to increase physical activity
<ul style="list-style-type: none">• Remodelling rehabilitation services to meet patient individual needs
<ul style="list-style-type: none">• Broader perspective to increase participation of significant others in rehabilitation
<ul style="list-style-type: none">• Regular extraction of the group and individual reports with a focus on results to design specific improvement plans

Table 5.
Examples of improvement work using measures of the registry.

The registry also includes self-reported background information. There are some variables that are evaluated by the professionals in the program (**Table 6**).

Some other Swedish quality registries were built to answer research questions and are now working to adapt the output of information to the needs of clinicians at the sites where healthcare is provided. On the other hand, SQRP has been working to improve its operations to allow for research questions to be explored by improving the validity of its information, reducing dropouts, and enhancing routines to avoid missing values and registration errors. In 2011, a national research network (SQRP research group) was formed through initiatives developed by the SQRP’s steering group. This group has developed different research programs focused on the registry, leading to grants from different research funds, dissertations, and many publications. In this way, SQRP is becoming a source of knowledge for researchers interested in finding answers to the complex interventions included and the heterogeneous group receiving treatment.

10. Clinical presentations – results from SQRP

SQRP collects a large amount of self-reported mandatory data concerning pain aspects, psychological distress, interference, health aspects, etc. together with background data from patients referred to specialist pain care in Sweden. The information covering the BPS framework complements information included in the clinical assessments. To determine which variables are generally important in patients with chronic pain, one approach investigates variables important for health aspects.

Pain severity, pain interference, and pain intensity were the most important regressors of health (N > 37 000 patients at baseline) followed by two variables that focus on control of pain and coping with pain, and four variables (also significant) reflecting mood aspects according to a cross-sectional SQRP study (**Figure 2**) [69]. Extent and duration of pain, age, gender, and background variables were not significant regressors.

Another approach is to use PCA to identify variables associated with prominent variations—i.e., high scores. Pain aspects, such as intensity and interference, psychological distress, coping, and health aspects, are the most important and therefore carry the most information for the clinical presentation according to SQRP studies [70, 71].

Type	Variables and instruments
Self-report and background information	
	Socio-demographic data
	Work
	Sick leave
	Pain duration
	Pain extent
	Attitude towards the future
Self-report, Instruments, and variables	
	Numeric Rating Pain Scale (NRPS)
	The Hospital Anxiety and Depression Scale (HAD)
	Multidimensional Pain Inventory (MPI)
	Health-related life quality (RAND-36)
	Perceived health (the EuroQol Group) (EQ-5D)
	Chronic Pain Acceptance Questionnaire (CPAQ 8)
	Insomnia Severity Index (ISI)
	Perceived work ability index (WAI)
	Kinesiophobia (TAMPA)
	Perceived physical activity (3 items)
	Changes in pain experience (retrospective items)
	Changes in ability to handle life situations (retrospective items)
	Patient satisfaction (six items)
Professional-evaluated variables	
	Diagnosis
	Pain mechanisms
	Expected future financial-support form
	Swedish language ability
	Rehabilitation plan

Table 6.
Variables of SQRP.

It is a clinical experience that patients with the same diagnosis show considerable variations in their presentations and consequences. Therefore, in the context of improving outcomes of interventions, there is a great interest to identify relevant subgroups of chronic pain patients. Most studies have been hypothesis-driven with respect to the input variables for subgrouping. Based on some mandatory variables covering the BPS framework, two subgroups/clusters of patients have been identified from SQRP data (N = 37 100) [70]. The subgroup with the most intense pain intensity/severity had the worst situation regarding psychological distress, interference in daily life, and least life control [70]. Furthermore, according to variables not used as input variables, this subgroup had more pain extent (spreading of pain) and more

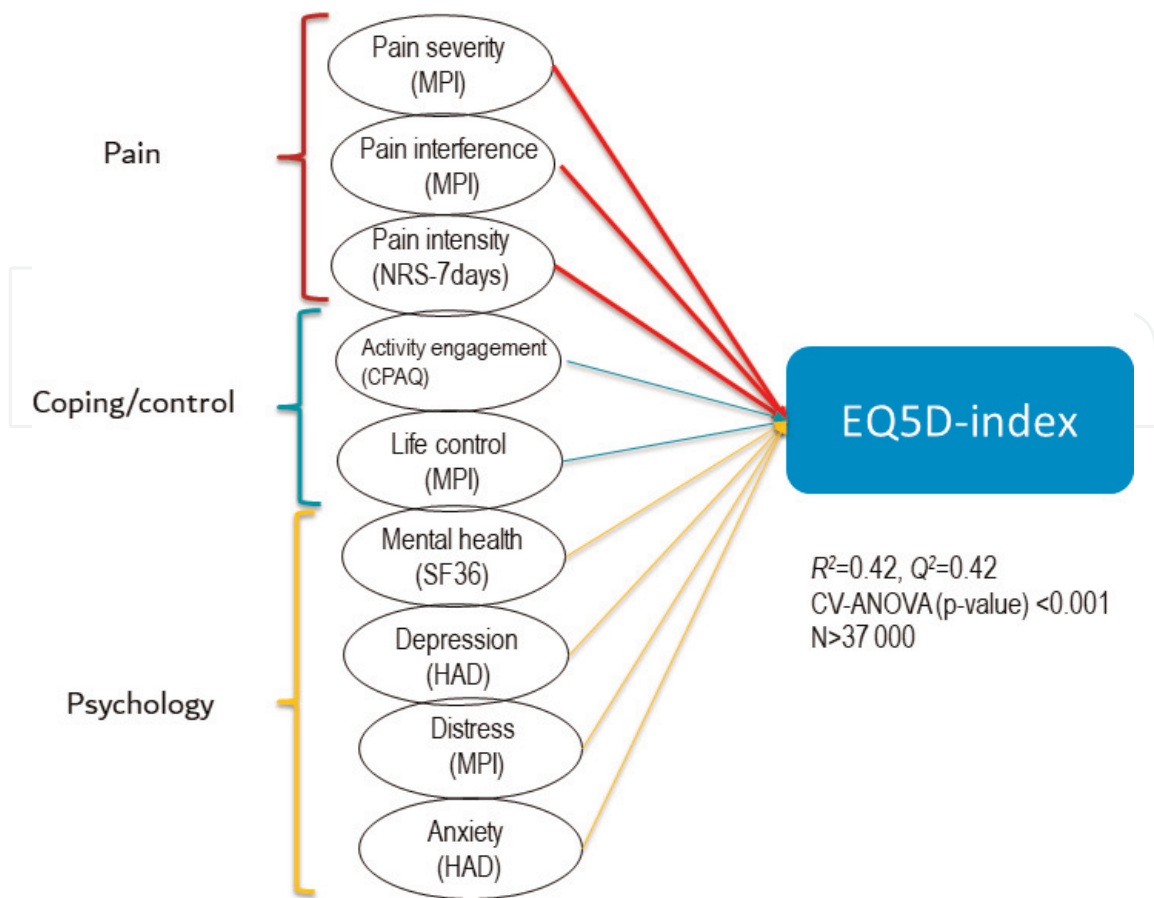


Figure 2.
OPLS regression of health (EQ5D-index) using other self-reported variables at baseline as regressors. Only significant variables are shown. Data are from [69]. EQ5D-index = The European Quality of Life instrument index; MPI = Multidimensional Pain Inventory; NRS-7days = Average pain intensity the last week rated using a numeric rating scale; CPAQ = Chronic Pain Acceptance Questionnaire; SF36 = The Short Form Health Survey; and HAD = Hospital Anxiety and Depression Scale.

people born outside Europe. Also, smaller SQRPs report that the patient group is not homogenous and different subgroups have been identified [71, 72].

The Multidimensional Pain Inventory (MPI) classifies patients into subgroups [73, 74]. These subgroups—Adaptive Copers (AC), Dysfunctional (DYS), and Interpersonally Distressed (ID)—were identified in a large cohort from the SQRP (N = 34 513) and the validity of these subgroups of MPI was partially confirmed [75]. However, in contrast to results reported by Turk and Rudy, the subgroups differed in socio-demographic characteristics, pain duration, and pain extent [73]. Hence, factors other than psychosocial may be important for understanding MPI responses.

In an SQRP sample (N > 38 000), the presence of severe anxiety symptoms was detected in 39.5% and the corresponding outcome for depression was 35.2% according to established cut-offs for the Hospital Anxiety and Depression Scale (HAD) [70]. Although psychological distress was common, the strength of the intercorrelations between pain intensity and anxiety and depression scales of HAD were low. The explained variations (r^2) were between 3 and 11%. Two SQRP studies from different times investigated the prevalence of clinical insomnia according to Insomnia Severity Index (ISI) and reported a prevalence between 65 and 66% [76, 77]. Hence, it is important to assess insomnia in patients with complex chronic pain. A network analysis (N = 2 241) reported that psychological variables, such as acceptance and

depression mainly were associated with pain interference, whereas the associations with pain intensity and extent together with insomnia were weak [78]. These results taken together may be important for expectations about treatment results (i.e., improvements in psychological distress may not necessarily lead to important improvements in pain intensity).

