Cultural Influences on Low Back Pain - Extending the Biopsychosocial Model

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by

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Abstract.

The present investigation examined the influence of cultural factors on Low Back Pain (LBP). Multiple regression techniques were used to determine the relative importance of clinical, social and psychological factors to LBP disability and cultural influences on these factors were then explored.

The findings indicated that compared to clinical and social factors, LBP disability was most strongly associated with psychological factors (adjusted R^2 change = 0.38, $p<0.00$), the most important of which was psychological distress. Clinical (adjusted R^2 change = 0.11, $p<0.00$) or social (adjusted R^2 change = 0.02, $p=0.09$) factors were only moderately or weakly associated with LBP disability. A series of hierarchical regression models examined the mediating role of cognitive Coping Strategies (Catastrophising & Praying and Hoping (Rosenstiel and Keefe (1983)) and Pain Control Beliefs (Control of Pain & Responsibility for management of Pain (Main and Waddell (1991)) on the relationship between LBP disability and distress. In support of the Cognitive Behavioural Mediational Model of chronic pain (Rudy and Turk, 1987), evidence was found to suggest that the relationship between LBP disability and distress was largely dependent upon Coping Strategies and Pain Control Beliefs. The findings also suggested that Pain Control Beliefs were largely dependent upon Coping strategies, although these relationships varied between specific Pain Control Beliefs and Coping Strategies.

The study found evidence to suggest that certain self report questionnaires which are commonly used to assess cognitive factors associated with LBP may not have robust cross cultural reliabilities as measured by Cronbach's Alpha (Cronbach 1951) (Praying and Hoping (P&H) subscale of the Coping Strategies Questionnaire (CSQ) Rosensteil and Keefe 1983; Pain Responsibility (PR) subscale of the Pain Locus of Control (PLC) Main and Waddell 1991). The findings indicated that when used in their present form, these self reported

questionnaires may provide inconsistent results with South Asian, African-born or Muslim LBP patients.

The study provided evidence for the role of Cultural factors (self defined Ethnicity, Country of Birth and reported Religious Affiliation) on the experience of LBP. Although the relationship between cultural factors and LBP was generally weak (R^2 change < 0.15), it appeared that South Asian, African-born and Muslim patients experienced LBP significantly worse than other LBP patients. The cultural group differences were strongest for the "passive" coping strategy "Praying and Hoping" (Rosensteil and Keefe 1983) (R^2 change = 0.15, $p < 0.001$). The most apparent cultural differences were for Muslim patients who compared with all other Religious groups consistently reported the worst experience of LBP. Muslim LBP patients were clinically more disabled than either Christian (mean Roland and Morris Disability Questionnaire (RMDQ) difference (Roland and Morris, 1983) = 4.13) or other (mean RMDQ difference = 4.29) LBP patients. The statistical control of clinical variables in the regression models led to the conclusion that these groups of patients had a more "chronic" experience of LBP. Religious affiliation may help to identify LBP patients who present to secondary care with more chronic symptoms of LBP. Standardisation of self report questionnaire in these cultural groups may improve the precision of these findings.

The present investigation was primarily descriptive in that reasons for cultural differences were not empirically examined. However the study findings suggest potentially fruitful areas for further investigation particularly that work on the meaning of "Praying" as a coping strategy and on its relationship with LBP disability for non-Christian groups would appear warranted.

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Glossary

Variables

RMDQ	Roland and Morris Disability Questionnaire
MZSRDS	Modified Zung Self Rating Depression Scale
MSPQ	Modified Somatic Perception Questionnaire
CSQ	Coping Strategies Questionnaire
CAT	Catastrophising subscale of the CSQ
P&H	Praying and Hoping subscale of the CSQ
PLC	Pain Locus of Control
PC	Pain Control subscale of the PLC
PR	Pain Responsibility subscale of the PLC
SC	Social Class
QTF	Quebec Task Force Classification
DURATION	Duration of LBP
PROP IN UK	Proportion of Life spent in the UK

Statistics

Mean	Sample mean
Median	Sample median
Range	Range of scores (lowest to highest)
Min	Minimum score
Max	Maximum score
sd	sample standard deviation
n	number of cases
%	Percentage
z-score	Standardised score
R	Multiple R.
R^2	Multiple R squared
Adj R^2	Adjusted R^2
Change Statistics	Incremental change in for each step of a hierarchical regression model
R^2 Change	Incremental change in R^2
SE	Standard Error
F	Analysis of Variance F statistic
df	Degrees of Freedom
Sig. F	probability of F due to chance
B	Unstandardised regression coefficient
Beta	Standardised regression coefficient
t	Student's t test statistic
Sig.	Significance of t due to chance
95% CI for B	95% Confidence Intervals for regression coefficient (B)
Lower	Lower bound 95% Confidence Interval
Upper	Upper bound 95% Confidence Interval
Zero-order	Pearson's correlation coefficient
Partial	Partial correlation coefficient

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Chapter 1. Introduction.

Low Back Pain (LBP) is a common benign health problem (Frank 1998). Lifetime prevalence rates for LBP are around 60% to 70% (Nachemson et al., 2000; Dionne 1999), and approximately 25% of people report an episode of LBP lasting 24 hours or more during the last month (Nachemson et al., 2000). Direct health care costs in the UK were estimated to exceed £1630 million, and indirect costs over £10000 million during 1998 (Maniadakis and Gray, 2000). Increases in the reports of LBP during the last half of the 20th century, and escalating socio-economic costs associated with LBP, have led some researchers to argue that LBP is an health problem of epidemic proportions in the UK (Frank 1998) and other industrialised countries (Waddell 1998). LBP also appears to be a worldwide health problem, although the literature on epidemiological surveys of LBP in low and middle-income countries is sparse and often methodologically flawed (Volinn 1997).

LBP patients often report a reduction in their activities of daily living (Roland and Morris 1983), which has been called LBP disability (Waddell 1998). However standard models of disability (e.g. WHO 1980) provide an inadequate account of disability associated with LBP (Fordyce et al, 1995). The relationship between pain and disability in LBP appears to be weak (Linton and Gotestam, 1986). Waddell (1998) argued that although these two concepts were important aspects of LBP, they are best regarded as largely independent, but linked, factors.

There is an abundant and diverse literature on LBP and chronic pain (e.g. Nachemson 2000). Waddell (1992) produced a synthesis of the available literature and proposed a Biopsychosocial Model of LBP that emphasised the inter-relationships between biological, social and psychological aspects of the condition.

Due partly to the lack of a strong observable relationship between pain and disability associated with LBP, and partly due to professional backgrounds, the available literature on LBP can be broadly divided into two groups: research on

pain and research on disability. Pain is largely addressed by biomedical research and disability is largely addressed by research on psychological mechanisms, although this is not always the case (e.g. Crombez and others 1996; 1998).

The literature on chronic pain and LBP often refers to the influence of cultural factors (e.g. Waddell, 1993; 1998). However in reviews of the literature Waddell and Waddell, (2000) and Dionne (1999) found that the evidence for the influences of these factors on LBP was sparse and the research that was available often had serious methodological flaws. Waddell and Waddell (2000) concluded that the available literature on cultural influences on LBP was of little scientific value.

The literature on LBP will be reviewed under a Biopsychosocial framework (Waddell, 1992). Theoretical positions regarding influences of biomedical, psychological and social and cultural factors will be outlined and the evidence for and against these models described and evaluated. A study will be proposed to address apparent gaps in the currently available literature and scientific knowledge.

Chapter 2.

Epidemiology of LBP and disability.

Definition of LBP.

Spitzer et al., (1987) argued that a precise definition of LBP was difficult. Most definitions of LBP are topographical. Nachemson et al., (2000) defined LBP as pain occurring between the costal margins and the gluteal folds. The International Association for the Study of Pain (IASP) defined of LBP as "pain which was perceived as arising from within a region bounded laterally by the lateral borders of the erector spinae, superiorly by an imaginary transverse line through the T12 spinous process, and inferiorly by a line through the S1 spinous process" (Bogduk and Twomey, 1997). Bogduk and Twomey (1997) argued that this definition of LBP did not presuppose either the cause of the pain or the source of the pain, but referred primarily to the location of where the patient perceived that the pain was coming from. Frank (1998) referred to LBP as "a symptom complex" where pain was "localised to the lumbar spine or referred into the leg or foot, and where other specific conditions causing such pain have been excluded". These definitions tend to agree that LBP is the *perception* of pain located in the lumbar region of the spine. This definition was adopted for the present investigation.

Epidemiology.

Epidemiology is the study of the distribution and determinants of health states in populations (von Korff, 1999). Epidemiology is based the assumption that human disease processes do not occur at random and that their causal and preventative factors can be identified through systematic investigation of different populations, or subgroups of individuals within a population, in different places or at different times (Hennekens et al., 1987). Hennekens et al, (1987) argued that epidemiology examines three components of disease: the measurement of disease frequency, the distribution of disease and its determinants.

Epidemiology and LBP.

Shekelle (1997) noted that the epidemiology of LBP is complicated by difficulties in identifying the aspect of LBP to be measured. The definitions of LBP discussed above tend to refer to the self report of pain emanating from the lumbar region of the spine. However when attempting to determine the frequency of LBP in any given population, other aspects of the condition, such as severity, are often included. Recognising that not all LBP can be "bothersome" (Shekelle, 1997) severity of LBP has referred to pain qualities such as intensity or duration, or to disability associated with LBP. Nachemson et al., (2000) pointed out that most large scale epidemiological surveys usually determine LBP lasting for longer than 24 hours so as to exclude minor or passing symptoms. Some epidemiological surveys have also referred to the frequency of disabling LBP (Waddell, 1998).

Nachemson et al., (2000) pointed out that most of the epidemiological literature on LBP discuss prevalence rates, which is the percentage of a known population who report LBP during a specified time period. However recall of previous episodes of LBP has been shown to be inaccurate (Linton and Gotestam, 1983). Point prevalence is the proportion of individuals who report LBP on the day of the assessment. One-month or one-year prevalence is the proportion of individuals in a known population who report having had LBP at some time during the last month or year. Lifetime prevalence rates refer to the patients who can recall having LBP at some point during their life (Shekelle 1987; Nachemson 2000; von Korff 1999; Dionne 1999).

Epidemiology of LBP.

