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What do the numbers mean? Normative data in chronic pain measures

Michael K. Nicholas [a,*], Ali Asghari [a,b], Fiona M. Blyth [a,c]

[a] *Pain Management Research Institute, University of Sydney at Royal North Shore Hospital, Sydney, Australia*
[b] *School of Psychology, University of Shahed, Tehran, Iran*
[c] *School of Public Health, University of Sydney, Sydney, Australia*

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Abstract

Although self-reported measures play a central role in the assessment of pain and its treatment, it has long been recognized that interpretation of these measures is severely limited by the absence of normative data. Despite that, relatively few of the measures used in pain clinics or research studies have normative data for reference. Using a pain centre sample ($n = 6124$), this paper describes the development of a normative dataset on a number of commonly used pain-related measures. The measures cover many of the key dimensions in pain assessment, including pain severity/quality, disability (physical functioning), and mood (emotional functioning). Measures of different cognitive and coping constructs are also included. Mean scores are reported for each measure according to age group, gender, pain site, as well as percentiles for different scores for patients with chronic low back pain. The potential uses for datasets of this type include the assessment and evaluation of individual cases, as well as the interpretation of published clinical trials. It is also argued that future systematic reviews of pain treatments should include consideration of such patient characteristics as pain levels, disability and mood in the studies reviewed rather than pain site and chronicity alone.

Keywords: Chronic pain; Normative data; Assessment; Self-report

1. Introduction

Self-reported measures play a central role in the assessment of chronic pain. As the name implies, normative data represent the performance on a measure or test by a standardization sample against which other performances on the measure can be compared (Anastasi and Urbina, 1997). Lack of normative data limits the interpretation of scores in individual cases as well as in treatment outcome research (as we cannot know if a score is typical, high or low for the population being studied) (Kendall et al., 1999). This has implications for our ability to assess the clinical significance of a score (or change in a score). Although data on some measures with different pain samples are now available (e.g. Kerns et al., 1985; Von Korff et al., 1992; Chibnall and Tait, 1994; Wittink et al., 2006), there is little evidence that the repeated calls for normative data on commonly used measures have been widely heard (e.g. Turk and Melzack, 1992). In Turk and Melzack's (2001) text on pain assessment few measures reported normative data. More recently, in the IMMPACT recommendations on core outcome domains for chronic pain clinical trials (Turk et al., 2003) it was noted that "the next step would be to select measures that meet appropriate psychometric standards (i.e. reliability,

* Corresponding author. Tel.: +612 9926 7318; fax: +612 9926 6548.
E-mail address: miken@med.usyd.edu.au (M.K. Nicholas).

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validity, responsiveness, appropriate, *normative data*)" (p. 338) (italics added). So the quest for normative data is still an active one.

In recent years there been an extensive discourse in the field of clinical epidemiology on the interpretation of test results, including the use of normative data. However, many different views on the nature of norms have been expressed. Sackett et al. (1991) identified six definitions of 'normal' in common clinical use. Definitions of normal have also been queried in the pain field (Cronje and Williamson, 2006). In depression research, there have been repeated calls for normative data on commonly used measures (Kendall et al., 1999). In part, the call for normative data for self-report measures in chronic pain reflects a wider concern with how test data are used in clinical and research settings.

It was in this context that we created a normative dataset derived from patients with chronic noncancer pain presenting for assessment and treatment at a tertiary-referral multidisciplinary pain management centre over 10 years from mid-1994. The dataset includes measures of pain severity, disability (physical functioning), mood (emotional functioning), quality of life, cognitions (beliefs), and coping strategies. These measures cover the first three domains recommended by the IMMPACT groups (Turk et al., 2003; Dworkin et al., 2005), as well as others relevant to the assessment of pain, and they all meet the basic criteria of adequate psychometric properties.

The aims of this initial report are:

(1) To describe the process of establishing this normative dataset.
(2) To provide normative data, according to gender, age and pain site, for a range of self-report measures.
(3) To illustrate, with case studies of patients and selected areas of the pain treatment literature, how a normative dataset might be used in clinical practice and research.

2. Method

2.1. Subjects

From June 1994 to May 2004, a total of 6124 pain patients referred by their treating physicians from across the Australian state of New South Wales (population about 6 million) were seen at the Pain Management and Research Centre at the Royal North Shore Hospital, Sydney, for assessment and treatment. All patients attending this tertiary-referral centre were asked to complete the measures and the normative data set is based on this population.

Of these 6124 patients, 5941 (97%) patients in the sample completed a series of commonly used questionnaires on different dimensions of pain. The numbers of patients varied for different measures as changes were made in the measures used over the data collection period and not all patients completed all measures in the assessment booklet. The remaining183 (3%) did not provide any data for the present study. The main reasons were refusal to complete questionnaires and lack of adequate English proficiency to understand the content of the questionnaires. If more than 10% of items in one questionnaire were not completed then that questionnaire was not included in the normative database. If 10% or less of the items in one questionnaire were not completed the scores were pro-rated (from the 90+% that were completed). Data on age and gender were collected for all patients. The use of the (de-identified) dataset for this study was approved by the Hospital's Ethics Committee.

2.2. Measures

All measures described in this section are self-report scales.

2.2.1. Numerical rating scale (NRS)

Patients reported their present pain intensity as well as their highest, lowest and usual pain intensity over the last week, using NRS. The NRS asks patients to rate their pain intensity on a 0–10 (11-point) scale where 0 indicates "no pain" and 10 means "pain as bad as it could be". The validity of the NRS and its sensitivity to treatment effects have been well documented (Jensen and Karoly, 1992a).

2.2.2. The McGill Pain Questionnaire (MPQ)

The MPQ (Melzack, 1975) measures three dimensions of pain experience: the sensory, the affective and the evaluative dimensions of pain. The sensory dimension (42 items) of pain describes the sensory qualities of the experience in terms of temporal, spatial, pressure, thermal and other properties. The affective dimension (14 items) describes affective qualities of pain in terms of tension, fear and autonomic properties that are part of pain experience. The evaluative dimension (5 items) of pain consists of words that describe the overall intensity of the total pain experience. A further 17 adjectives have been classified under the category of miscellaneous, but these are not included in the present study. The MPQ can be scored in several different ways but the most common method is the Pain Rating Index (PRI). The PRI is based on the order of each adjective in a group. In this scoring system, the first word in each group is given a value of 1, the next one is given a value of 2, and so on. The rank values of the words chosen by a patient are summed to obtain a separate score for each dimension. The maximum possible scores are: Sensory (42), affective (14), and evaluative (5). Higher scores indicate more severe pain. Several studies have documented the reliability and validity of the three dimensions of the MPQ (see Melzack and Katz, 2001).

2.2.3. Roland and Morris Disability Questionnaire (RMDQ)

A slightly modified form of the RMDQ, an instrument developed and validated by Roland and Morris (1983) for assessing the functional impact of back pain, was used to measure current physical disability. As the present study involved a heterogeneous group of chronic pain patients, references to back pain were removed and subjects were asked

to relate the items to their pain, regardless of site. This modified version of the RMDQ has been reported to have good psychometric properties (Jensen et al., 1992b; Asghari and Nicholas, 2001) and in this study Alpha = 0.88.

2.2.4. SF-36 Health Survey Questionnaire

The SF-36 Health Survey Questionnaire (Ware and Sherbourne, 1992) is a general health-related quality of life questionnaire. Thirty-five of the 36 items of the SF-36 measure eight scales representing generic health concepts, considered to be universal and representing basic human functions and well-being. These eight health concepts (and their Alpha values in this study) are Physical Functioning (0.89), Role Function-Physical aspects (0.80), Bodily Pain (0.70), General Health (0.81), Vitality (0.75), Social Functioning (0.84), Role Function-Emotional aspects (0.85), and Mental Health (0.82). The score for each of the eight scales ranges from 0 to 100. A higher score indicates better health on that aspect. SF-36 has been used in several studies among chronic pain patients and has been found to be reliable, valid and responsive (Kavien et al., 1998; Schlenk et al., 1998). It is one of the most widely used generic measures of health-related quality of life in the world.

