

Chronic Pain: Ethno-Cultural Variation and
the Role of Mindfulness

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Abstract

Chronic pain has been associated with significant distress and disability (Dahl, Wilson & Nilsson, 2004; McCracken, Eccleston & Vowles, 2005). Consequently, it has been the focus of much investigation in the search for evidence based clinical interventions. Recent empirical inquiry has identified the role of psychological and social factors in the prediction of these adverse effects (Green et al., 2003; Keefe et al., 2000; Severeijns, van der Hout, Vlaeyen & Picavet, 2002). This thesis explores two of these social and psychological spheres. Firstly, a literature review was conducted that systematically assessed ethno-cultural variation in physical and psychological functioning and related processes in people experiencing chronic pain. Studies were included where participants were differentiated into at least two ethnically or geographically defined cultural groups. Some evidence was provided for ethno-cultural variation in North America. Overall, however, research studies were limited by weak designs, sparse cultural groups and a failure to address process issues.

Secondly, this thesis explored the concept of mindfulness which originates from Eastern traditions of Buddhist Vipassana philosophy and practice and involves moment-to-moment, non-judgmental and non-responsive attention and observation of thoughts, feelings and bodily sensations (Baer, 2003; Kabat-Zinn, 1982). A quantitative study examined the role of catastrophising and kinesiophobia for the operation of mindfulness benefits in people with chronic low back pain. Questionnaire assessments of mindfulness, pain intensity, disability, affect, pain catastrophising and kinesiophobia were collected from 116 adults embarking on a pain management programme. Longitudinal questionnaire data was also collected from 87 of these participants. Findings provided some support that mindfulness acts as a protective agent against catastrophising, kinesiophobia, disability and distress.

As a result of these investigations, suggestions were identified for future research and effective chronic pain interventions. The critical appraisal encapsulates reflection on the processes and stages involved in the thesis and highlights avenues for chronic pain research linking ethno-cultural factors and mindfulness.

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Do Ethno-cultural Differences Exist in the Psychological and Physical Functioning of People with Chronic Pain?

1 Abstract

The psychological and social correlates of chronic pain have largely been researched within Western societies. This review systematically identified and evaluated quantitative literature comparing ethno-cultural differences in distress, disability and related cognitive and coping constructs in people with chronic pain. The reviewed studies identified African American groups as reporting greater levels of physical disability, anxiety and depression than Caucasian groups. Explanation was sought within findings that African Americans consistently reported greater use of praying and hoping and pain catastrophising than Caucasian samples. Only circumscribed evidence was found to suggest geographically defined between-group variation. Conclusions were limited by contradictory findings, methodological limitations and insufficient exploration of relationships between the variables. Robust assessment of ethno-cultural variation is required to explore the complexity of social, cultural and psychological variables influencing chronic pain experience.

Target Journal: Journal of Health Psychology (Appendix J)

2 Introduction

2.1 Chronic Pain Prevalence

A significant number of individuals experience chronic pain, with prevalence rates ranging from 2-40% within Western populations (Verhaak, Kerssens, Dekker, Sorbi, & Bensing, 1998). Reports of chronic pain have increased over the last forty years and are represented across cultural and geographic boundaries (Gureje, Von Korff, Simon, & Gater, 1998; Harkness, Macfarlane, Silman, & McBeth, 2005: World Health Organisation), with major impacts on individual distress and disability, and wider effects upon society and the economy (Dahl, Wilson, & Nilsson, 2004; McCracken, Eccleston & Vowles, 2005).

2.2 Bio-psycho-social Framework

Chronic pain may be best understood within a bio-psycho-social framework (Turk, 1996), with substantial research indicating the importance of psychological variables as equally or more predictive of disability than the more traditionally researched pain characteristics such as pain intensity, location and duration (Crombez, Vlaeyen, Heuts, & Lysens, 1999; Keefe et al., 2000; Severeijns, van der Hout, Vlaeyen & Picavet, 2002; Sullivan, Stanish, Waite, Sullivan, & Tripp, 1998). Psychological variables, including pain beliefs, coping strategies, catastrophising, and the acceptance of chronic pain, have been the target of interventions such as cognitive behavioural therapy to enhance helpful and reduce unhelpful, cognitions, coping styles, and cognitive processes. These phenomena and their management, however,

have largely been studied with reference to white people within Western countries - surprising given the recognition of chronic pain as a bio-psycho-social phenomenon and with questionable applicability when understanding presentation in ethnic minorities and non-Western cultures given potential linkages to inequalities in health care access (Cintron & Morrison, 2006; Green et al., 2003).

2.3 Ethno-cultural Definitions and Chronic Pain

Culture has been defined as the knowledge, customs, values, beliefs and behaviours that define a social group (Bolaffi, Bracalenti, Braham, & Gindro, 2003). A key element to the term's definition is the historical transmission of these characteristics from one generation to another through socialisation (Bolaffi et al., 2003) via social groups linked by ethnicity, age, gender, social class, religion and language.

Early scientific study explored differences between racial groups founded on genetic and physical variation underlying the definition of race with attendant links to racism (Bolaffi et al., 2003). The scientific validity of race as a concept is also questionable since little genetic difference has been noted between groups defined by race in comparison to within-racial group differences (Goodman, 2000). For these reasons this review will focus on ethno-cultural variation including an assessment of pain experience in sub-cultural groups separated by race, ethnic identity and geographical location. Bates and Edwards (1992) summarises ethnic identity as an 'individual's sense of belonging in an ethnic group and to the parts of that individual's thinking, perceptions, feelings, and behaviours that are due to group membership' (p.64).

Ethno-cultural variation may therefore incorporate differences in religion, language, ancestry and historically formed world-views.

Given these factors and the bio-psycho-social nature of pain, it is unsurprising that researchers have investigated pain experience variation across ethno-cultural groups. The prominent Gate Control Theory of pain perception proposing that psychological and cognitive variables influence sensory transmission of pain signals within the nervous system (Melzack & Wall, 1965) has been extended by Bates' (1987) bio-cultural model drawing upon social learning theory and social comparison processes to explain the variation in psychological and cognitive influences on the gate control mechanisms (Bandura, 1977; Festinger, 1954). Beliefs and attitudes are thought to be shaped through vicarious and direct learning experiences as a person interacts with familial and community environments. A cognitive-behavioural framework would also propose that these cognitive factors influence pain responses such as the avoidance of activity, the social expression of pain and ultimately psychological affect and disability (Turk, Meichenbaum, & Genest, 1983; Vlaeyen, Kole-Snijders, Boeren, & van Eek, 1995a). Taken together these models suggest that variation in social and cultural processes may bring about variation in pain perception and emotional and cognitive responses to chronic pain. Psychological affect and disability and potentially related cognitive processes are the focus of this review.

2.4 Ethno-cultural Variation: Pain Perception and Prevalence

Support for Bates' (1987) model has emerged from socio-cultural and ethno-cultural research (Mcbeth & Jones, 2007), including studies assessing experimental and

clinical pain prevalence, thresholds and tolerance. South Asian samples in the United Kingdom, for example, have reported more disabling back pain, neck pain and widespread pain than non-South Asian samples (Macfarlane et al., 2005; Webb et al., 2003) and African American and Hispanics with chronic pain appear to report greater levels of pain than Caucasian samples (Creamer, Lethbridge-Cejku & Hochberg, 1999; Edwards, Fillingim, & Keefe, 2001). Similar findings have emerged from experimental studies using pain induction techniques, with African American samples reporting lower tolerance and greater pain unpleasantness (Campbell, Edwards, & Fillingim, 2005; Edwards & Fillingim, 1999; Edwards, Doleys, Fillingim & Lowery, 2001). Additionally, Watson, Latif, & Rowbotham, (2005) found that South Asian males reported lower pain thresholds and higher pain report when compared with matched White British males.

Minority groups (Indo Pakistani and Chinese) appear to be significantly under-represented in patients attending a tertiary care service for pain (Mailis-Gagnon et al., 2007) but this may not reflect chronic pain prevalence rather ethno-cultural differences in treatment use and access, since ethno-cultural disparities have also been described in patients' attitudes to treatment, pain management access, and physician's responses (for reviews see Cintron & Morrison, 2006; Green et al., 2003).

Conversely, there are contrary findings that indicate no ethnic differences in pain management expectations or physician's treatment decisions (Lee, Burelback, & Fosnocht, 2001; Weisse, Sorum, & Dominguez, 2003). There is substantial evidence, however, that ethnic minorities in America are under-treated compared to non-Hispanic Whites (Cintron & Morrison, 2006; Green et al. 2003).

Proposed explanations for the differences in pain perception and prevalence have included biological factors (e.g. vitamin levels; Macfarlane et al., 2005), physician management, differences in treatment seeking, variable access to pain management (Cintron & Morrison, 2006; Green et al. 2003) and variation in influential psychological variables (Mcbeth & Jones, 2007).

2.5 Ethno-cultural Variation: Chronic Pain Experience

A number of models incorporate recognition of emotional, cognitive and behavioural aspects of chronic pain experience (Wade, Dougherty, Archer, Price, 1996; Wade, Dougherty, Hart, Rafii, & Price 1992; Vlaeyen et al., 1995) with early research indicating qualitative differences in these between ethnic groups, including pain expression and beliefs (Zboroski, 1952, 1969). Zborowski (1952, 1969) interviewing Jewish and Italian respondents noted their emphasis on emotional descriptors whereas Old American and Irish participants understated their pain experience.

To date, two North American narrative reviews described studies that assessed racial and ethnic variation in chronic pain experience (Edwards et al. 2001; Green et al., 2003). Edwards et al. (2001) focused on variation in pain perception between African Americans and Caucasians and this was extended by Green et al. (2003) who identified research where African American samples reported greater ‘psychological disturbance’, ‘physical and psychosocial disability’ and poorer quality of life than Caucasian samples.

2.6 Review Aims and Rationale

To date, there has been no systematic assessment of the extent and validity of findings on ethno-cultural variation in emotional, cognitive and physical functioning factors relating to chronic pain. This paper aims to address this gap by reviewing quantitative research on ethno-cultural similarities and differences in chronic pain experience in terms of 1) psychological distress and disability and 2) cognitive and coping factors that may act as predictors of distress and disability. This should contribute to informed provision of treatment strategies to meet the needs of ethnically diverse societies and reduce chronic pain-related health burden.

3 Methods

3.1 Development of Search Terms and Selection Criteria

Search terms and selection criteria were constructed with reference to the review question and prior theoretical and empirical literature on ethnic and cultural differences in chronic pain experience. This was informed by a scoping review which aimed to assess the breadth of the literature. The study outcomes (e.g. psychological and physical functioning and cognitive phenomena) were not included in the search terms given their heterogeneity, and to widen the search field with expectation that there would be only a limited number of studies examining non-medical (biological, physiological) group comparison variables. The search terms, database search limits and selection criteria are outlined in Appendix A, B and C.

3.2 Rationale for Selection Criteria

Only quantitative study designs were included to allow for robust statistical comparison of ethnic and cultural groups. It was anticipated that most studies would utilise cross-sectional observational designs, because of the comparative nature of the review question. To embrace cross-cultural comparisons, studies were included where sample groups were separated by geographical location as well as racial and ethnic identity categorisations. Population criteria included heterogeneous chronic pain conditions excluding those related to life-threatening illness, trauma, and respondents experiencing experimental and acute pain response. These latter conditions were

excluded due to recognised differences in sensory and emotional pain responses (Green et al., 2003).

The sensitivity of the search criteria was verified by checking whether previously identified papers were found using the search terms and inclusion/exclusion specifications.

3.3 Procedures for the Identification and Selection of Studies

Two main methods were used to identify relevant studies. Firstly, a computerised search was undertaken on 6th and 7th October 2008 using the Cochrane collaboration on-line library, Medline, Psycinfo, Scopus and Web of Science databases using the search terms and database limits (see Appendix A, B and C)¹. For an outline of the stages and resultant numbers of studies see Appendix B. Secondly, the reference sections of relevant reviews were scrutinised for relevant studies and then these studies were searched for on the aforementioned databases. These reviews differed from the present review as they did not use systematic procedures and solely focussed on North American samples (Edwards et al. 2001; Green et al., 2003). The titles and abstracts (where available) of resultant studies were screened with 46 found that potentially met the research selection criteria (Appendix C). Full text articles were retrieved for these references.

¹ This search was repeated on 20th December 2008 with no additional findings.

3.4 Full Text Retrieval

The 46 full text articles were further screened against the selection criteria with criteria sensitivity checks made by cross-reference to the studies' reference lists. No additional titles were deemed relevant. Figure 1 highlights the selection process including the reasons for exclusion (Appendix D). This resulted in the selection of 18 articles to be included in the critical review

3.5 Data Extraction and Quality Assessment

Specific data from the remaining 18 articles were extracted and input to an Excel file (see Appendix E for the extraction categories). Some categories were descriptive and some acted as a checklist for assessing study quality (e.g. the inclusion and statistical control of potentially confounding demographics).

The extraction categories were informed by the NHS CRD (2001) description of data extraction and study quality assessment. The data extracted within the categories were viewed with reference to internal and external validity. Each study was given an ID code ranging from 1- 18.

3.6 Data Synthesis

A narrative description was produced from the Excel file that covers general study summary, key findings regarding target outcomes and study quality. Some studies were identified that used both standardised and non-standardised assessments. For

these, only the findings from the standardised assessments were extracted and evaluated. A meta-analysis was not conducted given the heterogeneity of ethnic, racial and cultural categorisation, chronic pain populations, target outcomes and statistical analyses.

4 Results

4.1 General Description

The 18 studies all used observational, cross-sectional designs. The studies were categorised into those that assessed ethnic or cultural variations in impairment in functioning (e.g. psychological distress, disability, eight studies) and studies that assessed cognitive factors (alone or in addition to functioning variables, 10 studies). Across these groups, four studies assessed cultural variation of people residing within at least two different countries and 14 studies described comparison groups in ethnic or racial terms.

A summary of methodology and results for the studies that focused on variations in functioning impairment are presented in Tables 1 and 2 respectively². Similarly this information for the studies including cognitive variables is referenced in Tables 3 and 4. Table 5 summarises key characteristics for all of the studies.

² The references for the measures cited in these tables are from the corresponding study.

Table 1 *Studies Focussing on Ethno-cultural Variation in Psychological Distress and Disability (n8): Sample Characteristics and Methodology*

ID)Author/s	Country	Pain condition	Groups (N, female)	Sample selection	Mean age, years (SD)	Review specific variables and measures
1) Brena, Sanders & Motoyama (1990)	America, Japan	Low back	Japanese (11, 7), American (10, 5)	Randomly selected patients from Back Clinic (Tokyo), and Pain Control and Rehabilitation Institute (Georgia).	Japanese: 54 (14). American: 41 (14)	1) Physical, Psychosocial and Other (i.e. work, recreational, sleep-rest, home management) Impairment: Sickness Impact Profile (SIP, Bergner et al., 1981).
2) Edwards et al. (2001)	USA	Heterogeneous	African American (68, 33), White (269, 99)	Consecutive patients attending inter-disciplinary pain treatment program.	AA grp: 40.6 (NR) W grp: 40 (NR)	1) Impact of pain on life, daily activity level: Multidimensional Pain Inventory (MPI; Kerns et al., 1988). 2) Depression: Beck Depression Inventory (BDI; Beck et al., 1961). 3) Disability: Oswestry Disability Questionnaire (ODQ; Fairbank et al., 1980) 4) Pain experience: McGill Pain Questionnaire (MPQ; Melzack, 1975) 5) Anxiety: State-Trait Anxiety Inventory (STAI; Spielberger, 1983). 6) Physical functioning: 100-yard timed walking test.
3) Gralnek et al. (2004)	USA	Irritable Bowel Syndrome	Non-white (166, 118): African-American (66), Hispanic (56), Asian American (25), Native American (2) and 'other' (17), White (707, 469)	Consecutive ambulatory patients evaluated at a Functional Bowel Clinic .	Non-white: 42.9 (13), White: 46.1 (14)	1) Health-related Quality of Life (Physical, mental and social functioning and well-being): SF36 Health Survey Version 1 (Ware & Sherbourne, 1992).
4) Green et al. (2003)	USA	Heterogeneous	Black American (353, 248), White American (3316, 1986)	Retrospective analysis of database information on people presenting at a tertiary care pain centre.	BA grp: 37.1 (7.5), WA grp: 36.1 (7.7)	1) Perceived pain experience: Multidimensional Pain Inventory (MPQ; Latham & Davis, 1994) 2) Physical functioning: Pain Disability Index (PDI; Tait, Chibnall & Krause, 1990) 3) Psychosocial factors (pain severity, mood, coping): McGill Pain Questionnaire (MPI; Melzack, 1975) 4) Depression: Beck Depression Inventory (BDI; Beck, 1961) 5) Symptoms associated with PTSD: Post Traumatic Chronic Pain Test (PCPT; Muse & Frigola, 1986).
5) Green et al. (2004) ^a	USA	Heterogeneous	African American (163, 114), White (1906, 1109)	Patients at initial assessment and treatment at a university pain centre.	AA grp: 42.2 (10.8), W grp: 42.4 (11.7)	1) Pain Severity: Multidimensional Pain Inventory (MPQ; Latham & Davis, 1994) 2) Physical and social functioning: Pain Disability Index (PDI; Tait, Chibnall & Krause, 1990) 3) Depression: Beck Depression Inventory (BDI; Beck, 1961) 4) Symptoms associated with PTSD: Post Traumatic Chronic Pain Test (PCPT; Muse & Frigola, 1986). 5) Affective distress: 3 items from West Haven-Yale Multidimensional Pain Inventory on pain severity, mood and coping (WHYMPI; Kerns et al 1985).

^aSubset of this population reported in Green et al. (2003), ♪ Japanese and American sample and results same as Brena et al. (1990), NR Not reported, **AA grp** African American, **BA grp** Black American, **WA grp** White American, **W grp** White.

Table 1 *Continued*

ID)Author/s	Country residence	Chronic pain problem	Groups (N, female)	Sample selection	Mean age, years (SD)	Review specific variables and measures
6) McCracken et al. (2001)	USA	Heterogeneous	Black (57, 42), White (207, 133)	Patients seeking treatment at university pain management centre.	Black: 47.3 (14.1), White: 46.6 (13.7)	1) Depression: Beck Depression Inventory (BDI; Beck, Ward & Mendelson, 1961) 2) Physical Symptoms associated with emotional distress: Modified Somatic Perception Questionnaire (MSPQ; Main, 1983) 3) Pain-related anxiety: Pain Anxiety Symptoms Scale (PASS; McCracken, Zayfert & Gross, 1992) 4) Disability (physical and psychosocial): Sickness Impact Profile (SIP; Bergner et al., 1981).
7) Ndao-Brumblay & Green (2005)	USA	Heterogeneous	Black (104, 104), White (1088, 1088)	Patients presenting for chronic pain assessment at a tertiary pain centre.	Black: 41.4 (11), White: 43.2 (14)	1) Pain severity and characteristics: McGill Pain Questionnaire (MPQ; Melzack, 1975) 2) Physical and Social interference of pain: Pain Disability Index (PDI; Tait et al., 1990) 3) Depression: Beck Depression Inventory (BDI; Beck et al 1961) 4) Post Traumatic Stress Disorder: modified version of Post-traumatic Chronic Pain Test (PCPT; Muse & Frigola, 1987) 5) Affective distress: Items from the West Haven-Yale Multidimensional Pain Inventory (WHYMPI; Kerns et al., 1985).
8) Sanders et al. (1992) ‡	USA, Japan, Mexico, Columbia, Italy, New Zealand	Low back	American (10, 5), Japanese (11, 7), Mexican (10, 5), Colombian (10, 6), Italian (11, 8), New Zealand (11, 8)	Randomly selected patients treated at chronic pain treatment programmes.	American: 41 (14), Japanese: 54 (14), Mexican: 49 (11), Colombian: 40 (12), Italian: 50 (18), New Zealand: 39 (12)	1) Physical, Psychosocial and Other (i.e. work, recreational, sleep-rest, home management) Impairment: Sickness Impact Profile (SIP, Bergner et al., 1981).

^aSubset of this population reported in Green et al. (2003), ‡ Japanese and American sample and results same as Brena et al. (1990), NR Not reported, **AA grp** African American, **BA grp** Black American, **WA grp** White American, **W grp** White

Table 2 *Studies Focussing on Ethno-cultural Variation in Psychological Distress and Disability: Methodological Controls and Results*

ID)Author/s	Groups (N, female)	Matched grps/ Similarities*	Group differences**	Statistical Controls	Results: differences (p< 0.05)	Non-significant findings
1) Brena, Sanders & Motoyama (1990)	Japanese (11, 7), American (10, 5)	Age, pain duration, gender, mean no. of pain surgeries.	NR	Pain duration	Americans: higher Overall Impairment, Psychosocial and Other impairment scores.	Physical impairment .
2) Edwards et al. (2001)	African American (68, 33), White (269, 99)	Age, pain location, pain duration, no. pain locations, percentage taking opioids, benzodiazepines, antidepressants.	W grp : more pain-related surgeries. AA grp : marginally significant greater percentage females, and people taking muscle relaxants, greater pain severity, higher pain rating.	2) No. of surgeries, gender, percentage taking muscle relaxants	1) AA grp : greater disability, greater walking time, higher life control score 2) AA grp : greater pain-related disability factor.	Pain interference, general activity, affective distress, depression, anxiety, emotional distress factor.
3) Gralnek et al. (2004)	Non-white (166, 118): African-American (66), Hispanic (56), Asian American (25), Native American (2) and 'other' (17), White (707, 469)	Gender, marital status.	Non-white : younger. White : greater percentage with professional/ graduate degree level education and higher percentage with greater income.	Income, education level, age, gender	AA grp : worse physical functioning than White grp , 'Other' non-white : worse emotional well-being, vitality and general health perception but all these not stat sig after adjusting for multiple comparisons.	All 8 Health-related quality of life scales. No difference between Hispanics or Asians compared with Whites .
4) Green et al. (2003)	Black American (353, 248), White American (3316, 1986)	Enjoyment of work, education, use of alcohol for pain.	BA grp : older, fewer married, fewer female, lower annual income, more involved in legal action, less use alcohol and caffeine, more pain.	Pain severity	BA grp : higher disability, more depressive symptoms, more irritable (one item), more anxious (one item), better 'overall mood'.	Ability to cope (one item).
5) Green et al. (2004) ^a	African American (163, 114), White (1906, 1109)	Education, age, pain duration, alcohol, caffeine and tobacco use.	AA grp : more female, lower income, less married, more likely to be taking legal action, more pain.	2) Age, gender, pain duration, income, litigation status	1) AA grp : higher disability, more depression. 2) Percentage of AA grp greater in cluster representing most severe outcomes. Within two clusters (most severe and intermediate profiles) AA grp had higher disability.	NR

* No statistical differences found, ** Statistical differences found (p<.05), ^a Subset of this population reported in Green et al. (2003), 1 Japanese and American sample and results same as those reported in Brena et al. (1990), NR Not reported, **AA grp** African American, **BA grp** Black American, **B grp** Black, **WA grp** White American, **W grp** White.