Nachemson et al.,(2000) reviewed the literature on the epidemiology of LBP and concluded that the best available evidence came from large, representative population based surveys which indicated a point prevalence for LBP of 15% to 30%. Dionne (1999) also reviewed the literature and reported a point prevalence of between 4.4% to 33% of adults who are experiencing LBP at any one time. Nachemson et al., (2000) and Dionne (1999) reported that the lifetime prevalence rates for LBP were approximately 60% to 70%. The diversity amongst prevalence rates largely reflects the variety of definitions of LBP or question

wordings, rather than any real differences in the people studied (Nachemson et al., 2000; von Korff 1999). The higher prevalence rates correspond to more general definitions (Dionne 1999).

Walsh et al., (1992) studied the prevalence rates and geographical variation of LBP and disability in seven urban and one rural areas of the UK. Their findings (lifetime prevalence rate of 58.3% and a one year prevalence of 36%) were broadly in line with other major international surveys reviewed by Nachemson et al., (2000). They also found evidence that social class was significantly associated with reporting LBP for men but not for women, and that this was largely due to occupational factors (Walsh et al,. 1992). Croft and Rigby (1994) also examined the influence of socio-economic factors on LBP in a British sample of n=9000 people living in the community. Their findings supported Walsh et al.,'s (1992) conclusions that social class was associated with reported back pain, and that this was primarily due to occupational factors. Walsh et al., (1992) also found some geographical variations in rates of GP consultations and concluded that this was largely due to regional variations in patient behaviour, once symptoms had developed. Similar regional variations in LBP disability were also reported by Volinn et al., (1988) in the USA.

Boucher (2000) reported findings from the UK Office of National Statistics (ONS) Omnibus which indicated a 40% 1-year prevalence rate of LBP of lasting 24 hours or more. 30% of patients who had experienced an episode of LBP also reported restricted activity (36% women and 29% men) (Boucher 2000).

Palmer et al., (2000) examined whether prevalence rates of LBP in the UK had changed over a 10 year period. They found evidence that the 1-year prevalence rate had increased from 36% in 1987-8 (Walsh et al,. 1992) to 49% in 1997-98. They suggested that the increase in LBP prevalence rates was largely accounted for by an increase in the prevalence of "less disabling" back pain (Palmer et al,. 2000). Palmer et al., (2000) suggested that their findings may be due to cultural changes in attitudes and behaviours where in the more recent sample (1997-98), study participants had a greater awareness of more minor back symptoms and increased willingness to report them.

Reviews of the literature suggest that LBP is a common health problem that occurs in many adults at some point during their lives (Shekelle et al., 1995). However Volinn (1997) pointed out that most of the epidemiological literature on LBP has been restricted to high-income countries and that for the most part the epidemiology of LBP for low or middle income countries has been overlooked. Volinn (1997) reviewed the literature on the epidemiology of LBP in low and middle income countries and concluded that although there were many methodological flaws in the available literature which made firm conclusions difficult, there appeared to be differences in the LBP prevalence rates between rural and urban populations. Volinn (1997) concluded that hard physical labour was not a risk factor for LBP per se, but was more strongly associated with the urbanisation of work forces with prevalence rates being particularly high for workers in enclosed workshops.

Epidemiology of LBP Disability.

Waddell (1998) argued that the most important characteristic of LBP was its impact on the individual's life. Restriction in activities of daily living associated with LBP is often referred to as LBP Disability (e.g. Nachemson et al., 2000). The World Health Organisation (WHO) defined disability as "any restriction or lack (resulting from an impairment) of ability to perform an activity in the manner or within the range considered normal for a human being" (WHO, 1980). However a number of researchers have pointed out the inadequacies of this model in explaining disability associated with LBP (e.g. Fordyce 1995; Nachemson et al, 2000). Nachemson et al., (2000) argued that LBP disability is not only a question of physical impairment but is associated with behaviour and performance, which are largely determined by effort, and that these are factors are primarily psychological. Waddell (1992) proposed a Biopsychosocial model of LBP that addressed some of these issues.

A number of epidemiological studies in the UK have indicated that LBP is often associated with LBP disability (e.g. Walsh et al,. 1992; Palmer 2000; Croft et al., 1996; Croft et al., 1994). Mason (1994) reported from a population based UK sample that approximately 3% of adults reported that as a result of their LBP they had lain down all day for at least 1 day during the previous 4 weeks. The

UK Clinical Standards Advisory Group (CSAG, 1994) estimated the work loss due to back pain during 1993 was approximately 52 million days, while 106 million days worth of state benefits were paid in respect of LBP.

Economic Costs of LBP in the UK.

The costs of LBP are substantial (CSAG 1994). Maniadakis and Gray (2000) estimated that the direct health care costs of LBP in the UK during 1998 were £1638 million, approximately 63% of which were met by the National Health Service (NHS). The indirect costs of informal care and the associated lost production were estimated to be £10668 million. They concluded that these costs were likely to increase due to changing attitudes and expectations, and changes in methods of medical management and social provision.

Conclusion of Epidemiology of LBP and Disability.

The overview of literature on epidemiological research on LBP and disability presented in the current chapter suggests that LBP is a common health problem in Western European or North American populations and is also associated with significant costs to the individual in terms of disability and wider societal costs. Although the evidence is less compelling, it is also suggested that LBP and disability may be associated to some extent with economic development and urbanisation.

Disability is an important aspect of LBP. There are apparent inadequacies in the WHO (1980) model of Disability when applied to LBP. Re-conceptualisations of the LBP disability model indicate the importance of physical and psychological influences on LBP disability.

Chapter 3.

Literature Review.

3.1 Clinical or Biomedical influences on Low Back Pain (LBP).

Twomey et al., (1992) pointed out that it has been difficult to identify a common cause for LBP. A number of competing models have been proposed, the most influential of which was the bio-medical approach (Allan and Waddell, 1989).

Biomedical approaches to LBP are primarily concerned with the pathogenesis of LBP whereas psychological models were largely concerned with examining responses to the condition.

The current chapter examined the contribution of biomedical and physical models to LBP and the influence that these factors have on the experience of LBP. An overview of the available literature evaluated the degenerative model with particular emphasis on the pathogenic role of the disc and the contribution of central neural plasticity to chronic pain states. Each theory is outlined and evaluated against the available empirical evidence.

The Medical Model and LBP.

The medical model is based on a dualistic Cartesian model of health and disease where the mind and the body are independent and physical disease processes are separate from psychological processes (Ogden, 1996; p2). In this paradigm patterns of symptoms are recognised to infer underlying pathology (diagnosis) to which physical therapy is applied (treatment) to affect a cure (Waddell 1998; Frank 1998). Pain is regarded as an important indicator or symptom of an underlying pathological process. Biomedical approaches to LBP have generally assumed that pain is a symptom associated with underlying spinal pathology.

A number of pathological processes have been reported in the literature to be associated with LBP. These have been classified into categories according to the presumed pathogenetic process involved.

Flor and Turk (1984) described four classes of processes:

1. inflammatory such as ankylosing spondylitis or nerve root inflammation
2. degenerative such as disc hernia or spondylosis
3. structural such as postural abnormalities or congenital spinal deformities
4. traumatic (e.g. injury to the spine)
5. muscular (e.g. myalgia).

Frank (1993) suggested that LBP was associated with other specific causes such as infection, neoplasm, bone disease and other uncommon causes such as sickle cell disease or vascular claudication. However serious spinal pathology is rare and accounts for only approximately 1% of all LBP (Waddell, 1998). Frank and others (1993; 2000) reported that 1% of consecutive referrals to a rheumatologist with an interest in LBP in a secondary care setting were diagnosed with neoplasm. In a tertiary care setting Waddell (1982) found 11% of patients referred to an orthopaedic back clinic had pain associated with tumours.

If rare specific causes of LBP such as tumour are excluded, LBP has been described as degenerative (Flor and Turk, 1984), mechanical (Waddell, 1998) non-specific (Frank 1993; 1998, Fordyce et al., 1995), or simple (CSAG 1994). These terms describe similar clinical presentations (episodic or cyclical pain in the lumbar region of the spine, often referred to the buttocks or thighs, morning stiffness or pain, relief by a change of position and aggravation by standing or sitting), although they differ in the proposed pathogenic process involved. Frank (1998) distinguished between these processes as LBP arising from either normal stresses on degenerative discs/facet joints (degenerative) or excessive mechanical stress on normal structures (bio-mechanical).

Influence of Degeneration on LBP.

Waddell (1998) argued that a first step to determine whether a specific degenerative process was a causative agent in the pathogenesis of LBP was demonstrate that the particular finding was a more common finding in patients who reported LBP than in those who did not. In a review of the literature on degenerative processes and LBP, Flor and Turk (1984) found that research that

had examined this relationship had often produced contradictory findings. Van Tulder et al., (1997) examined 31 studies (18 of which were assessed as "good" quality) which examined the relationship between radiological findings of gross degeneration and a history of LBP (degeneration was defined as including disc space narrowing, the presence of osteophytes and sclerosis). They concluded that there was weak but significant association between gross spinal degeneration and LBP (Van Tulder et a. 2000). However they pointed out that due to methodological problems of the reviewed research (only n=18 studies were assessed as "good" quality), there was no clear evidence to either support or reject a casual relationship between radiological findings of gross degeneration and non-specific LBP.

Some researchers have found it helpful to differentiate between the specific degenerative processes involved in gross degeneration (usually detected by x-ray) (Flor and Turk 1984). Early research suggested that spondylolisthesis, a measurable forward shift of one vertebra on another due to joint derangement, was a causal factor in LBP (e.g. Horal 1969, Torgerson and Dotter, 1976) although other researchers have been unable to confirm these findings (e.g. Rowe 1965, Splithoff 1952). More recently Waddell (1998) pointed out that although vertebral slippage may be severe to cause pain by affecting nerve root function, slippage of this magnitude is rare. Frank (1998) argued that although not uncommon, spondylolisthesis is usually unrelated to LBP. Other degenerative processes such as sacralization or lumbarization (i.e. abnormal fusion of vertebrae via ossification, especially of the fifth lumbar vertebrae with the sacrum) have been implicated in the pathogenesis of LBP (Stinchfield and Sinton, 1955: cited in Flor and Turk 1984) although subsequent research (e.g. Magora and Schwartz, 1980; cited in Flor and Turk 1984) was unable to confirm these findings. The role of the facet joints in the development of LBP has also been examined (Waddell, 1998) although little scientific support for "facet joint syndrome" has been found (Jackson et al., 1988 and Lilius et al., 1989: cited in Waddell 1998). In a systematic review of the literature van Tulder (1997) concluded that radiologically abnormal facet joints were not related to back pain.