2.2.5. West Haven–Yale Multidimensional Pain Inventory (MPI)

The MPI was developed using the cognitive behavioural model of chronic pain (Turk et al., 1983) to assess psychosocial variables relevant to the experience of chronic pain (Kerns et al., 1985). The MPI has been widely used in research and clinical practice, and has been shown to have good reliability and validity (Jacob and Kerns, 2001). For the purpose of this research only the first two sections, containing 42 items (forming eight subscales), were included. The five subscales in Section One (and their Alpha values in this study) are: pain severity (0.78), level of interference (0.92), life control (0.78), affective distress (0.64), and support from significant other (0.84). The three subscales from Section Two measure patients' perceptions of how their significant other responds to their pain. They (and their Alpha values in this study) are: punishing responses (0.82), solicitous responses (0.81) and distracting responses (0.71). Each subscale is scored on a 0–6 scale with higher scores indicating higher levels of each dimension.

2.2.6. Beck Depression Inventory (BDI)

Version 1 of the BDI (Beck et al., 1979) was used to measure mood. The inventory consists of 21 categories of symptoms. A total score is obtained by summing scores on each category, and it can range from 0 to 63. Higher scores reflect higher levels of depression (Beck et al., 1979). The BDI has been widely used in chronic pain populations and has well-established reliability and validity (Morley et al., 2002) (Alpha = 0.84 in this study).

2.2.7. Modified Zung Self-Rating Depression Scale (M-ZSDS)

A modified version of the original Zung Self-Rating Depression Scale (Zung and Durham, 1965) was used to measure depression in this study (Main and Waddell, 1984). The M-ZSDS has 18 items, each item is presented as a statement and the respondent indicates the extent to which each symptom is true for him/her. The M-ZSDS index score (based on 18 items) was derived by using 72 (rather than 80) as the denominator and then multiplying by 100, as usual. Scores range between 25 and 100, with higher scores indicating higher levels of depression. The modified ZSDS has been used with chronic pain patients with good internal consistency and validity (Taylor et al., 2005) (Alpha = 0.84 in this study).

2.2.8. Depression Anxiety and Stress Scales (DASS)

This 42-item questionnaire measures depression, anxiety and stress in adults (Lovibond and Lovibond, 1995). It has three subscales, identified with factor analysis (Brown et al., 1997): The Depression scale measures dysphoric mood, including inertia and hopelessness (e.g. 'I felt that I had nothing to look forward to'). Importantly, this scale has no somatic items and its validity with chronic pain patients has been reported by Taylor et al. (2005). The Anxiety scale measures symptoms of fear, panic and physical arousal (e.g., 'I experienced trembling (e.g. in the hands'). The Stress scale measures symptoms like irritability and tension (e.g. 'I found it difficult to relax'). The DASS has strong psychometric properties. All three scales have good internal reliability (Alphas in this study: stress, 0.95; depression, 0.96; and anxiety, 0.89). The scale has also been shown to discriminate reliably between clinical and non-clinical subjects (Antoney et al., 1998). The scores on each subscale range between 0 and 42, with higher scores indicating higher severity.

2.2.9. Pain Self-Efficacy Questionnaire

(PSEQ) (Nicholas, 1989) is based on Bandura's (1977) concept of self-efficacy. The PSEQ is a 10-item inventory which measures both the strength and generality of a patient's beliefs about his/her ability to accomplish a range of activities despite his/her pain. Scores on the PSEQ may range from 0 to 60, with higher scores indicating stronger self-efficacy beliefs (Nicholas, 2007). The psychometric properties of this measure are sound and have been reported in a number of studies (e.g., Gibson and Strong, 1996; Asghari and Nicholas, 2001; Nicholas, 2007) and the Alpha value in this study was 0.93.

2.2.10. Pain Response Self-Statements Scale (PRSS)

Pain Response Self-Statements Scales (Flor et al., 1993) assess situation-specific cognitions that either promote or hinder the individual's attempts to cope with pain. Individuals are asked to rate on a six-point scale (with 0 = almost never) and (5 = almost always) how often they think in such a way when they experience severe pain. There are two nine-item subscales, which are 'catastrophising' and 'coping'. Both subscales are scored on a 0–5 scale with higher scores indicating more frequent catastrophising or use of adaptive coping statements, respectively. The PRSS was originally validated by Flor et al. (1993), and has been shown to have good psychometric properties (in this study, Alpha = 0.86 for the catastrophising scale and 0.76 for the coping scale).

2.2.11. Tampa Scale for Kinesiophobia (TSK)

The Tampa Scale for Kinesiophobia (TSK) was designed to assess fear of movement/(re)injury in individuals with pain (Kori et al., 1990). The TSK is a 17-item questionnaire, which asks individuals to rate the extent to which they agree with statements such as 'pain always means that I injured my body' on a 4-point rating scale, with 1 = strongly disagree and 4 = strongly agree. Four items are reverse-scored and these were included in this study. Although factor analysis has revealed four subscales (harm, fear of [re]injury, importance of exercise, and avoidance of activity), the total score has been recommended as the most valid and reliable measure (Vlaeyen et al., 2002). The TSK has been shown to have good reliability and validity (Vlaeyen et al., 1995) (Alpha = 0.83 in this study).

2.2.12. Other health-related variables

Self-reported data were also collected on a range of demographic characteristics. Of these the following were extracted for the purpose of the present study: age, sex, education, occupation, marital status, pain duration, the main site(s) of persisting pain and identified cause(s) of pain. The main pain site categories are: head/face; neck; shoulders/arms; lower back; lower back and lower limbs; lower limbs; and those with two or more main pain sites (except for combined lower back and lower limbs). These sites are based on those used by the International Association for the Study of Pain (IASP) in the Axis I in the regional classification of pain (Merskey and Bogduk, 1994). A pain diagram was used to confirm the sites.

2.3. Descriptive statistics

The demographic characteristics of the study sample are reported. Means and standard deviations of the study variables are presented for the whole sample, and by gender, age group and individual pain sites as well as for patients who reported pain in 2 or more sites (i.e. multiple sites). As investigation of possible effects of age, gender and pain site on these variables was not the intention of this study, no comparisons are presented. To illustrate the potential uses of these data we have also presented percentile scores on all measures for those reporting low back pain as their main complaint.

Table 1
Demographic characteristics of the heterogenous chronic pain patient sample

Age ($n = 5941$)	
Age groups	*n* (%)
Up to 20 years	98 (1.6)
21–30	710 (12.0)
31–40	1239 (20.9)
41–50	1483 (25.0)
51–60	1037 (17.5)
61–70	653 (11.0)
71–80	547 (9.2)
81 years and more	174 (2.9)
Gender ($n = 5941$)	*n* (%)
Male	2528 (42.6)
Female	3413 (57.4)
Marital status ($n = 4508$)[a]	*n* (%)
Married/de facto	2886 (64.0)
Never married	800 (17.7)
Separated/divorced	544 (12.1)
Widowed	278 (6.2)
Educational status ($n = 4377$)[a]	*n* (%)
Post high school qualification	1529 (34.9)
Completed secondary schooling	453 (10.3)
Between 9 and 11 years of education	1678 (38.3)
Less than 9 years of education	717 (16.4)
Birthplace ($n = 4564$)[a]	*n* (%)
Australia	3335 (72.1)
Other countries[b]	1229 (27.9)
Current work status ($n = 4438$)[a]	*n* (%)
Full-time/Part-time work	1348 (30.4)
Home duties	462 (10.3)
Unemployed due to pain	1430 (32.2)
Retired	804 (18.1)
Other[c]	394 (8.9)

[a] Not all patients reported their marital and educational status, birth place, current work status, work restriction due to pain and compensation status.