The pain extent is registered using 36 predetermined anatomical regions in the SQRP, which were summarised and divided into four categories: 1–6 regions with pain (20.6% of patients), 7–12 regions (26.8%), 13–18 regions (22.0%), and 19–36 regions (30.6%) (N = 39 916) [79]. A higher extent of pain spreading was associated with a more severe clinical picture at baseline and longer pain duration with the strongest associations emerging in relation to health and pain aspects (pain intensity, pain interference, and pain duration) [79]; generally, there were at least medium effects sizes (ESs) when comparing the two extreme groups. A cross-sectional multivariate analysis found that pain spreading correlated strongest with general health, vitality, female gender, physical function, pain interference, pain intensity aspects, and pain duration [79].

Patients with chronic pain generally have a higher Body Mass Index (BMI) than healthy controls. Obese patients had a worse pain profile (e.g., pain intensity, pain extent, and pain duration) and more depressive and insomnia symptoms than normal-weight patients according to another SQRP study (N = 3 310) [80].

Most patients referred to the specialist departments in Sweden are women (about 70%). The reasons for this overrepresentation are unclear and are only partially explained by the higher chronic pain prevalence in the population [81, 82]. It is unclear whether sex/gender differences for pain severity exist [83–85]. According to SQRP data, there were generally small differences (generally insignificant ESs) in clinical presentation according to self-reported data between the two genders [86, 87]. Generally, patients born outside Europe had a more severe clinical picture than those born in Europe, for example, with respect to pain intensity and psychological distress (medium ESs) [87]. Patients with only an elementary school education generally reported a worse clinical situation than those with a university education (most variables small to medium ESs).

A cluster analysis using gender, country of birth (Europe vs. outside Europe), and education level (three categories) as input variables identified five subgroups—three subgroups of European women and different education levels, one subgroup of European men, and one subgroup of non-European men and women and different education levels [87]. Prominent differences in clinical presentations, such as pain intensity, psychological distress, interference, life control, and health aspects, were noted between European women with university education and the non-European subgroup (worst situation) (ESs generally medium to large). European women with only elementary school also displayed a worse situation than those with university education.

To summarise, patient groups referred to specialist pain care in Sweden are not homogenous with respect to clinical presentations as distinct subgroups are evident. The clinical presentations show clear associations with pain extent, BMI, and socio-demographic variables.

11. Who participates in IPRP?

Not all patients assessed and registered at baseline in SQRP are selected or choose to participate in IPRP. Unfortunately, the registry does not contain data that can

separate these two reasons and other possible reasons, nor does it collect detailed information about assessments, all interventions offered (including IPRP), the interventions' contents and dosages, and patient-related preferences and choices. Assessments of patients, including establishing treatment plans, are clinically necessary and perceived as important by patients. The assessment including a treatment plan with follow-up in primary care per se appears to be associated with positive significant effects on several aspects of the clinical presentation [88]. However, the ESs were insignificant to small.

The Swedish guidelines recommend that IPRP at the specialist level is offered to chronic pain patients with complex clinical presentations, for example, with respect to comorbidities [10]. However, the subgroup with the most severe clinical situation was somewhat underrepresented [70, 89]. Similar results were found for the DYS subgroup of MPI, male gender, and the non-European subgroup [75, 87]. In agreement with this SQRP, data from two university hospital departments showed negative correlations between participation/selection and pain intensity but positive correlations with pain extent [90]. The reasons for these selections are currently unclear and further research is needed.

12. Outcomes of IPRP – based on SQRP studies mainly for the period 2009–2016

IPRP in clinical settings is associated with improvements on the group level with small to medium effect sizes for the majority of the mandatory self-reported outcome variables, for an overall score and retrospective items. Sick-leave data retrieved from the Swedish Social Insurance Agency database show important decreases after IPRP.

12.1 The 22 mandatory outcome variables in SQRP

The outcomes of IPRP were investigated in a study of more than 14 000 patients (**Table 7**) [27]. Significant improvements were generally found except for one or two of the three scales of the second part of MPI (how husband/wife reacts when a patient has pain). Most outcomes showed small ESs and some outcomes were associated with moderate ESs (**Table 2**). For the pre vs. post-IPRP comparisons, three variables had moderate effects sizes—two pain intensity variables and vitality (**Table 7**). At the 12-month follow-up, the same pain intensity variables were associated with moderate effect sizes; this was also the case for pain interference and a health aspect (**Table 6**). The variables of the second part of MPI had insignificant ESs both post IPRP and at the 12-month follow-up.

In 2008, the Swedish government introduced a rehabilitation guarantee to enhance, for example, the implementation of IPRP in primary care. The SQRP created a module to collect data from IPRP in primary care. A relatively small study (N = 397) of the clinical presentation of the patients treated at this care level found that patients presented a considerable complexity [91]. A small study (N = 234) evaluated the outcomes of IPRP in primary care 1 year after discharge for 10 of the 11 variables selected. Eleven outcomes reflecting a BPS approach were evaluated 1 year after IPRP and 10 of these showed significant improvements although ESs were small (0.20–0.49) [92]. A cost-utility analysis indicated that IPRP in primary care was cost-effective [93].

12.2 Overall outcomes of IPRP

The intercorrelations of changes in the 22 mandatory outcome variables (cf. **Table 7**) were investigated using PCAs [27]. Two groups of variables (components), which were not correlated, were identified; the first showed significant intercorrelations between changes in 18 of the outcomes and the second mainly reflected the changes in the second part of MPI together with changes in social support of MPI. Using the score of the first component, a Multivariate Improvement Score (MIS) was defined reflecting changes in the 18 variables [27]. A cluster analysis of MIS was made, and three clusters were identified; retrospectively their baseline situation was analysed. Cluster 1—overall the worst situation pre IPRP—showed the most positive improvements in MIS. Cluster 3—no changes or deterioration in MIS—had the best situation at baseline. Cluster 2 was an intermediary group at baseline and was associated with overall slightly positive MIS improvements [27].

Both post-IPRP and at 12-month follow-up patients retrospectively estimate the degree of positive change in pain and in their ability to handle life situations in general (both rated on five-point Likert scales from markedly increased pain/markedly worsened life situation (score 0) to markedly decreased pain/markedly improved (score 4) [27]. At both time points, most patients reported that their pain situation (57% at both time points), as well as their ability to handle their life situation, had improved (84 and 77%); the two most positive alternatives were added [27].

12.3 Sick leave

All patients undergoing IPRP registered in SQRP between 2007 and 2011 (n=7 297) were linked to the Swedish Social Insurance Agency database and the development of sick leave was analysed [94]. Sick-leave benefits increased during the year before IPRP and decreased after IPRP (analysed up to 2 years after) (**Figure 3**). These reductions in benefits were significant for both men and women. It was concluded that IPRP could positively influence sick-leave benefits for these patients regardless of their sick-leave situation, sex/gender, or policy changes.

A larger study of sick absence for patients included in SQRP (N = 44 241) showed similar results—i.e., sick absence increased from 17% 5 years before to 48% at assessment at the specialist department and thereafter decreased to 38% [95]. Sickness absence history was the strongest predictor of future sickness. Decreases in pain intensity/severity and pain interference but not increases in life control and social support or reduced affective stress during IPRP were associated with decreased risk of being on full-time sick leave 1 year later according to another SQRP study (N = 1 468) from a university department [96]. The same authors reported from a cohort of 2 784 patients that the subgroup DYS of MPI decreased after IPRP [97]. Those belonging to AC or ID had less full-time sick leave 1 year later and therefore the DYS profile was associated with long-term sick leave.