Table 2 *Continued*

ID)Author/s	Groups (N, female)	Matched grps/ Similarities*	Group differences**	Statistical Controls	Results: differences (p<0.05)	Non-significant findings
6) McCracken et al. (2001)	Black (57, 42), White (207, 133)	Age, gender, pain location, work status, no. of surgeries, medical diagnosis, pain medications, recipient of wage replacement, involvement in litigation, education, pain duration.	B grp: less married, higher pain severity.	Pain severity	B grp: greater avoidance of pain and activity, fearful thinking about pain and total pain-related anxiety.	Depression, cognitive or physiological symptoms of anxiety. Physical, psychosocial and total disability. No interaction or main affect between sex and race.
7) Ndao-Brumblay & Green (2005)	Black (104, 104), White (1088, 1088)	Age, education, pain duration.	B grp: less married or having a significant other, more living in areas with lower household income, more involved in legal action, higher frequency of co-morbid conditions of gastric ulcers and high blood pressure, higher pain severity.	2) Age, income, education, litigation, blood pressure, gastric ulcer, pain duration, combined factor of physical and psychosocial factors	1) B grp: higher depression and affective distress 2) B grp: higher levels of disability and lower depression	Pain scores in relation to family and home responsibilities, No relationship between race and affective distress.
8) Sanders et al. (1992) ¹	American (10, 5), Japanese (11, 7), Mexican (10, 5), Colombian (10, 6), Italian (11, 8), New Zealand (11, 8)	Gender distribution, pain duration, no. of surgeries.	Japanese, Mexican and Italian: older than the American, Columbian and New Zealanders. Americans: higher pain intensity than other cultures.	Pain intensity, age, diagnostic code	American and Italian: higher Psychosocial impairment than Japanese, Mexican, Columbian or New Zealanders. American and New Zealanders: higher impairment on Other subscale of SIP than Japanese, Mexican, Columbian or Italian. American and Italian: highest social impairment. Italians and New Zealanders: highest emotional impairment. American and New Zealand: higher impairment on recreation and work scales and Italians: higher on recreation.	Overall and Physical impairment. No differences between countries not mentioned.

* No statistical differences found, ** Statistical differences found (p<.05), ^a Japanese and American sample and results same as those reported in Brena et al. (1990),

¹Subset of this population reported in Green et al. (2003), NR Not reported, **AA grp** African American, **BA grp** Black American, **B grp** Black, **WA grp** White American, **W grp** White.

Table 3 *Studies Assessing Ethno-cultural Variation in Cognitive Variables (n10): Sample Selection and Methodology*

ID)Author/s	Country	Pain Condition	Groups (N, female)	Sample: Selection	Mean age, years (SD)	Review specific variables and measures
9) Bates & Edwards (1992)	USA	Heterogeneous	Old American (100, 50), Hispanic (44, 15), Irish (60, 25), Italian (50, 21), French Canadian (90, 48) and Polish (28, 14)	Patients from pain control centre.	OA grp: 43.5 (14.7), H grp: 41.1 (10.5), It grp: 46.5 (15.9), FC grp: 44.2 (14.7), Ir grp: 46.1 (15.7), P grp: 46.6 (15.5)	1) Pain Perception: McGill Pain Questionnaire (MPQ; Melzack, 1975) 2) Locus of control: items taken from Rotter's (1966) scale.
10) Bates et al. (1994) ^a	USA, Puerto Rico	Low back pain	Anglo-American (48, 25) ^a , Puerto Rican: (48, 32)	Patients from pain control centre in USA, and medical centre in Puerto Rico.	AnA grp: 41.2 (14.3), PR grp: 60.5 (11.2)	1) Pain Perception: McGill Pain Questionnaire (MPQ; Melzack, 1975) and pain rating index 2) Locus of control: items taken from Rotter's (1966) scale.
11) Cano, Mayo & Ventimiglia (2006)	USA	Heterogeneous	Caucasian (69, ?) African American (58, ?)	Community sample recruited through newspaper adverts.	Total: 53.64 (13.10)	1) Coping: Coping Strategies Questionnaire-Revised (CSQ-R; Riley, Robinson & Geisser, 1999) 2) Pain severity and interference: Multidimensional Pain Inventory (MPI, Kerns et al., 1995) 3) Physical and psychosocial disability: Sickness Impact Profile (SIP, Bergner et al., 1981).
12) Edwards et al. (2005)	USA	Heterogeneous	African American (97, 51), Hispanic (97, 51), White (97, 51)	Patients seeking treatment at university pain management centre.	AA grp: 46.3 (11.6), H grp: 45.1 (15.5), W grp: 45.1 (15.1)	1) Pain experience (pain severity, impact of pain on life, daily activity levels): Multidimensional Pain Inventory MPQ; Kern et al., 1988) 2) Depression: Beck Depression Inventory (BDI; Beck et al., 1961) 3) Pain Perception: McGill Pain Questionnaire- Short Form (MPQ; Melzack, 1987) 4) Psychological symptoms: Brief Symptom Inventory (BSI; Derogatis & Melisaratos, 1983) 5) Coping: Coping Strategies Questionnaire (CSQ; Robinson et al., 1997).
13) Jordan, Lumley & Leisen (1998)	USA	Rheumatoid Arthritis	African American (48, 48) Caucasian (52, 52)	Patients from Outpatient Rheumatology clinic.	AA grp: 55.5 (11.7) C grp: 54 (13.4)	1) Coping: Coping Strategies Questionnaire (CSQ; Rosenstiel & Keefe, 1983) 2) Pain Control beliefs: Scale of the Survey of Pain Attitudes (Jensen et al., 1987) 3) Pain Severity: average of 4 VAS scales 4) Neg affect (Depression and Anxiety): composite score from: Center for Epidemiological Studies Depression Scale (CES-D 50; Radloff, 1977) and State Trait Anxiety Inventory (STAI; Spielberger, 1983) 5) Inactivity: Activity Scale from West Haven-Yale Multidimensional Pain Inventory (Kerns et al., 1985). 6) Behavioural impairment: bilateral grip strength, walking time.

^a Subset of sample reported in Bates and Edwards (1992), NR Not reported, **OA grp** Old American, **H grp** Hispanic, **It grp** Italian, **FC grp** French Canadian, **Ir grp** Irish, **P grp** Polish, **AnA grp** Anglo-American, **PR grp** Puerto Rican, **AA grp** African American, **W grp** White, **C grp** Caucasian, **NZ grp** New Zealander, **USA grp** American.

Table 3 *Continued*

ID)Author/s	Country	Pain Condition	Groups (N, female)	Sample: Selection	Mean age, yrs (SD)	Review specific variables and measures
14) Lumley et al. (2005) (3 studies)	USA	3 studies: 1) Rheumatoid Arthritis 2) Migraine headaches 3) Systemic Lupus erythematosus	1) African American (65, 60) Caucasian (90, 76) 2) African American (25, 23) Caucasian (135, 112) 3) African American (69) Caucasian (54)	1) Patients from rheumatology clinics 2) Patients at neurology headache clinic and students at a public university 3) Patients from two rheumatology clinics.	1) C grp: 54.9 (10.4) AA grp: 55 (12.5) 2) C grp: 32.6 (13.5) AA grp: 27.4 (11.2) 3) C grp: 41.2 (10.5) AA grp: 42.6 (11.9)	1) a) Alexithymia: Twenty-item Toronto Alexithymia Scale (TAS-20; Bagby et al., 1994), 3 facets: Difficulty Identifying Feelings (DIF), Difficulty Describing Feelings (DDF), Externally oriented thinking (EOT) b) Physical Disability: Arthritis Impact Measurement Scales-2 (AIMS2; Meenan et al., 1992) 2)a) Alexithymia: TAS-20 (Bagby et al., 1994) b) Headache Disability: Headache Disability Inventory (Jacobson et al., 1994) 3)a) Alexithymia: TAS-20 (Bagby et al., 1994).
15) Novy et al. (1998)	USA	Heterogeneous	African American (21), Caucasian (62), Hispanic (7)	Consecutive patients at a multidisciplinary pain centre.	Total: 39 (10)	1) Coping strategies and appraisals: Coping Strategies Questionnaire (CSQ; Rosenstiel & Keefe, 1983) 2) Dispositional Optimism: Life Orientation Test (LOT, Scheier & Carver, 1985).
16) Ruhlman, Karoly & Newton (2005)	USA	Heterogeneous	Non-Hispanic African Americans (214, 125). Non-Hispanic Caucasians (214, 125)	National sample, random-digit telephone dialling (stratified gender, age).	AA grp: 51, C grp: 56	1) Pain level, interference with functioning, emotional burden: Profile of Chronic Pain: Screen (PCP:S; Ruhlman et al., 2003). 2) Pain site, coping, pain attitudes and beliefs, catastrophising, positive, negative social responses from important person, functioning information, treatment efforts: PCP: Extended Assessment (PCP:EA; Ruhlman et al., 2003).
17) Tait, Degood & Carron (1982)	NZ, USA	Low back	New Zealand (96, 48), USA (188, 81)	Consecutive patient admissions to pain clinics.	NZ grp: 42.95 (13.51), USA grp: 43.1 (12.6)	1) Health Locus of Control: HLC Scale (Wallston et al., 1976).
18) Tan et al. (2005)	USA	Heterogeneous	Non-hispanic black (128, 14), Non-hispanic white (354, 34)	Patients referred to Integrated Pain Management Program (IPMP), tertiary teaching hospital.	Black: 48.3 (10.2), White: 52.0 (11.9)	1) Control appraisals and pain-related beliefs: Life Control scale of West Haven-Yale Multi-dimensional Pain Inventory (WHYMPI, Kerns et al., 1985), Arthritis Self-Efficacy scale (adapted for chronic pain to make Pain Self-Efficacy Scale with 2 subscales, Lorig et al., 1989), Survey of Pain Attitudes (SOPA, Jensen et al., 1994) 2) Coping: Coping Strategies Questionnaire (CSQ; Rosenstiel & Keefe, 1983), Chronic Pain Coping Inventory (CPCI, Jensen et al., 1995) 3) Depression: Center for Epidemiological Studies Depression Scale (CES-D, Radloff & Locke, 1977), 4) Disability: Roland and Morris Disability Questionnaire (RMDQ, Roland & Morris, 1983), 5) Pain Interference and severity: WHYMPI (Kerns et al., 1985).

^a Subset of sample reported in Bates and Edwards (1992), NR Not reported, **OA grp** Old American, **H grp** Hispanic, **It grp** Italian, **FC grp** French Canadian, **Ir grp** Irish, **P grp** Polish, **AnA grp** Anglo-American, **PR grp** Puerto Rican, **AA grp** African American, **W grp** White, **C grp** Caucasian, **NZ grp** New Zealander, **USA grp** American.

Table 4 *Studies Assessing Ethno-cultural Variation in Cognitive Variables: Methodology and Results*

ID)Author/s	Groups (N, female)	Matched grps/ Similarities*	Group differences**	Statistical Controls	Results: differences (p< 0.05, findings from non-standardised measures not included)	Non-significant findings
9) Bates & Edwards (1992)	Old Americans (100, 50), Hispanics (44, 15), Irish (60, 25), Italians (50, 21), French Canadians (90, 48) and Polish (28, 14)	Age, gender, income, pain duration, distribution of diagnoses, pain treatments, mean no. and type of medications	Heritage consistency differences between OA grp and all 5 other grps, between H grp with FC grp and Ir grp . H grp less yrs of education than all grps. OA grp : only group with more protestants than catholics. H grp : higher pain intensity than other s.	NR	In H grp over 80% showed external LOC style, in P grp 90% showed internal LOC, FC grp 60% internal, It grp and Ir grp 65% internal. Except for OA grp , ethnic grp predicted LOC style.	NR (in relation to review question and using standardised measures).
10) Bates et al. (1994) ^a	Anglo-Americans (48, 25) ^a , Puerto Rican (48, 32)	Gender, education, income, religion, LOC, workers compensation.	PR grp : higher pain duration, higher pain intensity, older and more Catholics.	NR	NR (in relation to review question and using standardised measures)	Locus of control.
11) Cano, Mayo & Ventimiglia (2006)	Caucasian (69, ?), African American (58, ?)	Distribution of education, diagnosis type except spine or disk problems	C grp : more spine or disk problems, mean years of education, less pain.	2) Education level 3) Age, pain intensity and severity, current major depressive disorder, dysthymia, pain duration, psychological treatment, medication usage and others.	1) AA grp : higher interference and disability. AA grp : greater use of diverting attention and prayer and hoping coping strategies 2) Race remained significant correlate of prayer and hoping 3) Interactions: Physical disability : Race X Education X reinterpreting pain sensations (higher education related to lower disability when higher levels of reinterpretation). Disability higher for AA grp . Race X Education X Coping self-statements (for C grp with lower education and AA grp with all levels education, greater coping self-statements associated with less disability. For C grp with high education however slight association more coping self-statements with more disability). Race X Education X Coping Self-statements- all with lower education greater coping self-statements associated with less Psychosocial disability. For those with higher education levels, greater coping self-statements slightly associated more disability.	1) Coping strategies: reinterpreting pain sensations, coping self-statements, ignoring pain sensations 2) After controlling education, diverting attention and other pain variables 3) No other 2 way or 3 way interactions (including race, education, coping).

* No statistical differences found, ** Statistical differences found (p<.05), ^a Subset of sample reported in Bates and Edwards (1992), NR Not reported, **OA grp** Old American, **H grp** Hispanic, **It grp** Italian, **FC grp** French Canadian, **Ir grp** Irish, **P grp** Polish, **AnA grp** Anglo-American, **PR grp** Puerto Rican, **AA grp** African American, **W grp** White, **C grp** Caucasian, **NZ grp** New Zealander, **USA grp** American.

Table 4 *Continued*

ID)Author/s	Groups (N, female)	Matched grps/ Similarities*	Group differences**	Statistical Controls	Results: differences (p< 0.05, findings from non-standardised measures not included)	Non-significant findings
12) Edwards et al. (2005)	African American (97, 51), Hispanic (97, 51), White (97, 51)	Matched: gender, pain location, duration, age, education, work status. No difference pain severity/intensity.	NR	NR	AA grp and H grp scored higher than W grp on praying and hoping subscale and catastrophising.	Disability, depression and psychological symptoms. Coping subscales, except praying and hoping.
13) Jordan, Lumley & Leisen (1998)	African American (48, 48) Caucasian (52, 52)	Age, education, RA duration, grip strength, joint count, pain severity.	AA grp : less income, less married and walking time slower.	1) Income, marital status, education, pain severity, negative affect, inactivity, RA duration, behavioural impairment (grip strength, walk time), no. swollen/tender joints.	1) AA grp : more use of diverting attention and praying/hoping coping strategies. C grp : use more ignoring pain and use of coping statements (p= 0.08) 2) AA grp : less physically active. 3) Significant interaction tests: 1: AA grp : praying/hoping positively correlated inactivity, C grp : inverse relationship, 2: AA grp : reinterpreting pain positively related to greater negative affect, C grp : inverse relationship.	Pain control beliefs and negative affect.
14) Lumley et al. (2005) (3 studies S1-S3)	1) African American (65, 60) Caucasian (90, 76) 2) African American (25, 23) Caucasian (135, 112) 3) African American (69) Caucasian (54)	1) Age, percentage females and education 2) Similar education, age, gender 3) All female, age, education.	S1) AA grp : Significantly lower income, greater pain severity (p= 0.07) S2) AA grp more headache days. S3) AA grp Significantly lower income.	S1) Age, gender, income, education S2) a and b Age, gender and education. S3) age, education, income.	S1) AA grp : greater disability S2) a) AA grp : sig higher on Difficulty Describing Feelings (DDF) facet and greater headache disability b) DIF facet positively correlated with disability for C grp but not correlated for AA grp .	S1) Alexithymia S3) Alexithymia (total). EOT difference not sig after controls All) No difference between the groups in correlations of Alexithymia with disability.
15) Novy et al. (1998)	African American (21), Caucasian (62), Hispanic (7)	NR	NR	NR	Ethnicity sig related to praying and hoping pain coping subscale in univariate ANOVA. C grp and H grp used praying and hoping less than AA grp .	Other coping strategies, praying and hoping when means compared using Tukey's test with Bonferroni at .01.

* No statistical differences found, ** Statistical differences found (p<.05), ^a Subset of sample reported in Bates and Edwards (1992), NR Not reported, **OA grp** Old American, **H grp** Hispanic, **It grp** Italian, **FC grp** French Canadian, **Ir grp** Irish, **P grp** Polish, **AnA grp** Anglo-American, **PR grp** Puerto Rican, **AA grp** African American, **W grp** White, **C grp** Caucasian, **NZ grp** New Zealander, **USA grp** American.

Table 4 *Continued*

ID)Author/s	Groups (N, female)	Matched grps/ Similarities*	Group differences**	Statistical Controls	Results: differences (p< 0.05, findings from non-standardised measures not included)	Non-significant findings
16) Ruehlman, Karoly & Newton, (2005)	Non-Hispanic African Americans (214, 125), Non-Hispanic Caucasians (214, 125)	Gender, pain sites and no., access to treatment, no. in F/T employment, rate of treatments, pain severity.	C grp : older, higher levels of education, greater married. AA grp : more used over-counter medication and C grp : more prescription. AA grp : higher levels of emotional support, greater insensitivity and impatience (p= 0.057) from most imp person.	Gender, age, level of education.	1) AA grp : more interference in 9/10 activities of daily living except sleep 2) Coping: AA grp : more guarding and less task persistence 3) AA grp : greater perceptions of disability (p= 0.055), lower levels of perceived control, greater belief in medical cure, more pain-induced fear 4) AA grp : higher levels of catastrophising.	Interference and emotional burden. Ignoring or positive self-talk.
17) Tait, Degood & Carron (1982)	New Zealand (96, 48), USA (188, 81)	Age, education.	USA grp : less pain duration.	NR	1) Three factors identified: 1: attributing control over health to external factors, 2: personal control and blame issues, 3: control by others. 2) NZ grp : less dependent on physicians' orders.	Personal control and external control subscales
18) Tan et al. (2005)	Non-hispanic black (128, 14), Non-hispanic white 354(34)	Gender, marital status, pain duration, receiving disability.	W grp : older, lower pain intensity.	1) pain severity 3) Age, gender, marital status, education	1) Black grp : greater praying/hoping as a coping strategy, depression, disability. 2) Black grp : lower scores on Factor 2 (pain control and disability attitudes) and higher on Factor 3 (behavioural coping), Factor 4 (external coping), and Factor 5 (appraisal of emotion and solicitude).	1) No other differences in control appraisals, pain beliefs and coping 3) Ethnicity not sig predictor of pain, depression and functioning variables after controlling for demographics and pain severity. No interaction effect with ethnicity and factors scores in prediction of pain, depression, functioning.

* No statistical differences found, ** Statistical differences found (p<.05), ^a Subset of sample reported in Bates and Edwards (1992), NR Not reported, **OA grp** Old American, **H grp** Hispanic, **It grp** Italian, **FC grp** French Canadian, **Ir grp** Irish, **P grp** Polish, **AnA grp** Anglo-American, **PR grp** Puerto Rican, **AA grp** African American, **W grp** White, **C grp** Caucasian, **NZ grp** New Zealander, **USA grp** American.

Table 5. *Summary of Study Characteristics*

Study Characteristics	Studies assessing impairment in functioning (8)	Studies assessing cognitive factors (10)
Population factors		
Sample size range	10 - 3316	7 – 354
Total no. participants (female, %) ^a	8488 (5594, 65.9)	2708 (b)
Mean ages range (yrs)	36.1 – 54	27.4 – 60.5
	Number of studies	
Chronic pain conditions		
Heterogeneous	5	6
Low back	2	2
Irritable Bowel	1	
Rheumatoid Arthritis		2
Migraine Headaches		1
Systemic Lupus		1
Erthematosus		
Variables measured (standardised self-report)		
Depression	4	} 5
Anxiety	1	
Affective Distress	2	
Physical functioning/ impairment	7	} 6
Psychosocial functioning/ impairment	6	
Quality of life	1	
Coping		6
Locus of Control		3
Alexithymia		1
Catastrophising		2
General and pain control beliefs		4
Additional measures		
Timed walk (physical functioning)	1	

^a Six studies used over lapping participant populations (study 4 with study 5, study 1 with study 8 and study 9 with study 10). ^b The percentage of females could not be calculated since two studies failed to report gender distribution within the groups.

4.2 Ethno-cultural Variation in Psychological Distress and Disability (8 studies)

4.2.1 Findings: Participants Residing within the Same Country

Six studies assessed distress and/or disability in participants with different ethnic identities living in America including African American (including 'black', n 811), Caucasian (including 'white', n 7493), Hispanic (n 56) and Asian American (n 25).

Statistically significant ethnic group differences in psychological distress (after various control/s applied) were identified for three of the six studies (studies 4, 6, 7). Some of these studies found that African American (including 'black') groups reported more depression (study 4) and anxiety (studies 4, 6) than Caucasian (including 'white') groups. Other studies identified that African Americans reported lower depression and better 'overall mood' than Caucasians (study 7 and study 4 respectively).