The available evidence suggests that there is little association between either gross or specific degenerative changes of the spine or spinal structures and LBP.

The influence of the disc on LBP.

Flor and Turk, (1984) described disc abnormalities as the most widely studied pathogenic causal process implicated in the aetiology of LBP. In a historical review of LBP Allan and Waddell (1989) traced the role of the disc in LBP to the early 20th Century when disc prolapse and its possible clinical significance were first described by Goldthwaite (1911) and Middleton and Teacher (1911) (cited in Allan and Waddell, 1989). Although research on the disc has continued (e.g. Videman et al., 1998), evidence for its role is controversial. After reviewing the available literature Frank (1993; p903) concluded that "lumbar disc disease is the most common major disease seen in back pain clinics" whilst Waddell (1998) concluded that disc degeneration is primarily a normal age-related process and unrelated to LBP.

A number of dysfunctional disc processes have been implicated in the pathogenesis of LBP (i.e. prolapse or herniation, bulge, or annular fissures or tears). Allan and Waddell (1989) argued that scientific advances in imaging techniques and the discs' relative accessibility to experiment and investigation have contributed to researcher's continuing attention to the disc as a causative agent in the development of LBP. Waddell (1998) argued that these factors have resulted in researcher's focus on disc abnormalities to the exclusion of other, more complex processes (i.e. bio-mechanical processes) and their role in the development of LBP.

Disc morphology.

The lumbar region of the spine consists of five lumbar vertebrae linked together by an intervertebral disc that provides the main articulation between the vertebral bodies. The disc is comprised of two basic structures; an outer ring or annulus (made up of collagen lamellae) which surrounds an inner nucleus pulpous (Tortora and Anagnostakos, 1984). The normal nucleus comprises about 90% water (which reduces with increasing age). When subject to pressure (axial

tension), as a result of normal mechanical forces, hydraulic forces cause the annulus to 'bulge'(Tortora and Anagnostakos, 1984).

Gross Disc Degeneration.

Disc degeneration is a global description of a complex process that results in morphologic, biochemical and mechanical changes within the disc (Beattie and Meyers, 1998). Progressive degeneration can lead to structural disintegration with fibrillation of the nucleus, ruptures of the annulus, narrowing of the disc space, oseophyte formation and narrowing of the spinal canal (Flor and Turk, 1984). Independently of progressive degenerative processes, prolapse may occur and impingement of the adjacent nerve roots can result in sciatica. However in a review of the literature Waddell (1998) and Allan and Waddell (1987) concluded that disc bulging is an essentially normal process.

The independent disc degenerative process of herniation or prolapse has also been implicated in the pathogenesis of LBP although it is generally agreed that with a point prevalence of approximately 3.5%, disc prolapse is an uncommon cause of LBP (Waddell, 1998). In a review of the evidence, van Tulder et al., (1997) reported that gross disc degenerative changes detectable by radiograph were at best only weakly associated with LBP (odds ratios ranging from 1.2 to 3.3). However they concluded that even this weak association may be a methodological artefact. Moneta et al., (1994) found in a re-analysis of 833 discs from 306 candidates referred for back surgery that signs of gross disc degeneration were not associated with LBP.

The Theory of Discogenic pain.

Discogenic pain refers to pain arising from the disc and does not refer to other spinal pain such as nerve root pain which may be related to disc prolapse (Schwarzer et al., 1995). Schwarzer et al., (1995) argued that "in principle, any structure in the lumbar spine that receives an innervation is a possible source of pain". In a review of the scientific literature, Bogduk et al., (1988) concluded that there was sufficient evidence to confirm the presence of free nerve endings and nociceptors in the outer annulus of the disc thereby suggesting that the disc could be a source of pain. Franson et al., (1992) provided evidence that the gel-

like nuclear material has inflammatory properties leading Snook et al., (1998) to propose that fissures or ruptures in the annulus (internal disc disruption) might expose annular nerve endings to the pain provoking material (human disc phospholipase A_2).

Research on Discogenic Pain.

Horton et al., (1992) studied the discs of 25 non-radicular LBP patients, who had failed conservative management and were being considered for surgery. They found evidence to support the hypothesis that certain patterns of disc abnormality would also be significant symptomatic findings (Horton et al., 1992).

Ito et al., (1998) examined the MRI and lumbar provocation discography results of 101 lumbar discs from 39 patients with chronic LBP who had not responded to 6 months of conservative treatments. Out of a range of differential disc morphologies (nuclear intensity, disc narrowing, type of annular tear, a high intensity zone at the posterior annulus, disruption of the posterior outermost annulus, adjacent vertebral body bone marrow intensity changes) they found that the common finding of radial annular tears had a low correlation with concordant pain reproduction. Less frequent signs such as massive disc degeneration and severe disc narrowing or bone marrow intensity changes were strongly associated with LBP, however these occur too infrequently to be regarded as common causes of LBP (Bogduk 1998). Ito et al., (1998) and Aprill and Bogduk (1992) reported 25-30% incidence rate of The High Intensity Zone (HIZ). HIZ coupled with positive discography provided a diagnostic confidence of approximately 80% (Bogduk, 1998). Bogduk (1998) concluded that a diagnosis of LBP could be made on MRI in at least one in four or one in three patients with chronic LBP. This finding has also been supported by Schwartzer et al., (1995) who found positive discography in approximately 40% of patients with LBP.

Clinical Implications of Discogenic Pain.

Bogduk (1998) pointed out that findings and conclusions that radial annular tears are associated with LBP can be considered to be of diagnostic value only as there is no data available to vindicate any therapeutic option for symptomatic internal disc disruption. Recently however, the literature has begun to address this issue

and therapeutic interventions based on this model of LBP have been investigated with positive results (Snook et al,. 1998).

However Schwarzer et al., (1995) was unable to determine a relationship between discogenic pain and clinical symptoms. In a study of 92 patients with LBP judged serious enough to warrant invasive investigations, Schwarzer et al., (1995) was unable to demonstrate an association between a range of clinical signs and discogenic pain. They found no statistically significant association between either historical or physical examination findings or whether patients demonstrated a positive discogram or not.

Limitations of Research on Discogenic Pain

Research conducted on groups of highly selected patients can cause problems for generalisation of findings (Crombie and Davis, 1998). Discogram is an invasive and pain provoking procedure which may lead to patient selection criteria which selects only those with symptoms severe enough to warrant this type of investigation. The Schwarzer et al., (1995) study included patients referred by neurosurgeons, orthopaedic surgeons or physiatrists, who had failed diagnosis by non-invasive techniques and based on the subjective opinion of the referring physician had severe enough pain to warrant invasive investigations. Ito et al., (1998) included patients who had failed to respond to 6 months of conservative treatments. Patients may also be selected from candidates for back surgery (Moneta et al., 1994; Horton et al., 1992). A comparison of the results obtained from research on these different patient groups is problematic. Patients included in these studies often present with severe symptoms and study samples are highly selected. Potential therefore exists to overestimate the prevalence of discogenic pain. Most investigations to date have been cross-sectional and many of the analyses correlational. Cohen and Cohen, (1983) and Tabachnick and Fidell (1996) pointed out the difficulties of inferring causality from such investigations.

Block et al., (1996) examined the relationship between discogenic pain and personality factors in a sample of n=72 chronic LBP patients. Their findings suggested that positive discography was related to elevated scores on the Hysteria and Hypochondriasis scales of the Minnesota Multiphasic Personality

Inventory (MMPI) (Hathaway and McKinley 1983). Block et al., (1996) concluded that patients with elevated MMPI scores may tend to over report pain during discographic injection.

Conclusion of the influence of the Disc on LBP.

The available literature suggests that there appears to be a lack of conclusive evidence to indicate a causal relationship between degenerative changes in spinal structures and LBP.

3.2 Theory of Central Neural Plasticity.

The theory of Central Neural Plasticity (CNP) proposes that semi-permanent biochemical changes in the central nervous system, which develop post peripheral nociceptive input, can contribute to and/or maintain pathological pain states after the original peripheral input has ceased (Coderre et al., 1993). Once induced, 'plasticity' may sustain or magnify the experience of pain. Although theories of central changes are not new, recent research that suggested that peripheral injury or noxious stimulation can produce plastic alterations in CNS function has provided some of the empirical basis for the development and empirical testing of the theory (Coderre et al., 1993). Kumazawa (1998) argued that as a fundamentally primitive system characterised by polymodal pain receptors, the pain system provides both the ideal environment and the widest range of freedom for development of plasticity.

Research on Central Neural Plasticity.

The development of a plastic hyperexcitable state in the spinal nociceptive system was initially demonstrated by Woolfe (1983) who found that acute injury could produce long lasting spinal changes. Gracely et al., (1992) demonstrated in a patient with post surgery induced peripheral neuropathy that both ongoing pain in the affected limb and secondary allodynia and hyperalgesia in spatially remote body areas could be abolished by differentially blocking A fibres. Kumazawa (1998) reviewed these findings and concluded that central hyperexcitability was dynamically maintained and modulated by a source of ongoing nociceptor stimulus. Woolfe (1989) demonstrated that "wind-up", in which repetition of noxious stimulus evokes a progressively escalating response

in the spinal cord, can further magnify pain sensations. Dickenson (1990) found that N-methyl-D-aspartic acid (NMDA) receptor channels located in the dorsal horn were critical for wind-up, thereby implicating an important role for neuropeptides in the plastic hyperexcitable states in the spinal cord (Kumazawa, 1998). Coderre et al., (1993) concluded in a review of the literature that in addition to the contribution of neuronal hyperactivity to pathological pain, there was evidence to suggest that specific cellular and molecular changes affect membrane excitability and induce new gene expression, thereby allowing for enhanced responses to future stimulation.