Decreases in sick leave after IPRP were reported in a target trial emulation study using SQRP data (N = 25 613) [68], but the results were not significantly better than for the comparison group. The article was the first target trial emulation attempt using SQRP data (see above). This study has been criticised for its heterogenous comparator group and lack of data concerning other interventions and patient preferences [98]. In addition, this critique emphasised that very complex processes may exist after the assessment when preparing and establishing the rehabilitation/treatment plan. Hence, registries such as SQRP need to collect detailed data concerning assessments, all

Pre vs. post-IPRP							Pre vs. FU					
	Pre		Post IPRP				Pre		FU			
Outcome variables	Mean	SD	Mean	SD	P-value	ES	Mean	SD	Mean	SD	P-value	ES
NRS-7days	6.86	1.72	5.95	2.09	<0.001	0.45	6.84	1.72	5.78	2.32	<0.001	0.47
HADS-Anxiety	9.00	4.76	7.78	4.55	<0.001	0.32	8.73	4.69	7.38	4.70	<0.001	0.33
HADS-Depression	8.49	4.44	6.70	4.31	<0.001	0.47	8.18	4.37	6.74	4.66	<0.001	0.35
MPI-Pain-severity	4.39	0.93	3.87	1.16	<0.001	0.52	4.36	0.91	3.71	1.33	<0.001	0.56
MPI-Pain-interference	4.38	1.02	3.94	1.19	<0.001	0.49	4.34	1.02	3.73	1.37	<0.001	0.54
MPI-Life Control	2.72	1.10	3.30	1.18	<0.001	0.47	2.77	1.10	3.28	1.27	<0.001	0.40
MPI-Distress	3.46	1.26	2.89	1.38	<0.001	0.42	3.42	1.27	2.92	1.45	<0.001	0.35
MPI-Social support	4.16	1.34	3.95	1.35	<0.001	0.21	4.17	1.33	3.77	1.42	<0.001	0.35
MPI-punish	1.74	1.36	1.72	1.33	0.037	0.02	1.69	1.34	1.69	1.35	0.676	0.01
MPI-protect	2.98	1.40	2.85	1.38	<0.001	0.12	2.96	1.39	2.78	1.40	<0.001	0.16
MPI-distract	2.54	1.19	2.56	1.17	0.043	0.02	2.52	1.17	2.45	1.17	<0.001	0.06
MPI-General activity index	2.44	0.84	2.63	0.82	<0.001	0.26	2.47	0.83	2.64	0.86	<0.001	0.20
EQ-5D-index	0.26	0.31	0.39	0.33	<0.001	0.40	0.27	0.31	0.44	0.34	<0.001	0.50
EQ-VAS	41.22	19.09	50.99	21.38	<0.001	0.44	41.90	19.29	52.96	22.87	<0.001	0.46
sf36-pf	52.76	20.58	57.67	21.17	<0.001	0.30	53.07	20.30	59.73	22.57	<0.001	0.36
sf36-rp	12.53	24.40	22.46	33.12	<0.001	0.30	13.07	24.91	27.74	36.32	<0.001	0.39
sf36-bp	24.36	14.49	32.96	17.41	<0.001	0.52	24.60	14.11	35.41	20.05	<0.001	0.56
sf36-gh	41.70	20.22	46.69	21.88	<0.001	0.29	42.59	20.49	47.35	23.52	<0.001	0.25
sf36-vt	23.95	18.48	35.67	22.76	<0.001	0.54	24.96	18.79	34.41	23.85	<0.001	0.41
sf36-sf	47.29	25.19	54.93	25.91	<0.001	0.30	48.95	25.50	57.66	27.05	<0.001	0.32
sf36-re	42.77	42.92	51.15	43.48	<0.001	0.18	44.69	43.17	55.60	43.53	<0.001	0.22
sf36-mh	55.03	21.35	62.55	21.55	<0.001	0.38	56.34	21.15	62.70	22.53	<0.001	0.30

The effect sizes >0.50 are given in bold. The significance (p-values) are reported in the columns to the left of the columns concerning effect sizes. NRS-7days = Pain intensity as measured by a numeric rating scale for the previous 7 days; HADS = Hospital Anxiety and Depression Scale; MPI = Multidimensional Pain Inventory; EQ-5D-index = The index of the European quality of life instrument; EQ-VAS = The European quality of life instrument thermometer-like scale; sf36 = The Short Form (36) Health Survey; subscales; pf = physical functioning; rp = role limitations due to pf physical functioning; bp = bodily pain; gh = general health; vt = vitality; sf = social functioning; re = role limitations due to emotional problems; and mh = mental health.

Table 7. Mandatory outcome variables at baseline (pre) and immediately after IPRP (post IPRP) (left part; N = 12 999–14 772) and at baseline and at 12-month follow-up (FU) (right part; N = 7 784–8 904). Statistical comparisons are presented with effects sizes (ES, i.e., Cohen’s d). Effect sizes in bold were moderate, i.e., Cohen’s d ≥ 0.50. These data have been reported in Ringqvist et al. [27].

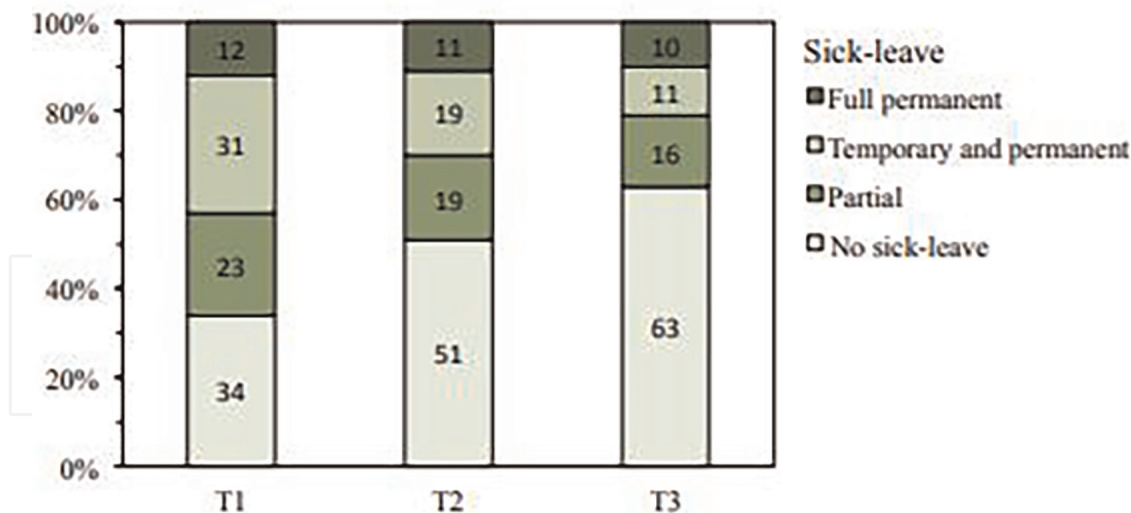


Figure 3.
Level of sick leave at 90–0 days before (T1) IPRP, 320–410 days after (T2) IPRP, and 775–985 days after (T3) IPRP; N = 7 297 (Rivano Fischer et al. [94]).

interventions offered (including contents and dosages), as well as patient-related preferences. More details about the clinical departments might also be beneficial [18]. Perhaps one might expect more prominent decreases of sick leave in IPRP than in the comparison group. According to Swedish guidelines, IPRP should be offered to the most complex chronic pain patients, but those participating in IPRP had gross sick leave days the year before IPRP, so that is necessarily not a correct expectation.

12.4 Long-term consequences of unmet needs?

Long-term opioid therapy (LTOT) for chronic pain is unfortunately common in clinical practise despite lack of evidence and serious adverse consequences [99–103]. At a university hospital reporting to SQRP, 30% of the patients referred to a clinical department used opioids daily [104]. These patients had higher pain intensity, more pain interference, lower quality of life, lower activity engagement, and less satisfaction with life than the other patients referred (medium ESs) [104]. Svanberg et al. investigated the opioid prescriptions 2 years after chronic pain patients were assessed for IPRP [105]. Opioid prescriptions were prescribed for 55% of the cohort (N = 1334). The odds of receiving LTOT were similar for those participating and not participating in IPRP. Patient characteristics at baseline/assessment in both these groups could predict LTOT. In those participating in IPRP, dysfunctional pain coping was a predictor; however, in those not participating in IPRP, pain intensity and depressive symptoms were predictors. Taken together, these studies indicate that long-term pharmacological treatment is not optimal for patients who are eligible for IPRP.

13. Who benefits the most from IPRP?

13.1 In relation to clinical presentation and profile

Evidence is contradictory when it comes to clinical presentation pre-treatment. A recent meta-analysis on prognostic factors for IPRP outcome demonstrated that both

higher levels of general emotional distress and pain-specific cognitive behavioural factors were related to worse long-term (>6 months) physical functioning post-treatment [106]. However, a similar pattern was not displayed in two large-scale SQRP cohort studies where patients reporting higher levels of perceived disability and suffering displayed slightly greater improvement [27, 70]. Hence, those with the most severe clinical presentations at baseline will display the largest improvements found in SQRP studies [70, 71, 75].

Pain distribution (i.e., spreading of pain) is another factor that needs consideration. Cross-sectional population studies have reported that spreading of pain is significantly associated with pain intensity, depressive disorders, and poor health [107, 108]. In a recent large-scale SQRP cohort study, spreading of pain was associated with poorer outcomes of treatment, but the effects were in the small range [79]. Thus, spreading of pain is important for understanding chronic pain as an indicator of severity, as previously described, and to some extent as a predictor of the poorer outcome of IPRPs.

