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Illness perceptions associated with patient burden with musculoskeletal pain in outpatient physical therapy practice, a cross-sectional study

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ABSTRACT

Introduction: Musculoskeletal pain (MSP) is a burden to patients and to society. In addition to well-known prognostic factors, illness perceptions (IPs) may be associated with pain intensity and physical functioning in MSP but their role is not fully understood. Our research focused on these questions: 1) Do IPs differ between patients with acute, sub-acute and persistent MSP 2) Are IPs, in addition to well-known prognostic factors, associated with pain intensity and with limitations in physical functioning?

Methods: Eligible MSP patients from 29 physical therapy practices were invited to participate in a cross-sectional study. IPs were measured with the Brief IPQ-DLV. We compared IPs between patients with acute, sub-acute and persistent MSP (1-way ANOVA with Tukey post-hoc tests). Secondly, associations between IPs with pain intensity and physical functioning were assessed (multiple linear regression).

Results: With 658 participants, most IP dimensions showed small differences between acute, sub-acute or persistent pain. For pain intensity, the IP dimensions Consequences, Identity and Comprehensibility explained an additional 13.3% of the variance. For physical functioning, the dimensions Consequences, Treatment Control, Identity and Concern explained an additional 26.5% of the variance.

Discussion/conclusion: Most IP dimensions showed small differences between acute, sub-acute or persistent pain. In addition to some well-known prognostic variables, higher scores on some IP dimensions are associated with higher pain intensity and more limitations in physical functioning in patients with MSP. Longitudinal studies are needed to explore the longitudinal associations.

1. Introduction

Musculoskeletal pain (MSP) is recognized worldwide as a main cause of increased years lived with disability. This illustrates clearly that Musculoskeletal pain (MSP) is a burden on patients as MSP is a major cause of pain and limitations in physical functioning (Vos et al., 2013). These limitations include problems in the mobility of patients but also limitations in the ability to work and problems in actively participating in all aspects of life (March et al., 2014). In addition, MSP is also a burden to society. Direct health care costs, social compensation, retirement pensions, and other indirect costs contribute to this load (Woolf et al., 2012).

Understanding the associations between various patient and disease characteristics in MSP is one important challenge in order to be able to improve the management for MSP and to reduce the burden of MSP, both to patients and society.

Patients' beliefs about their pain, is one of these patient characteristics that may be associated with the intensity of pain and limitations in physical functioning in MSP (de Raaij et al., 2018). Across 15 cross-sectional studies on 9 different musculo-skeletal conditions, the researchers found limited to moderate evidence for a consistent direction of the relationship of illness perceptions with pain intensity and physical function. Higher maladaptive illness perceptions imply stronger pain intensity and more limitation in physical function.

A framework which explores patients' beliefs about their MSP is the Common Sense Model of Self-Regulation of health and illness (Leventhal

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et al., 2016). This CSM is based on a parallel processing model, describing individual representations in response to health threats. These representations are called Illness Perceptions (IPs). Based on initial clinical research, five IP dimensions were identified (Box 1). Ongoing research explored this in more depth and added the dimensions of Timeline Cyclical (periodical changes in symptoms), Comprehensibility (making sense of the illness), Emotional Representations (impact on emotional level) and Concern (anxiousness about the illness) to the CSM (Moss-Morris et al., 2002; Broadbent et al., 2006).

In most MSP cases (i.e. low back pain), a specific cause for the pain cannot be identified and consequently MSP is frequently labelled as non-specific (Hartvigsen, 2018; Carlson and Carlson, 2011). Non-specific MSP can be classified according to the duration of pain as acute (<7 weeks), subacute (7–13 weeks) or persistent (>13 weeks) (Dionne et al., 2008). It is not known whether IPs differ between acute and chronic patients with MSP. Therefore, our first research question was: *Do illness perceptions differ between patients with acute, subacute and persistent musculoskeletal pain?*