Kumazawa (1998) reviewed the literature on phantom limb pain and concluded that persisting nociceptive inputs prior to amputation may cause plastic hyperexcitable changes in the CNS resulting in a "pain memory". There is also some evidence for the persistence of painful and non-painful sensations associated with removal or deafferenation of body structures other than the limbs, including breasts (Kroner et al., 1989) teeth (Hutchins and Reynolds, 1948), ulcer (Szasz 1949) and labour pains or menstrual cramps following total hysterectomy (Dorpat, 1971). Coderre (1993) argued that although it is largely unknown whether deaffernation was a necessary pre condition for pain memories to develop, these examples of persistent pain post amputation or removal of body part suggest that the pain is centrally represented. Kumazawa (1998) reviewed the evidence on phantom limb pain and concluded that plastic changes in the pain system may be construed as a kind of memory in the nociceptive neuronal networks since similar mechanisms have be found in structures implicated in cognitive learning and memory (i.e. the hypocampus).

Cross Talk.

Kumazawa (1998) concluded that under pathological conditions, abnormal coupling between nociceptive afferents and sympathetic nervous outflow may be either directly and/or indirectly plastically constituted. He also argued that these plastic changes in primary afferants might be implicated in sympathetically maintained pain under pathological conditions. Kim et al., (1993) found in the rat model that allodynia and hyperalgesia associated with spinal nerve ligation or partial sciatic nerve injury were relieved after surgical sympathectomy.

Furthermore, Desmeules et al., (1995) reported that sympathectomy partially extinguished pain behaviours associated with chronic constriction of the rat sciatic nerve. Jones et al., (1999) concluded that in most current animal models of neuropathic pain, an intact sympathetic nervous system is required for a complete repertoire of pain behaviours.

Like much of the literature on CNP, the empirical evidence for cross talk is at an early stage of development and more work is required before definitive conclusions can be drawn. However the conclusions of Kumazawa (1998) and Jones et al., (1999) have important potential implications for an understanding of human chronic pain states as they provide support for the clinical observation that activating the sympathetic nervous system (i.e. by stress or other means) can aggravate pathological pain. Generalisation of the literature on the animal model to human pain states suggests that plastic changes in the CNS may contribute to 'cross-talk' among the neuronal networks, including circuits related to motor, autonomic, or psychological functions.

Limitations of the Theory of Central Neural Plasticity.

The theory of CNP offers a causal theory and explanation for clinical observations of primary and/or secondary allodynia or hyperalgesia. It also appears to provide an explanation for pathological pain states. The model therefore could be applied to understanding the development of persistent LBP. However available research has primarily been conducted on the animal model (i.e. Jones et al., 1999) and therefore may or may not be appropriate for the examination of human chronic pain states in which psychological processes are known to contribute (Turk et al, 1983). The literature on human subjects has primarily been either anecdotal (Szasz 1949) or involved single case studies conducted on patients with phantom limb (Kroner et al., 1989) or other post-surgery pain problems (Dorpat, 1971). A MEDLINE assisted literature search of abstracts (1981-2000), employing boolean terms 'back pain *and* plasticity' did not retrieve a single reference. Kumazawa (1998 p26) concluded that "research directed from bench to bed and reciprocally from bed to bench is now required". In view of the lack of available evidence the association between LBP or other chronic pain states and neural plasticity is largely theoretical.

Implications of CNP for LBP.

The theory of CNP is under development and the precise mechanisms involved in plastic changes are unknown. However based on the available literature, tentative conclusions on the implications of CNP for LBP can be drawn.

Protracted input.

Cervero (1996) demonstrated that the pre-existence of enhanced inputs from nociceptors is an important factor in the development of plastic changes. Kumazawa (1998) concluded that for plasticity to develop there must be protracted nociceptive input. Kumazawa (1998) pointed out that important sources of protracted input are inflammatory tissues. These findings and conclusions imply that for CNP to develop in LBP, protracted nociceptive input is required. Kumazawa (1998) suggested the most effective way of controlling chronic pain is to prevent chronic pain by the elimination of protracted nociceptive inputs soon after the role of pain as a warning signal has ceased. Kumazawa (1998) concluded once plasticity has developed "chronic pain cannot be treated by blocking pain pathways, which may be effective against acute pain, but requires treatment from a multidisciplinary perspective".

Site of pain.

Waddell (1998) criticised research that attempted to identify a structural basis and/or site for LBP based on current symptomology. Clinical manifestations of plastic changes within the CNS such as secondary hyperalgesia or referred pain (Coderre et al., 1993) suggest that the current site of the pain may be neither the original injury site nor the current cause of the pain. Development of plastic changes within the CNS may reduce the reliability of identifying painful sites as the causal agents of LBP.

Cross talk.

Under normal physiological conditions, afferent neurones are neither excited nor sensitised by activation of sympathetic neurons (Shea and Perl, 1985; Barasi and Lynn, 1986). The animal model (Sato and Perl, 1991; Sato and Kumazawa 1996; Janig 1996) and clinical observation (Kumazawa, 1998) has suggested that "cross-talk" may exist between the sympathetic and nociceptive nervous systems

during pathological pain. Jones (1999) stated that "The sympathetic nervous system is now considered to play an important role in the generation of pain following peripheral nerve trauma". Plastic change-induced cross talk between neural networks, including circuits related to motor, autonomic or psychological functions might be present in pathological pain states. The literature suggests that cognitive (e.g. Main and Waddell., 1991; Waddell et al., 1993) and behavioural (e.g. Fordyce 1976) characteristics of LBP are important. In the chronic condition these features can become dominant (Turk et al,. 1983). Further research is required to determine whether this feature of the theory of CNP provides a neurological mechanism through which psychological and behavioural characteristics can contribute to and maintain Chronic LBP.

Summary and Conclusions.

The central neural plasticity model offers a mechanism for the development and maintenance of chronic pain. Currently the empirical evidence for much of this theory is lacking. This is particularly evident for clinical conditions such as LBP. The relevance of CNP to LBP remains largely theoretical at present, however the implications of the model are important and may provide potentially fruitful areas of future research. The model also provides a potential theoretical role for psychological influences on the development and maintenance of centrally mediated chronic pain states.

3.3 Summary and conclusions of Biomedical Influences on LBP.

Bio-medical models have attempted to explain the pathogenesis of LBP and generally investigations are directed towards determining a structural source of pain, that is damage or injury of a specific spinal site. The available research suggests that gross degenerative processes of the spine are not implicated in the pathogenesis of LBP as radiological findings of abnormality are common in both asymptomatic and symptomatic backs. However recently research on disc morphology has suggested that certain features of internal disc disruption (particularly the High Intensity Zone) may be associated with LBP determined by provocation discography. As yet there is no evidence to suggest that these findings are associated with clinical symptoms (other than the reproduction of pain), although there is evidence to suggest that psychological distress may

confound positive findings. Research on discogenic pain is generally cross-sectional and therefore reported correlations or associations cannot be implied to determine causality.

Central Neural Plasticity has been described in the animal model and studies of phantom limb pain. Although research on the theory is still in the early stages of development, there may be important implications for LBP. Plastic CNS changes in response to prolonged nociceptive input suggest that the identification of a structural site for LBP may be inappropriate as pathological pain states such as referred pain and secondary allodynia or hyperalgesia may contribute to the site of present pain. Plastic CNS changes also suggest that 'cross-talk' may exist between the nociceptive and sympathetic nervous systems, suggesting a neurophysiological mechanism for the mediational influence of arousal and behaviour on pain.

Functional based models of LBP have been proposed (Panjabi 1992a; 1992b) and there is some supporting evidence for these influences on LBP (e.g. Hides et al, 1994). However there is generally a lack of evidence on the effects that dysfunction in one system can have on others, the implications of these effects on integrated function, and the interaction between physical stresses and individual vulnerabilities.

Bio-medical and physical models have been employed to delineate the causal and maintaining factors that contribute to LBP. Apart from gross degenerative changes, to date there is not enough evidence to either refute or confirm the validity of these models. Implications of central neural plasticity and movement dysfunction suggest that arousal and/or behaviour may be important influences on LBP, particularly chronic LBP.

Research on biomedical influences on LBP demonstrates the importance of psychological and behavioural factors.

3.4 Psychological Influences on Low back pain.

Introduction.

Bio-medical approaches to LBP are primarily concerned with the pain associated with LBP and they generally propose that this should be the primary target of investigation. The disability or psychological distress associated with LBP are regarded as a secondary reaction to the pain.

Psychological Influences on LBP disability.

Turk (1996; p4 in Gatchel and Turk) argued that an assumption of the biomedical approach is that once the pain is cured, secondary reactions such as disability and psychological distress will resolve. This assumption is not implicit within psychological approaches to LBP management.

Psychological approaches to LBP take as their primary focus the psychosocial disability associated with the condition. This may include a range of behavioural and psychological factors. Investigations have demonstrated that the relationship between pain and disability or distress is weak at best (e.g. Main 1984; Linton 1985). Psychological models suggest that psychological factors contribute to the development and maintenance of LBP disability. Fordyce et al., (1985 p.115) pointed out that behavioural approaches to chronic pain "are not intended to 'treat pain'" and generally psychological models do not address the aetiology of LBP but are instead concerned with the psychosocial factors associated with the development of LBP disability. Although the pain associated with LBP is not the primary target for psychological theory or interventions, it has been observed that reductions in pain intensity are often reported following psychosocial interventions (Morley et al., 1999). However Nicholas et al., (1992) noted that research findings that reported reductions in pain intensity following psychological intervention may reflect reductions in distress rather than alterations in nociceptive processes per se.

LBP and Chronic Pain.

Psychological research that has examined LBP has often been conducted on patients with heterogeneous chronic pain conditions. Turk (1996, p7; in Gatchel and Turk) argued that common elements shared by diverse pain conditions are likely to be more evident at behavioural and psychological levels and therefore the psychological and behavioural characteristics assume greater significance than any specific site of the pain such as the low back. However there is some evidence that psychological and behavioural responses do vary by pain site. Toomey et al., (1984) reported that behaviour, pain description, and some psychological variables varied as a function of the site of pain (head/neck, low back, neither or both) in a small group of patients. Klonoff et al., (1993) found that appraisal and emotional response to pain may vary as a function of bodily location, although this study did not explicitly consider LBP.

Therefore while there may be practical advantages to conducting research on heterogeneous chronic pain groups, there are also theoretical and emprical reasons for conducting research on clearly defined homogeneous chronic pain conditions such as patients with LBP.

Research Setting.

