ORIGINAL ARTICLE

Illness perceptions and illness behaviours in back pain: A cross-sectional cluster analysis

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Abstract

Background: Individuals' perceptions of back pain may shape what they do in response to manage their pain, for example, self-care, medication and seeking healthcare. Illness perceptions encompass a variety of beliefs such as how long pain is expected to last and whether treatments are perceived to control pain. Whether these beliefs meaningfully cluster and whether these clusters are associated with how people manage their back pain are currently unknown.

Methods: 1,343 individuals with back pain from a general population sample completed the brief Illness Perceptions Questionnaire and measures about their pain and illness behaviours. Using a two-stage cluster analysis, we identified four distinct clusters of individuals. Logistic regression was used to investigate relationships between cluster membership and illness behaviours.

Results: After adjustment for socio-demographic characteristics, pain severity, interference and duration, relative to a low threat illness perception cluster, a high threat cluster was more likely to have contacted a general practitioner (OR: 3.03, 95% CI: 1.75, 5.23) and a moderate threat–high treatment control cluster was more likely to have consulted a physical therapist (OR: 2.21, 95% CI: 1.26, 3.87). Both the moderate threat–high treatment control cluster and high threat cluster were also less likely to have reported self-care (OR: 0.64, 95% CI: 0.43, 0.95; OR: 0.53, 95% CI: 0.34, 0.83, respectively).

Conclusions: The cluster analysis provided a meaningful classification of individuals based on their cognitive illness perceptions of their back pain, as these clusters were associated with different illness behaviours. Interventions which modify clusters of illness perceptions may be effective in influencing how individuals respond to back pain.

Significance: Within a general population setting, we identified four clearly distinct groups of people based on the perceptions they held about their back pain. These groupings seemed to reflect meaningful characterisations as they differed based on the characteristics of their pain (e.g., severity and duration) and, after adjustment for these characteristics, were associated with different ways of managing pain. Interventions which focus on targeting the sets of illness perceptions that people hold may be effective in influencing how individuals manage back pain.

1 | INTRODUCTION

Back pain is a "nearly ubiquitous part of human experience" (Deyo, 1996). It is the primary cause globally of years lived with disability (Vos et al., 2016) and carries with it substantial direct and indirect costs (Hartvigsen et al., 2018). However, for the majority, prognosis is positive, and primary care guidelines for back pain management emphasise the importance of providing early reassurance and advice about self-care behaviours (Van Tulder et al., 2006). Reassurance about back pain focusses on providing explanations about "the benign nature of their symptoms... the good prognosis during the next weeks and months, and that pain will be resolved spontaneously in the majority of patients", as well as advice about the importance staying active (Hasenbring & Pincus, 2015; Van Tulder et al., 2006).

Providing information and advice about back pain ultimately aims to influence individuals' perceptions of their pain and how people respond to or manage their pain, in order to ultimately improve symptoms and lessen their impact (Coia & Morley, 1998). Successfully influencing individuals' perceptions of back pain may represent one way in which education about back pain affects how people manage their pain. This model of influence resonates with the common-sense model (CSM) of self-regulation where cognitive perceptions of illness (beliefs about an illness's consequences, timeline, control/cure, identity and cause) are framed as important drivers of different coping responses (Leventhal et al., 2007, 2016).

However, few studies have investigated whether the perceptions an individual has of their pain are associated with different ways of managing pain, and these studies have focussed on the role of individuals' beliefs about back pain's consequences and fear-avoidance beliefs (Morton et al., 2019). Instead, it is possible that a broader set of cognitive perceptions about back pain may be important in shaping how individuals manage back pain (e.g., those described within the CSM). Furthermore, understanding the set of different perceptions that an individual holds about their pain may provide a deeper understanding of why different people respond to illness in different ways (Clatworthy et al., 2007). Identifying groups of individuals with similar sets of perceptions (illness schemas) more closely reflects early CSM research which focused on describing individuals' illness schemas qualitatively, as opposed to more recent research which has focused on summarising a given population's score on one illness perception domain (e.g., a population's mean score on a measure of pain's expected duration) (Clatworthy et al., 2007). In line with other musculoskeletal conditions, it is possible that different groups of people with back pain could be identified by the set of their illness perceptions, and these sets may have unique implications for illness-related outcomes, including treatment

response and illness behaviours (Hobro et al., 2004; Norton et al., 2014).