[b] UK (363), Europe (347), Asia and Middle East (291), New Zealand (89), Africa (45), Pacific Islands (34), North America (30) and South America (30).

[c] Re-training (98), unemployed due to reasons other than pain (93), students (99), voluntary work (103).

3. Results

The 5941 chronic pain patients who provided data for the study were compared with the 183 who did not, using *t*-tests for age and chi-square analyses for gender. The results revealed that those who participated in the study were significantly younger than those who did not provide data ($\bar{x} = 48$ years, SD = 16, vs. $\bar{x} = 56$ years, SD = 15, t (df = 2,5122) = 3.03, $p = 0.002$). No significant gender difference was found between the two groups ($\chi = 0.08$, df = 1, $p = 0.77$).

The demographic characteristics of the sample are shown in Table 1. The mean age of the patients was 48.4 (SD: 16.2) years. The bulk of the sample (4795 or 80.7%) was in the working age group (18–65 years) and 1106 (18.6%) were 65 and over. The majority (57.4%) were female, most (64.0%) lived with a partner, almost 35% had a post high school qualification (i.e. attended university or technical college after leaving high school) and most (72%) were born in Australia.

Pain-related demographic variables are presented in Table 2. Almost 30% of the patients reported their work status as full-time or part-time, 32.1% were unemployed due to their pain, and the majority (almost 80%) of those who were working at the time of the study reported that pain interfered with their ability to work. Traumatic (or sudden) onset of pain

Table 2
Pain-related characteristics of normative chronic pain patient sample

Pain duration ($n = 5285$)[a]	
Mean (SD) (months)	80.2 (111.2)
Number of specialists have been visited for pain ($n = 4451$)[a]	
Mean (SD)	6 (3)
Mode of onset of pain ($n = 4635$)[a]	*n* (%)
Accident at work	1245 (27.0)
At work but not involving an accident	318 (6.9)
Accident at home	166 (3.6)
Car accident	589 (12.7)
After surgery	546 (11.8)
After illness	185 (4.0)
Pain just began, no obvious reason	1028 (22.1)
Other reasons	558 (12.0)
Pain site ($n = 4932$)[a]	*n* (%)
Head, face, mouth	364 (7.4)
Cervical region	146 (3.0)
Upper shoulder and upper limbs	566 (11.5)
Lower back, lower spine, sacrum	641 (13.0)
Lower limbs	391 (7.9)
Lower back and lower limbs	701 (14.2)
2 or more major pain sites (generalised pain)	1816 (36.8)
Other[b]	307 209 (6.2)
Work restricted due to pain ($n = 1543$)[a]	*n* (%)
Yes	1233 (80)
No	310 (20)
This visit is related to compensation claim ($n = 4467$)[a]	*n* (%)
A workers compensation claim	1429 (32)
A third party accident compensation claim	318 (7)
Some other legal cases	78 (1.7)
None of the above	2642 (59)

[a] Not all patients reported their pain duration, their number of visits, the mode of onset of their pain and their pain sites.
[b] Thoracic region (102 patients), abdomen (92 patients), pelvic region (53 patients) anal, peri-anal and genital areas (60 patients).

(i.e., accident at work, accident at home or car accident) was more common than insidious onset (43.3%vs. 22.1%). The location of pain was diverse, with about one-third (36.8%) reporting pain in 2 or more main sites. This group could be considered under the heading of 'multiple pain sites'.

3.1. Normative data

The data are organised according to categories commonly evaluated in pain populations (see Tables 3–5). These include: pain severity, disability (physical functioning), mood (emotional functioning), general health status, and pain-related beliefs/cognitions. Mean scores (and standard deviations) are presented for each category according to age group, gender and main pain site. The proportions of patients (presented as percentiles) with different score levels on each measure for low back pain are reported in Table 6. Due to space limitations, the data on the other sites mentioned in this paper are available on the centre's website (http://www.pmri.med. usyd.edu.au/clinical/index.php).

3.2. Examples of possible uses of norms in clinical and research contexts

3.2.1. Clinical application of normative data

This section describes how the normative data were employed in the assessment of two patients (Patient A, a female, and Patient B, a male) with failed back surgery and persisting low-back pain who were assessed for treatment in this multidisciplinary pain centre. After initial medical examination, both were thought suitable for a spinal cord stimulator (SCS), but their profiles on the psychometric questionnaires were quite different. Their pretreatment scores are presented in Table 7. The clinically important differences between the two patients become clearer after comparison with the clinic's normative dataset for other chronic pain patients with pain in the same anatomical region (lower back). While both were more disabled than 70% of the normative sample (on the RMDQ) and their usual pain scores (7/10) were worse than 60–70% of the normative sample, patient A was much less depressed than most of the normative sample (better than 75%, versus Patient B who was worse than 80–85% of the normative sample). Patient A was close to the median of the normative sample on pain self-efficacy (on this measure higher scores are better), while patient B was worse than 80% of the normative sample; and Patient A's level of catastrophising was better than 80–85% of the normative sample (versus worse than 90% for patient B).

These findings indicate that despite the same pain diagnosis (failed back surgery syndrome/ lumbar spinal or radicular pain after failed spinal surgery: Merskey and Bogduk, 1994) these patients were substantially different in their mood state, beliefs and perceptions in relation to their pain. This suggested that Patient B required more help with these domains than Patient A. Accordingly, different treatment plans were developed for each patient. Both were to undergo implantation of a SCS, but Patient B was also recommended for our cognitive-behavioural pain management program to address the problems identified above. As can be seen in Table 7, following the implantation of the SCS (in both patients), Patient A reported improvement on all measures and required no further treatment (scores now in percentile range: 5–15, or better than 85–95% of the normative sample). In contrast, Patient B (who reported substantial initial pain reduction with the SCS) had changed little on most measures a few weeks later and continued to take strong analgesic medication. He was then admitted

Table 3
Mean (SD) of study variables for the total sample and for males and females