Much of the psychological research on chronic pain has been conducted on convenience samples of heterogeneous chronic pain patients attending tertiary care centres. Turk and Rudy, (1990) pointed out that these samples may not generalise to the other populations of chronic or LBP patients, particularly those who experience ongoing pain and who do not attend tertiary pain clinics. Much of the empirical and clinical research has therefore been conducted on a very small subset of individuals with pain.

Psychological Approaches to Chronic Pain.

The psychological literature can be divided into three main psychological approaches; psychodynamic, behavioural and cognitive (Lindzey, Hall and Thompson 1975). Each approach is predicated on a different theoretical model, therefore when applied to the study of pain or chronic pain, a different dimension of the experience is usually emphasised. Personality models have been broadly

concerned with pre-disposing factors for chronicity or the description of a 'pain-prone' personality typology. Behavioural approaches have been mainly concerned with examining the development and maintenance of pain behaviour and disability and the Cognitive model is concerned with the effects of beliefs, thoughts, cognitions or patterns of such on coping efforts, disability or distress.

3.5 Personality Influences on LBP.

Weisberg and Keefe (1997) and Grzesiak, Ury and Dworkin (1996) described two approaches to examining personality influences on pain; pre-disposing individual psychological traits and their contribution to the aetiology and development of chronic pain and the description and diagnosis of incidence rates of personality disorders in patients with chronic pain. Most of the available research has been conducted on personality factors associated with the development of chronic pain. Some recent evidence has emerged on the incidence and nature of specific personality disorders of chronic pain patients (e.g. Weisberg and Keefe 1997).

Personality traits and Chronic Pain – Theoretical Background

Weisberg and Keefe (1997) defined a personality trait an individual's realm of emotional and behavioural characteristics. Traits are usually understood to have developed during childhood and are stable over time. Personality trait approaches to chronic pain and LBP are largely derived from the Psychodynamic Model (Main 1987). Although Grzesiak, et al., (p7; in Gatchel and Turk 1996) pointed out that there is neither a single approach nor a unifying theory of psychodynamic psychology, most current approaches share notions of the aetiological impact of early childhood developmental experiences on subsequent adult behaviour. Freud (1895) was one of the first authors to make explicit the association between past events and current pain. He proposed a 'protective barrier' which when penetrated by physical sensation produces unpleasant feelings by relating these sensations to past experiences or memories. Although this concept has not remained salient in psychodynamic theory, the relationship between early developmental experiences, (particularly those of trauma, loss or abandonment) and subsequent intra-psychic and inter-personal conflict has

remained central to psychodynamic formulations of chronic pain (Grzesiak, Ury and Dworkin, in Gatchel and Turk 1996).

Current psychodynamic and personality conceptualisations of chronic pain are largely predicated on a theory of pain-proneness proposed by Engel (1959). This theory proposed that certain specific negative early developmental experiences lay a foundation of vulnerability to pain or suffering which remains unconscious until an adverse life event, such as physical or psychic trauma, provides an arena for its expression (Engel 1959). Engel (1959) argued that certain individuals with specific personality characteristics (i.e. people who have a long-term background of guilt, who are chronically depressed, pessimistic and often present with a gloomy outlook) are more likely to complain of pain, which may or may not be concomitant with peripheral change. Breuer and Freud (1955) pointed out that it is often relatively common organically founded pains, (such as low back pain), that are increased and maintained by neurotic patients. Freud (1959) also argued that the motivation for maintaining symptoms may have little to do with the mechanism that caused the initial biological problem. However Engel's (1959) vulnerability to pain concept is controversial and more recent psychodynamic formulations have largely rejected "psychogenic pain" as a common cause for chronic pain. Grzesiak, Ury and Dworkin, (in Gatchel and Turk 1996) acknowledged that chronic pain is a complex interaction between biological, psychological and social factors (i.e. The Biopsychosocial Model: Waddell, 1992), with individuals who have suffered from early trauma more likely to develop chronic pain *syndrome* in response to physical pathology. They argued that if an individual with such an underlying vulnerability to suffering is presented with the physical and/or psychological trauma of persistent pain, then this individual is more likely to present with symptomology associated with suffering. Grzesiak, Ury and Dworkin, (in Gatchel and Turk 1996) proposed a neo-psychodynamic model which hypothesised that the psychological conflicts associated with past negative experiences emerge and are expressed as symptoms associated with chronic pain (psychological distress and disability), where the pain is the trigger for repressed psychic suffering. Grzesiak et al., (in Gatchel and Turk 1996) has also suggested that if an individual has persistent pain, the unique cognitive and perceptual features of their premorbid personalities will

colour both their perception of and their adaptation to the pain. Recent psychodynamic models such as that proposed by Grzesiak (1994) are concerned with the vulnerability to distress and disability and are not primarily concerned with pain.

Although psychodynamic and neo-psychodynamic approaches to chronic pain stress the importance of early developmental traumatic events to the development of chronic pain (Adler et al., 1989), they diverge in that neo-psychodynamic approaches propose that these events are causative of the suffering associated with pain (i.e. Grzesiak 1994) whereas the psychodynamic approaches suggest that these experiences directly cause pain (e.g. Pilowsky, 1990).

Research on Personality Influences on Low Back Pain.

Research on personality factors and LBP has focused on investigating "pain" and "disability".

Sternbach (1974) used the Minnesota Multiphasic Personality Inventory (MMPI) (Hathaway and McKinley 1983) to investigate the personality characteristics of patients with pain. The results suggested that pain patients comprised of four independent groups based on their personality characteristics; "Conversion V (elevated scores on the hypochondriasis, and hysteria sub-scales); "Hypochondriasis" (elevated scores on hysteria, depression, and hypochondriasis sub-scales); "Emotionally overwhelmed" (elevated hysteria, depression, hypochondriasis and at least 3 other sub-scales scores); and "Denier/coper" (normal MMPI profile). These findings have been replicated with LBP patients (Bradley and others, 1978, 1984), although some researchers (e.g. Bradley et al., 1978, Guck, 1988) have only found the Conversion V profile in female patients.

In a review of the literature, Bradley et al., (1992) noted that the MMPI clusters had been associated with specific behavioural and psychological correlates; Conversion V sub-group described as employing somatic symptoms to obtain dependency gratification, the hypochondriasis sub-group patients usually presenting with neurotic symptoms which are characterologic, coupled with severe pain, affective disturbance and disability, and Emotionally Overwhelmed patients usually presenting with high levels of psychopathology, marked

depression and moderate levels of disability. The Denier/coper sub-group cluster was associated with few pain related disabilities but has been described by Wade et al., (1992) as patients who may deny uncomfortable emotions and maintain control over unacceptable impulses.

BenDebba (1997) followed up a large group of LBP patients (n=2348) over a 2 year period (58% completed follow assessments). Their findings suggested that psychological distress, disability and pain intensity were weakly associated at enrolment. They also found that before treatment these factors were associated with aspects of the patients' personality such as neuroticism. However following treatment the relationships between personality factors and disability/distress/pain were weakened, but that the inter-relationships between disability, distress and pain were strengthened. BenDebba (1997) attributed these changes to changes in the patient's perception of their illness.

Grzesiak, Ury and Dworkin, (in Gatchel and Turk 1996) pointed out that most of the studies conducted on Personality influences on LBP and chronic pain are cross-sectional and used patients attending tertiary pain clinics. They are therefore unable determine the antecedents of chronic pain from its consequences and cannot be employed to support the theory that personality characteristics are pre-morbid and preceded LBP. Wade et al., (1992) examined the normal personality structure of the four MMPI clusters in a group of n=59 chronic pain patients (70% low back or leg pain). Their results suggested that other than emotionally overwhelmed patients, MMPI cluster sub-groups presented with an essentially normal personality structure. They concluded that the personality disturbance reflected in the MMPI sub-scale elevations may be either an emotional and/or behavioural response to chronic pain or simply represent endorsement of somatic items associated with the illness. In a 20 year longitudinal study Hansen et al., (1995) examined the relationship between MMPI scores and LBP. Within the context of a general health survey primarily designed to assess cardiovascular risk factors, n=404 subjects were asked to complete the MMPI at 0, 10 and 20 years. Although relying on retrospective data, Hansen et al., (1995) found that over the period of their study personality

type did not predict pain, but that the pain predicted personality factors. Hansen et al., (1995) concluded that chronic pain changed personality over time.

Recently new conceptualisations of Engel's (1959) 'pain-prone' personality have focused on the predisposing factors of disability and distress (Grzesiak et al., in Gatchel and Turk 1996). Research interest in this area is relatively recent, and therefore only a few studies on the personal histories of chronic pain patients are currently available (e.g. Adler et al., 1989). However the available research suggests that this area may have potential for addressing the finding that some patients present with increased suffering in response to persistent pain.

Suffering is often associated with chronic pain patients (Sternbach, 1989). Grzesiak et al., (in Gatchel and Turk 1996) pointed out that although difficult to quantify, the suffering of chronic pain patients is often represented by a range of mood alterations such as depression and anxiety coupled chronic disabled behaviours. Grzesiak et al., (in Gatchel and Turk 1996) offered an interpretation of Engel's (1959) work to argue that as a consequence of unresolved traumatic childhood events, some chronic pain patients may have a vulnerability to suffering that can result in increased features of disability and distress when that person is confronted with persistent pain.

Thus there is some evidence that traumatic childhood events may be related to the disability and distress of chronic pain (Schofferman et al., 1992). However, firm conclusions from these studies are limited as they are retrospective and may be subject to recall bias. Grzesiak et al., (in Gatchel and Turk 1996) acknowledged that prospective studies in this area are unlikely.

Influence of Personality Disorders on Low Back Pain.

Weisberg and Keefe (1997 p1) defined personality disorder as "...a long standing pattern of disordered behaviour and emotions with symptoms severe enough to interfere with the individual's ability to function, interact with others, and in some cases, maintain reality testing". Assessment of personality disorders is usually obtained through the use of semi-structured interview (Weisberg and Keefe, 1997), whereby patients are asked how they would react in various

situations. The outcome is determined by clinical judgement guided by the Diagnostic and Statistical Manual (DSM III/IV) of the American Psychiatric Association (1994).

Research on Personality Disorders and Chronic Pain.