The current study aims to investigate whether individuals' cognitive perceptions of back pain are associated with different illness behaviours for back pain by:

- exploring the classification of individuals based on a set of cognitive illness perceptions; and
- investigating unique relationships between any identified classifications and specific illness behaviours.

2 | METHODS

2.1 | Design and setting

The Understanding Symptom Experiences Fully (USEFUL) study was a general population-based observational study which aimed to understand individuals' experiences, interpretations of, and responses to symptoms which are potentially indicative of four types of cancer (colorectal, lung, breast, upper gastrointestinal tract) in the UK general population (Hannaford et al., 2020). This study was developed with reference to the CSM and two other process models of responses to symptoms. The sample was drawn from individuals registered with 21 general practitioner (GP) practices in Scotland and England in 2015 and the survey was sent to over 50,000 men and women aged 50 years and older. Ethical approval for the USEFUL study was provided by NRES Committee East Midlands-Derby (14/EM/1124), and individuals provided their consent to take part in the study. The analysis presented within this manuscript represents a secondary analysis of the baseline questionnaire.

2.2 | Participants

16,778 individuals responded to the survey, and 7,212 individuals (43%) reported experiencing 'back or joint pain' within the previous month. Of those who reported 'back or joint pain' within the previous month, 4,657 (28% of total respondents) reported that their 'back or joint pain' was their most bothersome symptom that month. The current analysis aimed to identify a subset of respondents who had back pain specifically, rather than joint pain in another location, by coding responses to the questions, "What did you think this symptom was?" and, "Please list in order the most important factors that you believe caused your symptom." If any of the following terms were used, an individual's pain was assumed to be, at least partly, in their back: back, disc*, [ankylosing] spondylitis, spin*, sciatic*, stenosis, cauda equina, lumbar, scoliosis, vertebrae, facet joint, lumbago, coccyx, sacroil*, fibromyalgia, posture, bending. Coding

using these terms resulted in 1,399 participants with pain in their back.

2.3 | Measures

2.3.1 | Socio-demographic factors

The questionnaire asked about individuals' gender, age, employment status (full-time, part-time, self-employed, retired, not in paid employment), household income (eight income bands) and highest completed level of education (no qualification, secondary school, college/vocational, professional, degree/postgraduate).

2.3.2 | Symptom information

The questionnaire asked about different physical symptoms that individuals had experienced in the previous month—one of which was 'back or joint pain'. For each symptom that individuals had experienced, they indicated for how long the symptom had lasted. Responses were coded to three levels (1–6 days, 1–4 weeks, ≥1 month) when the final dataset for the study was developed. For each symptom that individuals had experienced, they were asked to think to when each symptom was at its worst in the last month and to rate (on 5-point Likert scales) the severity of the symptom (very mild to very severe) and how much the symptom had impacted day-to-day activities (not at all to extremely), the latter reflecting a measure of symptom interference. These responses

were coded to three levels (low/medium/high) when the final dataset for the study was developed.

2.3.3 | Illness perceptions

The Illness Perception Questionnaire (IPQ) assesses five domains of an individual's cognitive illness perceptions (consequences, timeline, control/cure, identity, cause), how well individuals feel they understand their illness (coherence), their level of concern associated with it (illness concern) and how much they were affected emotionally by the illness (emotional representation)—all of which are factors which may be important determinants of coping responses, as hypothesised within the CSM (Weinman et al., 1996). A revised version of the IPQ comprises over 80 items and within some situations is therefore prohibitively long (Broadbent et al., 2006). The brief Illness Perception Questionnaire (bIPQ) can be used as an alternative in these situations—each illness perception domain is assessed by a single item. The bIPQ has been demonstrated to have good test–retest reliability, concurrent validity and predictive validity (Broadbent et al., 2006). For the current study, individuals were asked to choose the one symptom which bothered them the most in the previous four weeks and to complete the bIPQ about this symptom. The bIPQ asks about the cognitive illness perceptions described above, as well as Coherence, Illness Concern and Emotional Representation. The wording of each item as used in the USEFUL Study is provided in Table 1. Individuals responded to each bIPQ item using an 11-point Likert scale (values 0–10). Responses were coded so that a