Psychosocial coping profiles with three subgroups have been derived from the MPI and are commonly used to aid in the assessment of patients with chronic pain. Based on a BPS approach to chronic pain, MPI and its subscales are sensitive to changes in the severity of chronic pain and predict sick leave. The dysfunctional (DYS) subgroup reports high pain severity, marked interference in daily life, high affective distress, low perception of life control, and low levels of activity. The adaptive copers (AC) subgroup is characterised by less severe pain, less interference with activities, less affective distress, and positive perceptions of life control and activity level. The interpersonally distressed (ID) subgroup has been described as perceiving low social support and non-supporting behaviours from significant others [109–111]. Some reports suggest that the DYS and/or ID subgroups have better treatment outcomes than the AC group [109, 112–116], whereas other studies have found no significant differences in outcomes amongst subgroups [110, 111, 117–121]. These results are supported by a large-scale cohort study from the SQRP: DYS and ID subgroups that had the most severe clinical presentation at baseline showed the largest improvement following IPRP [75].

13.2 In relation to socio-demographic variables

The existing literature regarding sex differences in outcomes of IPRP is conflicting—women benefit more [84, 122, 123], no sex differences [124–126], and men benefit more [127, 128]. The outcomes of IPRPs in a primary care study were better in women than in men [92]. A recent large-scale cohort study from SQRP found sex differences in outcomes—women had slightly better results than men [87]. The conflicting results in the literature may be due to different cohorts investigated as well as the choice of outcomes.

An important principle in healthcare is equity (i.e., prioritization of healthcare based on the need of the patient); however, social contexts are seldom considered in studies [129]. Several studies have reported that prevalence of chronic pain, the severity of pain, and disability are inversely related to the socio-economic position and low education, male sex, and/or non-European origin (in European studies), which appear to be associated with lower participation rates and worse IPRP results [129–132].

14. Shortcomings and possible improvements of IPRP

One-fifth of the European adult population lives with at least *moderate* intense chronic pain [12]. Patients with chronic pain describe wide consequences, such as

intense and disturbing pain, psychological distress, and insomnia, reduced workability and sick leave, ill health, and low quality of life. Pain conditions caused 21% of all Years Lived with Disability (YLDs), which is a measure of non-fatal health outcomes, globally ahead of 287 other conditions [133]. These striking effects of chronic pain on both the individual and the family and society emphasise the need to improve and develop new treatment methods. Both the systematic reviews and the results from real-world settings indicate the need to improve IPRP.

As described in previous passages, results from IPRP demonstrate low to moderate effect sizes on outcomes with conflicting results concerning effects on RTW. Possible gains for the individual and society might be accomplished with improvements of routines and contents of IPRP. It is thus problematic that IPRP is somewhat heterogeneous as this can constitute problems establishing strategies for improvements. As a comparison, *in vitro* fertilization (IVF) has been able to increase success rates from single digits to nearly 50% in largely the same time frames as IPRP have existed, which at least partly can be attributed to registries with clear and transparent descriptions of different protocols and results [134]. It could be advantageous for a registry such as the SQRP to specify protocols to increase transparency when interpreting results, which might possibly inspire involvement and larger effect sizes on outcomes of IPRP. Currently, IPRP has different approaches and might or might not include, for example, sleep interventions, opioid tapering, workplace interventions, and treatments for psychiatric comorbidities. Moreover, CBT is a large umbrella entailing a multitude of techniques, one of which is exposure. Interventions using exposure have shown beneficial results and it is possible that IPRP, including exposure, might produce better results. Therefore, registries should specify the CBT techniques used [135].

The results obtained by the SQRP show that the subgroup of patients with a relatively better clinical picture before IPRP had worse IPRP results than those with a more severe clinical picture [70]. The patient group with the more difficult clinical picture is most improved by IPRP but not so much that they reach the subgroup with a better clinical picture. Both circumstances indicate a need for the development of IPRP so that IPRP better matches the clinical picture. For example, individual treatments, short interventions, small group activities with different content to be selected for individual patients, individual treatments with the team as a backup, and closer communication with primary care to ensure that recommendations can improve the lives of patients without going through extensive IPRPs, which might be more appropriate for the less severe subgroups [15]. In the long run, this could mean that different IPRPs are available in clinical settings. In addition, the activated, mainly unknown, neurobiological pain mechanisms might not be sufficiently targeted by the various interventions in IPRP.

Early interventions might also improve results. The association between prominent pain extent (i.e., widespread pain) and pain duration supports the concept of early intervention as clinically important and an opportunity to possibly change prognosis with conceivable gains for the individual and society. Early interventions with psychological risk factor screening combined with protocols for active collaboration between caregivers and key stakeholders have been demonstrated to positively impact return to work [136].

Poorer results of IPRP in socially more challenged populations might suggest that equal care is not delivered. For example, IPRP in Sweden may not meet the needs of patients outside Europe. It has been suggested that in particularly non-Western backgrounds might be associated with other attitudes towards self-management interventions, passive symptom-focused management strategies, as well as pharmacological

treatments [137], which could influence IPRP outcomes. Selection to participation in IPRP and outcomes might also be disadvantaged by different biases of professionals towards non-European patients and/or insufficient knowledge about immigration and other cultures. Lower socio-economic groups may differ from health professionals in culture, beliefs, and communication style, resulting in disadvantages and possibly feelings of inferiority. Carr and Moffet provocatively suggest that CBT interventions designed by middle-class health professionals are more suitable for middle-class patients [130]. Also, a common goal of IPRP is increased physical functioning; however, exercise and sports activities are less likely to be adopted by people in lower socio-economic groups than by people in higher socio-economic groups [138–140].

This raises important questions concerning fairness and equality. The combination of sex, education, and country of birth needs to be considered in the assessment of chronic pain patients and is important to consider when optimising the content and delivery of IPRP in clinical practice. IPRPs need to be adapted and educational elements fitted to meet different learning styles using techniques to increase retention of new information as described in textbooks, such as ‘Explain pain supercharged’ [141]. In addition, Carr and Moffet suggest that a useful starting point when considering how to improve treatments is the knowledge that people in socially-deprived areas endure higher levels of stress and lower perceived control [130]. Techniques are suggested to reduce stress and learned helplessness and include involving patients in shared decision-making of treatment, increased social support, incorporating individual coaching where the individual can learn to take more control, and additional validation where IPRPs are supplemented by phone calls between sessions. When attendance is challenged, audio and video material could be provided for patients unable to attend.

15. Conclusions

The patient group with chronic/persistent pain conditions referred to specialist care in Sweden are heterogenous and different subgroups exist. The clinical presentations show clear associations with the extent of pain spreading, BMI, and socio-demographic variables. IPRP is an evidence-based intervention for chronic pain patients who suffer from substantial consequences of their chronic pain condition regarding function, social, and/or psychological well-being. The intervention is complex and is delivered by an interdisciplinary team of professionals in close collaboration with the patient. Observational analyses of IPRP in clinical settings agree with the evidence presented in SRs and MAs. However, results differ amongst subgroups and benefits are not present for all patients. Interestingly, those with the most severe clinical presentation, according to registry data, an assessment benefit most from IPRP. Also, socio-economic factors can influence results and need to be addressed to warrant more equal opportunities for improvement in IPRP.

Units offering IPRPs differ in their strategies, services, and resources, both in intensity and duration, as well as in the degree of individual interventions opposed to group treatment. This diversity should be addressed by researchers and incorporated in studies by looking into the impact of referral flow, traditions, and the heterogeneity of the patients assessed. Methods other than randomised studies, such as emulated trials, repeated measured for patients (patients as controls) should be refined to enhance the potential gaining of analysing real-life information in registries.

There is thus room for enhancement of IPRP possibly by a more structured use of registries. Furthermore, pain registries should expand to cover a variety of clinical

efforts designed to meet the individual needs of people with chronic pain and to deliver information about the effectiveness of these measures.

Conflict of interest

The authors declare no conflict of interest.