	Total sample	Male	Female
Disability/interference			
Physical disability (RMDQ) (0–24)	12.3 (5.7)	12.7 (5.8)	11.9 (5.7)
N	4897	2108	2789
Interference (MPI) (0–6)	4.3 (1.2)	4.4 (1.3)	4.2 (1.3)
N	4561	1977	2583
Physical functioning (SF-36) (0–100)	39.9 (25.3)	40.8 (25.3)	39.1 (25.2)
N	4363	1878	2485
Role functioning-physical (SF-36) (0–100)	15.1 (28.5)	14.3 (28.1)	15.6 (28.8)
N	4234	1814	2420
Social Functioning (SF-36) (0–100)	43.0 (27.0)	41.4 (26.3)	44.2 (27.4)
N	4044	1772	2272
Distress			
Affective distress (MPI) (0–6)	3.4 (1.3)	3.5 (1.2)	3.4 (1.3)
N	4809	2066	2742
Depression (DASS) (0–42)	14.3 (11.9)	15.9 (12.2)	13.1 (11.6)
N	2445	1037	1408
Depression (BDI) (0–63)	16.7 (10.0)	16.9 (9.9)	16.5 (10.0)
N	1810	798	1012
Depression (Mod-Zung) (18–72)	57.2 (13.4)	58.4 (13.4)	56.4 (13.3)
N	1282	529	753
Anxiety (DASS) (0–42)	9.3 (8.7)	9.6 (8.7)	9.1 (8.6)
N	2421	1025	1396
Stress (DASS) (0–42)	16.3 (11.2)	17.5 (11.6)	15.3 (10.9)
N	2440	1038	1402
Vitality (SF-36) (0–100)	35.4 (20.9)	36.8 (20.7)	34.2 (21.0)
N	4291	1865	2426
Role functioning-emotion (SF-36) (0–100)	43.5 (43.6)	41.0 (43.2)	45.5 (43.8)
N	4166	1779	2387
Mental health (SF-36) (0–100)	55.5 (21.2)	45.2 (21.5)	56.8 (21.0)
N	4317	1862	2455
Pain-related beliefs/cognitions			
Pain self-efficacy (PSEQ) (0–60)	25.5 (13.8)	24.3 (13.7)	26.31 (13.8)
N	4645	1998	2647
Catastrophising (PRSS) (0–5)	2.7 (1.2)	2.7 (1.1)	2.7 (1.2)
N	4051	1730	2321
Active coping (PRSS) (0–5)	2.7 (1.0)	2.6 (1.0)	2.8 (1.0)
N	3713	1574	2139
Fear avoidance (TSK) (17–68)	41.2 (9.4)	43.1 (9.2)	39.7 (9.4)
N	1180	546	634
Pain intensity			
Pain intensity (MPI) (0–6)	4.2 (1.1)	4.2 (1.2)	4.2 (1.1)
N	4846	2092	2753
Bodily pain (SF-36) (0–100)	26.0 (18.4)	25.8 (18.1)	26.1 (18.5)
N	4264	1836	2428
Highest pain intensity-last week (NRS) (0–10)	8.3 (1.7)	8.2 (1.6)	8.3 (1.7)
N	4520	1942	2568
Lowest pain intensity-last week (NRS) (0–10)	4.0 (2.5)	3.9 (2.4)	4.1 (2.6)
N	4125	1781	2336
Average pain intensity-last week ((NRS) (0–10)	6.4 (2.1)	6.2 (2.0)	6.5 (2.1)
N	4350	1876	2474
Pain intensity-Sensory (MPQ) (0–42)	16.4 (7.8)	16.7 (7.9)	16.3 (7.7)
N	2815	1210	1605
Pain intensity-Affective (MPQ) (0–14)	3.9 (3.1)	4.0 (3.1)	3.9 (3.0)
N	2627	1112	1515
Pain intensity-Total (MPQ) (0–78)	29.7 (13.1)	30.2 (13.3)	29.4 (12.7)
N	2499	1060	1439

to our 3-week cognitive-behavioural pain management program (for more details see Molloy et al., 2006). As can be seen in Table 7, following the program Patient B largely caught up with Patient A on most variables (scores now in percentile range: 5–35, or better than 65–95% of the normative sample on

Table 4
Mean and standard deviations of study variables by age groups

	Age group							
	⩽20	21–30	31–40	41–50	51–60	61–70	71–80	>81
Disability/interference								
Physical disability (RMDQ) (0–24)	11.5 (6.1)	11.9 (5.9)	12.5 (5.8)	12.6 (5.7)	12.1 (5.6)	11.7 (5.7)	12.4 (5.9)	13.2 (5.5)
N	81	593	1045	1244	873	525	416	118
Interference (MPI) (0–6)	4.1 (1.2)	4.4 (1.2)	4.6 (1.1)	4.5 (1.1)	4.3 (1.2)	3.9 (1.4)	3.9 (1.4)	3.8 (1.3)
N	76	579	1013	1201	801	456	343	92
Physical functioning (SF-36) (0–100)	43.5 (25.7)	43.2 (25.7)	40.9 (24.9)	39.5 (25.2)	41.3 (24.4)	40.3 (26.2)	31.4 (24.5)	30.1 (25.5)
N	76	539	950	1134	779	458	336	91
Role functioning-physical (SF-36) (0–100)	15.3 (29.3)	15.3 (28.8)	12.7 (25.9)	14.3 (28.0)	15.4 (27.9)	19.1 (32.3)	16.0 (29.8)	19.5 (33.7)
N	74	521	922	1110	764	435	326	82
Social functioning (SF-36) (0–100)	38.7 (25.9)	40.3 (26.5)	38.1 (24.8)	40.8 (26.1)	46.5 (26.1)	51.1 (28.3)	49.8 (29.8)	47.6 (29.8)
N	73	499	890	1049	730	417	304	82
Distress								
Affective distress (MPI) (0–6)	3.5 (1.2)	3.7 (1.6)	3.7 (1.2)	3.5 (1.2)	3.3 (1.3)	3.1 (1.3)	3.0 (1.3)	2.6 (1.3)
N	79	587	1028	1238	850	519	398	110
Depression (DASS) (0–42)	13.9 (11.4)	16.1 (12.8)	17.1 (12.5)	15.6 (11.9)	12.6 (11.3)	10.8 (10.8)	10.6 (10.6)	7.8 (8.9)
N	48	267	512	641	480	254	191	52
Depression (BDI) (0–63)	14.2 (8.84)	19.1 (10.9)	18.8 (9.9)	17.4 (9.8)	16.2 (10.1)	13.1 (8.9)	12.1 (7.7)	11.4(5.1)
N	19	250	413	460	277	191	148	44
Depression (Mod-Zung) (0–72)	58.1 (13.3)	59.2 (10.1)	60.4 (13.3)	58.6 (13.4)	54.5 (13.2)	52.2 (11.9)	50.7 (11.3)	51.3 (9.1)
N	26	172	288	356	228	115	78	10
Anxiety (DASS) (0–42)	10.0 (8.9)	10.8 (9.4)	10.9 (9.5)	9.3 (8.5)	8.9 (8.3)	6.6 (7.0)	7.5 (7.3)	6.3 (5.4)
N	48	265	510	637	475	247	188	51
Stress (DASS) (0–42)	16.1 (11.4)	18.6 (11.4)	19.0 (11.4)	17.3 (10.9)	15.5 (11.1)	12.2 (10.1)	11.3 (9.7)	8.7 (8.1)
N	48	267	512	640	482	251	190	50
Vitality (SF-36) (0–100)	31.6 (20.5)	33.6 (21.4)	32.6 (20.8)	33.9 (20.6)	37.7 (20.3)	40.1 (20.8)	38.8 (21.6)	38.7 (19.9)
N	73	527	934	1120	767	444	333	93
Role functioning-emotional (SF-36) (0–100)	39.2 (43.1)	41.0 (43.2)	37.7 (41.9)	40.9 (43.4)	48.7 (43.9)	53.5 (43.8)	46.8 (44.1)	54.1 (44.6)
N	73	510	911	1091	747	429	320	85
Mental health (Sf-36) (0–100)	52.9 (20.6)	51.0 (21.8)	50.5 (21.4)	53.9 (20.4)	58.5 (20.8)	61.7 (19.7)	63.0 (20.0)	67.2 (19.2)
N	75	533	938	1121	779	444	335	92
Pain-related beliefs/cognitions								
Pain self-efficacy (PSEQ) (0–60)	24.3 (13.6)	24.3 (13.7)	23.4 (13.2)	24.7 (13.5)	27.4 (13.5)	28.5 (14.4)	27.0 (14.9)	26.7 (14.8)
N	79	580	1018	1200	822	482	362	101
Catastrophising (PRSS) (0–5)	2.8 (1.1)	2.9 (1.1)	2.9 (1.1)	2.8 (1.1)	2.6 (1.4)	2.4 (1.1)	2.33 (1.24)	2.4 (1.3)
N	72	500	899	1055	715	417	320	76
Active coping (PRSS) (0–5)	2.4 (1.0)	2.5 (1.0)	2.6 (0.9)	2.8 (9.0)	3.0 (0.9)	2.8 (1.0)	2.7 (1.1)	2.7 (1.3)
N	69	446	830	968	645	390	294	71
Fear avoidance (TSK) (17–68)	39.1 (11.2)	42.3 (9.9)	42.1 (9.2)	41.8 (9.4)	40.4 (9.2)	39.8 (9.1)	40.2 (9.7)	39.1 (7.4)
N	26	125	250	305	237	126	87	24
Pain intensity								
Pain severity (MPI) (0–6)	4.1 (1.1)	4.2 (1.3)	4.3 (1.1)	4.2 (1.1)	4.1 (1.1)	4.1 (1.1)	4.1 (1.2)	4.1 (1.2)
N	80	595	1039	1245	859	512	405	113
Bodily pain (SF-36) (0–100)	24.4 (21.8)	26.4 (18.5)	25.1 (17.0)	25.1 (18.2)	26.8 (17.8)	28.5 (18.9)	26.2 (18.8)	26.1 (19.7)