Significant differences in physical disability (having controlled for other variables) were identified in four studies (studies 2, 4, 5, 7) finding that African Americans (including 'black') reported greater physical disability than Caucasian (including 'white') populations.

Four studies revealed non-significant inter-group differences. These included psychological distress (depression: study 2 and 6. anxiety: study 2 and 6, emotional well-being: study 3, affective and emotional distress: study 2 and 7), physical disability (activity levels: study 2, physical functioning/disability: studies 3 and 6),

psychosocial disability (study 6) and health related quality of life (study 3). Notably there were no differences between the Hispanic or Asian populations and other ethnic groups (study 3).

4.2.2 Findings: Participants Residing within Different Countries

Two studies assessed psychological distress and disability in people with chronic pain according to their nationality and country of residence.

Both studies controlled for demographics. American populations reported higher psychosocial impairment than Japanese (study 1 and 8), Mexican, Columbian and New Zealand populations (study 8). Sanders et al. (1992) also found additional cultural differences in psychosocial, social and emotional impairment, and work and recreational activity levels (see Table 2), with American, New Zealand and Italian groups reporting the highest levels of impairment (Sanders et al., 1992). Neither study revealed cultural differences in physical impairment.

4.3 Ethno-cultural Variation in Cognitive Variables and the Prediction of Psychological Distress and Disability (10 studies)

4.3.1 Findings: Participants Residing within the Same Country

Eight of the studies assessing cognitive factors included respondents with different ethnic/cultural identities living within America including ‘Old Americans’ (n 100),

Caucasians (n 1127), African American (n 901), Hispanic (n 148), Irish (n 40), Italians (n 50), French Canadians (n 90) and Polish (n 28).

Five of the six studies that assessed coping found that African Americans reported greater use of praying and hoping as a coping strategy than Caucasians (studies 11, 12, 13, 15 and 18). Three of these differences remained after a variety of demographic variables were controlled for (studies 11, 13 and 18). African Americans were also found to be more likely to use coping strategies such as attention diversion and guarding, and were less likely to persist with tasks (studies 11, 13 and 16). Two studies identified interaction effects involving ethnicity and coping in the prediction of distress and/or disability (studies 11 and 13). Jordan, Lumley and Leisen (1998) found that, for African Americans greater use of praying and hoping was related to greater inactivity and reinterpreting pain to greater negative affect; the inverse was true for the Caucasian group. Cano, Mayo & Ventimiglia (2006) found that ethnicity featured within three interaction effects involving coping strategies with education in the prediction of physical and psycho-social disability.

Statistically significant group differences were not found in participants' use of the coping strategies: reinterpreting pain sensations, coping self statements, ignoring pain sensations and positive self-talk. Additionally, Tan, Jensen, Thornby, & Anderson (2005, study 18) found no interaction effect with ethnicity and coping factors in the prediction of depression and disability.

Significant differences were found in three additional cognitive constructs assessed in participants residing within the same country; locus of control (study 9);

catastrophising (studies 12 and 16); and alexithymia (study 14). All constructs were measured using either validated questionnaires or items from such questionnaires.

Regarding locus of control, Bates and Edwards (1992, study 9) found that 80% of the Hispanic group reported an external locus of control in contrast to the Polish, French Canadians, Italian and Irish groups where the majority reported an internal locus of control (not measured statistically and without controlled variables). Of the two studies that assessed catastrophising, both found that African American groups reported this more highly than White/non-Hispanic Caucasian groups (study 12: without controlled variables, study 16: with controlled variables). Regarding alexithymia, Lumley et al. (2005) found that the African American group more highly endorsed the sub-facet concerning difficulty describing feelings. No differences emerged between African American and Caucasian groups in endorsement of alexithymia in general or between the groups associations of alexithymia with disability (study 14: with controlled variables).

Finally, no differences were found in pain control beliefs and appraisals in two studies (studies 13, 18). Additionally, no interaction effects were found between ethnicity and factor scores (assessing attitudes, beliefs and coping) in prediction of depression and functioning (study 18). One difference was noted in one study where the African American group reported less perceived control over pain than the Caucasian group (study 16).

The studies described in this section also reported findings on psychological distress and disability. In summary, when demographic variables were controlled no

significant ethnic differences were found in variables assessing psychosocial disability (study 11), depression (study 12 and 18), negative affect (study 13) and emotional burden (16). The findings on physical disability were equivocal with reported differences (studies 13, 16) and similarities (study 18).

4.3.2 Findings: Participants Residing within Different Countries

Two studies involving chronic pain populations within different countries (America and Puerto Rico: study 10, America and New Zealand: study 17) revealed that locus of control (external and internal/personal control) was unrelated to cultural group. The only difference was where a New Zealand group was less dependent on physician orders than an American group (study 17).

4.4 Study Quality

A number of methodological caveats question internal and external validity and suggest instances where the existence of difference should be questioned or indeed why differences were not identified.

4.4.1 Samples

Study samples had three implicit sources of bias. Primarily, studies sampled small numbers of respondents with no apriori power calculations reported. Additionally, group sizes varied greatly within studies, increasing within-group homogeneity in smaller groups and questioning generalisability of significant findings. Reduced

power in the multivariate analyses may also account for the lack of significant findings in some of the variables assessing distress, disability and cognitive factors.

Secondly, the majority of samples compared patient populations (16 of 18 studies). Four studies reported that participants were selected on a consecutive basis and only one utilised randomisation procedures. Only two studies recruited community samples with one using random-digit dialling procedures (study 16). For patient populations African American reports prior to treatment may have been elevated due to distrust of health care services and the desire to seek validation and acquire treatment (LaVeist, Nickerson & Bowie, 2000). Reporting is therefore based on a very specific group of people for whom responses may not be generalised to the wider population of people living with chronic pain. Moreover one study included a mixed sample of students and clinic patients with no mention of the distribution of these participants across the groups (study 14). An unequal sample distribution in this study may explain why the African American group had higher scores related to difficulty describing feelings.

Thirdly, the definition and description of ethnic and cultural groups, and assessment of participants' ethnic and cultural identity, varied considerably. For the majority of studies reporting method of group categorisation, racial or ethnic identity was self-defined by participants or independently by the researchers. Additionally, of the four studies assessing geographically defined cultural differences, only one reported participant ethnicity (study 10). This, in conjunction with the use of wide racial classifications (e.g. 'whites'), may have increased group heterogeneity and decreased apparent differences. Despite these shortcomings, two studies used a multi-factorial measure to define ethnic group membership and included data on the residence of

older generation family members and degree of heritage consistency³ (studies 9 and 10).

4.4.2 Measurement

All data reported in this review was generated through the use of standardised measures with known reliability and validity. Most studies used self-report measures, limited by the ability of insight into thoughts, feelings and behaviours. Reports from significant others and the use physical measures would have offered additional triangulation of data. For a substantial majority of assessments no information was provided on measures' cross-cultural sensitivity; a weakness given that constructs such as distress and disability may vary considerably in their expression between cultures. Greater use of measures assessing psychosomatic symptoms therefore may have aided in this investigation. Ethnic and cultural influences in language, such as metaphor use, may also influence reporting of distress and disability (Reiter, Eli, Gavish, & Winocur, 2006). Such concerns may indicate that some studies did not measure what they intended to measure. Some studies did however report on reliability statistics from the sample population, strengthening their findings (studies 11, 12, 13, 14, 15 and 17).

In addition to the nature of assessments, their timing for the patient populations may undermine external and internal validity. Thirteen studies reported measurement at an assessment and evaluation stage prior to treatment. For certain ethno-cultural groups

³ Heritage consistency referred to whether the participant's lifestyle reflected their ethnic heritage (Bates & Edwards, 1992).

there may have been greater investment in expressing and validating distress and disability at this time-point in order to ensure treatment is provided. This explanation is in part supported by findings of ethno-cultural disparities in pain management access, and physician's responses and substantial evidence that ethnic minorities in America are under-treated compared to non-Hispanic Whites (Cintron & Morrison, 2006; Green et al. 2003).

4.4.3 Control of Potentially Confounding Variables

Methods to address the bias arising from confounding variables included testing for the significance of inter-group differences, using groups with successfully matched demographics (study 12) and employing statistical controls as part of multivariate analysis (13 studies). Group differences were noted in a number of socio-demographic and pain-related variables (see Tables 2 and 4).

Of most relevance to bias are situations where important socio-demographic and pain-related group differences are found but not statistically controlled. This occurred in 10 studies (Studies 4, 5, 6, 7, 9, 10, 11, 15, 16, and 17) with the most common uncontrolled difference being marital status (studies 4, 5, 6, 7 and 16). Such uncontrolled variables may have caused some of the group differences in functioning or cognitive variables. For example, in Tait, Degood and Carron's (1982) study the New Zealand groups greater mean pain duration may have been responsible for their report of less dependency on physician's orders than the American group.

Finally, some studies did not measure potentially confounding variables; the nature of the chronic pain condition, marital status, occupational status, educational achievement, income, religion, receipt of incapacity benefit and health insurance, acculturation and access to care. Taken together these limitations may mean that group differences in dependent variables were actually attributable to social demographics and not purely ethno-cultural factors.

5 Discussion

A proportion of empirical literature reviewed demonstrated ethnic and geographically defined cultural group differences in distress, disability and related cognitive and coping phenomena. These findings are consistent with Bates' (1987) bio-cultural model of chronic pain perception and early empirical literature (Zborowski, 1952, 1969). However contradictory evidence was also found and it is therefore important to outline the nature, direction, and robustness of the apparent differences.

5.1 Ethnic and Cultural Groups Living within the Same Country

5.1.1 African American Groups vs Caucasian Groups

A significant proportion of studies reviewed assessed variation in experience between African American and Caucasian patients and community residents living in America. A corpus of these studies identified that African American groups reported greater levels of physical disability, anxiety and depression than Caucasian groups. All of these studies used standardised measures and limited inter-group differences in potentially confounding individual and socio-demographic variables. These findings are consistent with an earlier review that identified African American samples reporting greater 'psychological disturbance' and 'physical and psychosocial disability' than Caucasian samples (Green et al., 2003)

There are several reasons, however, why it cannot be conclusively argued that the experience of chronic pain is more psychologically and physically disabling for

African Americans than Caucasians. These reasons include the existence of contradictory differences, a relatively large number of non-significant findings and substantial methodological limitations.

If we assume, that the findings are an accurate reflection of lived reality for chronic pain sufferers there are various possible explanations. One suggestion is that greater pain levels and lower pain tolerance reported by African American samples (Creamer et al., 1999; Edwards et al., 2001) may lead to greater disability and depression. In a number of studies, however, there were no ethnic group differences in pain intensity or differences in disability and depression remained when pain intensity was controlled (study 4, 6 and 18).

Alternative explanations may emerge from the impact of social experiences. Earlier reviews identified that American ethnic minorities are under-treated compared to non-Hispanic Whites, perhaps related to communication problems between physicians and patients, treatment quality and treatment access difficulties related to economic limitations (Cintron & Morrison, 2006; Green et al., 2003). African American groups may also have experienced discrimination and have been found more likely to experience post-traumatic stress symptoms compared to Caucasian groups experiencing chronic pain (Ndao-Brumblay & Green, 2005). Such factors could contribute to elevated levels of physical disability and distress for African Americans with chronic pain.

Bates' (1987) bio-cultural model and cognitive behavioural models of chronic pain propose that individuals' socially acquired coping strategies, cognitive styles and

beliefs play a role in pain perception and the development of responses such as anxiety, depression and disability (Turk et al., 1983, Vlaeyen et al., 1995a). Studies reviewed provide some evidence for differences in these coping and cognitive constructs for people experiencing chronic pain. After a number of demographic variables were controlled in three studies African Americans consistently reported greater use of praying and hoping. Praying and hoping may reflect a more external health locus of control and has been linked with poorer functioning outcomes (Geisser, Robinson & Henson, 1994). Two studies also reported greater catastrophising, difficulty describing feelings and less perceived control over pain than the Caucasian group. Catastrophising has been defined as the cognitive exaggeration of threat associated with current or anticipated experiences, positively related to distress and disability (Keefe et al., 2000; Severeijns et al., 2002; Sullivan et al., 1998; Sullivan et al., 2001). Unfortunately, the majority of the reviewed studies did not assess relationships and interactions between coping and cognitive factors with distress and disability. Specifically, no studies directly assessed whether these constructs could justifiably be statistical mediators of ethnic group variation in distress or disability (Baron & Kenny, 1986).

5.1.2 Additional Ethnic and Cultural Groups

A relatively smaller number of studies assessed for ethno-cultural variation in pain responses and cognitive and coping variables in other ethnic and cultural groups living within the same country with no statistically significant differences identified. Two studies for example, found no differences between Hispanic groups and both African American and Caucasian groups in domains assessing depression, emotional

well-being and physical functioning. In one of these studies this lack of difference emerged following the addition of income and education as statistical controls implicating these socio-economic factors in producing cultural differences. Similarly no consistent pattern emerged for the Hispanic groups compared to the Caucasian and African American groups with regards to adoption of coping strategies (study 12 and 15).

5.2 Cultural Groups Living in Different Geographical Locations

Evidence was obtained within two studies to suggest that American people with chronic pain suffer from greater psychosocial impairment than Japanese (study 1 and 8), Mexican, Columbian and New Zealand populations (study 8). The findings involving American and Japanese populations may be related to an eastern cultural stoicism (Brena, Sanders, & Motoyama, 1990). The concept of health locus of control has been offered as a predictor of distress, and differences in this could also explain some of these differences (Arraras, Wright, Jusue, Tejedor, & Calvo, 2002). The study assessing locus of control with American and New Zealand participants however found no cultural differences in attributions of external and personal control over health (Tait, Degood & Carron, 1982). Finally, no evidence was found for significant geographically defined cultural differences in physical disability. In summary, little evidence was found to imply geographically-based cultural differences in chronic pain experience.

5.3 Summary of the Strength of Findings

A number of conclusions can be drawn from the identified findings and the quality analysis. Where differences were found in physical disability between ethnic groups, African American groups consistently reported greater disability than Caucasian groups. Likewise, where differences in praying and hoping were found, this coping strategy was consistently more highly endorsed for African American groups as opposed to Caucasian groups. Findings between these two ethnic groups in terms of psychological distress however were far more equivocal. Similarly, within the very small number of studies assessing geographically defined cultural groups, conclusions on disability, distress and cognitive factors are limited.

5.4 Further Investigation and Clinical Utility

Further research is needed to illuminate these equivocal findings concerning ethno-cultural variation in chronic pain experience, and needs to assess experience of diverse ethnic groups residing in different countries to extend the more solid body of research undertaken within Western countries and predominantly with African American and American Caucasian samples. The North American focus in particular limits the generalisability of findings to societies that have predominantly publicly funded healthcare systems. Such research could elicit strategies enabling coping and resilience. Recent research, for example has illuminated the positive role of the Eastern-born concept of mindfulness in the reduction of distress and disability (McCracken, Gauntlett-Gilbert & Vowles, 2007).

To strengthen the validity and reliability of findings, studies should aim to reduce between-group differences in potentially confounding socio-economic variables, such as education and income, and add greater clarity to the definition of cultural distinctions. Additionally, multivariate analysis could assess predictors of distress and disability. Combined, these methods could help draw out the unique contribution of cognitive processes, beliefs and coping strategies that are advocated as essential considerations for an understanding of chronic pain (Bates, 1987, Turk et al., 1983) and in turn highlight treatment targets. Cross-culturally sensitive measures could also be developed through qualitative, in-depth research aimed to address the beliefs and values of people from different cultures. Qualitative research would also highlight individual differences and the complexity of influential socio-cultural factors.

Despite the vulnerabilities of reviewed studies the existing evidence for ethno-cultural differences in chronic pain experience is clinically salient. Chronic pain services should aim to develop an awareness of the needs of the culturally-influenced communities that they serve. In America for example the effectiveness of chronic pain services might be aided by treatments that take into account the emotional and religious experiences of African Americans (Lipton & Marbach, 1984). The equivocal nature of the findings points to the complexity of multiple interacting cultural influences such as ethnicity with education (Cano et al., 2006) and highlights the need to consider ethnicity alongside cultural influences on individuals such as gender, religion and age and with associated external social circumstances such as income and education.

5.5 Review Critique

This review aimed to identify and critique the literature comparing the psychological and physical functioning experiences between ethno-cultural groups experiencing chronic pain. Although undertaken due to the lack of quantitative literature on the review question, the heterogeneity of both the ethnic and cultural group categories and the outcome variables has prohibited a neat synthesis of the research findings. Additionally, the selection of only English language studies is likely to have contributed to a significant bias and explanation for the focus on people residing in Western countries. This review focused largely on negative effects of chronic pain however further reviews could explore the qualitative literature on ethno-cultural variation in resilience and positive adaptation to a life with chronic pain: potentially identifying the meaning of chronic pain in relation to social concerns, which in vivo defy partitioning as easily as in the world of statistics.

In conclusion, there is some evidence for ethno-cultural variation in chronic pain experience. More important, however, is the recognition that cultural factors interplay in complex ways. This should encourage the clinician to remain curious about individuals' life stories and the personal meanings attached to their chronic pain experience. More rigorous and geographically-wider research is needed to provide further insight into the complexities of cultural influence on chronic pain responses. Such investigation is essential for understanding the processes involved in physical and psychological functioning. In turn, chronic pain related health burden can be reduced by ensuring effective treatment strategies that recognise these processes.

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⁴ * Asterisks denote references for studies subjected to the critical review.

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6 Abstract

There is growing evidence linking mindfulness as both an intervention and a state of consciousness, with enhanced well-being in those experiencing chronic pain (Kabat-Zinn, 1982; Kabat-Zinn, Lipworth & Burney, 1985; Kabat-Zinn, Lipworth, Burney & Sellers, 1987; McCracken, Gauntlett-Gilbert & Vowles, 2007). Mindfulness involves moment-to-moment, non-judgmental and non-responsive attention and observation of stimuli, such as thoughts, feelings and bodily sensations (Baer, 2003; Kabat-Zinn, 1982). This study examined potential processes underpinning the operation and benefits of mindfulness in the field of chronic pain. Questionnaire assessments of mindfulness, pain intensity, disability, affect, pain catastrophising, kinesiophobia and chronic pain acceptance were collected from 116 adults with chronic low back pain. Longitudinal questionnaire data was also collected from 87 of these participants following a pain management programme. Correlational analyses on the cross-sectional data revealed greater mindfulness was significantly related to reduced disability ($r = -.31, p < .01$), anxiety ($r = -.57, p < .01$), depression ($r = -.53, p < .01$), catastrophising ($r = -.56, p < .01$) and kinesiophobia ($r = -.30, p < .01$). Longitudinal analyses also identified significant negative correlations between change scores for mindfulness and these variables (except for kinesiophobia). Mediator analyses suggested that the relationship between mindfulness and disability was at least partially mediated by catastrophising and kinesiophobia, and the relationship between mindfulness and depression was partially mediated by catastrophising (Baron & Kenny, 1986). Catastrophising and kinesiophobia have been identified as influential in the development of disability and psychological distress (Fear-avoidance model of

chronic pain; Vlaeyen, Kole-Snijders, Boeren, & van Eek 1995). These findings provide some support for the role of mindfulness as a protective agent against catastrophising, kinesiophobia, disability and distress, and this therefore supports the use of mindfulness interventions for people experiencing chronic pain. Potential explanations for these relationships are discussed in relation to future inquiry.

7 Introduction

7.1 Chronic pain, Distress and Disability

Chronic pain has been associated with both significant personal distress and disability, and with wider effects upon society and the economy (Dahl, Wilson & Nilsson, 2004; McCracken; Vowles & Eccleston, 2005). Consequently it has been the focus of much investigation in the search for evidence based clinical interventions. In addition to biological determinants of the adverse effects of chronic pain, research has identified that psychological and social correlates also contribute significantly (Crombez, Vlaeyen, Heuts, & Lysens, 1999; Keefe et al., 2000; Severeijns, van der Hout, Vlaryen & Picavet, 2002; Sullivan, Stanish, Waite, Sullivan, & Tripp, 1998). Effective and targeted treatments can be devised through the exploration of these roles.

7.2 Psychological Intervention and Chronic Pain

Several meta-analyses have highlighted the efficacy of cognitive behavioural therapies for improving functioning in chronic pain populations (Guzman et al., 2002; Morley, Eccleston & Williams, 1999; Van Tulder, Koes & Malmivaara, 2006). These therapies involve both behavioural exposure to feared physical and mental stimuli and experiences, and the identification, alteration and challenging of thoughts about illness and bodily sensations (Turk, Meichenbaum, & Genest 1983).

Recently developed third wave approaches to cognitive behavioural therapy incorporate principles of mindfulness and acceptance and whilst like CBT these interventions focus on recognition of thoughts, by contrast they do not focus on attempts to challenge or change them (Fletcher & Hayes, 2005, Hayes, 2004). Early empirical research on such interventions has shown significant psychological and physical health benefits for people with mental and physical health problems (Grossman, Niemann, Schmidt & Walach, 2004; Hayes, Luoma, Bond, Masuda & Lillis, 2006).

7.3 Mindfulness

Mindfulness meditation has roots in Buddhist Vipassana philosophy and practice and has been independently adopted within clinical practice in Western societies with promising results (Baer, 2003; Kabat-Zinn, 1982). The development of mindfulness as a theory has largely been through the inductive processes of experiential practise. It involves moment to moment attention and the observation of external and internal stimuli (e.g. thoughts, feelings, bodily sensations) in a non-judgemental and non-responsive way (Kabat-Zinn, 1982).

Definitions of mindfulness have varied though have often incorporated constructs emphasising abilities to; observe, describe, act with awareness, to be non-judgemental and to be non-reactive (Baer, Smith, Hopkins, Krietemeyer & Toney, 2006). Brown and Ryan's (2003) Mindful Attention Awareness Scale (MAAS) defines mindfulness as a fluid, naturally occurring state that differs across individuals and refers primarily to awareness and attention. In relation to chronic pain, some researchers have defined

mindfulness in terms of pain acceptance (Segal, Williams & Teasdale, 2002) though as McCracken, Gauntlett-Gilbert and Vowles (2007) suggest, mindfulness can be seen as a broader process of noticing and accepting a range of stimuli as well as pain sensations. Mindfulness as a psychological state of consciousness has been associated with the enhancement of well-being in clinical and non-clinical populations (Brown & Ryan, 2003).