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References

- [1] Gatchel R, Peng Y, Peters M, Fuchs P, Turk D. The biopsychosocial approach to chronic pain: Scientific advances and future directions. *Psychological Bulletin*. 2007;**133**:581-624
- [2] Linton S, Bergbom S. Understanding the link between depression and pain. *Scandinavian Journal of Pain*. 2011;**2**: 47-54
- [3] Ossipov MH, Dussor GO, Porreca F. Central modulation of pain. *The Journal of Clinical Investigation*. 2010;**120**(11): 3779-3787
- [4] Dworkin RH, Turk DC, Farrar JT, Haythornthwaite JA, Jensen MP, Katz NP, et al. Core outcome measures for chronic pain clinical trials: IMMPACT recommendations. *Pain*. 2005;**113**(1-2):9-19
- [5] WHO. International Classification of Functioning, Disability and Health (ICF). 2001. Available from: <https://apps.who.int/iris/handle/10665/42407>
- [6] Loeser J. Multidisciplinary pain management. In: Merskey H, Loeser J, Dubner R, editors. *The Paths of Pain 1975-2005*. Seattle: IASP; 2005. p. 511
- [7] Turk D, Stanos S, Palermo T, Paice J, Jaminson R, Gordon D, et al. *Interdisciplinary Pain Management*. Available from: <http://www.americanpainociety.org/uploads/pdfs/2010%20Interdisciplinary%20White%20Paper-FINAL.pdf>2010
- [8] Kaiser U, Treede RD, Sabatowski R. Multimodal pain therapy in chronic noncancer pain-gold standard or need for further clarification? *Pain*. 2017;**158**(10):1853-1859
- [9] Brecht D, Stephens J, Gatchel R. Interdisciplinary pain management programs in the treatment of pain conditions. In: Noe C, editor. *Pain Management for Clinicians*. Cham: Springer; 2020
- [10] Gerdle B, Stålnacke B-M, Söderlund A, Åsenlöf P. Indikation för multimodal rehabilitering vid långvarig smärta. Stockholm: Nationella Medicinska Indikationer (Svenska Läkaresällskapet, Sveriges Kommuner och Landsting, Socialstyrelsen och SBU); 2011. Document no: 2011:02
- [11] Cousins MJ, Lynch ME. The declaration Montreal: Access to pain management is a fundamental human right. *Pain*. 2011;**152**(12):2673-2674
- [12] Breivik H, Collett B, Ventafridda V, Cohen R, Gallacher D. Survey of chronic pain in Europe: Prevalence, impact on daily life, and treatment. *European Journal of Pain*. 2006;**10**(4):287-333
- [13] Dahlhamer J, Lucas J, Zelaya C, Nahin R, Mackey S, DeBar L, et al. Prevalence of chronic pain and high-impact chronic pain among adults – United States, 2016. *MMWR. Morbidity and Mortality Weekly Report*. 2018;**67**(36):1001-1006
- [14] Engel G. The need for a new medical model: A challenge for biomedicine. *Science*. 1977;**196**:129-136
- [15] McGeary D, McGeary C, Nabity P, Villarreal R, Kivisalu T, Gatchel R. Improving stress reduction and wellness in interdisciplinary chronic pain management: Is transdisciplinary care a better option? *Journal of Applied Biobehavioral Research*. 2016;**21**:205-215
- [16] Stanos S. Focused review of interdisciplinary pain rehabilitation programs for chronic pain management.

Current Pain and Headache Reports. 2012;**16**:147-152

catastrophizing. European Journal of Pain. 2007;**11**(7):779-787

[17] Garschagen A, Steegers MA, van Bergen AH, Jochijms JA, Skrabanja TL, Vrijhoef HJ, et al. Is there a need for including spiritual care in interdisciplinary rehabilitation of chronic pain patients? Investigating an Innovative Strategy. Pain Practice. 2015; **15**(7):671-687

[23] SBU. Methods for treatment of chronic pain a systematic review of the literature (In Swedish: Metoder för behandling av långvarig smärta: En systematisk litteraturöversikt). Vol. 177. No. 1. Stockholm: SBU – Swedish Council on Health Technology Assessment; 2006. pp. 1-504

[18] Rivano Fischer M, Schults M, Stålnacke B, Ekholm J, Persson E, Löfgren M. Variability in patient characteristics and service provision of interdisciplinary pain rehabilitation: A study using the Swedish national quality registry for pain rehabilitation. Journal of Rehabilitation Medicine. 2020;**52**(11): jrm00128

[24] Henry SG, Bell RA, Fenton JJ, Kravitz RL. Goals of chronic pain management: Do patients and primary care physicians agree and does it matter? The Clinical Journal of Pain. 2017;**33**(11): 955-961

[19] Waterschoot FPC, Dijkstra PU, Hollak N, de Vries HJ, Geertzen JHB, Reneman MF. Dose or content? Effectiveness of pain rehabilitation programs for patients with chronic low back pain: A systematic review. Pain. 2014;**155**(1):179-189

[25] McCracken LM, Zhao-O'Brien J. General psychological acceptance and chronic pain: There is more to accept than the pain itself. European Journal of Pain. 2010;**14**(2):170-175

[20] Dragioti E, Bjork M, Larsson B, Gerdle B. A meta-epidemiological appraisal of the effects of interdisciplinary multimodal pain therapy dosing for chronic low back pain. Journal of Clinical Medicine. 2019;**8**(6):871

[26] Thompson M, McCracken LM. Acceptance and related processes in adjustment to chronic pain. Current Pain and Headache Reports. 2011;**15**(2):144-151

[21] Tseli E, LoMartire R, Vixner L, Grooten WJA, Gerdle B, Ang BO. What is the effectiveness of different duration interdisciplinary treatment programs in patients with chronic pain? A large-scale longitudinal register study. Journal of Clinical Medicine. 2020;**9**(9):2788

[27] Ringqvist Å, Dragioti E, Björk M, Larsson B, Gerdle B. Moderate and stable pain reductions as a result of Interdisciplinary Pain Rehabilitation—A cohort study from the Swedish quality registry for pain rehabilitation (SQRP). Journal of Clinical Medicine. 2019;**8**:905

[22] Vowles KE, McCracken LM, Eccleston C. Processes of change in treatment for chronic pain: The contributions of pain, acceptance, and

[28] Epton T, Currie S, Armitage CJ. Unique effects of setting goals on behavior change: Systematic review and meta-analysis. Journal of Consulting and Clinical Psychology. 2017;**85**(12):1182-1198

[29] Schut HA, Stam HJ. Goals in rehabilitation teamwork. Disability and Rehabilitation. 1994;**16**(4):223-226

[30] Doran G. There's a S.M.A.R.T. way to write management's goals and

objectives. *Management Review*. 1981; **70**(11):35-36

[31] Turk DC, Dworkin RH, Allen RR, Bellamy N, Brandenburg N, Carr DB, et al. Core outcome domains for chronic pain clinical trials: IMMPACT recommendations. *Pain*. 2003;**106**(3): 337-345

[32] Kaiser U, Kopkow C, Deckert S, Neustadt K, Jacobi L, Cameron P, et al. Developing a core outcome-domain set to assessing effectiveness of interdisciplinary multimodal pain therapy: The VAPAIN consensus statement on core outcome-domains. *Pain*. 2018;**159**(4):673-683

[33] Zidarov D, Zidarova-Carrié A, Visca R, Miller J, Brecht K, Viens N, et al. Core patient-reported outcome domains for routine clinical care in chronic pain management: Patients' and healthcare professionals' perspective. *Quality of Life Research*. 2020;**29**(7):2007-2020

[34] Gerdle B, Molander P, Stenberg G, Stalnacke BM, Enthoven P. Weak outcome predictors of multimodal rehabilitation at one-year follow-up in patients with chronic pain—A practice based evidence study from two SQRP centres. *BMC Musculoskeletal Disorders*. 2016;**17**(1):490

[35] Kamper SJ, Apeldoorn AT, Chiarotto A, Smeets RJ, Ostelo RW, Guzman J, et al. Multidisciplinary biopsychosocial rehabilitation for chronic low back pain. *Cochrane Database of Systematic Reviews*. 2014;**9**: Cd000963

[36] SBU. Rehabilitation of chronic pain [In Swedish: Rehabilitering vid långvarig smärta. En systematisk litteraturöversikt]. Vol. 198. Stockholm: SBU – Swedish Council on Health Technology Assessment; 2010. pp. 1-286

[37] Scascighini L, Toma V, Dober-Spielmann S, Sprott H. Multidisciplinary treatment for chronic pain: A systematic review of interventions and outcomes. *Rheumatology*. 2008;**47**(5):670-678

[38] Papadopoulou D, Fassoulaki A, Tsoulas C, Siafaka I, Vadalouca A. A meta-analysis to determine the effect of pharmacological and non-pharmacological treatments on fibromyalgia symptoms comprising OMERACT-10 response criteria. *Clinical Rheumatology*. 2016;**35**(3):573-586

[39] Arnold LM, Williams DA, Hudson JI, Martin SA, Clauw DJ, Crofford LJ, et al. Development of responder definitions for fibromyalgia clinical trials. *Arthritis and Rheumatism*. 2012;**64**(3):885-894