Four studies have examined the incidence rates of personality disorders in chronic pain conditions to date (Reich et al., 1983; Large 1986; Fishbain 1986; Polatin et al., 1993). Incidence rates for diagnosed psychopathology (Axis II described in DSM III/IV) ranged from 37% (Reich et al., 1983) to 58% (Fishbain et al., 1986). These findings suggested that personality disorders are relatively common in chronic pain populations. However, Fishbain (1997) pointed out that the prevalence could vary considerably according to the type of interview or assessment tool employed, the threshold criteria for interview items and the variation in the prevalence of the disorders across settings. Demographic characteristics such as age and sex, setting and presence of an Axis I disorder (e.g. clinical depression, anxiety) can also affect the assessment of personality disorders, further complicating accurate determination of incidence rates (Fishbain 1997).

One prospective study (Gatchel et al., 1995) followed n=400 acute back pain patients to determine whether psychopathology, diagnosed by semi-structured interview, was predictive of chronicity (defined as significant disability at one year follow-up). The results indicated that although personality disorders were not predictive, chronicity was predicted by MMPI sub-scale 'Hypochondriasis'. Polatin (1997) interpreted these findings under a diathesis-stress framework (a generic model that integrates the concepts of vulnerability and stress - Banks and Kerns 1996) and suggested that an existing trait vulnerability (such as a personality disorder) can be exacerbated into the full psychopathology under conditions of stress (pain). This model is similar to the vulnerability to suffering formulation of Grzesiak et al., (1996).

There is little evidence for a relationship between personality disorders and chronic pain. However, the tools used are imprecise as yet (Gatchel, 1997), and

results need to be interpreted in the context of the assessment conditions and the characteristics of the subjects under investigation.

Conclusion of Personality Influences on LBP.

Personality factors may play a weak role in the development and maintenance of chronic pain and LBP. The literature suggests that rather than having a direct aetiological influence on pain, these factors may influence the disability and distress which is associated with chronic pain, through a person's 'vulnerability to suffering' (Grzesiak et al., 1996). Main (1987) concluded the relationship between physical severity and disability or distress may be better understood by a patient's reaction to LBP rather than their pre morbid personality structure.

3.6 Behavioural Influences on LBP.

Theoretical Background.

Behavioural approaches to chronic pain are predicated on learning theory concepts (Skinner 1953), which Fordyce and others (1968a, 1968b) applied to the treatment of pain behaviours.

Learning theory.

Sanders (1996 p112-113) pointed out that "... the learning/conditioning effects on patients with clinical pain are multileveled and interactional. They involve operant, respondent, and observational learning effects...". Although each of these conditioning models may be important for a comprehensive understanding of the chronic pain patient (Sanders, 1985), Fordyce (1968a) argued the most salient processes involved in the development and maintenance of pain behaviours are respondent and operant conditioning.

Respondent conditioning is proposed to occur when a stimulus is closely followed by a behaviour with no reinforcement e.g. a reflex vocalisation (respondent behaviour) following tissue damage (stimulus) Fordyce (1968a). Turk and Flor (1987) have pointed out that this process represents classical conditioning and that the (pain) behaviour elicited under these conditions could be termed reflexive pain behaviour. Operant conditioning, on the other hand,

refers to the learning process whereby the behaviour is under direct control of its consequences. Fundamental to this process is reinforcement that Sanders (1996) noted occurs when a behaviour is followed by the application or removal of reward or punishment so that the behaviour becomes contingent upon its consequence. Reinforcement is either "positive", when something is applied as a consequence of the behaviour or "negative" when something is removed as a consequence of the behaviour. Negative reinforcement is also known as escape or avoidance conditioning and is argued to be extremely resistant to change (Sanders 1996). Recent developments of the negative reinforcement paradigm have included "fear-avoidance" (Phillips 1987, Waddell et al., 1993, Vlaeyen 1995). These theories, based on the authors' original research findings (Sanders 1983; Turk et al, 1985; Fordyce 1968b) propose that certain aspects of the chronic pain experience (pain behaviours) are governed by learning theory principles.

Pain Behaviours.

Fordyce et al., (1985) noted that for patients in pain, some behaviours are respondent in that they are initiated by painful stimuli. However initially respondent behaviours may persist long after normal healing time and painful stimuli has ended because they have been reinforced by powerful consequences in the patient's environment. These 'operant' pain behaviours are the main focus of behavioural approaches to chronic pain. Attention is applied to the relationship between the emission of the pain behaviours and the occurrence of the reinforcing contingencies. Antecedent events (nociception) are not generally considered (Fordyce et al., 1985). Behavioural approaches to chronic pain are not therefore concerned with 'pain' per se, but with behaviours associated with pain, although Fordyce et al., (1985) noted that a reduction in pain behaviours was often accompanied by reductions in pain intensity as a secondary effect.

Pain behaviour is 'overt or observable actions' which communicate that someone is experiencing the private and subjective experience of pain (Fordyce et al., 1985). As pain behaviours are public, they are subject to external or environmental reinforcement and thus potential operant conditioning.

Fordyce (1976) proposed that pain behaviours included:

1. Para verbal sounds such as sighs
2. verbal complaints of pain
3. body posturing and gesturing such as limping or guarding
4. display of functional limitations (e.g. excessive periods of rest "downtime"
5. pain reduction behaviours such as medications or use of the health care system.

Fordyce et al., (1976) argued that because pain behaviours were observable communications of pain and potential operants, their frequency could be increased if desirable outcomes are achieved or undesirable outcomes are avoided. Turk and Flor (1987 p281) pointed out that these pain behaviours are likely to be respondent in the acute pain patient and closely related to nociception. However they may lose their adaptive functions over time and may be "...maintained by the environment by means of a process of operant conditioning long after the resolution of any pathological process and the termination of nociceptive stimulation".

Two types of pain behaviour were proposed (Fordyce 1985); one associated with injury and the other associated with environmental reinforcement. It is the latter that the behavioural model is primarily concerned with.

Research on Behavioural Influences on LBP and chronic pain.

Fordyce (1985) argued that evidence of environmental contingencies, in the form of social support, provided confirmatory evidence for the operant model of pain behaviour. However, the results of early studies of social support and pain behaviour cited by Fordyce (1985) in support of the operant model (i.e. Block et al., 1980) have been the target of criticism. Gil et al., (1987) pointed out that Block et al., (1980) only examined the effects of marital support on pain behaviour and Schmidt (1987) offered an alternate conclusion from that proffered by the authors (Block et al., 1980). Gil et al., (1987) examined the effects of satisfaction with social support and the number of people available for

social support on the observed pain behaviour of n=51 chronic pain patients (78% low back pain). The results indicated that whilst there were no differences in pain ratings, those individuals who were classified as having a high satisfaction with their social support were more likely to exhibit significantly more pain behaviours than those patients who had low satisfaction with their social support. Gil et al., (1987) concluded that patients who are satisfied with their social support may be exhibiting more pain behaviours such as guarding, rubbing or bracing because they receive positive reinforcement from their social environment when they engage in such behaviours. Lousberg et al., (1992) examined the relationship between spouse solicitousness and pain behaviour in a group of n=40 chronic LBP patients. Their results provide contradictory evidence for Block et al., (1980) conclusions in that LBP patients who reported high ratings of spouse solicitousness did not exhibit more pain behaviour (performance on a treadmill) than patients with low ratings of spouse solicitousness. Only patients whose spouses rated themselves as solicitous displayed more pain behaviour. However there may have been methodological problems with Lousberg et al.,'s (1992) use of self-report instruments to measure spouse solicitousness. In an attempt to mitigate some of the undesired effects of self report instruments encountered by Lousberg et al., (1992), Romano et al., (1995) videotaped interactions between n=50 chronic pain patients and their spouses whilst engaged in everyday household activities. The video recordings were analysed to determine objective measures of both spouse solicitous and pain behaviours. Romano et al., (1995) found that spouse solicitous responses to patient pain behaviour did not predict either total pain behaviours or self-reported psychosocial dysfunction as assessed by the Sickness Impact Profile (SIP). A complex relationship existed between spouse solicitousness and physical dysfunction in that the relationship was only significant for those patients who reported relatively higher rates of depression. Furthermore solicitousness was only related to observed pain behaviour for patients who reported higher rates of pain.

These findings suggest that Gil et al.,'s (1987) conclusion that the favourable perception of social attention may reinforce and maintain pain behaviour or

disability, may only be related to specific sub-groups of chronic pain patients such as the depressed or those in severe pain (Romano et al., 1995).

The research on environmental reinforcement, as represented by spouse solicitousness, provides partial support for an operant behavioural model of chronic pain behaviour or disability.

In a review of the literature on behavioural remediation of chronic pain, Linton (1986 p129) concluded that "There is no longer any question as to whether the operant program is potent in increasing activity levels and decreasing medication use...the question is no longer 'does it work' but 'how well does it work, for whom and why?'". Since Linton's (1986) comments, (based on five studies, many of which had methodological problems (Vlaeyen et al., 1995)), further work has included investigations of behavioural interventions in a range of pain patients including LBP patients.

Turner and Clancy (1988) compared the effects of operant-behavioural and cognitive-behavioural treatment in a group of n=81 mildly disabled chronic LBP patients. They found that the operant behavioural group exhibited significant improvements in pain behaviour and disability ratings post treatment and that these improvements were greater than those of either the cognitive-behavioural or the waiting list control groups. These effects were maintained at 6 and 12 month follow-ups although the differential between the operant and the cognitive-behavioural groups disappeared. In a group of n=58 moderately disabled chronic LBP patients, Nicolas et al., (1991) found that behaviour therapy produced a significant improvement in self-rated disability and a reduction of medication intake over cognitive therapy or attention-control groups. However, there were no differences between the behaviourally or cognitively treated groups on measures of pain, spouse rated disability, pain behaviour or depression. Finally Vlaeyen et al., (1995) compared operant, operant-cognitive and operant-respondent (relaxation) therapies in a group of n=71 moderately to severely disabled patients with chronic LBP. Their findings provided support for operant derived treatment of chronic LBP patients over

waiting list controls. However they found that these treatment effects were improved if supplemented by respondent or particularly cognitive techniques.