TABLE 1 Wording of bIPQ items as used in the USEFUL study questionnaire

Illness perception domain	Questionnaire item	Low and high score interpretations
Consequences	*How much did this symptom affect your life?*	0: no affect at all 10: severely affected my life
Timeline	*How long did you think this symptom would continue?*	0: a very short time 10: forever
Personal control	*How much control did you feel you had over this symptom?*	0: extreme amount of control 10: absolutely no control
Treatment control	*How much control did you think treatment could help this symptom?*	0: extremely helpful 10: not at all
Identity	*How much did you experience other symptoms which you thought were related to this symptom?*	0: no symptoms at all 10: many severe symptoms
Coherence	*How well did you feel you understood this symptom?*	0: understood very clearly 10: didn't understand at all
Illness concern	*How concerned were you about this symptom?*	0: not at all concerned 10: extremely concerned
Emotional representation	*How much did this symptom affect you emotionally? (e.g. Did it make you feel embarrassed, frustrated, anxious, annoyed, scared, upset, depressed, etc.)*	0: not at all affected emotionally 10: extremely affected emotionally

higher value always reflected a more threatening view of illness, e.g., more associated symptoms, less personal control over the symptom, less understanding of the symptom.

2.3.4 | Illness behaviours

For each of the 25 symptoms, participants reported whether they had, in the previous month, taken any of ten different actions (plus an option to write in other behaviours). Of relevance to the current study is whether individuals contacted their GP, consulted a physical therapist (e.g. chiropractor, osteopath, physiotherapist), reported self-care (which reflected reporting either 'self-care/home remedy' or 'did nothing/decided to wait and see' and indicating that they did not consult their GP), looked for information, and took medicine.

2.4 | Analysis

A cluster analysis was used as an approach to classify individuals according to their cognitive illness schema, based on the cognitive illness perceptions that are assessed within the bIPQ: consequences, timeline, treatment control, personal control and identity. A cognitive illness schema therefore represents the set of cognitive perceptions that an individual holds about their symptom/illness. Within the CSM, the cognitive processing and emotional processing of symptoms/illness are hypothesised to happen in parallel within two different processing streams. Actions can be taken in response to the cognitive or emotional representation of the symptom/illness. For this reason, we chose to include only cognitive illness perceptions within the cluster analysis. Emotional representation, illness concern and coherence were analysed separately. A previous Monte Carlo study of different clustering methods, specifically for identifying clusters based on individuals' illness perceptions, identified a two-stage method (using a Ward's hierarchical method to identify the number of clusters, followed by a K-means analysis using cluster centroids determined by the Ward's analysis) as the clustering method with the highest rate of accurately classifying individuals within 420 artificial datasets (Clatworthy et al., 2007). This method was used within the current study, and the cluster analysis was conducted using IBM SPSS Statistics (Version 24). The first step of the analysis, Ward's hierarchical analysis, used squared Euclidean distance as the cluster measure. The dendrogram produced from the Ward's analysis, along with measures of intracluster variation from K-means analyses (produced by specifying $k = 2$–11 clusters), was used to identify the most appropriate number of clusters. The number of chosen clusters was then used within the K-means analysis, using the initial cluster centroids which were generated by the Ward's analysis. There is no specific

criterion for identifying the most appropriate number of clusters (Field, 2000), and the Ward's analysis dendrogram and K-means graph were used to identify a number of clusters which did not lead to a large, relative increase in the rescaled cluster distance measure (in the case of the dendrogram), and which led to a clear, relative decrease in the amount of intracluster variation (in the case of the K-means graph). For the latter, intracluster variation was plotted as a function of $k = 2$–11 clusters and inspection of the inflection point was taken to indicate that the rate of intracluster variation reduction per added cluster had declined. Using this method, every case is assigned to a cluster. Complete data on the variables used within the cluster analysis are also required, and the cluster analysis was therefore conducted using illness perception data from 1,343 people from the back pain sample who had complete data on these variables.

Once individuals' cluster membership was determined, clusters were described in terms of their sociodemographic and pain characteristics. Overall and intercluster differences were assessed using chi-squared and Kruskal–Wallis tests as appropriate (inter-cluster differences Bonferroni adjusted). Associations between identified cognitive illness schemas and illness behaviours were investigated using logistic regression analyses. Relationships between individuals' coherence of pain, illness concern, emotional representation and illness behaviours were also investigated. Socio-demographic characteristics (gender, age, level of education and income) and pain characteristics (duration, severity, disability/interference) have previously been shown to be associated with healthcare use for musculoskeletal conditions including back pain (Chevan & Riddle, 2011; Ferreira et al., 2010). Within the CSM, socio-demographic characteristics and symptom characteristics reflect the socio-cultural context and situational stimuli, respectively, which inform individuals' illness perceptions (Hagger et al., 2017). As the aim of this analysis was to understand 'unique relationships between any identified classifications and specific illness behaviours', we adjusted for participants' age, gender, employment status, highest completed level of education, and income within the analyses in order to remove variance in the outcome variables potentially attributable to these factors. This component of the analysis was conducted using Stata (Version 14).