A second important topic is to identify prognostic factors for MSP outcomes and there are a few well-known prognostic factors in relation to the ongoing patient burden of MSP: pain intensity, limitations in physical functioning, multiplicity of pain-sites, pain duration and the psychological factors somatization, distress, anxiety and depression (Pincus et al., 2002), (Hartvigsen, 2018), (OSullivan et al., 2016), (Artus et al., 2017), (Nahit et al., 2003). However, little is known about the additional role IPs might play in pain intensity and limitations in physical functioning, up and above the prognostic value of these well-known prognostic factors. Especially in outpatients with MSP attending physical therapy practices this is unknown. In this multicentre explorative cross-sectional study, we hypothesized that higher scores on IPs, in addition to these well-known factors, would be associated with higher pain intensity and limitations in physical functioning in MSP. Therefore, our second research question was: *What is the additional association of illness perceptions with pain intensity or limitations in physical functioning in addition to the independent factors pain sites, pain duration, and the psychological factors somatization, distress, anxiety, and depression in patients with musculoskeletal pain, adjusted for gender and age?*

2. Materials and methods

2.1. Design and setting

This multicentre cross-sectional study took place at 29 primary care physiotherapy clinics across The Netherlands. Physiotherapists at these centres collected the data as part of their Master of Physiotherapy study at University of Applied Sciences Utrecht, The Netherlands Participants were asked to complete several questionnaires prior to their first consultation. Demographic characteristics and clinical variables collected in daily practice included age, gender, pain intensity (PI), and the completed Patient-Specific Functional Scale (PSFS) for limitations in physical functioning. The known prognostic factors of persistent pain were measured with questions about the number of pain sites, pain duration, and the Four-Dimensional Symptom Questionnaire (4DSQ). Finally, illness perceptions (participants' beliefs about their MSP) were measured using the Brief Illness Perception Questionnaire Dutch Language Version (Brief IPQ-DLV).

2.2. Study population

Over a period of three months, all consecutive patients, if eligible, were asked to participate in the study. Included were patients with MSP, aged between 18 and 75 years. Exclusion criteria were the presence of red flags, specific musculoskeletal diseases or physiotherapy treatment within six months prior to the first consultation. The study was approved by the Medical Ethical Committee of the ……..., …… (ref. no. 430002016) and all participating patients signed an informed consent form.

2.3. Measurements overview

In this study, pain intensity (PI) and the Patient-Specific Functional Scale (PSFS) for limitations in physical functioning were the primary outcomes. IPs were the observed exposure variables of primary interest. Based on published research, multiple pain sites, pain duration, and the psychological factors somatization, distress, anxiety, and depression were considered to be important prognostic factors for the persistence of MSP (Pincus et al., 2002), (Hartvigsen, 2018), (OSullivan et al., 2016), (Artus et al., 2017), (Nahit et al., 2003) and were therefore included in this study.

2.4. Pain intensity

To measure the average PI in the last 24 h, we used the Numeric Rating Scale (NRS). This is an 11-point rating scale in which 0 is no pain and 10 the worst pain imaginable (Ferreira-Valente et al., 2011).

2.5. Patient-Specific Functional Scale

Physical functioning was assessed with the PSFS, which is known to be a feasible and reliable instrument (Stevens et al., 2017; Beurskens et al., 1999).

2.6. Multiple pain sites

Participants were asked to register the number of different sites in which they experienced pain. We categorized the outcomes into 2 groups; 1) 1 pain site, 2) $\geq$ 2 pain sites.

2.7. Pain duration

Participants were asked how long their pain had existed prior to consultation. We categorized the outcomes into 3 groups; 1) acute pain <7 weeks, 2) subacute pain 7–13 weeks, 3) persistent pain >13 weeks.

2.8. Psychological measures

The Four-Dimensional Symptom Questionnaire (4DSQ) was used to assess participants' levels of risk for distress, depression, anxiety, and

Box 1
Illness perception dimensions.

1) Identity; the label or name given to the condition by patients and the symptoms that are perceived to go with it.
2) Timeline Chronic; how long the patient believes the illness will last.
3) Consequences; how strong the impact is of patients' illness on e.g. pain or physical functioning.
4) Causal beliefs; patient's beliefs about what causes the illness.
5) Control beliefs; patients beliefs about how to control or recover from the illness.

somatization: it is reported to show good reliability (18). Sum scores were calculated and cutoff points (Terluin et al., 2016) applied to categorize each participant as being at low, medium or high risk (Box 2).