N	73	526	932	1112	762	441	326	92
Highest pain intensity-last week (NRS) (0–10)	8.5 (2.1)	8.5 (1.7)	8.4 (1.6)	8.3 (1.6)	8.2 (1.6)	8.0 (1.8)	8.0 (1.8)	8.2 (1.6)
N	66	525	934	1108	745	491	397	125
Lowest pain intensity-last week (NRS) (0–10)	4.3 (2.5)	4.0 (2.4)	4.0 (2.4)	4.0 (2.5)	4.1 (2.6)	3.7 (2.6)	3.9 (2.6)	4.0 (2.9)
N	63	484	863	1034	673	432	353	110
Average pain intensity-last week (NRS) (0–10)	6.5 (2.0)	6.2 (1.9)	6.3 (1.9)	6.3 (2.1)	6.5 (2.1)	6.3 (2.1)	6.8 (2.1)	6.8 (2.1)
N	65	523	923	1105	732	485	391	126
Pain intensity-sensory (MPQ) (0–42)	20.4 (6.64)	18.5 (6.7)	18.8 (7.5)	17.2 (7.9)	15.9 (7.5)	13.8 (7.3)	12.4 (7.1)	11.4 (7.4)
N	43	312	591	702	495	321	260	91
Pain intensity-affective (MPQ) (0–14)	4.5 (3.3)	4.5 (3.1)	4.3 (3.1)	4.2 (3.1)	3.8 (3.0)	3.2 (2.8)	3.1 (2.7)	3.1 (2.8)
N	42	302	555	646	461	299	240	82
Pain intensity-total (MPQ) (0–78)	35.1 (11.4)	32.5 (12.1)	33.0 (12.6)	31.2 (13.0)	28.9 (12.4)	25.4 (12.5)	23.7 (12.3)	22.3 (13.2)
N	39	295	539	614	437	289	212	74

the different measures). He also stopped using analgesic medication. Both patients have subsequently had excellent long-term (8+ years) outcomes with no further treatment required.

For those interested in calculating the significance of the changes (e.g. using Reliable Change Indices: Ferguson et al., 2002) in individual patients, the internal reliability (Alpha value) of each scale has been calculated and included in Section 2.

3.2.2. Research applications of normative data

In research contexts, by comparing samples reported in the literature with normative datasets, it can help to evaluate the clinical significance of treatment outcome studies, especially when the norms are relevant to a clinician's own patient population, in this case a tertiary-referral pain centre (Kendall et al., 1999). They may also enable researchers and clinicians to better answer the question of what works for whom (e.g. Turk, 1990, 2005; Vlaeyen and Morley, 2005). In Table 8 some comparisons of studies that involved patients with chronic low back pain are made for illustration.

From Table 8 it can be seen that the sample treated by Frost et al. (1995) had a mean pain self-efficacy score (PSEQ) of 42 (out of 60) before treatment started. This means they were more confident of their ability to manage their pain than 85% of our normative sample with pain in a similar region. This would indicate that the Frost et al. sample is quite different to the sample seen at this tertiary-referral centre. Similarly, the mean RMDQ score of patients (with mainly sub-acute low back pain) attending the exercise program reported by Klaber Moffett et al. (1999) would place them at around the 90th percentile for chronic low back pain patients at this centre (i.e. more functional than 90% of our patients at initial assessment). As a result of these differences, the results obtained from these studies with exercises are unlikely to be generalisable to most of those attending centres such as this.

Examination of mean scores on the SF-36, BDI, and RMDQ for patients in two interventional studies (Dreyfuss et al., 2000; Pauza et al., 2004) reveals that, relative to those attending this centre with pain in the same region, their samples were less disabled and less depressed than about 80% of our patients at initial assessment. This also casts into doubt the generalisability of the findings of these studies to centres such as this, apart from selected patients with similar characteristics to those of the study samples. These samples were also much less disabled than those treated by de Jong et al. (2005) in a behavioural exposure program in the Netherlands. In contrast, the de Jong et al. sample was very similar (in terms of disability) and fear-avoidance beliefs (on the TSK) to those seen

Table 5
Means and standard deviations of study variables by pain site

	Pain site						
	Head/face/mouth	Cervical region	Shoulder/ upper limbs	Lower back/spine/sacrum	Lower limbs	Lower back/lower limbs	Two or more sites
Disability/interference							
Physical disability (RMDQ) (0–24)	7.2 (5.4)	10.4 (5.1)	10.4 (5.1)	13.5 (5.2)	12.2 (5.8)	14.3 (5.1)	13.4 (5.4)
N	270	112	440	504	294	597	1475
Interference (MPI) (0–6)	3.6 (1.6)	4.2 (1.3)	4.3 (1.2)	4.4 (1.1)	4.1 (1.4)	4.6 (1.1)	4.7 (1.1)
N	254	110	416	487	271	543	1333
Physical functioning (SF-36) (0–100)	64.0 (28.6)	45.6 (23.7)	52.8 (22.0)	34.5 (22.3)	35.1 (24.3)	30.8 (19.8)	36.3 (23.4)
N	236	97	381	465	255	546	1374
Role functioning-physical (SF-36) (0–100)	27.1 (37.1)	15.8 (29.8)	13.4 (27.5)	13.6 (27.8)	18.9 (31.5)	12.4 (25.2)	11.7 (24.3)
N	231	93	376	446	247	534	1332
Social functioning (SF-36) (0–100)	48.4 (29.8)	41.1 (25.1)	47.2 (25.9)	42.0 (27.3)	46.0 (27.3)	42.9 (26.8)	39.7 (26.1)
N	229	95	372	458	241	530	1327
Distress							
Affective distress (MPI) (0–6)	3.3 (1.3)	3.6 (1.2)	3.5 (1.2)	3.4 (1.3)	3.2 (1.3)	3.3 (1.3)	3.6 (1.2)
N	265	109	434	497	285	587	1440
Depression (DASS) (0–42)	12.8 (11.1)	17.7 (12.7)	13.8 (11.7)	13.3 (12.1)	12.3 (12.1)	13.8 (11.9)	15.2 (12.1)
N	116	39	192	147	114	303	944
Depression (BDI) (0–63)	15.7 (9.8)	17.3 (8.3)	16.7 (10.1)	16.0 (9.0)	15.2 (10.4)	17.3 (9.9)	19.8 (10.9)
N	112	71	200	335	139	201	356
Depression (Mod-Zung) (0–72)	50.1 (12.8)	60.4 (13.6)	57.5 (13.0)	55.1 (11.6)	53.6 (11.9)	59.0 (13.4)	59.7 (13.4)
N	53	20	100	71	50	149	349
Anxiety (DASS) (0–42)	7.2 (8.3)	12.5 (11.9)	8.7 (8.4)	7.7 (8.1)	7.7 (8.1)	8.8 (8.4)	10.2 (8.9)
N	115	39	192	145	110	299	934
Stress (DASS) (0–42)	14.7 (11.3)	19.8 (12.1)	16.2 (11.1)	14.9 (10.9)	14.3 (11.2)	15.8 (11.0)	17.1 (11.4)
N	116	39	192	146	114	299	944
Vitality (SF-36) (0–100)	38.6 (23.6)	35.7 (20.5)	38.7 (21.4)	36.1 (20.7)	40.2 (22.0)	37.1 (20.1)	32.1 (19.6)
N	238	97	379	459	251	538	1353
Role functioning-emotional (SF-36) (0–100)	48.4 (44.1)	45.7 (43.3)	43.3 (43.5)	43.7 (44.0)	47.6 (44.4)	43.5 (43.3)	40.3 (43.1)
N	227	90	370	442	249	528	1310
Mental health (Sf-36) (0–100)	55.9 (20.2)	53.2 (21.3)	56.4 (20.7)	56.2 (20.5)	60.3 (20.3)	56.2 (21.5)	53.2 (21.5)
N	237	99	376	455	245	540	1359
Pain-related beliefs/cognitions							
Pain self-efficacy (PSEQ) (0–60)	28.5 (15.5)	25.5 (14.4)	26.2 (13.9)	24.9 (13.4)	28.1 (14.8)	25.5 (13.4)	23.7 (13.2)
N	248	112	418	495	274	569	1419
Catastrophising (PRSS) (0–5)	2.6 (1.2)	2.9 (1.2)	2.7 (1.2)	2.8 (1.1)	2.5 (1.2)	2.8 (1.1)	2.8 (1.1)
N	275	121	414	538	276	537	1259
Active coping (PRSS) (0–5)	2.7 (1.1)	2.8 (1.0)	2.7 (1.0)	2.7 (1.1)	2.6 (1.1)	2.8 (1.0)	2.7 (1.0)
N	233	99	376	510	235	429	1243
Fear avoidance (TSK) (17–68)	36.2 (9.6)	41.5 (10.1)	40.3 (8.9)	41.4 (8.8)	37.6 (8.6)	42.9 (9.7)	42.3 (9.2)
N	60	13	106	70	61	163	532
Pain intensity							
Pain severity (MPI) (0–6)	3.9 (1.3)	4.1 (1.2)	4.2 (1.1)	4.2 (1.0)	4.0 (1.2)	4.3 (1.1)	4.3 (1.0)
N	268	113	438	503	285	590	1451