[40] Vervoort VM, Vrieseckolk JE, van den Ende CH. Development of responder criteria for multicomponent non-pharmacological treatment in fibromyalgia. *Clinical and Experimental Rheumatology*. 2017;**35**:86-92

[41] Grimby-Ekman A, Kim M, Stankovic N, Mannheimer C. Multidimensional health changes after a multimodal pain rehabilitation program: A registry-based study. *Pain reports*. 2021;**6**(2):e938

[42] Feise RJ. Do multiple outcome measures require p-value adjustment? *BMC Medical Research Methodology*. 2002;**2**:8

[43] Turk DC, Dworkin RH, McDermott MP, Bellamy N, Burke LB, Chandler JM, et al. Analyzing multiple endpoints in clinical trials of pain treatments: IMMPACT recommendations. Initiative on methods, measurement, and pain assessment in clinical trials. *Pain*. 2008;**139**(3):485-493

[44] Bagiella E. Clinical trials in rehabilitation: Single or multiple

outcomes? *Archives of Physical Medicine and Rehabilitation*. 2009;**90** (Suppl. 11):S17-S21

[45] Tyler KM, Normand SL, Horton NJ. The use and abuse of multiple outcomes in randomized controlled depression trials. *Contemporary Clinical Trials*. 2011;**32**(2):299-304

[46] Teixeira-Pinto A, Mauri L. Statistical analysis of noncommensurate multiple outcomes. *Circulation. Cardiovascular Quality and Outcomes*. 2011;**4**(6): 650-656

[47] Dragioti E, Dong HJ, Larsson B, Gerdle B. Reported outcomes in published systematic reviews of interdisciplinary pain treatment: Protocol for a systematic overview. *JMIR Research Protocols*. 2020;**9**(5):e17795

[48] Nielson WR, Weir R. Biopsychosocial approaches to the treatment of chronic pain. *The Clinical Journal of Pain*. 2001;**17** (Suppl. 4):S114-S127

[49] Guzmán J, Esmail R, Karjalainen K, Malmivaara A, Irvin E, Bombardier C. Multidisciplinary bio-psycho-social rehabilitation for chronic low back pain. *Cochrane Database of Systematic Reviews*. 2002;**1**:Cd000963

[50] van Geen JW, Edelaar MJ, Janssen M, van Eijk JT. The long-term effect of multidisciplinary back training: A systematic review. *Spine (Phila Pa 1976)*. 2007;**32**(2):249-255

[51] Norlund A, Ropponen A, Alexanderson K. Multidisciplinary interventions: Review of studies of return to work after rehabilitation for low back pain. *Journal of Rehabilitation Medicine*. 2009;**41**(3):115-121

[52] Häuser W, Bernardy K, Arnold B, Offenbächer M, Schiltenswolf M. Efficacy

of multicomponent treatment in fibromyalgia syndrome: A meta-analysis of randomized controlled clinical trials. *Arthritis and Rheumatism*. 2009;**61**(2): 216-224

[53] van Middelkoop M, Rubinstein SM, Kuijpers T, Verhagen AP, Ostelo R, Koes BW, et al. A systematic review on the effectiveness of physical and rehabilitation interventions for chronic non-specific low back pain. *European Spine Journal*. 2011;**20**(1):19-39

[54] Gianola S, Andreano A, Castellini G, Moja L, Valsecchi MG. Multidisciplinary biopsychosocial rehabilitation for chronic low back pain: The need to present minimal important differences units in meta-analyses. *Health and Quality of Life Outcomes*. 2018;**16**(1):91

[55] Casey MB, Smart KM, Segurado R, Doody C. Multidisciplinary-based rehabilitation (MBR) compared with active physical interventions for pain and disability in adults with chronic pain: A systematic review and meta-analysis. *The Clinical Journal of Pain*. 2020;**36**(11):874-886

[56] Martinez-Calderon J, Flores-Cortes M, Morales-Asencio JM, Fernandez-Sanchez M, Luque-Suarez A. Which interventions enhance pain self-efficacy in people with chronic musculoskeletal pain? A systematic review with meta-analysis of randomized controlled trials, including over 12000 participants. *The Journal of Orthopaedic and Sports Physical Therapy*. 2020; **50**(8):418-430

[57] Martinez-Calderon J, Flores-Cortes M, Morales-Asencio JM, Luque-Suarez A. Conservative interventions reduce fear in individuals with chronic low back pain: A systematic review. *Archives of Physical Medicine and Rehabilitation*. 2020;**101**(2):329-358

- [58] Martinez-Calderon J, Flores-Cortes M, Morales-Asencio JM, Luque-Suarez A. Intervention therapies to reduce pain-related fear in fibromyalgia syndrome: A systematic review of randomized clinical trials. *Pain Medicine*. 2021;22(2):481-498
- [59] Hong JC. Strategies to turn real-world data into real-world knowledge. *JAMA Network Open*. 2021;4(10):e2128045
- [60] Whiteneck GG, Gassaway J. SCIREhab uses practice-based evidence methodology to associate patient and treatment characteristics with outcomes. *Archives of Physical Medicine and Rehabilitation*. 2013;94(Suppl. 4):S67-S74
- [61] Sennehed CP, Stigmar K, Grahn B, Fischer MR, Forsbrand M, Nyberg A, et al. Evaluation of a multimodal pain rehabilitation programme in primary care based on clinical register data: A feasibility study. *Primary Health Care Research & Development*. 2020;21:e2
- [62] Hernan MA, Robins JM. Using big data to emulate a target trial when a randomized trial is not available. *American Journal of Epidemiology*. 2016;183(8):758-764
- [63] Admon AJ, Donnelly JP, Casey JD, Janz DR, Russell DW, Joffe AM, et al. Emulating a novel clinical trial using existing observational data. Predicting results of the prevent study. *Annals of the American Thoracic Society*. 2019;16(8):998-1007
- [64] Matthews AA, Szummer K, Dahabreh IJ, Lindahl B, Erlinge D, Feychting M, et al. Comparing effect estimates in randomized trials and observational studies from the same population: An application to percutaneous coronary intervention. *Journal of the American Heart Association*. 2021;10(11):e020357
- [65] Franklin JM, Patorno E, Desai RJ, Glynn RJ, Martin D, Quinto K, et al. Emulating randomized clinical trials with nonrandomized real-world evidence studies: First results from the RCT duplicate initiative. *Circulation*. 2021;143(10):1002-1013
- [66] Groenwold RHH. Trial emulation and real-world evidence. *JAMA Network Open*. 2021;4(3):e213845
- [67] Zhao SS, Lyu H, Solomon DH, Yoshida K. Improving rheumatoid arthritis comparative effectiveness research through causal inference principles: Systematic review using a target trial emulation framework. *Annals of the Rheumatic Diseases*. 2020;79(7):883-890
- [68] LoMartire R, Bjork M, Dahlstrom O, Constan L, Frumento P, Vixner L, et al. The value of interdisciplinary treatment for sickness absence in chronic pain: A nationwide register-based cohort study. *European Journal of Pain*. 2021;25(10):2190-2201
- [69] Molander P, Dong HJ, Ang B, Enthoven P, Gerdle B. The role of pain in chronic pain patients' perception of health-related quality of life: A cross-sectional SQRP study of 40,000 patients. *Scandinavian Journal of Pain*. 2018;18(3):417-429
- [70] Gerdle B, Akerblom S, Brodda Jansen G, Enthoven P, Ernberg M, Dong HJ, et al. Who benefits from multimodal rehabilitation—An exploration of pain, psychological distress, and life impacts in over 35,000 chronic pain patients identified in the Swedish Quality Registry for Pain Rehabilitation. *Journal of Pain Research*. 2019;12:891-908