2.9. Illness perceptions

The Brief IPQ-DLV was used as it has acceptable psychometric properties (de Raaij et al., 2012; Hallegraeff et al., 2013). This questionnaire consists of nine questions: eight questions are scored on a 0–10 scale; the ninth question is an open-ended question about the dimension 'Cause'.

2.10. Statistics

Descriptive statistics of demographic variables were reported as mean and standard deviation. Missing value analysis was performed and <5% missing data was assumed to be inconsequential (Schafer, 1999). For sample size in stepwise regression, several rules of thumbs are reported in literature. Ranging from 50 participants +8 - 30 per independent variable. We used a rule of thumb for a minimum sample size of 50 + >30 per independent variable based on the recommendations when expecting small associations (Wilson Van Voorhis and Morgan, 2007). The one-way ANOVA with Tukey post-hoc test was used to examine the differences between the three pain duration groups.

To examine the additional association of illness perceptions with pain intensity or limitation in physical functioning, a multiple linear regression was used. First, age, gender and the well-known prognostic factors were entered as 'fixed' in the model. Second, with univariate association we detected the most promising IPs (defined as those with $p < 0.10$) and added these to the model. We checked on multicollinearity between the IPs, and the distribution of residuals. A variable was considered redundant if its VIF value (indication of multicollinearity) was above 5. Our final model will report if IPs significantly add to the explained variance of pain and physical function, after adjusting for age, gender and well-known prognostic factors.

3. Results

A total of 658 patients were included in this study: their demographic characteristics are reported in Table 1. For the IPs in the univariate association (Table 3) missing value analyses showed that no IPs variable exceeded over 3.8 percent assumed to be inconsequential.

3.1. Differences in illness perceptions and pain duration

Illness perceptions mean scores and standard deviations are reported in Table 2. The total between-groups difference was statistically significant, apart from the IP dimension Comprehensibility. The mean differences between acute pain and subacute pain were significant for two out of eight IP dimensions, namely Timeline and Concern. The mean differences between acute pain and persistent pain were significant for seven out of eight IP dimensions (not Comprehensibility). For subacute pain and persistent pain, the differences were significant for two out of eight IP dimensions, namely Timeline and Identity. Overall, absolute point differences were small, with the largest between-groups points differences, ranging between 1 and 3, being for the IP dimensions Timeline, Concern and Emotional.

Table 1
Demographic characteristics of participating patients **N = 658**.

	Pain duration groups in weeks prior to consultation					
	<7 n = 226		7–13 n = 116		>13 n = 316	
Age years, mean (sd)	44.5	(13.7)	48.8	(13.0)	46.9	(14.6)
Female (%)	134	(63.3)	79	(68.1)	224	(71.0)
Pain duration in weeks mean (sd)	3.2	(1.5)	9.7	(1.8)	181.0	(336.6)
Pain intensity < 24 h 0–10 mean (sd)	5.2	(2.2)	5.0	(2.2)	5.2	(2.4)
Physical functioning 0–10 mean (sd)	6.2	(2.4)	5.9	(2.2)	6.3	(2.2)
≥2 pain sites (%)	25	(11.1)	23	(19.8)	115	(36.4)
Direct access (%)	130	(57.6)	56	(48.7)	118	(37.3)

sd = standard deviation.

3.2. Association of IPs with pain intensity and physical functioning

In Table 3, Univariate associations of IPs with pain intensity and physical functioning are reported. The IP dimensions that were significantly correlated ($p \leq 0.10$) with pain and physical function were added into the multiple linear regressions. The strength of the significant IP dimensions association with pain intensity varies; Identity r = 0.41, Consequences r = 0.36, Concern and Emotional r = 0.28, Timeline r = 0.18, Comprehensibility r = 0.10. Also, the IP dimensions association with physical function varies: Consequences r = 0.48, Identity r = 0.47, Emotional r = 0.32, Concern r = 0.26, Timeline r = 0.23, Treatment control r = −0.16.