Bodily pain (SF-36) (0–100)	35.3 (24.1)	27.4 (20.1)	27.1(19.1)	23.9 (15.6)	30.0 (21.0)	25.2 (16.4)	23.0 (15.8)
N	227	97	379	460	244	530	1343
Highest pain intensity-last week (NRS) (0–10)	8.0 (2.1)	8.2 (1.6)	8.3 (1.6)	8.2 (1.6)	8.1 (1.8)	8.2 (1.6)	8.4 (1.6)
N	308	113	497	535	353	660	1764
Lowest pain intensity-last week (NRS) (0–10)	3.7 (2.6)	3.6 (2.5)	4.3 (2.4)	3.7 (2.6)	3.6 (2.8)	4.1 (2.5)	4.3 (2.4)
N	273	103	452	488	309	606	1629
Average pain intensity-last week (NRS) (0–10)	5.9 (2.4)	6.1 (1.8)	6.5 (1.9)	6.2 (2.0)	6.1 (2.2)	6.5 (2.0)	6.5 (1.9)
N	298	111	489	527	338	644	1666
Pain intensity-sensory (MPQ) (0–42)	14.2 (7.7)	15.5 (7.1)	16.3 (7.3)	14.8 (7.6)	15.3 (7.6)	16.1 (7.7)	17.8 (7.8)
N	157	67	306	421	201	303	1238
Pain intensity-affective (MPQ) (0–14)	3.7 (3.4)	3.3 (3.2)	3.6 (3.1)	3.7 (2.9)	2.8 (2.7)	3.9 (2.8)	4.4 (3.1)
N	151	66	274	402	184	259	1175
Pain intensity-total (MPQ) (0–78)	25.7 (13.9)	25.9 (11.9)	28.8 (12.9)	26.7 (12.4)	26.4 (12.8)	30.5 (12.5)	32.3 (12.7)
N	145	65	263	393	175	238	1114

at this centre, which suggests that their results would be relevant to many of the patients seen at this centre.

The study comparing acupressure with exercises by Hsieh et al. (2006) involved patients with mean RMDQ scores indicating they were less disabled than 70–75% of our comparison pain centre group. Similarly, the sample with back pain trained in self-care strategies by Moore et al. (2000) in a primary care/health maintenance organisation setting was less disabled (on the RMDQ) than about 85% of our patients at initial assessment. However, the comparison between the normative sample and the two samples treated by Marhold et al. (2001), one with a short sick-list history (mean 3-months) and the other with a long sick-list history (mean 26-months), reveals clear differences on the pain, disability and mood measures. In this case the long sick-list group were worse than 40–70% of the normative sample on the respective measures while the short sick-list group were worse than only 20–35%. These comparisons with the normative sample would suggest that the findings from these studies may be generalisable to different sub-groups of those attending this centre.

4. Discussion

This study described the development of a normative dataset for measures commonly used in pain clinics. Unlike some previous studies' single measures, the present study employed several measures that together cover most domains typically assessed within a multidimensional evaluation of pain. The mean scores across all measures were described according to the demographic variables of age group, gender, and pain site. In addition, the proportion of patients (with chronic low back pain) scoring at different levels on each measure were described as percentiles. Examples of potential uses of norms such as these were also described.

To our knowledge this is the first paper to present normative data on a broad range of measures with chronic pain patients attending a tertiary referral pain centre. This paper addresses a gap in current pain clinic practice and research. Namely, although clinical practice and research involving patients with chronic pain depend heavily on self-report measures of key variables, most of the measures used have few normative data available for comparisons. This limits our ability to interpret assessment measures (Kendall et al., 1999; Turk and Melzack, 2001). Our findings should be of interest to pain researchers and clinicians wanting to improve their assessment and treatment of pain patients.

Table 6
Means, standard deviations, medians and percentiles of questionnaires for patients with pain in lower back region