The results of these investigations suggest that treatment of LBP patients with operant/behavioural therapy is significantly better than no treatment for a range of outcome variables. However it is unclear whether the addition of a cognitive component to the therapy in the form of cognitive-behavioural therapy can increase (Vlaeyen et al., 1995), decrease (Turner and Clancy 1988) or have a limited impact on these changes (Nicolas 1991). Vlaeyen et al., (1995) pointed out that this equivocation might be due in part to a lack consensus of what constituted behaviour/operant or cognitive therapy. For example the use of the term 'behavioural' in relation to cognitive-behavioural therapy referred to either relaxation (Turner and Clancy, 1988), a 'multi-modal' treatment package (Nicolas et al, 1991) or operant principles (a la Fordyce, 1968a) including spouse training (Vlaeyen et al., 1995). Until consensus on the definitions of behavioural therapy emerges in the literature, firm conclusions on the efficacy of this approach for LBP patients are likely to remain problematic.

Recently, Morley et al., (1999) conducted a meta-analysis of randomised controlled trials on patients with chronic pain, excluding headache (most of studies included a majority of patients with LBP). The findings indicated that compared to waiting list controls, behaviour therapy significantly improved the experience of pain (Effect Size (ES)=0.32), improved mood other than depression (ES=0.74), reduced the behavioural expression of pain (ES=0.45), increased behavioural activity (ES=0.54) and improved social role functioning (ES=0.34). Although the availability of trials involving other treatment controls were limited, it was found that behavioural therapy reduced the behavioural expression of pain and improved social role functioning compared with other treatments (Morley et al., 1999). However the "other treatments" were not defined.

Criticisms of the Behavioural Approach.

Several criticisms of the behavioural approach have emerged in the literature. Schmidt (1987) pointed out that evidence that pain behaviours are subject to modification by behavioural techniques cannot be used as evidence for the influence of operant factors in the development or aetiology of pain behaviours. Furthermore, Schmidt (1987) has criticised the interpretation of some of the evidence presented by Fordyce (1985) in defence of the behavioural position and offered an alternate formulation in which internal processes contribute to the development and maintenance of pain behaviours. However Fordyce (1985) pointed out that if a reduction of these behaviours is produced after the application of behavioural techniques then behavioural therapy can be judged as effective *in these terms*. As the behavioural approach is not directed at reducing pain (Fordyce et al., (1985 p115) "Behavioural methods for treating pain problems (chronic pain behaviours) are not intended to 'treat pain'"), Schmidt's (1987) criticism may be misdirected. However recent reviews of the literature on the behavioural management of chronic pain, (Morley et al., 1999) and chronic LBP (Vlaeyen et al., 2001) have found that behavioural management significantly reduced pain. The mechanisms responsible for these reductions in pain are not outlined in the behavioural model and are presently unclear.

Summary of Research on Behavioural Influences on LBP.

The main studies reported in the literature to date seem to support Fordyce's (1968) model of pain behaviour, at least for some patients and under certain circumstances. Furthermore there is equivocal support for Linton's (1986) conclusion that behavioural management is efficacious in a number of dimensions of the pain experience as it seems that the addition of further interventions, particularly cognitive therapy in the guise of cognitive-behavioural therapy, may increase benefits of treatment.

Future Directions for the Behavioural Approach.

Recently fear avoidance, one particular aspect of learning theory, has been investigated by a number of researchers (Rose et al., 1992; Waddell et al., 1993; Phillips 1987; Vlaeyen et al., 1995, McCracken et al., 1996; Asmundson et al., 1997). Although this model focuses on negative operant reinforcement of pain

behaviour, research has concentrated primarily on the cognitive aspects of fear avoidance (e.g. Waddell and Main, 1993) rather than a strictly behavioural approach (e.g. Phillips 1987).

3.7 Cognitive Influences on LBP and Chronic Pain

Sternbach (1975) emphasised the importance of beliefs to the experience of chronic pain and suggested that the ability to manage pain may be disrupted or facilitated by the beliefs or attitudes of patients who adopt certain lifestyles in response to their pain. Pilowsky (1976) examined general attitudes and beliefs of pain patients within the context of a psychiatric diagnosis of hypochondriasis. These early studies measured the beliefs of pain patients to infer generalised traits about health and illness rather than specific cognitions or cognitive processes that may pertain directly to pain management (Schwartz et al., 1985). During the last decade an increasing amount of attention has been paid to the cognitions and beliefs of people who experience LBP or chronic pain and their relationships with behaviour, disability or distress (Turk et al., 1993). To facilitate research and assist with clinical management a number of dedicated pain belief measures have been developed (e.g. Jensen et al., 1987; Williams et al., 1989; Riley et al,. 1988; Main and Waddell, 1991; Waddell et al., 1993; Linton 1988). However it is presently unclear which particular cognitive constructs may be important for a comprehensive assessment of the patient with chronic pain, which are related to outcome (and the relative strength of these associations) and whether or not there are particular inter-group differences in the prevalence of these beliefs.

Theoretical Background.

Cognitive approaches to chronic pain are largely predicated on the application of the theoretical framework provided by the Cognitive-Behavioural Model (Beck 1979) that was generalised to the study of pain by Turk, Meichenbaum and Genest (1983). Turk and Rudy (1992) pointed out that the Cognitive-Behavioural approach is regarded as an umbrella model subsuming a number of theoretical positions e.g. Social Learning theory (Rotter 1967), Social Cognitive approaches (Bandura 1977) and theories derived from social psychology such as

theories of attitude (Ajzen and Fishbein, 1978). Generally these models propose that individuals actively process information (Turk and Rudy, 1992) and that "affect and behaviour are largely determined by the way in which the individual construes the world" (Turk, Meichenbaum and Genest, 1983 pp4). This model proposes that beliefs, attitudes and/or cognitions are the primary mediators of emotions and behaviours. In relation to chronic pain Turk and Rudy, (1992), proposed that nociceptive stimuli is interpreted in the context of a patient's cognitive schemata which is the primary determinant of a behavioural or emotional response. Specific types of cognitive experience include attentional processes, beliefs, attributions, expectations, coping self-statements, appraisals, images and problem solving cognitions (Turk et al., 1983). Some authors have described cognitive processes as essentially uni-directional (Tait and Chibnall 1997: "Beliefs impact behaviour through information that a person possess relevant to a target"), whilst others have pointed out that the relationships between these psychological constructs are not necessarily simple, direct or casual (Turk, Meichenbaum and Genest 1983,pp14; "There are complex interactions among cognitive, affective and behavioural change. Positive change in one of these may promote positive change in the others").

The premise of the Cognitive-behavioural approach is that beliefs influence functioning in two primary ways: by their direct effect on mood (e.g. catastrophic, negative thoughts about control/helplessness or cognitive errors are hypothesised to lead to depressed mood), and/or by their direct effect on behaviours or perhaps coping efforts (Jensen et al., 1991). In the context of chronic LBP where behavioural and emotional components are proposed to be integral to the experience of the condition (e.g. Klapow, Slater, Patterson et al., 1995), cognition is proposed to be the primary determining factor associated with the emotional and behavioural response (Lefebvre 1981). However, although there is general agreement amongst cognitive psychologists that the beliefs of patients with chronic pain are important for a comprehensive understanding of the variety of responses exhibited by those patients, there is considerably less agreement about which *specific* beliefs are important, and in particular how much of the variance in outcomes they predict (DeGood and Shutty, 1992).

Control Beliefs.

The importance of control to physical and emotional health has been well documented (e.g. Steptoe and Appels, 1989; Steptoe 1989; Peterson and Stunkard, 1989; Norman and Norman 1991; Johnston et al., 1992). Locus of Control (Rotter, 1966) was originally proposed as a generalised outcome expectancy construct and measured on a uni-dimensional, internal-external (I-E) scale. Individuals who have an internal locus of control believe that reinforcements come from their own behaviour, whist an external locus of control indicates a belief that reinforcements come from external sources (Main and Waddell, 1991). Early research on the construct (Levinson, 1972) indicated that the external dimension could be further divided into two empirically and conceptually distinct dimensions; "chance" and "powerful others", resulting in a multi-dimensional locus of control scale (Levenson 1972). Further work on Locus of Control questioned its' generalisability and it was noted that its predictive validity could be increased if employed as a measure of specific outcome expectancies (Rotter 1975). Wallston and Wallston (1978) developed the Multi-dimensional Health Locus of Control Scale (MHLC) incorporating the "chance" and "powerful others" dimensions to specifically assess health beliefs. In a further refinement of the construct, Wallston et al, (1994) noted that it was possible that with a given specific chronic health condition, patients could hold different locus of control beliefs about that condition from their general health status. This led to the development of a condition specific measure of locus of control (Wallston et al., 1994). Measures that directly assessed the control beliefs of chronic pain patients (Toomey and others 1991, 1993; Flor et al, 1993) or LBP patients (Main and Waddell, 1993) have also been developed.

Beliefs about pain control incorporate attributional beliefs (Cheatle et al,. 1990), and individual items or subscales which assess these beliefs have been incorporated into many pain belief questionnaires (e.g. Rosenstiel and Keefe, 1983; Schwartz et al., 1983; Jensen et al., 1987; Williams and Thorn 1989; Main et al., 1991; Flor et al., 1993; Edwards et al., 1992; Waddell et al., 1993). Beliefs about pain control have been shown to be related to depression (Rudy, Kerns and Turk, 1988; Cheatle et al., 1990; Wells 1994; Fisher and Johnston 1998), disability (Schwartz et al., 1983; Wells 1994; Fisher and Johnston 1998) and

have been shown to be subject to change following pain management (Lipchik et al., 1993).

Harkapaa (1991) examined the relationships between health locus of control, psychological distress and coping strategies in a sample of n=415 LBP patients. Their findings suggested that patients who had high external locus of control beliefs were more likely report psychological distress than LBP patients with a high internal locus of control. In subsequent work, Harkappa (1992) found that LBP patients with high internal Health Locus of Control beliefs also demonstrated increased likelihood of successful outcome following treatment. Finally Harkapaa (1996) showed that LBP patients with an internal health locus of control were also likely to have demonstrated pain control beliefs that were associated with more active coping strategies and less symptoms of psychological distress.

Crisson and Keefe (1988) also examined the relationship between pain control beliefs and coping strategies in a sample of n=62 chronic pain patients (82% LBP). Their findings suggested that patients who viewed their outcomes as controlled by chance factors such as fate or luck tended to rely on maladaptive pain coping strategies and demonstrated increased psychological distress.