- [71] Gerdle B, Åkerblom S, Stålnacke B-M, Brodda Jansen G, Enthoven P, Ernberg M, et al. The importance of emotional distress, cognitive behavioural factors and pain for life impact at baseline and for outcomes after rehabilitation – A SQRP study of more than 20000 chronic pain patients. *Scandinavian Journal of Pain*. 2019;**19**(4):693-711
- [72] Backryd E, Persson EB, Larsson AI, Fischer MR, Gerdle B. Chronic pain patients can be classified into four groups: Clustering-based discriminant analysis of psychometric data from 4665 patients referred to a multidisciplinary pain centre (a SQRP study). *PLoS One*. 2018;**13**(2):e0192623
- [73] Turk D, Rudy T. Toward an empirically derived taxonomy of chronic pain patients: Integration of psychological assessment data. *Journal of Consulting and Clinical Psychology*. 1988;**56**:233-238
- [74] Turk DC. The potential of treatment matching for subgroups of patients with chronic pain: Lumping versus splitting. *The Clinical Journal of Pain*. 2005;**21**(1):44-55
- [75] Gerdle B, Cervin M, Rivano Fischer M, Ringqvist A. Outcomes of interdisciplinary pain rehabilitation across subgroups of the multidimensional pain inventory—A Study from the Swedish quality registry for pain rehabilitation. *Pain Practice*. 2021;**21**(6):662-679
- [76] Alfoldi P, Wiklund T, Gerdle B. Comorbid insomnia in patients with chronic pain: A study based on the Swedish quality registry for pain rehabilitation (SQRP). *Disability and Rehabilitation*. 2014;**36**(20):1661-1669
- [77] Lind J, Andrell P, Grimby-Ekman A. Insomnia symptoms and chronic pain among patients participating in a pain rehabilitation program—A registry study. *Journal of Clinical Medicine*. 2021;**10**(18):4040
- [78] Åkerblom S, Cervin M, Perrin S, Rivano Fischer M, Gerdle B, McCracken LM. A network analysis of clinical variables in chronic pain: A study from the Swedish quality registry for pain rehabilitation (SQRP). *Pain Medicine*. 2021;**22**(7):1591-1602
- [79] Gerdle B, Rivano Fischer M, Cervin M, Ringqvist A. Spreading of pain in patients with chronic pain is related to pain duration and clinical presentation and weakly associated with outcomes of interdisciplinary pain rehabilitation: A cohort study from the Swedish quality registry for pain rehabilitation (SQRP). *Journal of Pain Research*. 2021;**14**:173-187
- [80] Dong HJ, Larsson B, Rivano Fischer M, Gerdle B. Facing obesity in pain rehabilitation clinics: Profiles of physical activity in patients with chronic pain and obesity—A study from the Swedish quality registry for pain rehabilitation (SQRP). *PLoS One*. 2020;**15**(9):e0239818
- [81] Bergman S, Herrstrom P, Hogstrom K, Petersson IF, Svensson B, Jacobsson LT. Chronic musculoskeletal pain, prevalence rates, and sociodemographic associations in a Swedish population study. *The Journal of Rheumatology*. 2001;**28**(6):1369-1377
- [82] Gerdle B, Bjork J, Henriksson C, Bengtsson A. Prevalence of current and chronic pain and their influences upon work and healthcare-seeking: A population study. *The Journal of Rheumatology*. 2004;**31**(7):1399-1406
- [83] Bartley EJ, Fillingim RB. Sex differences in pain: A brief review of

clinical and experimental findings. *British Journal of Anaesthesia*. 2013; **111**(1):52-58

[84] Pieh C, Altmeyen J, Neumeier S, Loew T, Angerer M, Lahmann C. Gender differences in outcomes of a multimodal pain management program. *Pain*. 2012; **153**(1):197-202

[85] Unruh AM. Gender variations in clinical pain experience. *Pain*. 1996; **65**(2-3):123-167

[86] Rovner GS, Sunnerhagen KS, Bjorkdahl A, Gerdle B, Borsbo B, Johansson F, et al. Chronic pain and sex-differences; women accept and move, while men feel blue. *PLoS One*. 2017; **12**(4):e0175737

[87] Gerdle B, Boersma K, Asenlof P, Stalnacke BM, Larsson B, Ringqvist A. Influences of sex, education, and country of birth on clinical presentations and overall outcomes of interdisciplinary pain rehabilitation in chronic pain patients: A cohort study from the Swedish quality registry for pain rehabilitation (SQRP). *Journal of Clinical Medicine*. 2020; **9**(8):2374

[88] Merrick D, Sundelin G, Stalnacke BM. An observational study of two rehabilitation strategies for patients with chronic pain, focusing on sick leave at one-year follow-up. *Journal of Rehabilitation Medicine*. 2013; **45**(10):1049-1057

[89] Svanberg M, Stalnacke BM, Enthoven P, Brodda-Jansen G, Gerdle B, Boersma K. Impact of emotional distress and pain-related fear on patients with chronic pain: Subgroup analysis of patients referred to multimodal rehabilitation. *Journal of Rehabilitation Medicine*. 2017; **49**(4):354-361

[90] Enthoven P, Molander P, Oberg B, Stalnacke BM, Stenberg G, Gerdle B. Do

pain characteristics guide selection for multimodal pain rehabilitation? *Journal of Rehabilitation Medicine*. 2017; **49**(2): 161-169

[91] Stenberg G, Enthoven P, Molander P, Gerdle B, Stalnacke BM. Patients selected to participate in multimodal pain rehabilitation programmes in primary care—A multivariate cross-sectional study focusing on gender and sick leave. *Scandinavian Journal of Pain*. 2020; **20**(3):511-524

[92] Pietila-Holmner E, Enthoven P, Gerdle B, Molander P, Stalnacke BM. Long-term outcomes of multimodal rehabilitation in primary care for patients with chronic pain. *Journal of Rehabilitation Medicine*. 2020; **52**(2): jrm00023

[93] Eklund K, Stalnacke BM, Stenberg G, Enthoven P, Gerdle B, Sahlen KG. A cost-utility analysis of multimodal pain rehabilitation in primary healthcare. *Scandinavian Journal of Pain*. 2021; **21**(1):48-58

[94] Rivano Fischer M, Persson E, Stalnacke B, Schult M, Löfgren M. Return to work after interdisciplinary pain rehabilitation: One- and two-years follow-up based on the Swedish quality registry for pain rehabilitation. *Journal of Rehabilitation Medicine*. 2019; **51**: 281-289

[95] LoMartire R, Dahlstrom O, Bjork M, Vixner L, Frumento P, Constan L, et al. Predictors of sickness absence in a clinical population with chronic pain. *The Journal of Pain*. 2021; **22**(10): 1180-1194

[96] Nyberg VE, Novo M, Sjolund BH. Do Multidimensional Pain Inventory scale score changes indicate risk of receiving sick leave benefits 1 year after

a pain rehabilitation programme?
Disability and Rehabilitation. 2011;33
(17–18):1548-1556

[97] Nyberg VE, Novo M, Sjolund BH. Changes in multidimensional pain inventory profile after a pain rehabilitation programme indicate the risk of receiving sick leave benefits one year later. *Journal of Rehabilitation Medicine*. 2014;46(10):1006-1013

[98] Rivano Fischer M, Stalnacke BM. Comment on ‘The value of interdisciplinary treatment for sickness absence in chronic pain: A nationwide register-based cohort study’. *European Journal of Pain*. 2022;26(2):543-544

[99] Chaparro LE, Furlan AD, Deshpande A, Mailis-Gagnon A, Atlas S, Turk DC. Opioids compared with placebo or other treatments for chronic low back pain: An update of the Cochrane review. *Spine (Phila Pa 1976)*. 2014;39(7):556-563

[100] Krebs EE, Gravelly A, Nugent S, Jensen AC, DeRonne B, Goldsmith ES, et al. Effect of opioid vs nonopioid medications on pain-related function in patients with chronic back pain or hip or knee osteoarthritis pain: The SPACE randomized clinical trial. *Journal of the American Medical Association*. 2018;319(9):872-882

[101] Chou R, Turner JA, Devine EB, Hansen RN, Sullivan SD, Blazina I, et al. The effectiveness and risks of long-term opioid therapy for chronic pain: A systematic review for a national institutes of health pathways to prevention workshop. *Annals of Internal Medicine*. 2015;162(4):276-286

[102] Sullivan MD. Depression effects on long-term prescription opioid use, abuse, and addiction. *The Clinical Journal of Pain*. 2018;34(9):878-884

[103] Von Korff M, Kolodny A, Deyo RA, Chou R. Long-term opioid therapy reconsidered. *Annals of Internal Medicine*. 2011;155(5):325-328

[104] Kallman TF, Backryd E. Prevalence of analgesic use in patients with chronic pain referred to a multidisciplinary pain centre and its correlation with patient-reported outcome measures: A cross-sectional, registry-based study. *Journal of Rehabilitation Medicine*. 2020;52(11):jrm00126

[105] Svanberg M, Stalnacke BM, Quinn PD, Boersma K. Opioid prescriptions in chronic pain rehabilitation. A prospective study on the prevalence and association between individual patient characteristics and opioids. *Journal of Clinical Medicine*. 2021;10(10):2130

[106] Tseli E, Boersma K, Stalnacke BM, Enthoven P, Gerdle B, Ang BO, et al. Prognostic factors for physical functioning after multidisciplinary rehabilitation in patients with chronic musculoskeletal pain: A systematic review and meta-analysis. *The Clinical Journal of Pain*. 2019;35(2):148-173

[107] Dragioti E, Larsson B, Bernfort L, Levin LA, Gerdle B. Prevalence of different pain categories based on pain spreading on the bodies of older adults in Sweden: A descriptive-level and multilevel association with demographics, comorbidities, medications, and certain lifestyle factors (PainS65+). *Journal of Pain Research*. 2016;9:1131-1141