7.4 Mindfulness in Interventions and Chronic Pain

As well as a psychological state of consciousness, ability and outcome, mindfulness has also been defined as a set of meditation techniques and practices (Fletcher & Hayes, 2005). Such techniques have been incorporated into interventions, such as Dialectical Behaviour Therapy for personality disorder (DBT; Linehan, 1993a,) and Mindfulness-Based Cognitive Therapy for depression (MBCT; Segal, Williams, & Teasdale, 2002). Interventions incorporating mindfulness techniques have been used with chronic pain populations: Mindfulness-Based Stress Reduction (MBSR; Kabat-Zinn, 1982) and Acceptance and Commitment Therapy (ACT; Hayes, Strosahl, & Wilson, 1999). MBSR is a psychosocial intervention which was initially used with people with chronic pain and stress (Kabat-Zinn, 1982). It includes different forms of meditation such as a body scan where attention is gradually directed at parts of the body, a sitting meditation where focus is placed on mindfulness of breath and hatha yoga positions that emphasise and develop mindfulness of movement (Kabat-Zinn, 1982). A key principle is that participants learn to attend to stimuli in a non-judgemental manner and when their thoughts wander, attention is brought back to the

present moment (Baer, 2003). The intervention philosophy promotes the application of mindfulness skills in everyday life.

MBSR has been used with groups of people with a variety of physical and mental health problems ostensibly to enhance the perceived ability to cope with the stress (Majumdar, Grossman, Dietz-Waschkowski, Kersig, & Walach, 2002). However, it is not directed primarily at relaxation, a goal that would conflict with its underlying philosophy of non-judgemental awareness (Melbourne Academic Mindfulness Interest Group, 2006). Research has indicated immediate and longer term benefits of MBSR, for psychological distress and medical symptom outcomes in people with chronic pain (Kabat-Zinn, 1982; Kabat-Zinn, Lipworth & Burney, 1985; Kabat-Zinn, Lipworth, Burney & Sellers, 1987; Randolph, Caldera, Tacone, & Greak, 1999; Sephton et al., 2007). Similarly, positive outcomes for those experiencing chronic pain have been found using Acceptance and Commitment Therapy (ACT), a model of therapy that less formally incorporates mindfulness philosophy and techniques (Dahl, Wilson & Nilsson, 2004; Wicksell, Melin, & Olsson, 2007; McCracken, Eccleston & Vowles, 2005; McCracken, MacKichan, & Eccleston, 2007; Vowles & McCracken, 2008; Vowles, Wetherell & Sorrell, 2009).

In contrast to mindfulness the inception of ACT was derived from deductive processes. It is based on behavioural analysis and a new theory of language and cognitions; Relational Frame Theory (Hayes, Barnes-Holmes & Roche, 2001; Hayes, 2004). This theory asserts that ‘humans learn to relate events’ (e.g. words, objects) ‘mutually and in combination, without being limited by their form’ (Fletcher & Hayes, 2005, p.648). This theory can be related to mindfulness with regard to the

notions that these relations between events can take over, with the process of thinking being forgotten (Fletcher & Hayes, 2005). Fletcher and Hayes (2005) have explained how this is related to harmful processes such as ‘experiential avoidance’, the attachment to ‘self-descriptions’, and the loss of the ‘present moment’ which all in turn produce ‘psychological inflexibility’. The notion that psychological inflexibility results from the contextual attributions within human language is a principal tenet of ACT (Hayes et al., 2006). ACT therefore primarily focuses on changing the relationship thoughts have with emotions and behaviour, as opposed to changing the nature of thoughts themselves. These researchers have identified four components of ACT that overlap with mindfulness concepts such as the present moment non-evaluative attention to stimuli: contact with present moment, acceptance, defusion and self as context. ‘Self as context’ refers to the method of observing oneself from a non-threatening metaphorical ‘place’. ACT techniques include experiential exercises and metaphors designed among many things to loosen the idea that thoughts and feelings must be controlled, to identify and alter the context of thoughts, and to promote acceptance and a transcendent sense of self (Hayes, 2004).

7.5 Associations Between Mindfulness and Functioning

Despite the identification of positive outcomes emerging for interventions that incorporate mindfulness philosophy and techniques, the lack of both mindfulness measurement and control groups in chronic pain MBSR and ACT intervention studies questions the exclusive role of mindfulness processes in improving functioning. Such concerns have also been identified for mindfulness-based intervention studies in heterogeneous populations (for reviews see Baer, 2003; Grossman, Niemann, Schmidt

& Walach, 2004) and in chronic pain populations where surprisingly little empirical attention has been paid to the direct assessment of the relationship between functioning and mindfulness as a state.

One recent cross-sectional study has, however, directly measured and identified positive associations between mindfulness and functioning in a heterogeneous chronic pain population seeking care in a tertiary pain management service in the United Kingdom (McCracken et al., 2007). Greater mindfulness as measured by Brown and Ryan's (2003) Mindfulness Attention Awareness Scale was found to be related to lower disability, depression and pain-related anxiety even after patient demographics, pain intensity and acceptance were controlled.

In a more recent attempt to add further scientific credibility to the concept of mindfulness in relation to chronic pain McCracken and Thompson (2009) have examined the factor structure of Brown and Ryan's mindfulness questionnaire with chronic pain patients (MAAS, 2003) identifying that 'Acting with Awareness' and 'Present Focus' components derived from the factor analysis were positively correlated with physical functioning and psychological distress variables. Of these, Present Focus emerged as a more consistent predictor of functioning variables when the potential influences of patient demographic and pain characteristics were accounted for. The two remaining components: Social Awareness and Responsiveness did not demonstrate internal consistency and were not useful in the prediction of chronic pain functioning.

However, generalisability of these studies is somewhat undermined since the sample populations were attending a highly selected tertiary service. These results may therefore not reflect the experiences of other groups of patients with chronic pain.

7.6 Mindfulness: How Does it Work?

Further research is needed to replicate McCracken et al. (2007) findings and ascertain the mechanisms underpinning the relationship between mindfulness and functioning for people with chronic pain. Mindfulness-based methods aim to encourage wider awareness and acceptance of all internal and external stimuli and this may therefore disintegrate associations between these experiences and habitual distressing psychological and behavioural responses. Theoretical explanations for the effectiveness of mindfulness approaches in reducing distress and disability have included the positive effects of meta-cognition (thinking about thinking, which maybe the same process as CBT), exposure to and acceptance of experience, and cognitive flexibility (Melbourne Academic Mindfulness Interest Group, 2006). Mindfulness Based Cognitive Therapy for example has been linked to increased autobiographical memory specificity, decreased generality of memories, and improved cognitive flexibility (Heeren, Van Broeck & Philippot, in press). Explanatory processes, however, have received little empirical attention in the field of chronic pain.

7.7 Mindfulness and the Fear-Avoidance Model of Chronic Pain: Processes

Reference to phenomena associated with functioning in chronic pain patients may illuminate some of the bases for positive effects of mindfulness.

7.7.1 Catastrophising

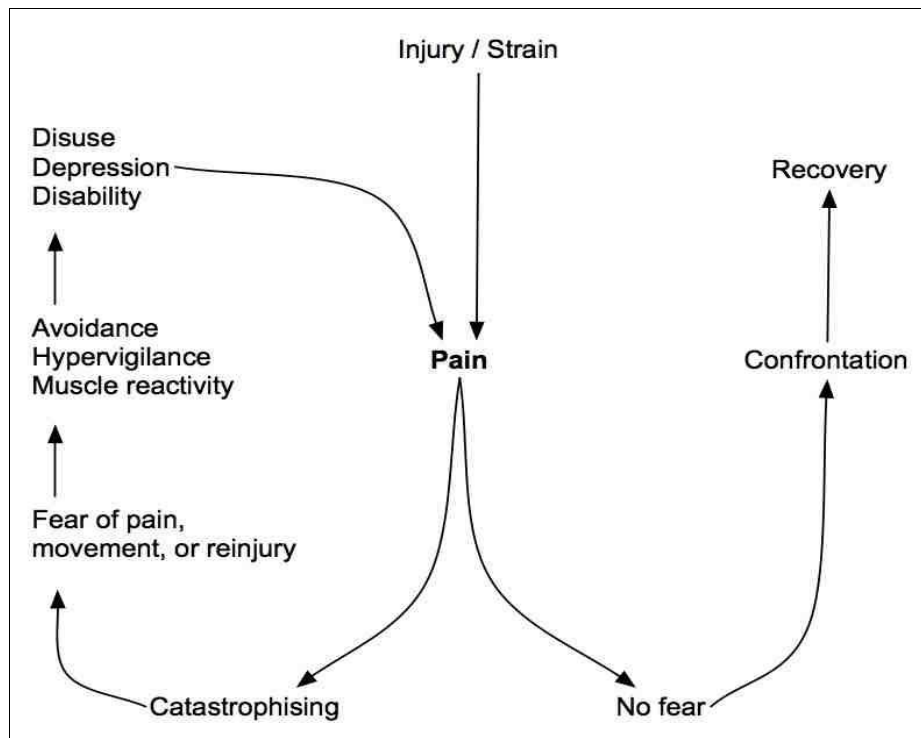
The cognitive style of catastrophising has been shown to have significant relationships with functioning in adults with chronic pain, such that higher catastrophising scores relate to greater levels of psychological distress and disability (e.g. Keefe et al., 2000; Severeijns et al., 2002; Somers et al. In press). Sullivan, Bishop and Pivik (1995) have highlighted that catastrophising has been defined in various ways, incorporating aspects of focused attention on pain related thoughts (Spanos, Radtke-Bodorik, Ferguson, & Jones, 1979), exaggeration of the threat of pain stimuli (Chaves & Brown, 1987) and a helplessness in coping with pain (Rosenstiel & Keefe, 1983). Sullivan et al. (1995) identified three components of catastrophising; rumination, magnification and helplessness. These components echo similarities with opposing processes involved in mindfulness. The items within the rumination subscale, for example highlight focused attention on pain-related thoughts. Researchers have suggested that this may reflect an inability to use distraction or to attend to coping strategies (Heyneman, Fremouw, Gano, Kirland & Heiden, 1990; Spanos et al., 1979). At face value therefore, mindfulness (a process in which all stimuli are monitored and thoughts are de-centered) may be seen to be the obverse of catastrophising and may act to protect against it, possibly by encouraging cognitive flexibility and decreasing focussed attention solely on pain stimuli. Preliminary research has indeed suggested links between mindfulness ability and the ability to intentionally let go of or control negative thoughts rather than automatically respond to them (Frewen, Evans, Maraj, Dozois & Partridge, 2007; Teasdale et al., 2002; Wells, 2002). Although recent research has identified links between chronic pain acceptance and catastrophising

(Vowles, McCracken & Eccleston, 2008), associations between mindfulness dispositions and states and catastrophising are unexplored in the field of chronic pain.

7.7.2 Kinesiophobia

A construct linked to catastrophising and receiving attention in relation to its prediction of chronic pain functioning is kinesiophobia, a belief and fear that movement will bring about (re)injury (French, France, Vigneau, French, & Evans, 2007; Kori, Miller, & Todd, 1990). With catastrophising it has been incorporated within the fear-avoidance model of pain, whereby disability, depression and disuse are viewed as resulting from processes within which catastrophising responses to pain lead to fear of movement/reinjury (kinesiophobia) and subsequent avoidance of movement and physical activity (Vlaeyen, Kole-Snijders, Boeren, & van Eek 1995, Figure 1). Components of this model have been supported and kinesiophobic responses have been empirically linked to catastrophising (Cook, Brawer & Vowles, 2006; Picavet, Vlaeyen & Schouten, 2002). Recent investigations have suggested that the mechanisms by which kinesiophobia operate upon emotional and physical functioning lie in a heightening or narrowing of attention onto painful bodily sensations (Asmundson, Norton & Norton, 1999; Peters, Vlaeyen & Kunnen, 2002). Additionally, indirect evidence has emerged of cognitive behavioural treatments targeting fear of movement and thus reducing this selective attention. With these associations evident, the ability to mindfully attend to all stimuli in the moment might be useful in counteracting the potential harmful effects of focusing attention solely on painful bodily sensations.

Figure 1. Fear-avoidance model of chronic pain (Vlaeyen et al., 1995).



7.8 Summary and Rationale for Study

In summary, research relating mindfulness and functioning in chronic pain is in infancy. Although further replication is needed, greater mindfulness has been associated with less depression and disability in patients with chronic pain (McCracken et al., 2007). The processes underpinning relationships between mindfulness and functioning found in the intervention and correlation studies need further investigation. The fear-avoidance model proposes that depression and disability arise as a result of processes initiated by catastrophising and kinesiophobic responses to pain (Vlaeyen et al. 1995). Relationships between greater mindfulness with lower depression and disability may be mediated by catastrophising and

kinesiophobia. Mindfulness may thus reduce both catastrophising and kinesiophobia which in turn lowers depression and disability.

The identification of associations between mindfulness and functioning would provide further support for the use of interventions aimed at enhancing mindfulness in chronic pain populations. Additionally, further elicitation of underlying processes behind these associations would identify specific processes to target with such interventions e.g. catastrophising.

7.9 Specific Aims and Objectives

The first aim was to determine if mindfulness as a state was significantly and uniquely associated with psychological and physical functioning in adults with chronic low back pain, while other identified predictors of functioning were controlled (e.g. participant demographics, chronic pain acceptance as defined by McCracken, Vowles & Eccleston, 2004; McCracken et al. 2007).

The second aim was to determine if mindfulness was significantly associated with catastrophising and kinesiophobia.

The final aim was to determine whether any relationships between mindfulness with depression and disability are mediated by catastrophising and kinesiophobia.

7.10 Hypotheses

- 1) There will be a significant negative correlation between scores on mindfulness and disability inventories.
- 2) There will be a significant negative correlation between scores on mindfulness and depression inventories.
- 3) There will be a significant negative correlation between scores on mindfulness and anxiety inventories.
- 4) There will be a significant negative correlation between scores on mindfulness and catastrophising scales.
- 5) There will be a significant negative correlation between scores on mindfulness and kinesiophobia scales
- 6) Mindfulness will be a significant unique predictor of the functioning variables (disability, depression and anxiety), catastrophising and kinesiophobia when participant demographics and chronic pain acceptance are controlled.
- 7) There will be a significant negative correlation between change scores for mindfulness and change scores for the functioning variables, catastrophising and kinesiophobia (NB change scores measure the extent and direction of change, calculated by the difference between post and pre-intervention scores).

- 8) The association between mindfulness with depression and disability will be mediated by catastrophising and kinesiophobia.

8 Method

8.1 Participants

Participants comprised 116 adults with chronic low back pain (65 female and 51 male) attending a specialist unit in the East Midlands during the period January 2008-March 2009. Low back pain affects approximately one quarter of adults in any 1 year (Linton, Hellsing & Hallden, 1998) and studies have identified it as the most frequent pain complaint (e.g. McCracken et al. 2007). Such a sample will therefore be reflective of a large number of chronic pain sufferers who attend specialist care services. Patients are referred to the Back Pain Unit from another hospital department within the same acute trust and a teaching hospital. The majority of referrals originate from a Pain Clinic or Orthopedic Department. Figure 2 highlights the inclusion and exclusion criteria for referrals made to the Back Pain Unit.

Figure 2. Inclusion and exclusion criteria for patients attending the Back Pain Unit.

<p>Inclusion Criteria</p> <ul style="list-style-type: none">• Disability primarily caused by lumbosacral pain, as perceived by patient and assessor.• Back pain ≥ 9 months.
<p>Exclusion criteria</p> <ul style="list-style-type: none">• Pending investigations or treatment for back pain.• Physical pathology or psychological disorder most appropriately managed by individual treatment.• Inability to stand from seated, toilet or walk 5 m without the assistance of another person.• Major disability caused by factors other than back pain (e.g. lung or cardiac disease, primary psychiatric illness, addiction).• Patient unwilling to undertake a graded exercise programme.• Patient unable to accept that the programme may be the most effective available treatment option.• Age <18 y.• Completion of early intervention programme within previous six months.

8.2 Design

Cross-sectional and longitudinal observational designs were employed, incorporating self report, questionnaire responses. The longitudinal design involved the exploration of relationships between change scores, calculated from the difference between participants' scores taken at an initial time-point (Time 1) and a second time-point

following a multidisciplinary cognitive- behaviourally informed intervention (Time 2, see Appendix F for description of the intervention).

8.3 Procedure

Questionnaire measures were given to patients in the form of questionnaire packs in a session at the beginning and end of their pain management programme (See Appendix G for the questionnaire pack). A member of the pain management team familiar with the questionnaire measures introduced the questionnaires and remained available to answer any questions. The patients were also given written information about the purpose of the questionnaires if they chose to complete them (Appendix I). If the patients became distressed by thinking about and reporting their experiences they had the opportunity to talk to a member of the clinical team. Patients with literacy difficulties were identified prior to the administration of these questionnaires and were given the opportunity to complete them with a staff member in a private room. In addition to the questionnaires, the following demographic information was collected from patients' medical notes; ethnicity, pain duration (in months), age (in years), gender and employment status.

The individual questionnaire packs were given an ID code, and a list of ID codes and corresponding participant names was created and kept separately from the questionnaires at the Unit. This was only accessible by the chief investigator and lead clinicians within the Unit. The key that linked the ID codes to participants' names did not leave the hospital. The responses to the questionnaires were input into a database. To ensure anonymity and confidentiality, ID codes were listed on the database and

patient names were not listed. The database was kept on a password-protected computer programme stored at the hospital and on a portable memory stick looked after by the Principal Investigator.

In order to achieve a sample size that reflected adequate power the research measures were administered in combination with service evaluation questionnaires to be administered by the pain management clinical team. The main ethical issue therefore centred on using data for research that was provided for a service evaluation. The current project is research because it was intended to increase knowledge about mindfulness and pain and to obtain information that could generalise beyond the service. However, it was decided that it would be unlikely that patients would necessarily draw this same distinction between service evaluation and research. Rather, research in lay terms often implies an additional intervention, or potential for physical or psychological harm. It was decided that in agreeing to participate in a service evaluation, patients may reasonably expect their data to be used for the purposes described in this study. A request for additional consent to use data for this research was deemed unnecessarily confusing and distressing to patients. Ethical approval was obtained from both the hospital and regional ethics committees for this research project and the service evaluation using the same questionnaire data.

8.4 Materials

The majority of the questionnaire measures were standardized with chronic pain populations comprising relatively few items to aid participant engagement. Data in the

form of responses to the following standardized self-report measures were incorporated in the analysis:

8.4.1 Pain Severity: SF8 (Ware, Kosinski, Dewey & Gandek, 2001)

Pain severity was measured by an item within the SF8. This item asks respondents to rate how much bodily pain they have had during the last week, by marking, ‘none’, ‘very mild’, ‘mild’, ‘moderate’, ‘severe’ or ‘very severe’.

8.4.2 Mindfulness: Mindful Attention Awareness Scale (MAAS; Brown & Ryan, 2003)

The MAAS contains 15 items that assess attention and awareness in the present moment. It indirectly assesses mindfulness with items that denote ‘mindlessness’. Higher scores indicate greater mindfulness. An example item is ‘I find myself doing things without paying attention’. Brown and Ryan (2003) conducted a range of studies that emphasised the reliability and validity of the measure. It was also used as the measure of mindfulness within McCracken et al. (2007, McCracken & Thompson, 2009) analysis of the role of mindfulness in chronic pain. Cronbach’s alpha for time 1 data in this study revealed that the scale had good internal reliability (Cronbach’s alpha = .89).

8.4.3 Disability: Roland and Morris Disability Questionnaire (RDQ; Roland & Morris, 1983)

The Roland and Morris Disability Questionnaire comprises 24 items rated on a dichotomous yes/no scale (RMDQ; Roland & Morris, 1983). These items refer to impairments in physical functioning attributable to back pain, in a range of everyday activities, such as sleeping, walking and eating and undertaking jobs. Higher scores indicate greater levels of disability associated with low back pain. In their original study Roland and Morris identified a score of 14 or more as reflecting poor outcome. The RMDQ (Roland & Morris, 1983) has been extensively used in clinical and research domains with patients with low back pain demonstrating good psychometric properties (Roland & Morris, 1983). The measure's internal consistency with time 1 data in this study was found to be very good (Kuder-Richardson 20 $\alpha = .81$).

8.4.4 Anxiety and Depression: Hospital Anxiety and Depression Scale (HADS; Zigmond & Snaith, 1983)

The Hospital Anxiety and Depression Scale (HADS; Zigmond & Snaith, 1983) is a 14 item self-report scale that measures anxiety (7 items) and depressive states (7 items). The items are rated on a 4-point scale (0-3). It was originally developed for use with people experiencing physical illness, thus somatic symptoms of depression that could be caused by physical illness are omitted. Higher scores indicate greater anxiety or depression and a score of 8 or more has been identified as reflecting probable anxiety or depressive disorder (Bjelland, Dahl, Haug & Neckelmann, 2002). The scale has shown good internal consistency and reliability (Spinhoven et al., 1997). In a

literature review of the validity of the HADS, Cronbach's alpha for the anxiety subscale varied from .68 to .93 (mean .83) and for the depression subscale from .67 to .90 (mean .82, Bjelland et al., 2002). Within this study Cronbach's alphas were found to be .82 and .84, for the anxiety and depression subscales respectively.