	Disability/interference					Pain intensity								
	Physical disability (RMDQ) (0–24)	Interference (MPI) (0–6)	Physical function (SF-36) (0–100)	Role-physical (SF-36) (0–100)	Social function (SF-36) (0–100)	Pain intensity (MPI) (0–6)	Bodily pain (SF-36) (0–100)	Highest pain (NRS) (0–10)	Lowest pain (NRS) (0–10)	Average pain (NRS) (0–10)	Pain sensory (MPQ) 0–42	Pain affective (MPQ) 0–14	Pain evaluative (MPQ) 0–5	Pain Total (MPQ) 0–78
N	504	487	465	446	458	503	460	535	500	527	421	402	405	393
Mean	13.51	4.38	34.50	13.71	42.02	4.20	23.97	8.24	3.73	6.18	14.83	3.70	2.67	26.88
SD	5.17	1.08	22.35	27.92	27.27	0.99	15.65	1.56	2.55	1.96	7.57	2.92	1.44	12.43
Median	14	4.60	30.00	0.00	37.50	4.33	22.00	8.00	3.00	6.00	14	3.00	3.00	26.00
Mode	17.00	5.00	20.00	0.00	25.00	4.00	22.00	8.00	3.00	7.00	18.00	2.00	4.00	24.00[a]
95%	4.00	2.25	75.00	100.00	100.00	2.66	51.00	5.00	0.00	3.00	4.00	0.00	0.00	9.00
90%	6.00	2.90	70.00	50.00	75.00	3.00	41.00	6.00	0.00	4.00	5.00	0.00	1.00	11.00
85%	8.00	3.20	60.00	25.00	75.00	3.33	41.00	7.00	1.00	4.00	7.00	1.00	1.00	13.00
80%	9.00	3.47	55.00	25.00	62.50	3.33	41.00	7.00	1.00	4.00	8.00	1.00	1.00	15.00
75%	10.00	3.64	50.00	25.00	62.50	3.66	32.00	8.00	2.00	5.00	9.00	1.00	1.00	18.00
70%	11.00	3.90	45.00	0.00	50.00	3.67	31.00	8.00	2.00	5.00	10.00	2.00	1.00	19.00
65%	11.00	4.00	40.00	0.00	50.00	4.00	31.00	8.00	2.00	5.00	11.00	2.00	2.00	21.00
60%	12.00	4.27	35.00	0.00	50.00	4.00	22.00	8.00	3.00	6.00	12.00	2.00	3.00	23.00
55%	13.00	4.40	30.00	0.00	50.00	4.00	22.00	8.00	3.00	6.00	13.00	3.00	3.00	24.00
50%	14.00	4.60	30.00	0.00	37.50	4.33	22.00	8.00	3.00	6.00	14.00	3.00	3.00	26.00
45%	15.00	4.73	25.00	0.00	37.50	4.33	22.00	9.00	4.00	6.70	15.00	3.00	3.00	28.00
40%	15.00	4.90	25.00	0.00	37.50	4.33	22.00	9.00	4.00	7.00	17.00	4.00	4.00	30.00
35%	16.00	5.00	20.00	0.00	25.00	4.67	22.00	9.00	5.00	7.00	18.00	4.00	4.00	31.00
30%	17.00	5.10	20.00	0.00	25.00	4.67	12.00	9.00	5.00	7.00	18.00	5.00	4.00	32.00
25%	18.00	5.22	20.00	0.00	25.00	5.00	12.00	1.00	6.00	8.00	20.00	6.00	4.00	34.00
20%	18.40	5.40	15.00	0.00	12.50	5.00	12.00	10.00	6.00	8.00	21.00	6.00	4.00	37.00
15%	19.00	5.52	10.00	0.00	12.50	5.33	10.00	10.00	7.00	8.00	23.00	7.00	4.00	39.00
10%	20.00	5.64	10.00	0.00	0.00	5.33	0.00	10.00	8.00	9.00	25.00	8.00	4.00	42.00
5%	21.00	5.90	5.00	0.00	0.00	6.00	0.00	10.00	8.00	9.00	28.00	9.00	4.00	50.30

	Pain-related beliefs/cognitions				Distress								
	Pain self-efficacy (PSEQ) (0–60)	Catastrophising (PRSS) (0–5)	Active coping (PRSS) (0–5)	Fear-of movement (TSK) (0–68)	Affective distress (MPI) (0–6)	Vitality (SF-36) (0–100)	Role-emotional (0–100)	Mental health (0–100)	Depression (DASS) (0–42)	Depression (BDI) (0–63)	Depression (Mod-Zung) (0–72)	Anxiety (DASS) (0–42)	Stress (DASS) (0–42)
N	495	538	511	70	497	459	442	455	147	335	71	145	146
Mean	24.90	2.79	2.65	41.44	3.34	36.06	43.99	56.32	13.31	16.00	55.14	7.93	14.89
SD	13.42	1.14	1.01	8.77	1.30	20.74	44.00	20.58	12.01	8.99	11.62	8.16	10.88
Median	24.00	2.88	2.77	42.00	3.33	35.00	33.33	56.00	10.00	15.00	57.00	6.00	13.00
Mode	25.00	3.00	3.00	44.00	3.00	35.00	0.00	60.00	0.00	16.00	61.00[a]	0.00	0.00
95%	49.85	0.88	0.66	26.20	1.00	73.75	100.00	88.00	0.00	3.00	37.20	0.00	0.00
90%	44.00	1.33	1.22	31.10	1.66	65.00	100.00	84.00	1.00	5.60	39.10	0.00	1.00
85%	40.00	1.55	1.55	32.00	2.00	60.00	100.00	80.00	1.50	7.00	41.00	1.00	3.00
80%	37.00	1.77	1.78	33.20	2.33	55.00	100.00	76.00	2.00	9.00	42.80	1.00	4.00
75%	34.25	2.00	2.00	34.75	2.67	50.00	100.00	72.00	3.00	10.00	45.00	2.00	5.00

70%	31.00	2.11	2.22	36.30	3.00	50.00	100.00	68.00	4.00	11.00	48.54	3.00	8.00
65%	29.00	2.33	2.33	37.00	3.00	45.00	67.00	64.00	5.00	12.00	50.22	3.00	9.15
60%	27.00	2.50	2.44	38.00	3.00	40.00	67.00	64.00	7.00	13.00	52.80	4.00	11.00
55%	26.00	2.66	2.56	39.95	3.33	35.00	33.00	60.00	9.00	14.00	54.35	4.00	12.00
50%	24.00	2.88	2.77	42.00	3.33	35.00	33.00	56.00	10.00	15.00	57.00	6.00	13.00
45%	22.00	3.00	2.88	43.05	3.66	31.25	33.00	56.00	12.50	16.00	58.42	6.00	15.00
40%	20.00	3.11	3.00	44.00	3.67	30.00	0.00	52.00	14.00	17.00	59.20	7.00	16.40
35%	18.00	3.22	3.11	44.15	3.67	25.00	0.00	48.00	15.00	18.00	60.97	9.00	18.00
30%	16.00	3.44	3.22	46.00	4.00	25.00	0.00	48.00	18.00	19.00	61.36	10.00	20.00
25%	15.00	3.66	3.33	48.00	4.00	20.00	0.00	44.00	23.00	20.00	62.00	12.00	22.00
20%	13.00	3.77	3.55	50.00	4.33	15.00	0.00	36.00	26.00	23.00	65.12	13.00	26.00
15%	10.00	4.10	3.77	52.35	4.67	15.00	0.00	32.00	28.50	25.00	68.58	15.80	29.30
10%	7.00	4.44	3.97	53.90	5.00	10.00	0.00	28.00	32.00	28.00	71.73	20.00	32.00
5%	5.00	4.76	4.11	55.45	5.67	5.00	0.00	20.00	39.00	34.00	74.40	27.00	35.00

[a] Multiple modes exist. The smallest value is shown.

As normative datasets reflect the population from which they were drawn, thoughtful application of these norms is recommended. For example, this normative dataset contains a large proportion (32%) of patients with workers' compensation claims, reflecting the referral mechanisms to our centre. Other clinics may have differing proportions of patients with this background and this could alter their profiles and outcomes (e.g. Harris et al., 2005). However, as the patients referred to a tertiary pain centre are typically at the more disabled end of the spectrum, if similar scores (possibly above the bottom quartile of our norms) are achieved by patients attending primary care settings it might justify either more extensive assessment or referral to a multidisciplinary pain centre. The lower response rate by older patients is consistent with other reports and suggests that achieving higher response rates in this group might require modified assessment formats (e.g. fewer measures or more assistance) (Herr, 2005). Nevertheless, the vast majority of those aged over 60 did provide data for the normative dataset. While the focus of this paper is on pain patient norms, normative data from healthy populations should not be overlooked (Williams, 2003), primarily for measures that do not assume the presence of pain, such as general health measures like the SF-36 or mood measures.

A key use of normative data relates to the assessment of individual patients (e.g. Turk and Melzack, 2001; Dozois et al., 2003). The cases presented in Table 7 illustrate how a normative dataset can guide treatment decisions and help to evaluate outcomes. In addition to assessing a patient's pain in terms of a diagnosis, mechanism, site, and chronicity, clinicians using norms for comparison can more readily interpret a patient's performance on a number of relevant self-report dimensions as well. This should assist in the determination of whether or not an individual's responses are unusual for someone experiencing persisting pain. In turn, this may suggest possible courses of action, such as further investigation or a treatment (whose outcome can be evaluated against the normative dataset). In the cases described here, the pain diagnosis did not differentiate them. The normative data provided an explanation for the apparent SCS treatment failure in one case, helped to identify areas for therapeutic co-intervention, and to determine the clinical significance of the outcomes achieved.