3.3. Multiple regression: pain intensity/physical functioning and illness perceptions

For the independent variable pain intensity, the IP dimensions Personal Control and Treatment Control were not univariately significantly correlated and were therefore not added to the model. Also, for physical functioning, the IP dimension Personal Control was not added to the model. No multicollinearity was found between the IPs, and residuals were found to be distributed normally.

3.4. Pain intensity

The multiple linear regression (Table 4) showed 22.9% of explained variance. The IP dimensions Consequences (beta = 0.098), Identity (beta = 0.273) and Comprehensibility (beta = 0.084) were the statistically-significant contributors to pain intensity.

Box 2
Cut off points 4DSQ.

	Distress	Depression	Anxiety	Somatization
Low risk	0 – 10	0 – 2	0 – 3	0 – 10
Medium risk	11 – 20	3 – 5	4 – 9	11 – 20
High risk	21 – 32	6 – 12	10 – 24	21 – 32

Table 2
Comparisons of mean scores on the illness perception dimensions between three pain duration groups

	Mean (sd) per group				Tukey post hoc test					
	1	2	3	Overall	Group 1-2		Group 2-3		Group 1-3	
	< 7 weeks	7 – 12 weeks	≥ 13 weeks	*p*	*p*	*d*	*p*	*d*	*p*	*d*
Consequences	4.4 (2.8)	4.9 (2.7)	5.6 (3.0)	p < 0.005	0.43	- 0.04	0.51	- 0.08	p < 0.005	- 0.12
Timeline	3.3 (2.7)	4.7 (2.9)	6.2 (3.4)	p < 0.005	p < 0.005	- 0.06	p < 0.005	- 0.07	0.00	- 0.07
Personal Control	4.9 (2.5)	5.1 (2.5)	5.2 (2.6)	0.04	0.78	- 0.04	0.38	- 0.08	0.03	- 0.12
Treatment Control	2.5 (1.9)	2.9 (1.9)	3.2 (2.3)	p < 0.005	0.13	- 0.08	0.57	- 0.04	p < 0.005	- 0.12
Identity	5.3 (2.4)	5.3 (2.3)	6.1 (2.4)	p < 0.005	0.98	0.01	p < 0.005	- 0.11	p < 0.005	- 0.11
Concern	3.1 (2.8)	4.0 (2.8)	4.8 (3.0)	p < 0.005	0.01	- 0.07	0.05	- 0.05	p < 0.005	- 0.13
Comprehensibility	3.1 (2.4)	3.6 (2.5)	3.3 (2.5)	0.10	0.18	- 0.16	0.66	0.09	0.42	- 0.06
Emotional	3.8 (2.9)	4.3 (3.0)	4.9 (3.0)	p < 0.005	0.31	- 0.06	0.20	- 0.07	p < 0.005	- 0.13

sd = standard deviation, *p* = statistical significant, *d* = Cohen's *d* effect size.

Table 3
Univariate associations (r) between the illness perceptions and pain intensity or physical functioning.

	Pain Intensity N = 648			Physical Functioning N = 630		
	N	r	*p*	N	r	*p*
IP dimension						
Consequences	635	0.36	p < 0.005	618	0.48	p < 0.005
Timeline	624	0.18	p < 0.005	606	0.23	p < 0.005
Personal Control	633	0.06	0.131	616	0.02	0.590
Treatment Control	626	−0.04	0.319	612	−0.16	p < 0.005
Identity	633	0.41	p < 0.005	616	0.47	p < 0.005
Concern	630	0.28	p < 0.005	613	0.26	p < 0.005
Comprehensibility	623	0.10	0.011	606	−0.10	(0.011)
Emotional	633	0.28	p < 0.005	614	0.32	p < 0.005

N = sample size, IP = Illness Perception.

Table 4
Final model multiple linear regression of illness perceptions on pain intensity and physical functioning.