8.4.5 Pain Catastrophising: Pain Catastrophising Scale (PCS; Sullivan, Bishop and Pivik, 1995)

The Pain Catastrophising Scale (PCS; Sullivan et al. 1995) is a 13 item measure designed to assess catastrophic thoughts and feelings exhibited in response to pain. Respondents are asked to rate the extent to which they agree with statements on a scale of 0-4, where '0' denotes 'not at all' and '4' denotes 'all the time'. As well as a total score, three subscale scores can be calculated for rumination, magnification and helplessness components. In their initial study, Sullivan et al. (1995) found Cronbach's alphas for the rumination, magnification and helplessness subscales to be .87, .60 and .79 respectively (with an alpha of .87 for the total score). The scale has demonstrated good reliability and validity with both clinical and non-clinical populations (Sullivan et al., 1995; Sullivan et al., 2001). Cronbach's alpha statistic for the total catastrophising score in this study (at time 1) was .91.

8.4.6 Kinesiophobia (fear of movement/reinjury): Tampa Scale of Kinesiophobia (TSK; Kori et al. 1990)

The original version of the Tampa Scale of Kinesiophobia (TSK, Kori et al., 1990, Vlaeyen et al., 1995) requires respondents to rate the extent to which they agree with

17 items designed to assess fear of movement and (re)injury. The items are rated on a 4-point Likert scale (1-4, where 1 indicates 'strongly disagree' and 4 denotes 'strongly agree') and scores range from 17 to 68. Total scores are calculated following reversed scoring of items 4, 8, 12 and 16. Greater scores indicate greater fear of movement and (re)injury. In the initial validation study a medium score of 37 was denoted as differentiating between high and low scores (Vlaeyen et al., 1995). The scale has been shown to have good psychometric properties with patients with chronic back pain (French et al., 2007). Similarly a good internal consistency statistic was found within this study (time 1 data, Cronbach's alpha = .83).

8.4.7 Acceptance of pain: Chronic Pain Acceptance Questionnaire (McCracken et al., 2004)

The Chronic Pain Acceptance Questionnaire (CPAQ; McCracken et al., 2004) assesses acceptance of chronic pain. This measure of acceptance of chronic pain was included in order to assess its relative contribution to functioning in comparison with mindfulness. The measure has been revised since its original conception (Geiser, 1992, cited in McCracken et al., 2004) now containing 20 items assessing activity engagement and pain willingness. The items are rated on a scale of 1-6, where 0 indicates a statement is 'never true' and 6 indicates a statement is 'always true'. The CPAQ has demonstrated good reliability with Cronbach's alpha statistics of 0.82 and 0.78 for Activity engagement and Pain willingness subscales (McCracken et al., 2004). With this study population Cronbach's alpha suggested good internal consistency (Cronbach's alpha = .82). Additionally, validity has been demonstrated

with findings of associations between the measure and emotional and physical functioning scores in chronic pain populations (McCracken et al., 2004).

8.5 Apriori Sample Size Power Calculation

An apriori power calculation was undertaken to estimate the desired sample size for time 1 data (see Table 6). The statistical significance criterion was set at 0.05 and the power level was set at the standard convention of .80. It was anticipated that a maximum of 6 variables would be used in the regression analyses. An anticipated effect size for this calculation was estimated using the smallest R² value (.15 equating to an F₂ of 0.176471) found in McCracken et al. (2007) study for regression models, where 8 predictors (including mindfulness) were used to predict psychological and physical functioning variables. The estimated sample size for this regression was found to be 84. A calculation was also undertaken assuming a medium effect size (F₂) of 0.15 (Cohen, 1988), in which the estimated sample size was 97. In light of these calculations the objective was to obtain questionnaire responses from 120 individuals to provide scope for missing data and smaller effect sizes. Subsequently, data from four participants was not included in the final analysis due to large numbers of missing data.

Table 6 *Apriori Sample Size Power Calculation, for Multiple Regression Analyses*

Alpha Level	0.05
Number of predictors	6
Anticipated effect size (F2)	.176
Desired statistical power level	.80
Sample size required	84

8.6 Statistical Procedure

The data were input and analysed in SPSS version 14. A very small number of questionnaire items had not been completed by the participants. For the purpose of calculating total scores these items were substituted with the mean score for the subscales or scales. No questionnaire scales had fewer than 80% completed items. Data screening was conducted on all of the variables and descriptive statistics were generated using frequency outputs, including checking for outliers, and ensuring assumptions concerning normal distribution, homogeneity of variance and linearity were met. Additionally, Cronbach's alpha reliabilities were determined for each measure (reported in method section).

Scores within the disability, catastrophising, rumination, magnification, helplessness and pain duration variables were identified as not being normally distributed according to the Shapiro-Wilk test (Shapiro & Wilk, 1965). Following further inspection of skewness and kurtosis statistics the disability and rumination variables

were identified as significantly negatively skewed at $p < 0.01$ and $p < 0.05$ respectively and the pain duration variable had a platykurtic (flat) distribution with significant kurtosis statistics ($p < 0.05$). These were not significant, however, at the upper threshold of $p < 0.001$. Apart from for the pain duration variable the skew statistics were not above 1 or below -1 (Morgan et al. 2006). It can also be argued that central limit theory applies with this sample size (being above 50, Tabachnik & Fidell, 2007). On the basis of these considerations, parametric tests were applied. Due to the significance of the disability variable for hypothesis 1, this variable was transformed using a square root transformation (Field, 2005) which appeared to be normally distributed with reference to the Shapiro-Wilk and skewness and kurtosis statistics.

Pearson product-moment coefficient correlations were then applied to address hypotheses 1 to 5 and decipher initial relationships between the mindfulness variable and all of the other variables. Due to the significant kurtosis in the pain duration variable and its categorical nature Spearman's correlations for non-parametric data were generated for correlations that included this variable. Bonferoni adjustments to control for type 1 errors associated with multiple tests were not applied in this study due to problems identified with such an approach. Such problems include an increase in the likelihood of type 2 errors and that interpretation of results depends on the number of other tests regardless of theoretical considerations (Perneger, 1988). Additionally, the correlations between mindfulness and the functioning variables were all significant at a more conservative significance level of $p < 0.01$.

Subsequently, to address hypothesis 6, five hierarchical regressions were run, with disability, depression, anxiety, catastrophising and kinesiophobia scores as dependent

variables. The demographic variables of gender and age were entered in the first step, followed by pain severity in the next step. In the third step chronic pain acceptance scores were entered and finally mindfulness scores were entered in the last step. These variables and corresponding steps were chosen on the basis of prior empirical research findings of correlates of both the functioning and cognitive (catastrophising and kinesiophobia) variables. Additionally age and pain severity had been identified in the prior correlation analyses as being significantly related to the majority of the dependent variables. Gender was also added in the first block as gender differences in chronic pain experience have been observed in the literature (Keogh, 2006).

Questionnaire responses were obtained at post-intervention (Time 2) from 87 of the initial 116 participants. To assess whether the key variables had changed between the two time points, the difference between variable means were assessed using paired sample t-tests and Wilcoxon signed-rank tests. The latter tests were used with pairs of variables where at least one variable was not normally distributed (disability Time 1, depression Time 2, Kinesiophobia Time 2). Change scores were calculated by subtracting the Time 1 (pre-intervention) variable scores from the Time 2 (post-intervention) scores for the same variables. A small number of these change scores were found to have significantly non normal distributions according to Shapiro-Wilk, skewness and kurtosis statistics (catastrophising, anxiety, depression and pain duration variables). They also had skewness or kurtosis figures above or minus 1. Data transformations were not able to correct these distributions. Non-parametric statistics were therefore used with analyses for these variables. Therefore both Pearson product-moment and Spearman's correlation tests were employed to assess relationships between change scores.

In addressing hypothesis 8, two further analyses were conducted; partial correlations and mediator analyses. These were undertaken to explore the potential roles of catastrophising and kinesiphobia in the relationships between mindfulness with disability and depression. Four partial correlation analyses were undertaken to determine whether mindfulness was still related to depression and disability when catastrophising and kinesiphobia were controlled for and conducted due to the large number of significant correlations between mindfulness and the other variables. Mediator analysis involves conducting sequences of univariate regressions to ascertain potential mediator influences (Baron & Kenny, 1986). This was undertaken to determine whether catastrophising and kinesiphobia mediate the relationships existing between mindfulness with disability and depression.

9 Results

9.1 Demographics and Descriptive Statistics (Cross-sectional, pre-intervention data)

9.1.1 Participant Demographics

Of the 116 participants (65 female and 51 male), their mean age was 51.57 years (SD 11.57, range 18-79), with 56% of them being female. 50.8% had experienced chronic pain for 10 ten years or more and at the time of the study 76.5% were not working.

The majority of the participants were White British in ethnic identity and one participant was Asian Indian. Table 7 displays information on participant pain duration and employment status.

Table 7 *Pain Duration and Employment Status Information*

	N (% of total number of participants, 116)
Pain Duration in yrs (N108 ^a)	
0-4 ^ь	33 (28.4%)
5-9	16 (13.8%)
10-14	12 (10.3%)
15-19	15 (12.9%)
20-24	20 (17.2%)
25-29	4 (3.5%)
30 -35	8 (6.9%)
Employment Status (N115) ^a	
Employed and working	27 (23.5%)
Not currently working	88 (76.5%)

^a This information was unavailable for a small number of participants.

^ь The lowest pain duration was 9 months.

9.1.2 Population Characteristics

Descriptive statistics and Pearson's intercorrelations for all of the variables are represented in Table 8. Mean average pain severity was found to be 4.7 ('bodily pain' rating on SF8, 1-6 point scale from 'none' to 'very severe').

9.1.3 Mindfulness

The mean score for reported mindfulness (MAAS; Brown & Ryan, 2003) was 3.71 (SD 0.99), similar to the mean mindfulness score of 4.04 (SD 0.93) reported by McCracken et al. (2007). The most highly endorsed items on the MAAS according to modal response (reflecting areas demonstrating the opposite of mindfulness, ‘mindlessness’) are represented in Table 9.

Table 9 *The Most Highly Endorsed MAAS Items*

MAAS Item	Modal response (where < 2 ‘very frequently’ or ‘almost always’)
I forget a person’s name almost as soon as I’ve been told it for the first time (6).	1
I find myself listening to someone with one ear, doing something else at the same time (11).	2
I find myself preoccupied with the future or the past (13).	2
MAAS Mindfulness Attention Awareness Scale.	

Table 8 Descriptive Statistics and Inter-correlations Between Variables (pre-intervention data).

Variable (possible range)	N	M	SD	Range	1	2	3	4	5	6	7	7a	8	9	10	11	12
1. Gender 0, male, 1, female	116 51 (44%) 65 (56%)	-	-	-	-	-.01	-.13	.01/ -.00	.13	-.10	.02/ -.00	.00	-.05	.10	.08	-.07	-.03
2. Age	116	51.57	11.57	18 - 79	-	-.26**	.26**/ .23*	.06	.18	-.19*	-.20*	-.32**	-.28**	-.14	-.08	.28**	
3. Pain Severity (1-6)	116	4.7	0.81	2 - 6	-	-.06/ -.07	-.21*	-.15	.36**	.39**	.53**	.26**	.33**	.16	-.31**		
4. Pain Duration/ ^a (8 ‘don’t know’)	108	-	-	-	-	.08/ .08	.11/ .09	-.02/ .01	-.00/ .01	-.07/ -.07	-.04/ -.02	-.03/ .01	.08/ .11	.14/ .11			
5. Employment Status	115 ^b	-	-	-	-	.10	.27**	.27**	.13	.02	.23*	-.01	-.18				
6. Mindfulness (1-6)	116	3.71	0.99	1 - 6	-	-.35**	-.31**	-.53**	-.57**	-.56**	-.30**	.32**					
7. Disability (0-24)	116	17.02	4.13	4 - 24	-	-.54**	.47**	.65**	.41**	-.58**							
7a. Transformed Disability ^c	116	-	.50**	.44**	.64**	.45**	-.56**										
8. Depression (0-21)	116	9.46	4.18	1 - 20	-	.65**	.58**	.30**	-.58**								
9. Anxiety (0-21)	116	11.29	4.36	1 - 21	-	.69**	.44**	-.52**									
10. Catastrophising (0-52)	116	30.36	10.75	4 - 51	-	.53**	-.66**										
11. Kinesiophobia (17-68)	116	41.22	7.73	21 - 59	-	-.40**											
12. Chronic Pain Acceptance Total (0-120)	116	50.28	16.13	3 - 90	-												

^aSpearman’s correlations due to kurtosis found in pain duration data, ^б Information unavailable for one participant, ^çRMDQ transformed variable (Square Root Transformation), Pain Duration (Item 4 from SF8), Mindfulness (MAAS), Disability (RMDQ), Depression (HADS), Anxiety (HADS), Catastrophising (PCS), Kinesiophobia (TSK), Chronic Pain Acceptance (CPAQ), *p<.05, ** p<.01

9.1.4 Disability

The mean score for reported disability (RMDQ; Roland & Morris, 1983) was 17.02 (SD 0.99), higher than the score of 14 defined by Roland and Morris (1983) indicating poor outcome. Distribution frequencies of the raw Roland and Morris scores are represented in Table 10. These figures highlight the negative skew of this data.

Table 10 *Distribution Frequencies of RMDQ Total Scores (pre-intervention data)*

RMDQ score	RMDQ report	
	Frequency	%
0-4	1	.01
5-9	5	.04
10-14	23	19.8
15-19	50	43.1
20-24	37	31.9

RMDQ Roland and Morris Disability Questionnaire.

9.1.5 Depression and Anxiety

High levels of depression and anxiety were reported by the participants. The mean depression and anxiety scores were 9.5 (SD 4.18) and 11.3 (SD 4.36) respectively. A score of 8 or more on the two subscales of the HADS has been noted to be sensitive to patients with depressive and anxiety disorders (Bjelland et al., 2002). Of the participants 66.4 percent and 76.7 percent scored 8 or more on the depression and anxiety scales respectively.

9.1.6 Catastrophising and Kinesiophobia

The mean score for catastrophising was 30.36 (SD 10.75) and for kinesiophobia it was 41.22 (SD 7.73). In Sullivan et al. (1995) original study people were defined as ‘catastrophisers’ if they scored above 24. Of the participants in this sample, 75% scored above 24. On the TSK, 71.6% of the participants scored 37 or above. A score of 37 was specified by Vlaeyen et al. (1995) as differentiating between high and low Kinesiophobia.

9.2 Variables Associated with Mindfulness

9.2.1 Correlation Analyses (Hypotheses 1-5)

Findings from the correlation analyses are represented in Tables 8 and 11. In summary, mindfulness as measured by the MAAS (Brown & Ryan, 2003) was significantly negatively related to disability (Transformed RMDQ, $r = -.31$, $p < .01$), depression (HADS, $r = -.53$, $p < .01$), anxiety (HADS, $r = -.57$, $p < .01$), catastrophising (PCS, $r = -.56$, $p < .01$) and kinesiophobia (TSK, $r = -.30$, $p < .01$). Mindfulness was also positively correlated with chronic pain acceptance (CPAQ, $r = .32$, $p < 0.01$). Mindfulness was unrelated to gender, age, pain duration, pain intensity and employment status. Table 11 highlights the correlations of the Catastrophising subscales and the other variables. Mindfulness was negatively related to the rumination ($r = -.39$, $p < .01$), magnification ($r = -.53$, $p < .01$) and helplessness ($r = -.55$, $p < .01$) subscales of the Pain Catastrophising Scale.

Table 11. *Descriptive Statistics and Inter-correlations Between the Pain Catastrophising Subscales and the Other Variables (pre-intervention data)*

Variable	Subscales in Pain Catastrophising Scale		
	(PCS, Mean, SD, range)		
(Possible Range)	Rumination	Magnification	Helplessness
	(10.28, 3.96, 1-16)	(6.10, 2.96, 0-12)	(13.98, 5.20, 3-24)
Gender	.04	.04	.12
Age	-.03	-.09	-.21*
Pain Severity	.21*	.23*	.40**
Pain Duration/ ^a	.06 / .06	-.04 / -.01	-.07 / -.05
Employment Status	.22*	.14	.24*
Mindfulness (1-6)	-.39**	-.53**	-.55**
Disability (0-24)	.59**	.50**	.62**
Transformed Disability	.57**	.50**	.60**
Depression (0-21)	.44**	.40**	.64**
Anxiety (0-21)	.57**	.61**	.66**
Catastrophising Total (0-52)	.90**	.82**	.92**
Kinesiophobia (17-68)	.49**	.57**	.41**
Chronic Pain Acceptance	-.60**	-.50**	-.62**
Total (0-120)			

^a Spearman's correlations due to kurtosis found in pain duration data, *p<.05, **p<.01.

9.2.2 Regression Analyses (Hypothesis 6)

The results of the five hierarchical regression analyses using disability (original RMDQ), depression, anxiety, catastrophising and kinesiophobia as dependent variables are displayed in Tables 12 and 13. In the first block of the regression equation, gender (males 0, females 1) and age were accounted for, followed by pain severity, chronic pain acceptance and mindfulness in subsequent blocks.

Within the regression models the first block (including gender and age) generally accounted for a very small amount of the variance of the dependant variables with R^2 ranging from .012 to .105. This block was only significant in the regressions for depression and anxiety. The pain severity variable in the second block however was significant for all regression equations except in the prediction of kinesiophobia. The greatest contribution to the model variance by pain severity occurred in the prediction of depression (R^2 change = .208, $p < .001$). The acceptance of chronic pain variable added in the third block accounted for additional variance in all of the dependant variables. The largest variance contribution for this block was for catastrophising (R^2 change = .337, $p < .001$) and smallest was for kinesiophobia (R^2 change = .04, $p < .05$).

In the final stage of all of the regression equations, mindfulness was a significant and unique predictor of all of the dependant variables. The variance increments ranged from R^2 (change) = .026 ($p < .05$) for disability, to R^2 (change) = .166 ($p < .001$) for anxiety. The average variance increment was R^2 (change) = .096.

The variance explained by the overall models ranged from $R^2 = .205$ in the prediction of kinesiophobia to $R^2 = .598$ and $.594$ for the prediction of depression and catastrophising respectively (all $p < .001$).

In terms of the reliability of the statistical models, evidence was found in all five regression models for independence of the residuals and the absence of both multicollinearity and the influence of extreme cases. Scatterplots and histograms indicated that assumptions concerning homoscedasticity, linearity and normally distributed residuals were met.

Table 12 *Hierarchical Regression Results for the Prediction of Disability, Depression and Anxiety*

Dependant Variables	Step	Predictor	B	SE B	β	R2 Change	R2	Adj R2
1. Disability (RMDQ)	1	Age	0.007	0.028	.019	.038	.038	.021
		Gender	0.254	0.624	.031			
	2	Pain Severity (SF8 Item 4)	1.007	0.409	.198*	.108***	.146***	.123
	3	Chronic Pain Acceptance (CPAQ)	-0.119	0.021	-.464**	.223***	.370***	.347
	4	Mindfulness	-0.714	0.328	-.172*	.026*	.396***	.368
2. Depression (HADS)	1	Age	-0.025	0.023	-.070	.105**	.105**	.090
		Gender	-0.483	0.515	-.058			
	2	Pain Severity	1.753	0.337	.341***	.208***	.313***	.295
	3	Chronic Pain Acceptance	-0.088	0.018	-.339***	.166***	.479***	.460
	4	Mindfulness	-1.545	0.271	-.368***	.119***	.598***	.580
3. Anxiety (HADS)	1	Age	-0.034	0.028	-.091	.090**	.090**	.074
		Gender	0.519	0.615	.059			
	2	Pain Severity	0.418	0.403	.078	.044*	.134**	.111
	3	Chronic Pain Acceptance	-0.090	0.021	-.333***	.175***	.309***	.284
	4	Mindfulness	-1.906	0.323	-.434***	.166***	.475***	.451

Note. The reported beta values (B), their standard errors (SE B) and standardised beta values (β 's) are those from the final step in the regression analysis.

* $p < .05$, ** $p < .01$, *** $p < .001$.

Table 13 *Hierarchical Regression Results for the Prediction of Catastrophising and Kinesiophobia*

Dependant Variables	Step	Predictor	B	SE B	β	R ² Change	R ²	Adj R ²
1. Catastrophising (PCS)	1	Age	0.108	0.060	.116	.026	.026	.008
		Gender	1.068	1.332	.050			
	2	Pain Severity (SF8 Item 4)	1.946	0.873	.147*	.102***	.127**	.104
	3	Chronic Pain Acceptance (CPAQ)	-0.348	0.045	-.522***	.337***	.464***	.445
	4	Mindfulness	-4.161	0.700	-.385***	.130***	.594***	.576
2. Kinesiophobia (TSK)	1	Age	0.037	0.061	.055	.012	.012	-.006
		Gender	-1.511	1.341	-.097			
	2	Pain Severity	0.207	0.879	.022	.018	.029	.003
	3	Chronic Pain Acceptance	-0.163	0.046	-.340**	.136***	.165***	.135
	4	Mindfulness	-1.653	0.705	-.212*	.040*	.205***	.169

Note. The reported beta values (B), their standard errors (SE B) and standardised beta values (β 's) are those from the final step in the regression analysis.

* $p < .05$, ** $p < .01$, *** $p < .001$.

9.2.3 Longitudinal Analyses of Change Scores (Hypothesis 7)

Questionnaire responses from a subset of 87 of the original respondents were used for the analysis of change scores. These were the number of remaining respondent data after attrition. Attrition analyses revealed no significant differences in either the demographics and measure responses between participants who were and were not included in the longitudinal analyses (see Appendix I).

Descriptive statistics for this revised sample are presented in Tables 14, 15 and 16.

Pain duration and employment status information is presented in Table 14.

Table 14 *Pain Duration and Employment Status Information for Participants Responses Utilized in Change Analyses (N 87)*

	N (% of 87 participants)
Pain Duration (N80, 7 'don't know')	
0-4 yrs	23 (26.4)
5-9 yrs	11 (12.4)
10-14yrs	11 (12.4)
15-19 yrs	7 (8)
20-24 yrs	18 (20.7)
25-29 yrs	2 (2.3)
30 -35	8 (9.1)
Employment Status (87)	
Employed and working	22 (25.3)
Not currently working	65 (74.7)

Paired samples t-tests and Wilcoxon signed-rank tests revealed significant differences between the two time-point levels of mindfulness, disability, depression, anxiety, catastrophising, kinesiophobia and chronic pain acceptance. Mindfulness and chronic pain acceptance levels were significantly higher at Time 2 than Time 1. Disability, depression, anxiety, catastrophising and kinesiophobia levels were significantly lower at Time 2 than Time 1. Table 15 outlines these results. The effect sizes of the differences ranged from $r = .346$ to $r = .655$, which represent medium to large effects (Cohen, 1988).