The examples provided in Table 8 indicate that norms can also be helpful in interpreting published treatment studies (e.g. Kendall et al., 1999). Our ability to address the perennial question of which treatment for which patient could be improved (e.g. Turk, 1990, 2005; Vlaeyen and Morley, 2005) if more clinical trials used measures for which

normative values are available. While most published treatment studies report basic demographic information, it is rare for there to be any mention of level of pain, disability, or depression, relative to a normative sample. Yet these dimensions may be major determinants of the value of any treatment. For example, level of depression has long been known to influence the responsiveness to rehabilitation programs for chronic pain patients (e.g. Kerns and Haythornthwaite, 1988). This point was elegantly demonstrated by Haldorsen et al. (2002) who showed that more disabled patients with chronic low back pain required more extensive pain management programs than less disabled cases. A similar point has been made by others (e.g. Williams et al., 1996; Bendix et al., 2000; Marhold et al., 2001).

Another way of addressing the question of which treatment for which patient has been proposed by Turk and colleagues (see Turk, 2005). This involves the identification of sub-groups of patients with similar pain-response characteristics (e.g. 'disabled', 'active coper'), generated by the MPI. Turk has argued that different interventions may be appropriate for different sub-groups, and there is growing evidence to support this view (Turk, 2005). However, it might also be argued there is still a risk that those within a given category may be assumed to be homogeneous. Normative data on those within a given category could provide further discrimination of cases.

The use of norms also raises important questions for systematic reviews of pain treatments. Examination of some recent reviews (e.g. Hayden et al., 2005; Ostelo et al., 2005) reveals little consideration of the nature of the patient samples being treated in the studies reviewed, other than pain site and chronicity. Both these reviews lamented the lack of detailed description of samples treated and they recommended this should be addressed in future studies. Current approaches in systematic reviews of chronic pain treatments seem over reliant on the dubious assumption of homogeneity of people with pain in similar sites and chronicity. As we have tried to show (see Table 8), site of pain (and chronicity) may tell us very little about the nature of the patients involved in particular studies. Recommendations based on reviews of treatments of heterogeneous patient samples, even if they report pain in a similar region, must limit their clinical relevance. If systematic reviews took dimensions such as levels of disability and depression into account (as well as pain site and chronicity) when comparing studies, they might provide researchers and clinicians with additional useful information.

Researchers should also find the means and standard deviations (variance) for each measure (in this dataset) of use when calculating sample sizes for planned studies. Due to space limitations, this paper has limited percentile tables (on each measure) to the low back region. Those interested in examining percentiles (on these measures) for other major pain sites can find similar tables on our centre's website (http://www.pmri.med.usyd.edu.au/research/index.php – see Brain, Body, Behaviour, and Society Research Group).

The next steps in this process should include accruing more normative datasets in other pain clinics and from non-clinic samples of people living with pain in the community. In addition, selection of measures is likely to be an evolving process as new and better measures emerge to replace older ones. As our present data set represents measures commonly used from a starting point over 10 years ago, we have revised our measurement battery over time. Most recently, for example, we have added McCracken et al.'s (2004) revised measure of pain acceptance to our battery of measures and the results with a relatively small sample ($n = 252$) of patients have now been published (Nicholas and Asghari, 2006).

Some limitations of the paper should be acknowledged. Firstly, the sample used is not representative of people with chronic pain in the Australian community, but it is representative of patients referred to this centre. We know that many people with chronic pain in the community generally manage their pain quite well and suffer relatively little distress and disability, but a substantial proportion do not (Blyth et al., 2001). Typically, it is the latter group that are referred to pain centres. The sample used in this study is likely to be similar to the patients seen at other tertiary referral pain centres and there are some data to support this – from Canada (Sullivan et al., 2005); Hong Kong (Huey et al., 2007); Malaysia (Nicholas et al., 2006); the Netherlands (de Jong et al., 2005); Sweden (Hellstrom et al., 2000); the UK (Williams et al., 1996; Morley et al., 2002; McCracken et al., 2004), and the US (Buenaver et al., 2007). Other limitations include the lack of diagnostic categories and relatively low numbers for some measures in some sub-groups (when $n < 50$ we regarded the results as preliminary). In contrast, the strengths of the paper are that it includes a very large number of cases with an overall high response rate on well-validated measures. Finally, we have provided illustrations for how these normative data might be used and we have provided a material response to the call by the authors of the IMMPACT recommendations (Turk et al., 2003) for normative data on outcome measures.

Table 7
Comparison of scores between two patients (A and B) with failed back surgery syndrome, before and after SCS and a CBT pain management program (PMP)

Measures	Patients' scores (percentiles)				
	A Pre SCS	A Post SCS	B Pre SCS	B Post SCS	B Post PMP
Pain (NRS) (0–10)	7 (60–70)	1(5)	7 (60–70)	6 (40–50)	5 (25–35)
Depression (BDI) (0–63)	10 (25)	7 (15)	24 (80–85)	26 (85–90)	9 (20)
Disability (RMDQ) (0–24)	17 (70)	9 (10–15)	17 (70)	22 (95)	11 (30–35)
Self-efficacy (PSEQ) (0–60)	24 (50)	53 (5)	13 (80)	7 (90)	47 (5–10)
Catastrophising (PRSS) (0–5)	1.6 (15–20)	0.9 (5)	4.3 (90)	3.6 (75)	1.4 (10–15)

Percentile levels are in brackets (compared to standardization sample with pain in same region, see Table 6). For ease of reading, the percentiles have been adjusted (from Table 6) so that higher percentiles are worse.

Table 8
Comparison of pretreatment data from different studies (all with chronic low back pain) against our normative dataset on the same measures (see Table 6)

Study	Measure	Mean score	PMRC percentiles
Frost et al. (1995)	PSEQ	43.3	15th
Nicholas et al. (1992)	PSEQ	23.2	50th
Klaber Moffett et al. (1999)	RMDQ	5.56	10th
de Jong et al. (2005)	RMDQ	15	55th
Moore et al. (2000)	RMDQ	8.6	15th
Hsieh et al. (2006)	RMDQ	10.9	25th
Dreyfuss et al. (2000)	RMDQ	7	10–15th
Marhold et al. (2001) (short sick list)	MPI (interference)	4.1	35th
Marhold et al. (2001) (long sick list)	MPI (interference)	4.2–4.3	40th
de Jong et al. (2005)	TSK	41	50th
Nicholas et al. (1992)	BDI	17.3	60th
Evers et al. (2002)	BDI	12.8	40th
Dreyfuss et al. (2000)	BDI	6.0	15th
Keogh et al. (2005)	BDI	18.03	65th
Marhold et al. (2001) (short sick list)	BDI	9.2–11.3	20–30th
Marhold et al. (2001) (long sick list)	BDI	14.8–17.0	50–60th
Pauza et al. (2004)	SF-36		
	Physical functioning	54	20th
	Role function emotional	84	15th
	Social functioning	72	15th
	Mental health	79	35th
Dreyfuss et al. (2000)	SF-36		
	Physical functioning	60	15th
Marhold et al. (2001) (short sick list)	MPI (pain intensity)	3.7	30th
Marhold et al. (2001) (long sick list)	MPI (pain intensity)	4.4–4.7	60–70th

As high/low scores can mean different things between measures, in this table all percentiles have been adjusted so that higher percentiles are worse: thus, 60th percentile means worse than 60% of the comparison sample at PMRC or conversely, better than 40% of the comparison sample.

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