Illness perception dimensions	R^2	Changed[a] R^2	effect	95% CI	SE	*p*
Pain intensity N = 607	22.9%	13.3%				
Consequences			0.098	(0.005, 0.192)	0.127	0.04
Identity			0.273	(0.167, 0.378)	0.285	<0.005
Comprehensibility			0.084	(0.016, 0.152)	0.092	0.02
Physical functioning N = 588	32.2%	26.5%				
Consequences			0.283	(0.194, 0.372)	0.368	<0.005
Treatment Control			- 0.113	(-0.194, −0.033)	- 0.107	0.01
Identity			0.240	(0.139, 0.340)	0.255	<0.005
Concern			- 0.108	(-0.185, −0.030)	- 0.143	0.01

[a] = changed explained variance after adding illness perceptions to the model effects adjusted for Age, Gender, ≥ 2 pain sites, pain duration, risk of: Distress, Depression, Somatization, and Anxiety only significant illness perceptions are reported.

In the first step (where the confounders and prognostic factors were entered into the model), the explained variance was 9.6%. This means that an additional 13.3% of the variance was explained by adding the IPs to the model.

3.5. Physical functioning

The multiple linear regression (Table 4) showed 32.2% of explained variance. The IP dimensions Consequences (beta = 0.283), Identity (beta = −0.113), Treatment Control (beta = 0.240) and Concern (beta = −0.108) were the statistically-significant contributors to physical functioning. In the first step (where the confounders and prognostic factors were entered into the model), the explained variance was 5.7%. This means that an additional 26.5% of the variance was explained by adding the IPs to the model.

4. Discussion

To our knowledge, this is the first multicentre study of IPs in patients with MSP in primary care physiotherapy. Our findings enhance the understanding of IPs as possible associating factors with pain intensity and limitations in physical functioning in MSP.

4.1. Illness perceptions and pain duration

Our results show most IPs being significantly different between the pain-duration groups of acute, subacute and persistent pain. However, looking at the absolute mean differences between pain-duration groups, most IPs show no relevant difference apart from the IP Timeline. This invites the hypothesis that, the longer a patient experiences MSP, the higher the score on the IP Timeline will be. None of the other IP dimensions exceeded the smallest detectable change of 2.5 (de Raaij et al., 2012). Therefore, the differences according to pain duration in most IPs are not clinically relevant. This might indicate that high scoring (maladaptive) IPs are equally important for patients with acute, sub-acute and persistent pain. This is supported by qualitative research about perceptions, such as vulnerability, and poor prognoses for back pain (Darlow et al., 2015). In this study, patients shared the same beliefs

about their pain condition despite having acute or persistent pain. Though caution in the interpretation of the results is required, due to recall bias (Grimes and Schulz, 2002) and the cross-sectional design, we see possible implications for the management of MSP.

First, if maladaptive IPs contribute to the burden of MSP, screening for these in patients with acute or sub-acute MSP might be advised and could be done by using validated questionnaires (Moss-Morris et al., 2002)((Broadbent et al., 2006; de Raaij et al., 2012). Second, considering IPs could be a supplementary procedure to the use of risk stratification tools, such as the Keele STarT MSK Tool or STarT Back Screenings Tool (Hill et al., 2008), (Bier et al., 2017) for predicting poor recovery from MSP. In this way, the assessment of IPs might contribute to the identification of possible relevant psychosocial risk factors for poor recovery from MSP.

4.2. Illness perceptions and pain intensity

The IP dimensions Consequences, Identity and Comprehensibility explained an additional 13.3% to the initially-explained variance for pain intensity. As this is a rather substantial increase, this might imply that these IPs could potentially be relevant for the management of these patients. For instance, if a patient with MSP shows maladaptive IPs, such as '*My condition has a high impact on my daily life*' or '*I don't understand where my pain comes from*', these IPs could be risk factors for poor recovery and therefore should be assessed. Also, identifying maladaptive IPs opens opportunities for treatment options in trying to change these perceptions. To our knowledge, no studies have to date researched associations of IPs with pain intensity, or the changing of maladaptive IPs, within primary physiotherapy care (de Raaij et al., 2018). Consequently, we recommend further research to explore the possibilities of identifying IPs as risk factors and to study the feasibility of changing maladaptive IPs.