Table 15 *Means, Standard deviations, t-tests and Wilcoxon Signed-rank Tests for Pre and Post-intervention Variables (N87)*

Variable	Time 1 Mean (SE) or Median where Wilcoxon signed-rank used	Time 2 Mean (SE) or Median where Wilcoxon signed-rank used	Paired-SamplesT test (<i>t</i>) / Wilcoxon signed- rank test (<i>Z</i>)	Effect Size (<i>r</i>)
Mindfulness	3.74 (.104)	4.03 (.086)	-3.451(df 86)*	.349
Disability ^a	17.0	14.60	-5.960 **	-.45
Depression ^a	10.0	7.0	-6.465**	-.49
Anxiety	11.15 (.477)	9.0 (.433)	6.848 (df 86)**	.594
Catastrophising	29.88 (1.196)	20.99 (1.241)	8.037 (df 86)**	.655
Kinesiophobia ^a	41.0	32.0	-7.128**	-.54
Chronic pain acceptance	50.76 (1.775)	61.84 (1.612)	-6.886 (df 86) **	.596

^a Wilcoxon signed-rank test applied, SE Standard Error Mean, df degrees of freedom,

* $p < .01$, ** $p < .001$.

⁵ Significance level set at $p < .01$ due to multiple comparisons (Perneger, 1998)

The means, standard deviations and intercorrelations for the demographics and variable change scores are presented in Table 16. In summary, mindfulness (MAAS) change scores were significantly negatively related to change scores for disability (RMDQ, $r = -.31$, $p < .01$), depression (HADS, $r_s = -.27$, $p < .05$), anxiety (HADS, $r_s = -.33$, $p < .01$) and catastrophising (PCS, $r_s = -.33$, $p < .01$). Mindfulness change scores were not significantly related to kinesiophobia (TSK, $r = -.17$, $p > .05$) or chronic pain acceptance change scores (CPAQ, $r = .17$, $p > .05$).

Table 16 *Descriptive Statistics and Inter-correlations Between Demographics and Variable Change Scores*

Variable (possible range)	N	M	SD	Range	1	2	3	4~	5	6	7	8~	9~	10~	11	12
1. Gender 0, male, 1, female	87 39 48	-	-	-	-	.01	-.14	.03	.11	.04	-.13	.06	-.04	.00	.03	.00
2. Age	87	51.51	11.12	18 - 76	-	-.28**	.28*	.00	.02	.07	.13	.08	.13	.08	.08	-.16
3. Pain Severity at Time 2 (1-6)	87	4.2	.9	2 - 6	-	-.06	.45**	.01	.23*	-.18	-.02	.10	.00	.00	.00	-.00
4. Pain Duration ^a (7 'don't know')	80	-	-	-	-	-	.04	.10	.05	-.03	-.06	.20	-.06	-.14	-.06	-.14
5. Employment Status	87	-	-	-	-	-	-.08	.09	-.04	.07	.13	.10	.10	-.01	-.01	-.01
6. Change in Mindfulness	87	.29	.77	-1.27- 2.40	-	-.31**	-.27*	-.33**	-.33**	-.17	.17					
7. Change in Disability	87	-2.40	3.47	-11 – 10	-	.12	.19	.19	.08	-.30**						
8. Change in Depression ^a	87	-2.54	3.03	-16 – 4	-	.43**	.29**	.22*	-.33**							
9. Change in Anxiety ^a	87	-2.15	2.93	-14 – 4	-	.38**	.32**	-.41**								
10. Change in Catastrophising ^a	87	-8.89	10.32	-44 – 13	-	.21	-.49**									
11. Change in Kinesiophobia	87	-7.96	7.32	-30 – 9	-	-.33**										
12. Change in Chronic Pain Acceptance Total	87	11.08	15	-31 – 62	-											

^a Spearman's correlations, Pain Duration (Item 4 from SF8), Mindfulness (MAAS), Disability (RMDQ), Depression (HADS), Anxiety (HADS), Catastrophising (PCS), Kinesiophobia (TSK), Chronic Pain Acceptance (CPAQ), *p<.05, **p<.01.

9.2.4 Partial Correlation Analyses (Hypothesis 8)

The findings from the partial correlations for Time 1 data are presented in Table 17.

When reported catastrophising was controlled for, mindfulness scores were no longer significantly related to disability scores and they were less strongly related to depression scores. When kinesiophobia scores were controlled small differences from the original correlation coefficients were observed and they remained significant ($p < .05$).

Table 17 *Partial Correlation Results for Mindfulness with Disability and Depression Whilst Controlling for Catastrophising and Kinesiophobia*

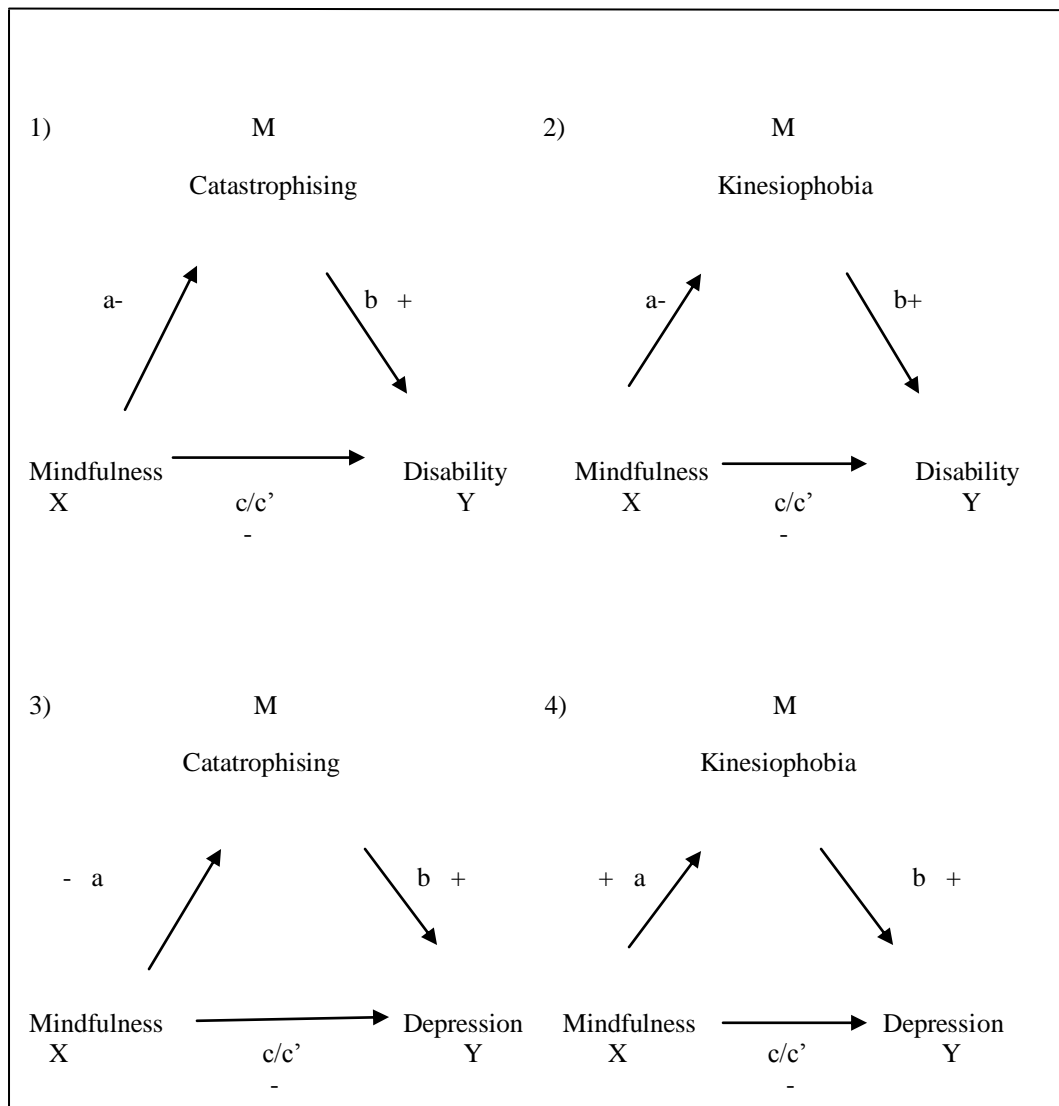
Variable pairs	Pearson's Correlations (r)		
	Original correlation	Catastrophising Controlled	Kinesiophobia Controlled
Mindfulness and Disability (transformed RMDQ)	-.31**	.07 (NS)	-.21*
Mindfulness and Depression	-.53**	-.31**	-.49**

* $p < .05$, ** $p < .01$.

9.2.5 Mediator Analyses (Hypothesis 8)

In order to further test hypothesis 8, mediator analyses were undertaken to establish whether catastrophising and kinesiophobia statistically mediated the relationships identified for mindfulness with depression and disability. The results from a series of univariate regression analyses involved in the mediation analysis are presented in Table 18 (steps are outlined in Figure 3). With the addition of catastrophising the relationship between mindfulness and disability lost significance and the standardized regression coefficient decreased. Sobel tests conducted on the four mediator analyses revealed that the first three were significant (Baron & Kenny, 1986, 1-3 in Figure 3). Catastrophising was found to be a mediator of the relationship between mindfulness and disability and a partial mediator of the relationship between mindfulness and depression. Kinesiophobia was found to be a partial mediator of the relationship between mindfulness and disability only.

Figure 3. Diagrammatic representations of the mediation analyses.



- negative relationship, + positive relationship, a, b, c, c' X, Y and M refer to steps and variables outlined in Table 18.

Table 18 *Mediator Analyses to Determine the Role of Catastrophising and Kinesiophobia in the Relationships Between Mindfulness and Disability, and Mindfulness and Depression.*

Mediation Analyses (X,Y)	Mediator (M)	Steps	B	Standard error of B	β
1) Mindfulness and disability	Catastrophising	Step 1 (c, X-Y)	-1.44	.365	-.347***
		Step 2 (a, X-M)	-6.006	.842	-.555***
		Step 3 (b, M-Y, incl. X-Y)	.256	.033	.666***
		Step 4 (c', X-Y, M controlled)	.095	.355	.023 ns
		Amount of mediation (step 1 - step 4)			-.37
2) Mindfulness and disability	Kinesiophobia	Step 1 (c, X-Y)	-1.44	.365	-.347***
		Step 2 (a, X-M)	-2.357	.694	-.303**
		Step 3 (b, M-Y, incl. X-Y)	.180	.046	.336***
		Step 4 (c', X-Y, M controlled)	-1.017	.361	-.245**
		Amount of mediation (step 1 - step 4)			-.102
3) Mindfulness and depression	Catastrophising	Step 1 (c, X-Y)	-2.231	.333	-.531***
		Step 2 (a, X-M)	-6.006	.842	-.555***
		Step 3 (b, M-Y, incl. X-Y)	.161	.034	.414***
		Step 4 (c', X-Y, M controlled)	-1.266	.368	-.301**
		Amount of mediation (step 1 - step 4)			-.23
4) Mindfulness and depression	Kinesiophobia	Step 1 (c, X-Y)	-2.231	.333	-.531***
		Step 2 (a, X-M)	-2.357	.694	-.303**
		Step 3 (b, M-Y, incl. X-Y)	.080	.045	.149 NS
		Step 4 (c', X-Y, M controlled)	-2.042	.346	-.486***
		Amount of mediation (step 1 - step 4)			.045

*p<.05, ** p<.01, *** p<.001.

10 Discussion

Findings from the present study support conclusions that a more mindful state of consciousness predicts lower levels of physical and emotional impairment, catastrophising, and kinesiophobia in people with chronic low back pain. Furthermore, mindfulness remained a unique predictor of these variables after pain severity and chronic pain acceptance were accounted for. Notably, the greatest increments in unique variance attributed to mindfulness were found for the prediction of anxiety, depression and catastrophising; with lower increments found for the prediction of disability and kinesiophobia.

10.1 Mindfulness and Functioning

These results are consistent with previous findings: linking greater physical and psychological well-being with mindfulness as both a state and as an intervention (Brown & Ryan, 2003; Kabat-Zinn, 1982; Kabat-Zinn et al., 1985; Kabat-Zinn, Lipworth, Burney & Sellers, 1987; Randolph et al., 1999). More specifically the present investigation replicates findings from McCracken et al. (2007) linking greater mindfulness with reductions in reports of depression and disability by people with chronic pain. Lower levels of global anxiety were also found to be associated with enhanced mindfulness in the present study. This is conceptually consistent with findings of lower pain-related anxiety in people reporting elevated mindfulness (McCracken et al., 2007). The results were consistent with this previous study despite clear methodological differences, such as the questionnaires used for the assessment of depression and disability. Also, in relation to the samples, the present study

consisted solely of people experiencing chronic low back pain compared to McCracken et al. (2007) more heterogeneous population. Additionally, the previous study's sample comprised only 9.6 % respondents in employment compared to 23% within the current study. Associations between enhanced mindfulness with greater well-being for people with chronic pain have therefore been further supported using alternative measures of functioning and differing chronic pain patient populations.

The present investigation also strengthens support for the beneficial effects of mindfulness given that changes in mindfulness reports were related to equivalent changes in disability, depression and anxiety reports. More specifically, greater improvements in mindfulness following a cognitive behavioural informed intervention were associated with equivalent improvements in physical and emotional functioning. In fact, mindfulness change scores were one of few change scores to be related to changes in disability (along with only chronic pain acceptance and pain severity). Taken together, these results, and the cross-sectional findings of mindfulness as a unique predictor of functioning, increase confidence that the relationships are valid and potentially causal.

If we are to assume that the ability of mindfulness acts as a protective agent against high levels of impairment a number of explanations can be offered. Theoretical accounts have suggested mindfulness mechanisms include meta-cognition whereby mental events are recognised as such rather than as representing reality, experiential exposure that prevents maladaptive avoidance, and cognitive flexibility whereby a greater range of experiences are observed thus reducing negative evaluation of specific stimuli (Melbourne Academic Mindfulness Interest Group, 2006).

McCracken et al. (2007) also draw parallels between mindfulness and previously researched psychological constructs such as attentional bias in psychological disorders (e.g. anxiety and depression), temporal focus of cognition and the inhibition of automatic responses. Indeed the items in Brown and Ryan's (2003) MAAS refer very explicitly to attention to external and internal stimuli, the temporal location of thoughts/attention and 'automatic' actions. Item endorsement may provide clues to the mechanisms behind the apparent negative impact of 'mindlessness'. Highly endorsed examples of 'mindlessness' included 'listening to someone with one ear whilst doing something else' and focusing on the present or the future: the latter item concerning the temporal location of thought content in particular, relates partially to the second aim of the investigation: the assessment of the relationship between mindfulness with catastrophising.

10.2 Mindfulness, Catastrophising and Kinesiophobia

The second aim of this investigation was to determine whether mindfulness was related to catastrophising and kinesiophobia; two highly researched components that are consistently related to distress and disability and encapsulated within the fear-avoidance model of chronic pain (Keefe et al., 2000; Severeijns et al., 2002; Somers et al. In press).

10.2.1 Catastrophising

Substantial evidence was found for a relationship between mindfulness and catastrophising, in both cross-sectional and longitudinal reports. Specifically, people

who reported greater mindfulness were more likely to report lower levels of catastrophising. At a single point in time mindfulness was associated with the catastrophising sub-components of magnification, rumination and helplessness, and uniquely related to catastrophising after controlling for pain intensity and pain acceptance. Furthermore, significant changes in both mindfulness and catastrophising following an intervention were significantly related: increases in mindfulness were related to equivalent decreases in catastrophising and vice versa.

One suggestion for this relationship is that the ability to be mindful of the present moment allows people to notice and let go of negative thoughts (Frewen et al., 2007), reducing the focus of their attention on pain-related thoughts and sensations and distinguishing the exaggeration of threat. This coincides with literature linking mindfulness with meta-cognition (Teasdale, 1999) and cognitive flexibility (Heeren et al., 2009, in press), a phenomenon that may facilitate greater problem solving (Frewen et al., 2007). The results suggest that although mindfulness and other third wave interventions do not focus on changing the content of thoughts, cognitive styles may still be altered, perhaps due to changes in the relationships people have with their thoughts (Fletcher & Hayes, 2005; Hayes, 2004). Thoughts are therefore intentionally observed and accepted, rather than acting as automatic agents invoking further escalation of thoughts focussed on pain sensations and threat. Catastrophic thoughts about future threat and past experiences within the magnification subscale may be particularly apt targets for present-focussed mindfulness. There was indeed a substantial relationship between these constructs, with greater reported mindfulness being associated with less reported magnification. The importance of temporal focus was also identified in McCracken and Thompson's (2009) factor analysis of the

MAAS, where the Present Focus factor emerged as the most consistent predictor of functioning variables.

An alternative explanation lies within the fact that both catastrophising and mindfulness reports changed significantly following the multidisciplinary cognitive-behavioural focused intervention. The reduction in catastrophising could be related to the cognitive-behavioural techniques employed in the intervention that target such thinking styles. It could therefore be argued that the enhancement of mindfulness was actually caused, in part, by a reduction in catastrophising (a more explicit target of the intervention). These two constructs could be related in a bi-directional fashion.

Alternatively, unmeasured treatment processes such as positive social experience, may have both improved participants' ability and desire to stay in the present moment and decreased distressing thinking styles.

10.2.2 Kinesiophobia

Some evidence was found to support a small and unique relationship between mindfulness and the belief and fear that movement will bring about (re)injury (kinesiophobia, French et al., 2007; Kori et al., 1990). The processes involving attention to and letting go of thoughts that were emphasized in the context of the relationship between catastrophising and mindfulness may also be applicable to this relationship. Consequently, mindful attention may act to decrease focused attention on painful bodily sensations that have been proposed to contribute to the fear of movement (Asmundson et al., 1999; Peters et al., 2002).

A relationship between these constructs, however, was not identified across time; with no significant correlation found between their change scores. This would suggest that they are perhaps not related in a causal fashion and that their relationships with other variables may have been responsible for their association at the single time-point. Kinesiophobia tended to have the lowest (albeit significant) correlations with both mindfulness and the functioning variables and the model derived for the prediction of kinesiophobia explained the least variance of all of the regression models. The specific fear of movement bringing about injury is perhaps more narrow than the construct of catastrophising and may not be as relevant for all individuals who profess chronic pain-related disability and depression. As a whole, these points question the relative utility of kinesiophobia and the validity of its relationships with mindfulness.

10.3 Mindfulness and the Fear-Avoidance Model of Chronic Pain

The final aim of the present study was to determine whether relationships between mindfulness with disability and depression were mediated by catastrophising and kinesiophobia. This hypothesis inferred that greater mindfulness is related to reduced depression and disability indirectly i.e. mindfulness reduces catastrophising and kinesiophobia which in turn leads to less disability and depression (the latter is specified within the fear-avoidance model of chronic pain, Vlaeyen et al., 1995, Figure 1).

In support of elements of the fear-avoidance model, moderate associations were found for catastrophising with disability and depression, and small associations were found between kinesiophobia and these functioning variables. Kinesiophobia did not greatly

influence the significance of mindfulness associations with disability and depression, although Sobel tests indicated it as a partial mediator of the relationship between mindfulness and disability. The addition of catastrophising resulted in the disappearance of a significant association between mindfulness with disability and a reduction in the relationship with depression. This indicates that catastrophising may be integral to these relationships. Sobel test results also supported the idea that catastrophising acted as a significant mediator in the relationship between mindfulness and disability and a partial mediator in the relationship between mindfulness and depression.

It is clear that complex relationships exist between reported mindfulness, functioning and process components of the fear-avoidance model. Mindfulness could also have been tested as a potential mediator because in reality it is likely that these relationships operate in multiple and circular directions i.e. mindfulness reduces catastrophising and vice versa. In support of mindfulness as a mediator, mindfulness significantly improved following the intervention, thus providing evidence for it as a state variable that could temporally succeed catastrophising. Several arguments, however, lead to the decision against using mindfulness as a mediator in this research. These drew upon evidence of mindfulness as a trait variable (Brown & Ryan, 2003) and reference to the fear avoidance model of chronic pain that suggests that differences between people who experience disability and depression result from differences in catastrophising. It could therefore be argued that differences in mindfulness dictate whether people catastrophise, and that the level of catastrophising then directly leads to the presence or absence of disability and depression.

Additional processes may also be responsible for the potential influence of mindfulness, in particular, for depression where the relationship remained significant with the addition of catastrophising and kinesiophobia. The association between mindfulness and disability was small and diminished when catastrophising reports were included. Further examination of the efficacy of mindfulness based treatments for physical functioning is therefore warranted.

10.4 Limitations

There are a number of empirical and theoretical limitations with the current study. Firstly, although representative of the local population, the sample lacked ethnic diversity and consisted of patients embarking on and completing a pain management programme, thus this questions the generality of the findings in describing all chronic pain sufferers. Similar research undertaken with community samples of people with chronic pain would help determine whether comparable levels of mindfulness are reported by people not accessing services. The second limitation refers to measurement. Both the definition and measurement of mindfulness has encouraged much debate (Baer et al., 2006, Singh, Lancioni, Wahler, Winton & Singh, 2008). The present study employed Brown and Ryan's (2003) measure that focuses on attention and awareness aspects of mindfulness. This excludes the abilities to be non-judgemental and non-reactive to internal and external stimuli that are facets recognised within Baer et al. (2006) examination of a number of mindfulness measures. Additionally, self-report mindfulness measures require a degree of self-awareness and supplementation with experimental assessments of mindfulness may further validate linkages with functioning (e.g. Mindfulness Breath Attention: Frewen

et al., 2007). Future research could also explore a broader range of notions of functioning as well as mindfulness to help validate the accuracy of these findings. Thirdly, the majority of statistical analyses within this study were undertaken with cross-sectional data, thus limiting ability to infer direction of causation.