3 | RESULTS

3.1 | Participant characteristics

The sample of persons reporting back pain as their most bothersome symptom ($n = 1,399$) was mostly female (57%) and had a median age of 64 (IQR = 57–71). Over half (54%) were retired, and 35% were working part-time, full-time or self-employed. Over half (55%) had completed some form

of training (e.g., vocational) or had completed a graduate or post-graduate degree. Only 2% of individuals reported low pain severity; low and moderate pain severities were therefore combined into one group. Most individuals had had their back pain for at least one month (72%) and reported mild-moderate pain severity (52%), while 44% and 42% reported medium and high levels of pain interference on daily activities, respectively.

3.2 | Cluster analysis

Assessing the Ward's analysis dendrogram and the graph of intracluster variation from the K-means analyses indicated that describing the sample in terms of three or four cognitive illness schema clusters seemed to be the most parsimonious clustering solutions (Figures S1 and S2). However, the four-cluster solution was selected by consensus of investigators as it meaningfully distinguished between two groups of participants from a large single cluster within the three-cluster solution based on the treatment control item (for further details, see Figures S3 and S4).

The clusters clearly diverged on consequences, timeline, treatment control and identity within the four-cluster solution (Figure 1). The defining features of Cluster 1 were relatively low scores on consequences, timeline and identity, and

therefore reflected a 'low threat' schema. Cluster 4 scored comparatively highly on all these measures and therefore reflected a 'high threat' schema. Cluster 2 also scored highly on consequences and timeline but was defined by a key distinction on the measure of treatment control—individuals within Cluster 2 held strong beliefs that treatments were helpful in controlling their pain, reflecting a 'moderate threat–high treatment control' schema. Cluster 3 reflected moderate beliefs about the negative consequences of pain on their life, despite having long timeline expectations and low perceptions of both personal and treatment control and therefore reflects a 'moderate threat–low control' schema. Each cluster is described in terms of its socio-demographic and pain characteristics (Table 2) which indicates that clusters differed based on these characteristics.

3.3 | Relationships between cognitive illness schemas and illness behaviours

The low threat schema was used as the reference group within each logistic regression analysis. After adjusting for pain-related characteristics (severity, interference, duration) and socio-demographic variables, cognitive schemas were associated with different illness behaviours (Table 3). For outcomes related to seeking healthcare, individuals within
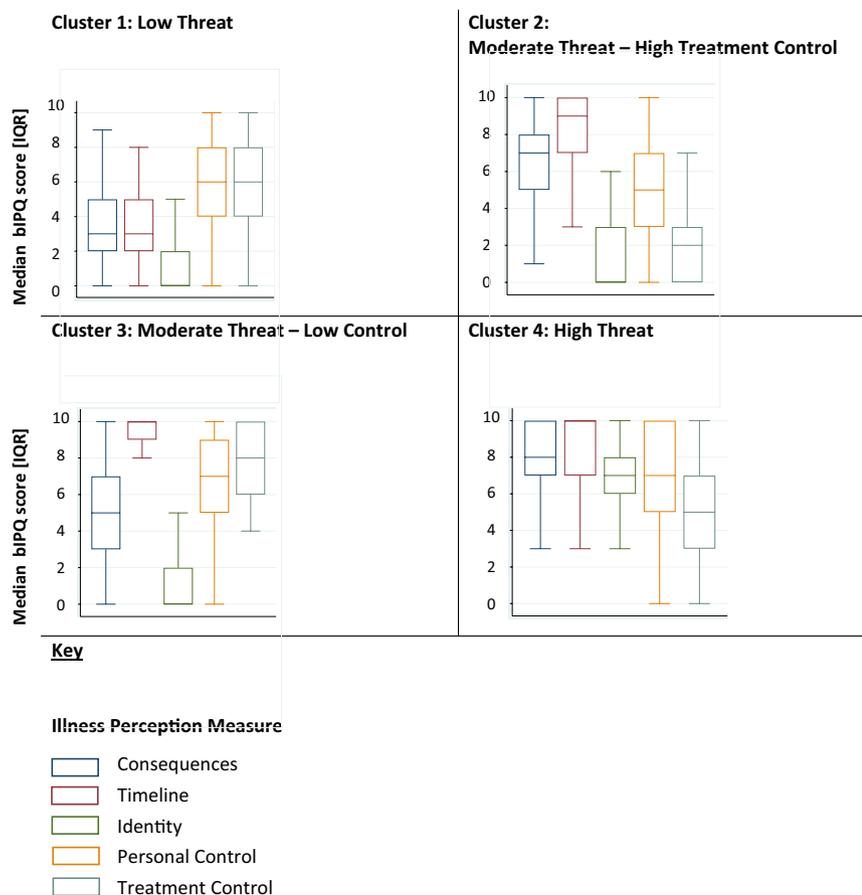
FIGURE 1 Median (IQR) cognitive illness perception scores on the brief Illness Perception Questionnaire, stratified by cognitive illness schema cluster