[108] Dragioti E, Larsson B, Bernfort L, Levin LA, Gerdle B. A cross-sectional study of factors associated with the number of anatomical pain sites in an actual elderly general population: Results from the PainS65+ cohort. *Journal of Pain Research*. 2017;10:2009-2019

- [109] Riipinen M, Niemisto L, Lindgren KA, Hurri H. Psychosocial differences as predictors for recovery from chronic low back pain following manipulation, stabilizing exercises and physician consultation or physician consultation alone. *Journal of Rehabilitation Medicine*. 2005;37(3): 152-158
- [110] Gatchel RJ, Noe CE, Pulliam C, Robbins H, Deschner M, Gajraj NM, et al. A preliminary study of multidimensional pain inventory profile differences in predicting treatment outcome in a heterogeneous cohort of patients with chronic pain. *The Clinical Journal of Pain*. 2002;18(3): 139-143
- [111] Persson E, Eklund M, Lexell J, Rivano-Fischer M. Psychosocial coping profiles after pain rehabilitation: Associations with occupational performance and patient characteristics. *Disability and Rehabilitation*. 2017; 39(3):251-260
- [112] Turk D, Okifuji A, Sinclair J, Starz T. Differential responses by psychosocial subgroups of fibromyalgia syndrome patients to an interdisciplinary treatment. *Arthritis Care and Research*. 1998;11(5):397-404
- [113] Turk DC, Zaki HS, Rudy TE. Effects of intraoral appliance and biofeedback/ stress management alone and in combination in treating pain and depression in patients with temporomandibular disorders. *The Journal of Prosthetic Dentistry*. 1993; 70(2):158-164
- [114] Harlacher U, Persson A, Rivano-Fischer M, Sjölund B. Using data from multidimensional pain inventory subscales to assess functioning in pain rehabilitation. *International Journal of Rehabilitation Research*. 2011;34:14-21
- [115] Strategier LD, Chwalisz K, Altmaier EM, Russell DW, Lehmann TR. Multidimensional assessment of chronic low back pain: Predicting treatment outcomes. *Journal of Clinical Psychology in Medical Settings*. 1997;4(1):91-110
- [116] Soderlund A, Denison E. Classification of patients with whiplash associated disorders (WAD): Reliable and valid subgroups based on the multidimensional pain inventory (MPI-S). *European Journal of Pain*. 2006; 10(2):113-119
- [117] van der Hulst M, Vollenbroek-Hutten MM, Groothuis-Oudshoorn KG, Hermens HJ. Multidisciplinary rehabilitation treatment of patients with chronic low back pain: A prognostic model for its outcome. *The Clinical Journal of Pain*. 2008;24(5):421-430
- [118] Davis PJ, Reeves JL, Graff-Radford SB, Hastie BA, Naliboff BD. Multidimensional subgroups in migraine: Differential treatment outcome to a pain medicine program. *Pain Medicine*. 2003;4(3):215-222
- [119] Bergstrom C, Jensen I, Hagberg J, Busch H, Bergstrom G. Effectiveness of different interventions using a psychosocial subgroup assignment in chronic neck and back pain patients: A 10-year follow-up. *Disability and Rehabilitation*. 2012;34(2):110-118
- [120] Verra ML, Angst F, Staal JB, Brioschi R, Lehmann S, Aeschlimann A, et al. Differences in pain, function and coping in multidimensional pain inventory subgroups of chronic back pain: A one-group pretest-posttest study. *BMC Musculoskeletal Disorders*. 2011; 12:145
- [121] Asih S, Mayer TG, Williams M, Choi YH, Gatchel RJ. Does classification of chronic musculoskeletal disorder

patients into psychosocial subgroups predict differential treatment responsiveness and 1-year outcomes after a functional restoration program? *The Clinical Journal of Pain*. 2015;**31**(12): 1036-1045

[122] Jensen IB, Bergstrom G, Ljungquist T, Bodin L, Nygren AL. A randomized controlled component analysis of a behavioral medicine rehabilitation program for chronic spinal pain: Are the effects dependent on gender? *Pain*. 2001;**91**(1-2):65-78

[123] Krogstad BS, Jokstad A, Dahl BL, Vassend O. The reporting of pain, somatic complaints, and anxiety in a group of patients with TMD before and 2 years after treatment: Sex differences. *Journal of Orofacial Pain*. 1996;**10**(3): 263-269

[124] Keogh E, McCracken LM, Eccleston C. Do men and women differ in their response to interdisciplinary chronic pain management? *Pain*. 2005; **114**(1-2):37-46

[125] Scascighini L, Litschi M, Walti M, Sprott H. Effect of an interdisciplinary outpatient pain management program (IOPP) for chronic pain patients with and without migration background: A prospective, observational clinical study. *Pain Medicine*. 2011;**12**(5):706-716

[126] Tseli E, Vixner L, LoMartire R, Grooten WJA, Gerdle B, Ang BO. Prognostic factors for improved physical and emotional functioning one year after interdisciplinary rehabilitation in patients with chronic pain: Results from a national quality registry in Sweden. *Journal of Rehabilitation Medicine*. 2020; **52**(2):jrm00019

[127] Hooten WM, Townsend CO, Decker PA. Gender differences among patients with fibromyalgia undergoing

multidisciplinary pain rehabilitation. *Pain Medicine*. 2007;**8**(8):624-632

[128] Murphy JL, Phillips KM, Rafie S. Sex differences between Veterans participating in interdisciplinary chronic pain rehabilitation. *Journal of Rehabilitation Research and Development*. 2016;**53**(1):83-94

[129] Ahlgren C, Fjellman-Wiklund A, Hamberg K, Johansson EE, Stalnacke BM. The meanings given to gender in studies on multimodal rehabilitation for patients with chronic musculoskeletal pain—A literature review. *Disability and Rehabilitation*. 2016;**38**(23):2255-2270

[130] Carr JL, Moffett JA. The impact of social deprivation on chronic back pain outcomes. *Chronic Illness*. 2005;**1**(2): 121-129

[131] Hammarstrom A, Haukenes I, Fjellman Wiklund A, Lehti A, Wiklund M, Evengard B, et al. Low-educated women with chronic pain were less often selected to multidisciplinary rehabilitation programs. *PLoS One*. 2014;**9**(5):e97134

[132] Jordan KP, Thomas E, Peat G, Wilkie R, Croft P. Social risks for disabling pain in older people: A prospective study of individual and area characteristics. *Pain*. 2008;**137**(3): 652-661

[133] Vos T, Flaxman AD, Naghavi M, Lozano R, Michaud C, Ezzati M, et al. Years lived with disability (YLDs) for 1160 sequelae of 289 diseases and injuries 1990–2010: A systematic analysis for the global burden of disease study 2010. *Lancet*. 2012;**380**(9859): 2163-2196

[134] Eskew A, Jungheim E. A History of developments to improve in vitro

fertilization. *Missouri Medicine*. 2017; **114**(3):156-159

[135] Batho A, Kneale D, Sutcliffe K, Williams A. Sufficient conditions for effective psychological treatment of chronic pain: A qualitative comparative analysis. *Pain*. 2021; **162**(10):2472-2485

[136] Nicholas MK, Costa DSJ, Linton SJ, Main CJ, Shaw WS, Pearce G, et al. Implementation of early intervention protocol in Australia for 'High Risk' injured workers is associated with fewer lost work days over 2 years than usual (stepped) care. *Journal of Occupational Rehabilitation*. 2020;**30**(1):93-104

[137] Stalnacke BM, Haukenes I, Lehti A, Wiklund AF, Wiklund M, Hammarstrom A. Is there a gender bias in recommendations for further rehabilitation in primary care of patients with chronic pain after an interdisciplinary team assessment? *Journal of Rehabilitation Medicine*. 2015; **47**(4):365-371

[138] Bauman A, Owen N, Rushworth RL. Recent trends and socio-demographic determinants of exercise participation in Australia. *Community Health Studies*. 1990;**14**(1):19-26

[139] Lantz PM, House JS, Lepkowski JM, Williams DR, Mero RP, Chen J. Socioeconomic factors, health behaviors, and mortality: Results from a nationally representative prospective study of US adults. *Journal of the American Medical Association*. 1998;**279**(21):1703-1708

[140] Lindstrom M, Hanson BS, Ostergren PO. Socioeconomic differences in leisure-time physical activity: The role of social participation and social capital in shaping health related behaviour. *Social Science & Medicine*. 2001;**52**(3):441-451

[141] Butler D, Moseley L. *Explain Pain Super Charged*. Adelaide City West: Neuro Orthopaedic Institute, Australia; 2017