10.5 Clinical Implications

Although methodological and theoretical issues abound to assess mindfulness constructs and process, this study clearly adds further justification for the use of mindfulness-based interventions. Specifically, links found between mindfulness and pain catastrophising, although complex, provides some support for the use of mindfulness with people who adopt this thinking style. If the relationship between these factors is bi-directional an argument is made for the flexible use of either or both mindfulness and cognitive behavioural interventions, based upon individual needs and preferences. Some people for example may engage more with the approach of challenging thoughts to reduce catastrophising, and therefore increasing contact with the present moment, and others may prefer more mindful and acceptance-based approaches to ameliorate the impact of distressing thoughts and emotions. One approach cannot be advocated more forcefully than the other without substantial evidence for superior effectiveness.

10.6 Further Inquiry

This exploratory study paves the way for a number of future investigations. Firstly, the speculative explanations for the relationship between mindfulness and

catastrophising could be validated through the use of questionnaire and experimental measures assessing the ability to let go of thoughts, cognitive flexibility and attention processes (Frewen et al., 2007; Heeren et al., in press; Crombez, Hermans & Adriaensen, 2000). Secondly, exploration of potential relationships between mindfulness and additional constructs within the fear-avoidance model, such as avoidance, hypervigilance and muscle reactivity is warranted. The assessment of mindfulness with behavioural avoidance would facilitate comparisons with the more cognitive variables and potentially illuminate explanatory mechanisms such as exposure. Finally, a supplementary investigation could explore the relationships between mindfulness and fear-avoidance model components prior to and in completion of a mindfulness-based intervention. Within this qualitative tools could be employed to ascertain individuals' experiences and understandings of mindfulness and its impact, which may also illuminate process issues.

This exciting area of development is eliciting much attention in a vast array of psychological and physical health difficulties. Mindfulness is emerging as a desirable and effective construct for understanding and treating chronic pain related distress and disability. Regardless of its relative merits in comparison with cognitive behavioural conceptualisations, recent research is supporting it as a robust treatment option for enhancing the quality of life with people experiencing chronic pain.

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11 Critical Appraisal

11.1 Origins of the Literature Review and Research Questions

My literature review and research project originated from a longstanding interest in the experience of chronic pain. As an Assistant Psychologist in a chronic pain service prior to clinical psychology training, I was introduced to Cognitive Behavioural and Third Wave Therapy techniques for people experiencing chronic pain related distress and physical limitations. I was particularly impressed by the Third Wave approaches that expanded cognitive behavioural frameworks for understanding human suffering and well-being with concepts of acceptance and a non-judgemental approach to thoughts. These newer conceptualisations resonated with my clinical experience of people attending chronic pain management programmes: their understandable attempts to eliminate and control their pain took them away from meaningful and pleasurable activities. Through my experience of other client groups in my training I have also become aware of the limitations of traditional cognitive behavioural strategies aimed at controlling and challenging thoughts.

Since the commencement of my clinical training course in October 2006 I have observed the developments of these new approaches. I have noticed the rapid application of mindfulness practice in many areas of clinical and health psychology, ranging from its use within structured approaches for people with complex needs, to its use for milder psychological problems within primary care services. I became increasingly aware through reference to the literature, however, that these popular mindfulness practices were emerging without substantial empirical indication of their

mechanistic properties. An initial literature review in my first year of the course identified intervention studies suggesting the beneficial effects of mindfulness for people experiencing pain. These did not, however, employ comparable cognitive behavioural interventions and often failed to include an assessment of mindfulness to infer change processes. Consequently I was interested in whether the effectiveness of mindfulness matched its popularity. This consideration, my own personal orientation to cognitive models and the compassion I have found within these new approaches lead to an interest in understanding the processes behind mindfulness.

Mindfulness practice originates from Eastern traditions of Buddhist Vipassana philosophy and practice. This led me to also question whether some cultural groups were more ‘mindful’ than others, in particular eastern cultural groups. Devising a viable cross-cultural study, however, proved to be impractical when I identified that it was not possible to recruit enough participants for adequate power from a local pain management service offering programmes for South Asian people. As a result it was necessary to address both ethno-cultural variation and mindfulness separately, in my literature review and research project respectively.

11.2 Literature Review

For the literature review quantitative studies were sought and reviewed to address the question of whether significant ethno-cultural differences exist in chronic pain experience. On reflection the sole inclusion of studies that tested for statistical difference between cultural groups meant intra-group variation was ignored and potentially interesting comparisons could have been drawn comparing intra-group

variation between cultural groups. During the writing process I became aware of the complexity of assessing cultural variation and the ubiquity of methodologies and findings produced by the studies. Although this created difficulties for developing a clear story from the data, it highlighted that conclusive generalisations cannot be drawn from the scientific literature often using heterogeneous cultural groups in North America. As a result I am now more curious about individuals' accounts of their experiences of chronic pain in relation to their cultural backgrounds and environments.

11.3 Study Development

In examining the literature on chronic pain and mindfulness I found two well designed quantitative cross-sectional studies that found relationships between reports of mindfulness as a state and chronic pain functioning (McCracken et al., 2007). I became very keen to theoretically and empirically extend this research by investigating the potential reasons for the beneficial effects of mindfulness. A quantitative approach seemed to be the most appropriate design: due to variation in the definitions of mindfulness and questionable ability to introspect on mindfulness processes. I therefore opted to use standardised and conceptually valid measures to investigate relationships that could be generalised to populations experiencing chronic low back pain. As a result, I would need a substantial sample size for adequate power to address my hypotheses; further preventing the exploration of ethno-cultural comparisons.

11.3.1 Collaboration with Back Pain Unit and Clinical Supervisor

I was extremely fortunate to be able to collaborate with enthusiastic staff at a Back Pain Unit running pain management programmes for people with chronic low back pain. My clinical supervisor and her manager at this Unit were extremely keen to be involved in the research and explained I could have access to a substantial amount of people experiencing chronic pain. I was also very keen to undertake a clinical placement with the unit because I felt uncomfortable about undertaking research in chronic pain experience without simultaneously having more direct contact with people experiencing chronic pain. Unfortunately, however, a placement was not possible during the research period though I have been undertaking a general health psychology placement instead.

Through discussion with my clinical supervisor, her manager and my academic supervisor we realised that the most efficient way to acquire an adequate sample size would be to combine my research measures with service evaluation questionnaires to be administered by the clinical team. Course commitments would mean that I would not have had access to patients at times convenient to approach and recruit them. Postal recruitment and administration of questionnaires was considered, although previous postal response rates in the Unit reflected sample sizes that would not generate adequate power to address the research hypotheses. The final research measures captured constructs that were also change targets of the programmes and therefore fell within the rubric of the service evaluation. I was initially slightly uncomfortable about the lack of clarity and communication with patients about the use of the service evaluation data for a research project. However, through discussion

with the manager of the Back Pain Unit it was deemed that patients consenting to complete questionnaire measures for the service evaluation would be unlikely to draw a distinction between these activities. The Regional Ethics Committee agreed and approved the use of the questionnaire responses for the purpose of this research.

The successful promotion of the research and engagement with the Back Pain Unit staff team was crucial for their investment in the research and subsequent delivery of questionnaire measures. This involved collecting staff feedback regarding my research ideas and proposed questionnaire measures. Academic and pragmatic input from academic and clinical supervisors and the Back Pain Unit staff was vital for the planning and implementation of the research. The collaboration was essential to acquire enough participants for a smooth data collection period. At an initial 4-way meeting, however, I found that merging these multiple perspectives was challenging, and as result became aware of some of the complexities of working with different agendas in research. I subsequently aimed to ensure clarity of the methodology and individuals' roles through the use of written agendas and meeting summaries reflected back in emails. Following this initial meeting and discussion with the clinical team I learnt that I needed to balance assertiveness about theoretical considerations with acknowledgement and acceptance of practical administration constraints, as well as the palatability of questionnaire measures for the client group and the service evaluation. This led to slight changes in the choice of research measures.

11.3.2 Evolving Research Questions and Measurement

I was concerned that the research extended the earlier discoveries of relationships between mindfulness and enhanced functioning in people with chronic pain (McCracken et al., 2007). I therefore spent time reading and thinking about potential processes behind these relationships. This involved merging the literature on the mechanisms of the beneficial effects of mindfulness with explanations behind chronic pain related distress and disability. This exploration directed me to discover and review a number of constructs and measures that were empirically related or theoretically consistent with chronic pain, mindfulness and general well-being. Some of the cognitive constructs that were considered initially included Mental Defeat (Tang, Salkovskis & Hanna, 2007), Hope (Snyder et al., 1991), and Pain Beliefs (Edwards, Pearce, Turner-Stokes & Jones, 1992). Reasons for excluding these constructs included a lack of 1) clear theoretical consistency with mindfulness, 2) palatability of the construct's measurement tool with the sample population and 3) measure standardisation with chronic pain populations.

The final process constructs were chosen on the basis of representing clear relationships with chronic pain functioning (pain catastrophising and kinesiphobia) represented within the fear-avoidance model (Vlaeyen et al., 1995) and coherence with theorised mindfulness processes e.g. attention and cognitive flexibility. There was also a small pool of well validated and succinct questionnaires measures for these constructs. Similarly the functioning measures were chosen on the basis of their applicability with chronic pain populations and their ease of completion. The Hospital Anxiety and Depression Scale (HADS; Zigmond & Snaith, 1983), for example, was

chosen for having relatively few somatic items that may denote physical rather than mood symptoms.

The decision making process concerning the measurement of mindfulness was more complex. I initially wanted to include two measures of mindfulness: the Mindful Attention Awareness Scale (MAAS; Brown & Ryan, 2003) and the Five Factor Mindfulness Questionnaire (FFMQ; Baer et al., 2006). The MAAS appealed due to its prior use with a chronic pain population and greater number of validation studies (McCracken et al., 2007) and the FFMQ appealed due to its broader conceptualisation of mindfulness, including facets representing an unresponsive and non-judgemental approach to stimuli. Concern was, however, expressed by the clinical team that some of the items in the FFMQ would not be palatable to the sample population and that the inclusion of two mindfulness measures would lead to a lengthy questionnaire booklet. It was therefore decided that only the MAAS would be included since it offered greater comparability with previous chronic pain research and clearer items. On reflection it may have been useful to pilot the FFMQ with a sample of patients at the Back Pain Unit to verify whether staff predictions of responses to this measure were accurate.

Although the measures that were employed were conceptually and theoretically valid in the context of the research questions, the functioning and process measures were skewed towards negative outcomes (e.g. depression and disability). Recent discourse has highlighted this bias in the empirical literature and has suggested the exploration of more positive variables such as hope, resilience and well-being (Unwin, 2008). Investigations into acceptance and mindfulness counteract this negative focus and

future simultaneous assessment of positive functioning would echo the spirit of these concepts.

11.4 Undertaking the Research Project and Writing

11.4.1 Data Collection

In order to ensure adequate data collection and management I made regular visits to the Back Pain Unit. Data collection ran smoothly and questionnaire responses were input into the SPSS database shortly after they were available. Managing the database to also meet the requirements required for the service evaluation involved the production of guidelines describing the SPSS variables and scoring information.

11.4.2 Data Screening and Analysis

Data screening proved to be more complicated than I had anticipated because it revealed questions about normal distribution and how to test for this. My initial assumptions that the decisions concerning statistical tests followed clear rules were challenged. This occurred with the discovery of contradictory indications from normality checks for a small number of variables. I found this initially confusing though through additional reading and by seeking statistical support I was able to understand and compare the arguments for and against using certain tests.

Once the data were screened I conducted the statistical tests of my hypotheses. I found exploring the relationships between the variables through the data very exciting

and due to time demands I had to regularly ensure that I was focussing the analyses on my hypotheses. I therefore had to acknowledge but not act upon my temptation to address remaining questions regarding relationships outside the focus of this thesis. Such questions could form the basis of future publications for example, exploration into the factor structure of the mindfulness questionnaire and relationships between potential factors and the other variables.

11.4.3 Writing

The project introduction and methodology sections were written over a large time period and were therefore largely completed by the data analysis phase. This was due to the considerable amount of time I had spent thinking about the theoretical basis of the research question and planning the procedure. The format of the results sections was largely guided by the hypotheses and this was therefore fairly straightforward to write up. The discussion, however, took more time than I had expected and as with the data analyses I had to continually check I was not overly elaborating. I also realised quite how many questions I was addressing and for publication these could actually be separated into a few shorter stories. I also really appreciated the opportunity to discuss drafts with my academic supervisor and became aware that my writing can at times be telegraphic and have therefore tried to develop a smoother style.

11.5 Limitations and Future Inquiry

As considered within the Discussion of the project there are a number of limitations with this study that pave the way for future research. A number of these are worth expanding upon. Firstly the ethnic homogeneity of this sample and that of McCracken and colleagues (McCracken et al., 2007; McCracken & Thompson, 2009) questions whether findings can be generalised across cultural groups. Future research could therefore determine whether mindfulness is related to functioning and the processes within the fear-avoidance model (Vlaeyen et al., 1995) in additional ethnic and cultural groups. Secondly, a more robust test of causation in the relationships between mindfulness and the variables within the fear-avoidance model would be to undertake a longitudinal study in which community samples experiencing acute pain are assessed and monitored at follow-up. Thirdly, although I feel that this study has further supported the encouragement of a more mindful state of consciousness, I have felt removed from clients' experiences of mindfulness in practice. With hindsight discussion with people experiencing chronic pain and using mindfulness approaches may have enhanced my discussion of the results. I am keen to further explore understandings of mindfulness and experiences of mindfulness meditation.

Finally, towards the end of this study I considered the irony of comparing constructs from two very different philosophies concerning human suffering and well-being. Essentially I compared mindfulness that focuses on neutral awareness and attention to all stimuli, including catastrophic thoughts, with a cognitive model of understanding distress and disability that emphasises changing these thoughts. The concept of experiential avoidance, however, could be considered to be more in line with both of

these philosophies and therefore warrants greater examination with mindfulness in the field of chronic pain.

11.6 Summary

In summary I have really enjoyed being able to explore an area of personal and clinical interest within this work. I have learnt about investigating theoretical relationships and narrowing these down to produce clear empirical questions. In addition, I have become very aware of the importance of effective working relationships for the smooth implementation of research protocols. Finally, the results of my project have provided me with further impetus to use mindfulness approaches with clients and more actively engage in personal meditation.

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13 Appendices

Appendix A

Database Search Terms

Chronic pain (*Population*)

AND

Ethnicity/ Ethnic

Culture/ Cultural/ Cultures

Cross-culture/ Cross-cultural

Race/ Racial

(*Group comparison criteria*)

Appendix B

Record of Database Search: 6th- 7th October 2008

Where possible the following limits were applied:

Adult, Human, Empirical study, Date of publication: 1970 to 2009

	No. hits			
Search term	Web of Science	Scopus	Psychinfo	Medline**
1) Chronic pain AND ethnic* (thus covering ethnicity and ethnic)	206	269	194	109
2) Chronic pain AND cultur* (for culture and cultural)	709	1276	176	233
3) Chronic pain AND cross-cultur*	53	96	55	17
4) Chronic pain AND rac* (for racial, and race)	246	344	232	192
5) All combined by OR (1 OR 2 OR 3 OR 4)	936	1732	428	454

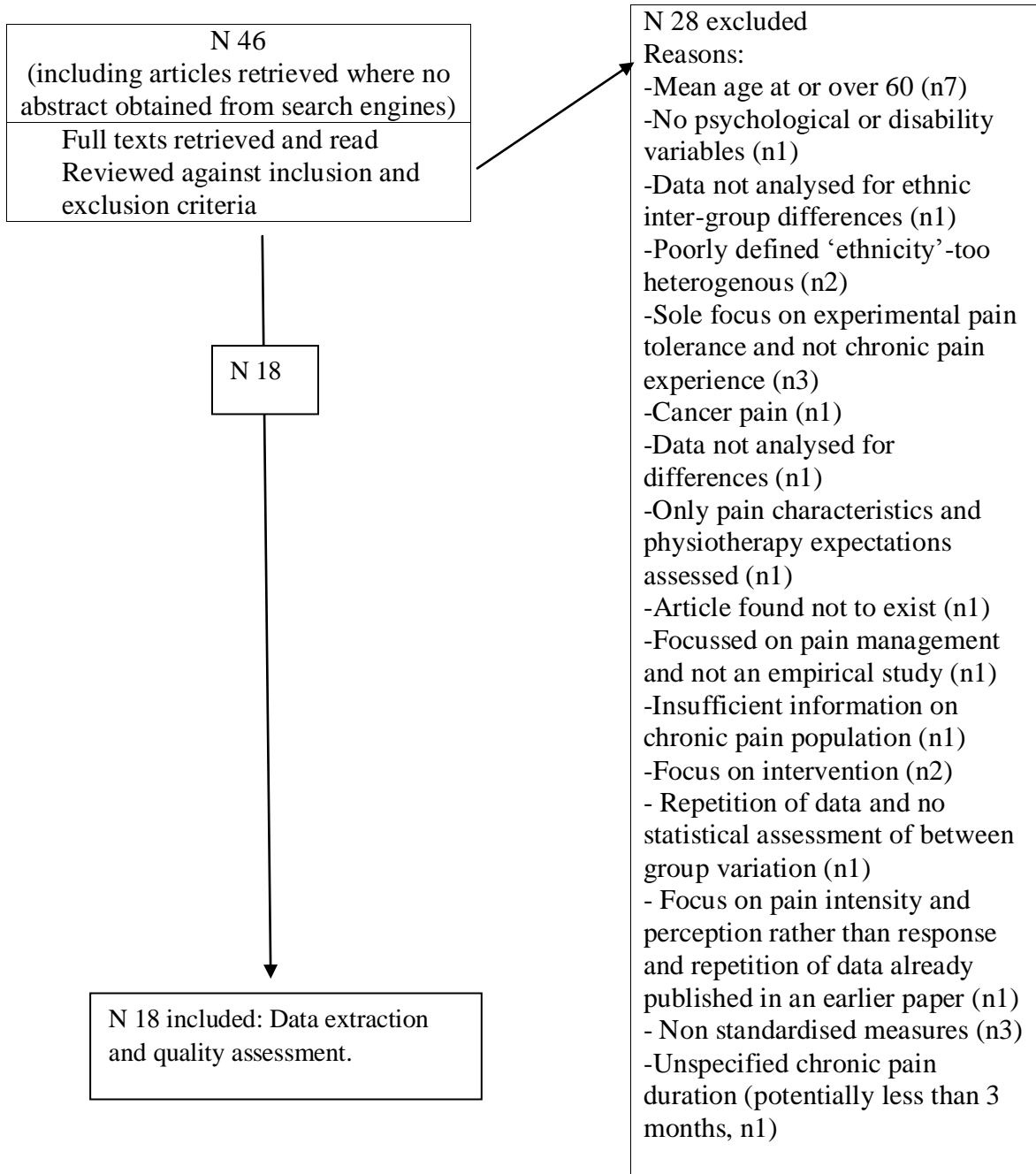
** \$ truncation used instead of *

Appendix C Selection Criteria

	Population and chronic pain condition	Independent variable: ethnicity/culture	Outcomes	Study Design/Methods	Database limits (where possible)
Inclusion	Chronic Pain Condition* Human adults with mean age 18 and over	Comparison of at least two distinct ethnic groups Comparison of at least two distinct cultural groups (defined on basis of distinct geographical location)	Psychological distress/ emotional factors (e.g. depression, anxiety) Physical and psychosocial functioning/disability/Quality of life Psychological/cognitive phenomena (e.g. beliefs (not treatment related), attitudes, coping styles)	Quantitative '3.Controlled observational and 4.Observational' (CRD, 2001) Cross-sectional Standardised and validated measures	Date Published: 1970- 2008 Peer-reviewed journal English language Empirical study
Exclusion	Insufficient information on participants with chronic pain (minimal information to include whole sample sample size, gender, mean age) Life-threatening or terminal conditions e.g. cancer, sickle cell disease, AIDS Acute pain, post-operative pain and experimentally induced pain Trauma e.g. sexual abuse, PTSD Adults with mean age 60 and over Young people under age of 18 Psychosomatic Illness	Insufficient information on participants' ethnicity/culture e.g. 'immigrant'	Physiological /Biological functioning (including solely reports on pain characteristics e.g. level/intensity or predictors of pain characteristics) Expectations of professional pain management and treatment Sole focus on access to care/treatment Sole focus on response to a pain intervention/ management Data not analysed for significant differences between ethnic/cultural groups Knowledge of pain conditions Pain behaviour	Epidemiological studies focussing on prevalence/existence of chronic pain and not on ethnic comparisons of psychosocial functioning '5 Expert opinion based on pathophysiology, bench research or consensus' (CRD, 2001) Qualitative Data from non standardised measures	Dissertation abstracts/ unpublished studies Opinion based article

* Pain having lasted for a minimum of 3 months (International Association for the Study of Pain criteria for point of division between acute and chronic pain).

Appendix D
Flow chart of full-text Screening



Appendix E

Data Extraction Variables

1) Author/s and date

Participant characteristics:

- 2) Country of research
- 3) Country of residence of participants
- 4) Chronic pain condition
- 5) Ethnicity/ culture of participants (N, N female)
- 6) Definition of group categorisation (e.g. ethnicity/ culture) and how defined (e.g. self/ other)
- 7) Details of participant selection
- 8) Mean ages

Checklist for inclusion of individual and socio-demographic variables*:

- 9) Mean pain duration
- 10) Description of pain site/ diagnosis
- 11) Education (level of attainment or years in education)
- 12) Marital Status
- 13) Employment Status
- 14) Income (actual or estimated from census data)
- 15) Population characteristics (physical condition, sex, N)
- 16) Other demographic variables

Methodological Factors:

- 17) Study design
- 18) Checklist for comparison between refuser/excluded population with study population.
- 19) Research questions
- 20) Key variables and measures used
- 21) Measures psychometric properties (i.e. adequate reliability and validity)
- 22) Procedure
- 23) Statistical differences between groups
- 24) Similarities/ areas with no statistical difference between groups
- 25) Statistical analyses
- 26) Statistical controls

Results:

- 27) Significant differences in target outcome variables
- 28) Areas with no significant difference in target outcome variables
- 29) Key conclusions

Critical evaluation comments:

Sample- strengths/bias

Measurement- strengths/bias

Confounding variable control-strengths/bias

Clinical implications/main conclusions

*NB these variables are noted in the literature as being related to pain experience variability and may therefore represent potential confounds (McBeth & Jones, 2007).