TABLE 2 Characteristics of the back pain sample, stratified by cognitive illness schema

	Frequency n (%)				
	Cluster 1, low threat n = 369	Cluster 2, moderate threat–high treatment control n = 300	Cluster 3, moderate threat–low control n = 315	Cluster 4, high threat n = 359	χ²/Kruskal–Wallis (as appropriate)
Gender	4			1	p < .001
Female	186 (50.4)	178 (59.3)	171 (54.3)	227 (63.2)	
Male	183 (49.6)	122 (40.7)	144 (45.7)	132 (36.8)	
Age	2,3	1	1		p < .05
Median [IQR]	63 [55–68]	65 [58–71]	65 [57–71]	63 [57–70]	
Completed education	2,4	1	4	1,3	p < .001
No qualification	21 (5.7)	38 (12.7)	30 (9.5)	44 (12.3)	
Secondary school	98 (26.6)	102 (34.0)	93 (29.5)	148 (41.2)	
College/vocational	17 (4.6)	14 (4.7)	10 (3.2)	20 (5.6)	
Professional	118 (32.0)	82 (27.3)	80 (25.4)	78 (21.7)	
Degree/postgraduate	114 (30.9)	58 (19.3)	96 (30.5)	60 (16.7)	
Missing	1 (0.3)	6 (2.0)	6 (1.9)	9 (2.5)	
Employment status	2,3,4	1,4	1,4	1,2,3	p < .001
Full-time	103 (27.9)	58 (19.3)	65 (20.6)	52 (14.5)	
Part-time	50 (13.6)	24 (8.0)	25 (7.9)	25 (7.0)	
Self-employed	26 (7.0)	18 (6.0)	22 (7.0)	17 (4.7)	
Retired	175 (47.4)	174 (58.0)	182 (57.8)	188 (52.4)	
Not in paid employment	12 (3.3)	22 (7.3)	17 (5.4)	70 (19.4)	
Missing	3 (0.8)	4 (1.3)	4 (1.3)	7 (1.9)	
Symptom duration	2,3,4	1,4	1,4	1,2,3	p < .001
Short	159 (43.1)	33 (11.0)	34 (10.8)	15 (4.2)	
Medium	68 (18.4)	18 (6.0)	16 (5.1)	10 (2.8)	
Long	136 (36.9)	247 (82.3)	257 (81.6)	322 (89.7)	
Missing	6 (1.6)	2 (0.7)	8 (2.5)	12 (3.3)	
Worst severity	2,3,4	1,4	1,4	1,2,3	p < .001
Low/medium	297 (80.5)	162 (54.0)	198 (62.9)	88 (24.5)	
High	59 (16.0)	127 (42.3)	103 (32.7)	238 (66.3)	
Missing	13 (3.5)	11 (3.7)	14 (4.4)	33 (9.2)	
Worst daily activity interference	2,3,4	1,3,4	1,2,4	1,2,3	p < .001
Low	68 (18.4)	23 (7.7)	41 (13.0)	0	
Medium	248 (67.2)	127 (42.3)	157 (49.8)	66 (18.4)	
High	43 (11.7)	143 (47.7)	105 (33.3)	270 (75.2)	
Missing	10 (2.7)	7 (2.3)	12 (3.8)	23 (6.4)	

Note: Superscripts ([1,2,3,4]) indicate significant differences between a given cluster and the cluster specified by the superscript text

the high threat schema (relative to the low threat schema) were more likely to consult a GP (OR: 3.03, 95% CI: 1.75, 5.23), while individuals in the moderate threat–high treatment control schema were more likely to have consulted a physical therapist (OR: 2.21, 95% CI: 1.26, 3.87). Individuals in each of these cognitive schema groups who were more likely to seek professional care were also less likely to have reported self-care (e.g., home remedy) (moderate threat–high treatment control, OR: 0.64, 95% CI: 0.43, 0.95; high threat, OR: 0.53, 95% CI: 0.34, 0.83).