4.3. Illness perceptions and limitations in physical functioning

For physical functioning, the additional explained variance of the IP dimensions Consequences, Timeline, Personal Control, Identity and Emotional Representations was 26.5%. This could mean that these IPs are potentially important for clinical practice. This is in line with the results from a RCT for persistent low back pain. A total of 10–14 h of cognitive treatment of IPs by occupational therapists resulted in statistically-significant and clinically-relevant improvements in patient-relevant physical activities at 18 weeks (Siemonsma et al., 2013). Included were patients with persistent LBP of, on average, more than one year's duration. We know of no intervention studies targeting high IP scores within a population having less than one year's MSP. We recommend further exploration of the feasibility of changing IPs by physiotherapists for improving patients' physical functioning, not only for persistent LBP but also for acute and sub-acute LBP.

4.4. Limitations and strengths

First, the cross-sectional design prevents a causal interpretation of the findings. The main aim of this study, however, was to explore whether IPs and, if so, which IPs were associated with pain intensity and physical functioning. Secondly, despite the large and geographically wide-ranging sample in the Netherlands, selection bias may exist since there is no information available regarding patients that did not sign an informed consent form and were therefore not included in this study. Thirdly, bias on the outcomes of pain duration cannot be excluded since these rely on the recall of the patients, which has been found to be unreliable. Patients with persistent MSP have to search further back in their memory than those with acute MSP, thereby producing less reliable data (Grimes and Schulz, 2002). Fourthly, the well-known prognostic factors did not contribute to the model. This may be explained by the fact that we chose well-known prognostic factors from studies on chronicity of MSP. We did not find studies on prognostic factors for pain intensity in MSP so we hypothesized that prognostic factors for chronicity might also be factors that mediate in the association of IPs with pain intensity and physical functioning. Our findings suggest that most prognostic factors for chronicity of MSP do not mediate the association between IPs, pain intensity and physical functioning.

A major strength of our study is its multicentered basis in the primary care setting throughout the Netherlands. This means that the MSP population in this research can be compared with patients attending any general physiotherapist in the Netherlands, and results can be generalized to the Dutch MSP patients visiting physiotherapists. Secondly, for prognostic studies, Hayden et al. proposed a three-phase framework: "Phase 1, identifying associations; Phase 2, testing independent associations; and Phase 3, understanding prognostic pathways" (Hayden et al., 2008). We have performed the first Phase 2 study exploring the cross-sectional independent association of IPs with pain intensity and physical functioning in primary physiotherapy care. We recommend further exploration of these pathways in a Phase 3 explanatory study, where IPs are explored longitudinally for their predictive value for pain intensity and physical functioning.

4.5. Practical implications

Maladaptive beliefs about MSP may contribute to pain intensity and limitations in physical functioning. Higher IP scores on Consequences, Identity and Comprehensibility were associated with higher pain intensity. Higher IP scores on Consequences, Treatment Control, Identity and Concern were associated with greater limitations in physical functioning. Due to the cross-sectional design of our study, a causal interpretation is not possible in patients with MSP, but this has already been shown in cohorts of patients with persistent pain from repetitive strain injury (Sluiter and Frings-Dresen, 2007) and low back pain (Bishop et al., 2015). This highlights the therapeutic potential of targeting higher IP scores and trying to alter maladaptive IPs to more favourable, adaptive, ones. Changing IPs is not only relevant for alleviating the burden of MSP, but also for reducing dependence on physiotherapy treatment. Higher scores on IPs are associated with more frequent use of physiotherapy (Opseth et al., 2017). Finally, our study calls for a Phase 3 explanatory study in which the IPs are explored longitudinally for their predictive value on pain intensity and physical functioning.

5. Conclusion

Most IP dimensions showed small differences between acute, sub-acute or persistent pain. In addition to some well-known prognostic factors, some higher scores in IP dimensions are associated with higher pain intensity and more limitations in physical functioning in patients with MSP. Longitudinal studies are needed to indicate the direction of the association.

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Review board or Ethics Committee approval

Medical Ethical Committee of the University of Applied Sciences Utrecht (ref. no. 430002016)

Declaration of competing interest

The authors have no conflicts of interest to declare.

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