Appendix F Nature of CBT Informed Pain Management Programmes

The pain management programmes run for groups of twelve patients and consist of eleven sessions. Patients attend one full day per week for nine weeks and two half day sessions three and nine months later. The aims of the programmes are to improve patients' quality of life, reduce their functional restrictions and improve their emotional well-being. The multidisciplinary team approach uses a Cognitive Behavioural model for pain management. Sessions include: anatomy of the spine, medication, the biology of pain, pacing techniques, improving sleep strategies, managing stress, the impact of thoughts and feelings on pain, relaxation and learning how to exercise appropriately. The groups that were run within the timeframe of this study had a one-hour stand alone introduction to mindfulness session. This included an outline of the nature of mindfulness, experiential exercises and reflection.

Appendix G
Questionnaire Booklet

The Back Pain Unit

Pain Management Programme Questionnaires Booklet

Name:.....

Date:.....

The purpose of these questionnaires is to help us monitor your progress and to evaluate the effectiveness of the Pain Management Programmes.

Please try not to take too much time over each question. There are no right or wrong answers.

If you are unsure how to fill in the questionnaires, please ask a member of staff for assistance.

The department is a NHS Foundation Trust Unit and is not linked to any non-NHS organisations. If you have any concerns, please do not hesitate to discuss them with the staff.

FOR ADMIN USE ONLY: Timepoint

Day 1	Day 9	Day 11

Roland and Morris Disability Questionnaire

When your back hurts, you may find it difficult to do some of the things you normally do.

These are some sentences that people have used to describe themselves when they have back pain. As you read the list, think of yourself *today*. **Please circle** the answer that best describes how much each statement applies to you today.

- | | | |
|----|--|--------|
| 1. | I stay at home most of the time because of my back | YES/NO |
| 2. | I change position frequently to try and get my back comfortable | YES/NO |
| 3. | I walk more slowly than usual because of my back | YES/NO |
| 4 | Because of my back, I am not doing any of the jobs that I usually do around the house. | YES/NO |
| 5 | Because of my back, I use a handrail to get upstairs. | YES/NO |
| 6 | Because of my back, I lie down to rest more often. | YES/NO |
| 7 | Because of my back, I have to hold on to something to get out of any easy chair. | YES/NO |
| 8 | Because of my back, I try to get other people to do things for me. | YES/NO |
| 9 | I get dressed more slowly than usual because of my back. | YES/NO |
| 10 | I only stand up only for short periods of time because of my back. | YES/NO |
| 11 | Because of my back, I try not to bend or kneel down. | YES/NO |
| 12 | I find it difficult to get out of a chair because of my back. | YES/NO |
| 13 | My back is painful almost all the time. | YES/NO |
| 14 | I find it difficult to turn over in bed because of my back. | YES/NO |
| 15 | My appetite is not very good because of my back pain. | YES/NO |
| 16 | I have trouble putting on my socks (or stockings) because of pain in my back. | YES/NO |
| 17 | I can only walk short distances because of my back pain | YES/NO |
| 18 | I sleep less well because of my back. | YES/NO |

19	Because of my back pain, I get dressed with help from someone else.	YES/NO
20	I sit down for most of the day because of my back	YES/NO
21	I avoid heavy jobs around the house because of my back.	YES/NO
22	Because of my back pain, I am more irritable and bad tempered with people than usual.	YES/NO
23	Because of my back, I go upstairs more slowly than usual.	YES/NO
24	I stay in bed most of the time because of my back	YES/NO

SF-8™ Health Survey

This survey asks for your views about your health. This information will help you keep track of how you feel and how well you are able to do your usual activities. Thank you for completing this survey.

Answer every question by selecting the answer as indicated. If you are unsure about how to answer a question, please give the best answer you can.

For each of the following questions, please mark an [x] in the one box that best describes your answer.

1. Overall, how would you rate your health during the past week?

Excellent	Very good	Good	Fair	Poor	Very poor
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

2. During the past week, how much did physical health problems limit your usual physical activities (such as walking or climbing stairs)?

Not at all	Very little	Somewhat	Quite a lot	Could not do physical activities
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

3. During the past week, how much difficulty did you have doing your daily work, both at home and away from home, because of your physical health?

None at all	A little bit	Some	Quite a lot	Could not do daily work
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

4. How much bodily pain have you had during the past week?

None	Very mild	Mild	Moderate	Severe	Very Severe
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

5. During the past week, how much energy did you have?

Very much	Quite a lot	Some	A little	None
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☐ ☐ ☐ ☐ ☐

6. During the past week, how much did your physical health or emotional problems limit your usual social activities with family or friends?

Not at all	Very little	Somewhat	Quite a lot	Could not do social activities
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

7. During the past week, how much have you been bothered by emotional problems (such as feeling anxious, depressed or irritable)?

Not at all	Slightly	Moderately	Quite a lot	Extremely
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

8. During the past week, how much did personal or emotional problems keep you from doing your usual work, school or other daily activities?

Not at all	Very little	Somewhat	Quite a lot	Could not do daily activities
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Thank you for completing these questions!

Tampa Scale for Kinesiophobia

This is a list of phrases which other patients have used to express how they view their condition. Please indicate the extent to which you agree with each statement.

	Strongly disagree	Somewhat disagree	Somewhat agree	Strongly Agree
1. I'm afraid that I might injury myself if I exercise	1	2	3	4
2. If I were to try to overcome it, my pain would increase	1	2	3	4
3. My body is telling me I have something dangerously wrong	1	2	3	4
4. My pain would probably be relieved if I were to exercise	1	2	3	4
5. People aren't taking my medical condition seriously enough	1	2	3	4
6. My accident has put my body at risk for the rest of my life	1	2	3	4
7. Pain always means I have injured my body	1	2	3	4
8. Just because something aggravates my pain does not mean it is dangerous	1	2	3	4
9. I am afraid that I might injure myself accidentally	1	2	3	4
10. Simply being careful that I do not make any unnecessary movements is the safest thing I can do to prevent my pain from worsening	1	2	3	4
11. I wouldn't have this much pain if there weren't something potentially dangerous going on in my body	1	2	3	4
12. Although my condition is painful, I would be better off if I were physically active	1	2	3	4
13. Pain lets me know when to stop exercising so that I don't injure myself	1	2	3	4
14. It's really not safe for a person with a condition like mine to be physically active	1	2	3	4

15. I can't do all the things normal people do because it's too easy for me to get injured	1	2	3	4
16. Even though something is causing me a lot of pain, I don't think it's actually dangerous	1	2	3	4
17. No one should have to exercise when he/she is in pain	1	2	3	4

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Day-to-Day Experiences (MAAS)

Instructions: Below is a collection of statements about your everyday experience. Using the 1-6 scale below, please indicate how frequently or infrequently you currently have each experience. Please answer according to what *really reflects* your experience rather than what you think your experience should be. Please treat each item separately from every other item.

1	2	3	4	5	6
Almost Always	Very Frequently	Somewhat Frequently	Somewhat Infrequently	Very Infrequently	Almost Never

I could be experiencing some emotion and not be conscious of it until some time later	1	2	3	4	5	6
I break or spill things because of carelessness, not paying attention, or thinking of something else	1	2	3	4	5	6
I find it difficult to stay focused on what's happening in the present.	1	2	3	4	5	6
I tend to walk quickly to get where I'm going without paying attention to what I experience along the way.	1	2	3	4	5	6
I tend not to notice feelings of physical tension or discomfort until they really grab my attention.	1	2	3	4	5	6
I forget a person's name almost as soon as I've been told it for the first time.	1	2	3	4	5	6
It seems I am "running on automatic," without much awareness of what I'm doing.	1	2	3	4	5	6
I rush through activities without being really attentive to them.	1	2	3	4	5	6
I get so focused on the goal I want to achieve that I lose touch with what I'm doing right now to get there.	1	2	3	4	5	6
I do jobs or tasks automatically, without being aware of what I'm doing.	1	2	3	4	5	6
I find myself listening to someone with one ear, doing something else at the same time.	1	2	3	4	5	6

I drive places on ‘automatic pilot’ and then wonder why I went there.	1	2	3	4	5	6
I find myself preoccupied with the future or the past.	1	2	3	4	5	6
I find myself doing things without paying attention.	1	2	3	4	5	6
I snack without being aware that I’m eating.	1	2	3	4	5	6

CPAQ

Directions: Below you will find a list of statements. Please rate the truth of each statement as it applies to you by circling a number. Use the following rating scale to make your choices. For instance, if you believe a statement is “Always True”, you would circle the 6 next to that statement.

0	1	2	3	4	5	6
Never True	Very Rarely True	Seldom True	Sometimes True	Often True	Almost Always True	Always True

1. I am getting on with the business of living no matter what my level of pain is	0	1	2	3	4	5	6
2. My life is going well, even though I have chronic pain	0	1	2	3	4	5	6
3. It's O.K. to experience pain	0	1	2	3	4	5	6
4. I would gladly sacrifice important things in my life to control this pain better	0	1	2	3	4	5	6
5. It's not necessary for me to control my pain in order to handle my life well	0	1	2	3	4	5	6
6. Although things have changed, I am living a normal life despite my chronic pain	0	1	2	3	4	5	6
7. I need to concentrate on getting rid of my pain	0	1	2	3	4	5	6
8. There are many activities I do when I feel pain	0	1	2	3	4	5	6
9. I lead a full life even though I have chronic pain	0	1	2	3	4	5	6
10. Controlling pain is less important than other goals in my life	0	1	2	3	4	5	6

0 Never True	1 Very Rarely True	2 Seldom True	3 Sometimes True	4 Often True	5 Almost Always True	6 Always True
---------------------------	------------------------------------	----------------------------	-------------------------------	---------------------------	--------------------------------------	----------------------------

11. My thoughts and feelings about pain must change before I can take important steps in my life	0	1	2	3	4	5	6
12. Despite the pain, I am now sticking to a certain course in my life	0	1	2	3	4	5	6
13. Keeping my pain level under control takes first priority whenever I am doing something	0	1	2	3	4	5	6
14. Before I can make any serious plans, I have to get some control over my pain	0	1	2	3	4	5	6
15. When my pain increases, I can still take care of my responsibilities	0	1	2	3	4	5	6
16. I will have better control over my life if I can control my negative thoughts about pain	0	1	2	3	4	5	6
17. I avoid putting myself in situations where pain might increase	0	1	2	3	4	5	6
18. My worries and fears about what pain will do to me are true	0	1	2	3	4	5	6
19. It's a relief to realize that I don't have to change my pain to get on with my life	0	1	2	3	4	5	6
20. I have to struggle to do things when I have pain	0	1	2	3	4	5	6

APPENDIX G

Pain Catastrophizing Scale (PCS)

Everyone experiences painful situations at some point in their lives. Such experiences may include headaches, tooth pain, joint pain, or muscle pain. People are often exposed to situations that may cause pain such as illness, injury, dental procedures, or surgery.

We are interested in the types of thoughts and feelings that you have when you are in pain. Listed below are thirteen statements describing different thoughts and feelings that may be associated with pain. Using the following scale, please indicate the degree to which you have these thoughts and feelings when you are experiencing pain.

0—not at all	1—to a slight degree	2—to a moderate degree	3—to a great degree	4—all the time
<hr/>				
<i>When I'm in pain . . .</i>				
1	<input type="checkbox"/>	I worry all the time about whether the pain will end.		
2	<input type="checkbox"/>	I feel I can't go on.		
3	<input type="checkbox"/>	It's terrible and I think it's never going to get any better.		
4	<input type="checkbox"/>	It's awful and I feel that it overwhelms me.		
5	<input type="checkbox"/>	I feel I can't stand it any more.		
6	<input type="checkbox"/>	I become afraid that the pain will get worse.		
7	<input type="checkbox"/>	I keep thinking of other painful events.		
8	<input type="checkbox"/>	I anxiously want the pain to go away.		
9	<input type="checkbox"/>	I can't seem to keep it out of my mind.		
10	<input type="checkbox"/>	I keep thinking about how much it hurts.		
11	<input type="checkbox"/>	I keep thinking about how badly I want the pain to stop.		
12	<input type="checkbox"/>	There's nothing I can do to reduce the intensity of the pain.		
13	<input type="checkbox"/>	I wonder whether something serious may happen.		
<hr/>				
. . . Total				
<hr/>				

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Appendix H

Patient Information Sheets

Introduction to Service Evaluation questionnaires session

Why do questionnaires?

- In the BPU we use questionnaires that ask about your experience of Chronic Low Back Pain in order to take a snapshot of how things are for you right now. We're interested in how pain impacts your life in various ways such as your emotional and physical wellbeing. We're also interested in how you understand your pain.
- Completing these helps us get to know you better and work with you in a more effective way.
- We'll ask you to complete these questionnaires again later in the Pain Management Programme so we can see how things have changed for you.
- Also, by looking at results across groups we can say to other people considering doing a Pain Management Programme, ways in which they are likely to change: that is we're able to accurately answer the sorts of questions you had when you were deciding whether to attend a PMP.

Suggestions for completing the questionnaires

- Sometimes people can feel a bit daunted when faced with a booklet of questionnaires.
- The questionnaires consist of statements and you have to indicate how much you agree or disagree with each. Each questionnaire has instructions at the top and it is important that you read these carefully.
- There are no right or wrong answers. It's not a test, so go with your gut feeling and try not to spend too long thinking about each item.
- Try to complete all items, but if you are really unsure leave it out.
- We're interested in how things are for you, so it's best if you don't discuss the questions or your answers with other people on the Pain Management Programme or people at home.
- If you struggle to read small print, or would like help for any other reason, we're happy to go through the questionnaires with you individually.
- Please make sure you put your name and the date on the front sheet.

Any questions?

Appendix I

Attrition Analyses

	Mean (SD) / N (where non parametric tests used)		Independent sample t-test (t, df 114)/Pearson chi-square test (X^2) ^a / Mann-Whitney test (U) _b
Demographic/ Variable	Non-completers at time 2	Participants included in change analyses	
Gender ^a (N 116)			
1 Male	N 12	N 39	.105 (df 1) NS ^a
2 Female	N 17	N 48	
Age (N 116)	51.76 (13.05)	51.51 (11.12)	.101 NS
Pain Duration _b (N 108)	N 28	N 80	.940 NS _b
Employment Status ^a (N 115)	N 28	N 87	.651 (df 1) NS ^a
1 Employed and working	N 5	N 22	
2 Not working	N 23	N 65	
Pain Severity (N 116)	4.69 (.66)	4.71 (.86)	-.131 NS
Mindfulness (N116)	3.62 (1.08)	3.74 (0.97)	-.585 NS
Disability (N116)	17.31 (3.39)	16.92 (4.36)	.444 NS
Depression (N116)	9.66 (4.30)	9.40 (4.16)	.290 NS
Anxiety (N116)	11.72 (4.14)	11.15 (4.45)	.613 NS
Catastrophising (N116)	31.79 (9.47)	29.88 (11.15)	.829 NS
Kinesiophobia (N116)	42.39 (7.79)	40.82 (7.72)	.945 NS
Chronic pain acceptance (N116)	48.81 (14.96)	50.76 (16.55)	-.563 NS

^a Pearson chi-square test for categorical data, _bMann-Whitney test due violation of parametric assumptions, DF degrees of freedom, NS not significant (p > .05).

Appendix J

Journal of Health Psychology Manuscript Submission Guidelines (for literature review)

Notes for Contributors

1. The Journal of Health Psychology is an international peer reviewed journal and has a fully web-based system for the submission and review of manuscripts. All submissions should be made online at the Journal of Health Psychology [SAGETRACK website](#)

Note: Online submission and review of manuscripts is now mandatory for all types of papers.

New User Account

Please log onto the website. If you are a new user, you will first need to create an account. Follow the instructions and please ensure to enter a current and correct email address. Creating your account is a three-step process that takes a matter of minutes to set up. When you have finished, your User ID and password is sent via email immediately. Please edit your user ID and password to something more memorable by selecting 'edit account' at the top of the screen. If you have already created an account but have forgotten your details type your email address in the 'Password Help' to receive an emailed reminder. Full instructions for uploading the manuscript are provided on the website.

New Submission

Submissions should be made by logging in and selecting the Author Center and the 'Click here to Submit a New Manuscript' option. Follow the instructions on each page, clicking the 'Next' button on each screen to save your work and advance to the next screen. If at any stage you have any questions or require the user guide, please use the 'Get Help Now' button at the top right of every screen. Further help is available through ScholarOne's® Manuscript Central™ customer support at +1 434 817 2040 x 167.

To upload your files, click on the 'Browse' button and locate the file on your computer. Select the designation of each file (i.e. main document, submission form, figure) in the drop down next to the browse button. When you have selected all files you wish to upload, click the 'Upload Files' button.

Review your submission (in both PDF and HTML formats) and then click the Submit button.

You may suspend a submission at any point before clicking the Submit button and save it to submit later. After submission, you will receive a confirmation e-mail. You can also log back into your author centre at any time to check the status of your manuscript.

Please ensure that you submit editable/source files only (Microsoft Word or RTF) and that your document does not include page numbers; the Journal of Health Psychology SAGETRACK system will generate them for you, and then automatically convert your manuscript to PDF for peer review. Furthermore, it is imperative that authors remove from their submissions any information that will identify them or their affiliations to reviewers. All correspondence, including notification of the Editor's decision and requests for revisions, will be by email.

Journal of Health Psychology operates a strictly blinded peer review process in which the reviewer's name is withheld from the author and, the author's name from the reviewer. The reviewer may at their own discretion opt to reveal their name to the author in their review but our standard policy practice is for both identities to remain concealed. All manuscripts are reviewed initially by the Editor and only those papers that meet the scientific and editorial standards of the journal, and fit within the aims and scope of the journal, will be sent for outside review.

If you would like to discuss your paper prior to submission, or seek advice on the submission process please contact the Managing Editor, David Marks, at the following email address: D.Marks@city.ac.uk

Submitting a Revised Submission

Authors submitting revised manuscripts should follow the instructions above to submit through the SAGETRACK system. To create a revision, go to the 'Manuscripts with Decisions' option in your Author Dashboard and select 'create a revision' in the 'Action' column. Authors of all revised submissions should, when prompted, provide information explaining the changes in your manuscript. As this will be provided to reviewers, it is important that authors do not identify themselves in these responses.

2. The Editorial Board of the Journal of Health Psychology considers for publication: (a) reports of empirical studies likely to further our understanding of health psychology; (b) critical reviews of the literature; (c) theoretical contributions and commentaries; (d) book reviews; and (e) signed editorials (about 1000 words) on significant issues.

3. The circulation of the Journal is worldwide and articles are invited from authors throughout the world.

4. Articles should be as short as is consistent with clear presentation of subject matter. There is no absolute limit on length but 6000 words, including footnotes and reference list, is a useful maximum. Tables and figures count as 500 words each which should be attached as separate pages at the end. INSERT HERE signs should be noted within the text. The title should indicate exactly, but as briefly as possible, the subject of the article. An abstract of 100 words should precede the main text, accompanied by up to five key words and a bio-bibliographical note of 25 to 50 words. The Journal also publishes brief reports of up to 3000 words. Brief Reports should include an abstract of 100 words, and may include a table or figure in lieu of 500 words of the 3000-word maximum. All papers are reviewed 'blind' by expert peers.

5. Authors should provide a standard and a 'blind' electronic version of their article - one version containing names, affiliations, full mailing address plus telephone, fax, email address; and one containing the title only. In all cases, the Editor will screen manuscripts for their overall fit with the scope of the journal in terms of relevance, rigour, and interest to the readership. Those that fit will be further reviewed by two or more independent, expert and internationally representative reviewers.

6. The Journal requires authors to have obtained ethical approval from the appropriate local, regional or national review boards or committees. Of particular importance are the treatment of participants with dignity and respect, and the obtaining of fully informed consent. The methods section of the paper must contain reference to the forum used to obtain ethical approval.

7. Authors must follow the Guidelines to Reduce Bias in Language of the Publication Manual of the American Psychological Association (5th ed.). These guidelines relate to level of specificity, labels, participation, gender, sexual orientation, racial and ethnic identity, disabilities and age. Authors should also be sensitive to issues of social class, religion and culture.

8. Typescripts must be typed in double spacing throughout. Titles and section headings should be clear and brief with a maximum of three orders of heading. Lengthy quotations (exceeding 40 words) should be displayed, indented, in the text. American or UK spelling may be used, to the author's preference. Indicate italic type by underlining, and use single quotation marks. Dates should be in the form 9 May 1994. Take out points in USA and other such abbreviations.

9. Tables and figures should have short, descriptive titles. All footnotes to tables and their source(s) should be typed below the tables. Column headings should clearly define the data presented. Camera-ready artwork for all figures must be supplied. Artwork intended for same-size use should be a maximum size of 192:125 mm (page depth: page width). The title page should contain the word count of the manuscript (including all references).

10. References cited in the text should be listed alphabetically and presented in full using the style of the Publication Manual of the American Psychological Association (5th ed.).

11. The corresponding author will receive page proofs for checking. He or she will be given controlled access to a PDF of the article and a complimentary copy (per author) of the whole issue after publication.

13. Reviews: books and suggestions should be sent to Michael Murray (Book Reviews Associate Editor), School of Psychology, Keele University, Staffordshire ST5 5BG, UK, m.murray@psy.keele.ac.uk

Appendix K

Chronology of Research Process

Task	Dates
Research project literature review	May '07 – March '09
Research protocol	May '07 – November '07
Ethics (LREC) submission	February '08
REC meeting	11 th March '08
Data collection	March '08 – March '09
Cross-sectional data analysis	January '09 – February '09
Longitudinal data analysis	March '09
Final write up	January '09 – April '09