TABLE 3 Associations between illness schemas, perceptions and illness behaviours

	Illness behaviour—crude		Illness behaviour—adjusted[a]	
	OR	95% CI	OR	95% CI
	Consulted GP		**Consulted GP**	
Low threat (ref)	1.00	—	1.00	—
MTHTC	2.87	1.87, 4.41	1.36	0.79, 2.34
MTLC	1.45	0.91, 2.31	0.69	0.39, 1.23
High threat	6.77	4.54, 10.08	3.03	1.75, 5.23
Coherence	1.05	1.00, 1.09	1.08	1.03, 1.14
Illness concern	1.33	1.27, 1.39	1.24	1.17, 1.32
Emotional rep.	1.24	1.20, 1.30	1.15	1.09, 1.22
	Consulted physical therapist		**Consulted physical therapist**	
Low threat (ref)	1.00	—	1.00	—
MTHTC	1.83	1.16, 2.88	2.21	1.26, 3.87
MTLC	0.70	0.41, 1.21	0.79	0.42, 1.47
High threat	1.29	0.81, 2.04	1.64	0.87, 3.10
Coherence	1.00	0.94, 1.06	0.98	0.91, 1.05
Illness concern	1.09	1.03, 1.14	1.12	1.04, 1.20
Emotional rep.	1.05	1.00, 1.11	1.05	0.98, 1.12
	Looked for information		**Looked for information**	
Low threat (ref)	1.00	—	1.00	—
MTHTC	1.09	0.65, 1.82	0.83	0.44, 1.55
MTLC	0.85	0.49, 1.45	0.70	0.38, 1.30
High threat	1.98	1.26, 3.10	1.75	0.94, 3.24
Coherence	1.10	1.03, 1.15	1.11	1.05, 1.18
Illness Concern	1.13	1.07, 1.19	1.13	1.06, 1.21
Emotional Rep.	1.15	1.10, 1.22	1.16	1.07, 1.24
	Self-care (e.g., home remedy and wait-and-see)		**Self-care (e.g., home remedy and wait-and-see)**	
Low threat (ref)	1.00	—	1.00	—
MTHTC	0.38	0.28, 0.52	0.64	0.43, 0.95
MTLC	0.72	0.53, 0.97	1.09	0.74, 1.60
High threat	0.20	0.14, 0.27	0.53	0.34, 0.83
Coherence	1.00	0.97, 1.04	0.99	0.94, 1.03
Illness concern	0.82	0.79, 0.85	0.88	0.84, 0.92
Emotional rep.	0.83	0.81, 0.86	0.90	0.86, 0.94
	Took medicine		**Took medicine**	
Low threat (ref)	1.00	—	1.00	—
MTHTC	1.79	1.31, 2.44	1.07	0.72, 1.58
MTLC	1.13	0.84, 1.53	0.76	0.52, 1.11
High threat	2.90	2.13, 3.94	1.23	0.79, 1.93
Coherence	0.97	0.93, 1.01	0.96	0.92, 1.01
Illness concern	1.12	1.10, 1.16	1.02	0.97, 1.07
Emotional rep.	1.14	1.10, 1.18	1.06	1.01, 1.11

Note: Abbreviations: CI, confidence interval; GP, general practitioner; High threat, Cluster 4; Low threat, Cluster 1; MTHTC, moderate threat–high treatment control, Cluster 2; MTLC, moderate threat–low control, Cluster 3; OR, odds ratio.

[a]Associations adjusted for age, gender, education, employment, income pain severity, interference and duration.

The level of understanding individuals felt they had of their symptom (coherence), their concern about it (illness concern), and the degree that they were affected emotionally by their symptom (emotional representation) were also each associated with different illness behaviours (Table 3). With regard to consulting a healthcare professional, having less of a sense of understanding their back pain (coherence; OR: 1.08, 95% CI: 1.03, 1.14), more illness concern (OR: 1.24, 95% CI: 1.17, 1.32), and pain having a greater effect on emotions (emotional representation; OR: 1.15, 95% CI: 1.09, 1.22) were each associated with being more likely to have consulted a GP. Each of these were also associated with having been more likely to have looked for information from family/friends or online. Individuals who were more concerned about their pain were also more likely to consult a physical therapist (OR: 1.12, 95% CI: 1.04, 1.20). Individuals who were more concerned (illness concern) and who were also more affected emotionally by their pain (emotional representation) were also less likely to have reported self-care (OR: 0.88, 95% CI: 0.84, 0.92; OR: 0.90, 95% CI: 0.86, 0.94, respectively).

4 | DISCUSSION AND CONCLUSIONS

4.1 | Summary of main findings

This is the first study to quantitatively investigate relationships between cognitive illness perception schemas of back pain and specific illness behaviours. Four distinct cognitive illness schemas were identified based on individuals' cognitive perceptions of their back pain. The four identified schemas reflected meaningful classifications of individuals' perceptions of their back pain, as not only were clusters of perceptions identified, but they were also shown to be associated with different healthcare-seeking and self-care behaviours. Schemas which reflected higher degrees of perceived threat related to back pain were associated with being more likely to have consulted a GP or physical therapist and less likely to have reported self-care. A sense of not understanding their pain, being concerned about it, and pain having a greater impact on emotions were also each associated with being more likely to seek healthcare from a GP, to look for information, and with being less likely to report self-care, highlighting the importance of both cognitive and emotional illness perceptions in relation to specific coping behaviours.

4.2 | Strengths & limitations

The current study provided an in-depth assessment of the cognitive illness perceptions of a large sample of individuals

from a general population setting. It used a tool to measure illness perceptions with defined constructs which has been informed by substantial theory development (Broadbent et al., 2006), rather than single items or belief questionnaires which only measure one dimension of beliefs that an individual might hold about back pain. The original version of the bIPQ is reliable and valid; however, the specific psychometric properties of the version used in the current study were not tested.

This study investigated specific illness behaviours as forms of problem-focused coping (Hagger et al., 2017). Using these specific behavioural outcomes extends other work which has often used vague outcomes like general healthcare-seeking (rather than healthcare-seeking from different, specific providers) or general coping scales. Additionally, it extends work within the back pain literature as a paucity of quantitative research in this setting has investigated the possible determinants of self-care behaviours, information-seeking and healthcare-seeking for back pain (Morton et al., 2019).

This study aimed to describe the perceptions of individuals who were very likely to be experiencing pain in their back, rather than musculoskeletal pain in another location. The coding of individuals based on responses to the questions, "What did you think this symptom was?" and, "Please list in order the most important factors that you believe caused your symptom." was therefore restrictive and only identified individuals who identified their pain as being specifically in their back. Furthermore, our sample was limited to individuals ages 50 and over, and therefore, the schemas identified do not necessarily reflect the cognitive schemas of younger individuals experiencing back pain.

While the current research questions were approached within the framework of the CSM, the cross-sectional nature of this study is at odds with the inherently dynamic processes involved in one's illness perceptions and behaviour that the CSM aims to describe. Studies on illness perceptions and behaviour have often been limited to cross-sectional designs (Wyke et al., 2013). Indeed, it is possible that the behaviours that individuals reported within the current study influenced their illness perceptions, and this would be coherent with the feedback loop proposed within the CSM where individuals' perceptions are continuously updated in response to the outcomes of actions taken in response to them. For example, the individuals in the high threat cluster of illness perceptions may have developed a more threatening schema of their pain as a result of their consultation with a GP (e.g., referrals for diagnostic imaging or explanations which describe pain as a form of 'wear and tear' may serve to increase the perception of threat). Additionally, while our approach focussed on identifying groups based on their cognitive illness perceptions for the reasons outlined in the Methods section, other approaches are possible which incorporate emotional illness perceptions (e.g., Frostholm et al., 2018). The approach

taken in the current analysis allowed for an understanding of which behaviours are associated with cognitive and emotional processing of illness respectively (and acknowledges that responses may differ in response to each of these), while analyses which include both cognitive and emotional perceptions in a cluster analysis describe groups of individuals who score similarly on both aspects.

4.3 | Comparison with existing literature

The findings from the cluster analysis resonate with recent work in the back-pain literature which has aimed to identify distinct subgroups of individuals based on different trajectories of back pain (Kongsted et al., 2016). In their review, Kongsted et al., (2016) identified that most longitudinal studies have identified four or five distinct trajectory patterns (Kongsted et al., 2016). It is possible that the four cognitive schemas identified within the current analysis may reflect the perceptions of individuals within some of these previously identified pain trajectories. For example, the consistent identification of a 'persistent severe' group across multiple cohort studies may mirror the snapshot of individuals within the high threat cluster in the current analysis.

Additionally, a recent cluster analysis of patients with chronic pain who were clustered according to a variety of psychological variables (e.g., kinesiophobia and pain acceptance) also identified four clusters (McNaughton et al., 2018). Two other studies which also took a cluster analytic approach within the musculoskeletal literature identified low and high threat groups, (termed 'positive' and 'negative' and 'adaptors' and 'non-adaptors' respectively) (Hobro et al., 2004; Norton et al., 2014). These previously identified groups may overlap with the low and high threat clusters in the current study. However the identification of two further clusters in the current analysis which varied in particular on the measure of treatment control expands these dichotomies and illustrates that more nuanced illness perception schemas can provide insights into the varied ways that people manage and respond to symptoms/illness. For example, there are differences between clusters which seem important in determining the likelihood of consulting a GP versus. a physical therapist.

The current findings highlight that the presentation of symptoms is not likely enough to 'trigger care-seeking', which is instead the result of elaborated representations that individuals form about the meaning and identity of those symptoms (Cameron et al., 1993). Importantly, the study identified that both cognitive schemas and emotional illness perceptions were associated with specific illness behaviours. In instances where the threat of pain is high, cognitively and emotionally one course of action is to seek help, possibly as a means to reduce the impact and threatening nature of pain. In this way, perceptions should not be considered 'misrepresentation'—rather, they are built on the individual's experience and seeking care in response to changes in symptoms or novelty of pain can be thought of as part of a normal process to control perceived threat or worry (Eccleston et al., 2001).

4.4 | Clinical and practical implications

Given illness perceptions are not expected to be static but rather to change both naturally with the course of illness and as a result of specific intervention (e.g., communication with a healthcare professional and health messages), the identified schemas represent clusters of potentially modifiable cognitions. When targeted, these cognitions could lead to changes in these behavioural outcomes of interest. Information and communication about back pain which helps to increase understanding of pain within these domains and helps to reduce individuals' concern about pain may therefore have implications for reducing subsequent consultation rates for back pain and increasing use of self-care strategies. Threatening interpretations of pain, which are more likely when pain is severe, may lead to healthcare consultation as a way to seek reassurance to downregulate negative emotional effects of pain (e.g., pain-related anxiety) (Broadbent, 2010). Clinically, these represent specific factors which may benefit from assessment within a consultation to facilitate explanation of symptoms which may in turn reduce pain-related worry or concern (Pincus & McCracken, 2013). Within the context of the current study, this may be particularly important for individuals who fit within the high threat cluster—appropriate reassurance and explanation of symptoms with self-care advice that fits coherently with explanations may be helpful. However, individuals' perceptions of their symptoms/illness are shaped by personal experience and observations of others' experiences, and this important to consider when discussing individuals' symptoms as "individuals seem to reject input from social sources by virtue of it being inconsistent with personal experience" (Leventhal et al., 2003, p. 56).

4.5 | Conclusions

This study found that a cluster analysis to identify groups of individuals with similar cognitive illness perceptions provided a meaningful way to classify individuals experiencing back pain. These schemas, as well as emotional illness perceptions, remained associated with different illness behaviours after adjustment for socio-demographic and pain-related characteristics, indicating that it may be the interpretation of one's symptoms, rather than solely the presence of certain symptom characteristics, which is important in informing how one responds behaviourally to their pain.

However, studies which test the temporality of these relationships, and the degree that these perceptions can be modified (and how), are needed to assess the true impact that these perceptions have on coping procedures, including illness behaviours, and subsequent illness-related outcomes.

CONFLICTS OF INTEREST

There are no conflicts of interest.

AUTHOR CONTRIBUTIONS

LM conceived the idea for the study and, in conjunction with GJM and MdB, designed the study and wrote the analysis plan. LM undertook data analysis and interpretation, supported by GJM and MdB. The manuscript was written by LM, with contribution from GJM and MdB. All authors reviewed the manuscript for important intellectual content.

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