Main and Waddell (1991) developed the Pain Locus of Control (PLC) questionnaire to assess how well LBP patients control their pain (PC scale) and how far they feel they are responsible for the management of their pain (PR scale). Both scales have been shown to be responsive to change on pain management programs and to predict future consulting behaviour (Main and Waddell, 1991).

Control beliefs are also related to self efficacy (Bandura 1977). Self efficacy describes the personal conviction that a person has the internal resources to effect desired outcomes (Bandura 1986). Dolce (1987) also argued that it is an individual's belief about their efficacy that predominantly determines whether a given behaviour will be attempted or not. Self efficacy has been found to be associated with treatment outcome (Koes et al., 1990), functional impairment

(Council et al., 1988), coping efforts (Jensen et al., 1991) and behavioural performance (Estlander et al., 1994). Nicholas (1992) and Altmaier et al., (1993) also demonstrated that self efficacy ratings are likely to change following cognitive behavioural management of LBP and that these changes were associated with improved outcomes.

The influence of Cognitive Coping Strategies on LBP.

Models of stress and coping have been proposed to be helpful in explaining adjustment to chronic pain and LBP. Jensen et al., (1991) defined coping as a purposeful effort to manage or vitiate the negative impact of stress. Coping strategies can be either behavioural or cognitive but always involve "purposeful effort" (Lazarus and Folkman, 1984). Stress associated with chronic pain or LBP may derive from either the long term effects of chronic illness, or directly from the pain itself. Coping strategies have been proposed to buffer chronic pain (Schmitz et al., 1996) or LBP (Weickgenant et al., 1993; Keefe et al., 1990) patients against distress associated with chronic pain (Jensen et al., 1991).

Research on Coping Influence on LBP.

In a review of the literature Jensen et al., (1991) suggested that out of the available pain coping strategy assessment tools, the Coping Strategies Questionnaire (CSQ) (Rosensteil and Keefe, 1983) had received the most attention. Recently Jensen et al., (1995) developed the Chronic Pain Coping Inventory. In its original form the CSQ contained n=42 items which assessed the frequency of seven pain coping strategies: diverting attention, reinterpreting pain sensations, use of coping self statements, ignoring painful sensations, praying and hoping, catastrophising and increasing activity levels. Tow additional items determine the ability to control and decrease pain (Rosenstiel and Keefe, 1983). Several attempts have been made to examine the factor structure of the CSQ to determine whether there are any underlying pain coping factors present in the model. However results of factor studies have proved inconsistent (Jensen et al, 1991).

Tuttle et al, (1991) found that their empirically obtained factors differed in important ways from the original CSQ model in a study of n=181 chronic pain

patients. They concluded that the validity of the original CSQ factors structure was questionable (Tuttle et al, 1991). In a study of n=126 whiplash patients, Swartzman et al., (1994) was able to replicate 5 of the sub-scales reported by Tuttle et al,. (1991) including the Distracting, Ignoring painful sensations, Reinterpreting pain sensations, Catastrophising and Praying and Hoping. Robinson et al, (1997) found in a large scale study of n=965 chronic pain patients, a factor structure that was similar to that found by Rosenstiel and Keefe (1983) in the original model. However they found evidence that the items from the original Praying and Hoping subscale were divided between two separate "Praying" and "Hoping" subscales. This finding was replicated by Riley et al., (1997).

Partly due to inconsistent factor structures, inconsistent relationships have also been found between CSQ factors and depression and disability, leading Jensen et al., (1991) to suggest that individual rather than composite subscales should be investigated.

Jensen et al,. (1992) and Dozois et al., (1996) examined the relationship between individual CSQ subscales and symptoms of disability and depression in samples of n=141 chronic pain and n=200 LBP patients respectively. Jensen et al.,'s (1992) findings suggested that out of all the CSQ subscales, Catastrophising was the most consistent predictor of outcome. This finding was also supported by Dozois et al, (1996) who also found that the Praying and Hoping subscale was related to LBP disability. Main and Waddell (1991) also found evidence that the Catastrophising was the most reliable of the CSQ subscales. In a study of LBP patients referred for chiropractic care, Burton et al., (1995) found that Catastrophising and Praying and Hoping were predictive of disability at 1 year.

3.8 Conclusion of Psychological Influences on LBP.

The evidence reviewed for the influence of personality factors on LBP suggests that these influences are weak at best. The primary psychological influences on LBP appear to be behavioural and cognitive factors. The reviewed literature also suggests that behavioural influences on LBP may be mediated by cognitive or belief-based factors.

The literature on Pain Beliefs and Coping strategies suggests that Pain control beliefs and specific coping strategies, particularly Catastrophising and Praying and Hoping, may be important influences on LBP disability and distress. However the extent to which these factors mediate the relationship between LBP disability and distress has not been fully explored in the literature. Furthermore, although the relationships between coping strategies and pain control beliefs have begun to be addressed (Harkapaa 1991; Haythornthwaite et al., 1998), their relative mediating roles in LBP adjustment have not been fully examined. For example, competing models of LBP have not been explicitly tested to clarify whether the mediational role of cognitive factors in LBP is best represented by pain control beliefs predicting coping strategies or pain coping strategies predicting pain control beliefs.

Limitations on Research on Psychological influences on LBP.

Psychological research on LBP and chronic pain is often conducted on highly selected groups of patients. Much of this work is conducted at specialist pain clinics which provide ready access to large numbers of patients with similar problems and which also house specialist clinicians who are likely to perceive the need for research and to have the clinical experience from which the important research questions can be identified (Crombie and Davies, 1998). Turk and Rudy (1990) pointed out that the majority of patients attending these tertiary and multidisciplinary pain centres are not representative of the population at large with persistent pain. Crook et al., (1986) found that compared with patients seen by a family doctor, patients attending a specialist clinic are more likely to have had work-related accidents, to complain of constant pain, and to have greater levels of disability and distress. Furthermore, Crombie and Davies

(1998) argued that patients at pain clinics are likely to be over represented by those whose condition induces the referring physician to refer and that these referral patterns are likely to be based on a complex array of patient, physician and/or situational factors. Therefore much of the available empirical and clinical research is based on a small and highly selected subset of individuals with chronic pain, whom Grzesiak et al., (1996) characterised as 'suffering'. It is therefore perhaps unsurprising that psychological processes are important for this group of patients.

Generalisation of findings from research conducted on groups of highly selected patients is difficult due to the potentially unique characteristics of each study sample. Crombie and Davis (1998) pointed out that findings that cannot be generalised are of little scientific value. Research findings from investigations on patients from these studies require replication in more heterogeneous samples before any firm conclusions can be made.

To date, the literature is lacking a clearly defined cohort study of LBP patients in a UK based secondary care setting (Frank et al., 2000).

3.9 Cultural Influences on Low Back Pain.

Introduction.

Biomedical approaches to LBP have tended to view LBP as a physiological phenomenon. Bates et al., (1987) argued that the traditional approach has been to consider sociocultural and psychological factors only after diagnostic procedures fail to reveal a somatic pathological cause for the pain.

The current chapter addresses some of the issues related to investigating cultural influences on LBP and reviews the available literature on these influences.

Definitions of Culture.

Triandis (1972) argued that most definitions of culture contained in the literature are necessarily "fuzzy" and tend to reflect the professional background of the author. They range from broad sociological definitions "social organisation, social relations, and political, ideological factors" (Bates et al,. 1995) to psychosocially orientated "the sum of beliefs, practices, habits, likes, dislikes, norms, customs, rituals" (Spector 1985), behaviourally orientated "an array or collection of beliefs, habits and practices" (Banja 1996) and social psychological "shared norms, roles, values, associations, particular ways of categorising experience" (Triandis 1990). Nagel (1994 p162) argued that the function of culture was to "provide a history, ideology, symbolic universe and system of meaning". Waddell and Waddell (2000) proposed that culture influenced LBP through its action on "broad, shared patterns of values, attitudes and behaviours that may interact with low back pain and disability". Although to some extent these definitions reflect the different professional backgrounds of the authors and therefore emphasise different aspects of culture, they tend to agree that a common culture indicates shared beliefs and behaviours amongst individuals (Triandis 1990).

The assessment of Cultural Influences.

Bates et al,. (1987) described groups of individuals who share a common culture as "social communities". They suggested that the most common social community that had been used to examine cultural influences on pain was

ethnicity (Bates et al,. 1987). Barth (1969) suggested that ethnicity is generally regarded as a categorisation of group membership based on self-report or labelling by others. The ethnic label is assumed to reflect perceived membership of, and individual identification with, the ethnic group to which the label refers. Thomas (1996) suggested that ethnic self-identity was both a necessary and a sufficient condition for establishing ethnic identity. However McAuley et al,. (1996) suggested that when investigating cultural influences on health, self defined ethnicity alone was not sufficient. They suggested that other social communities, such as Religious or Country of Birth (Nationality) should also be investigated.

Ethnic Groups.

Senior and Bhopal (1995) argued that much of the work on ethnicity and health was methodologically flawed. They suggested that improvements to the quality of research could be achieved by closer attention to the definition or derivation of ethnic groups or categories (Senior and Bhopal 1995). Sheldon and Parker (1992) argued that there was a lack of consistency in the way in which ethnicity was both incorporated into research studies and in the terminologies used. They argued that the literature displayed a generally poor comprehension of the concepts that underlie ethnic categories and the issues surrounding their operationalisation (Sheldon and Parker, 1992). Senior and Bhopal (1994), Nagel (1994) and Webster and Fox (in Cruickshank 1989) pointed out that ethnicity is a complex and fluid construct that may change over time. Hillier and Kelleher (1995) suggested that these processes may be independent of whether ethnicity was self defined or defined by the researcher.

Problems with Ethnic Group Definitions.

An inspection of the literature indicated that the classification and definition of the ethnic group "Asian" had varied over time. In the British literature this term was often employed to describe individuals who's family origins were the Indian sub-continent. However Cruickshank and Beevers (in Cruickshank 1989) and Shaunak et al., (1986) pointed out that "Asian" lacks specificity and does not take into account the heterogeneity of this group. They argued that it potentially includes individuals from geographically distant Asian countries such as

Malaysia, Japan and Afghanistan. Bhopal, et al., (1991) and Lambert and Sevak (1995) pointed out that "Asian" has different meanings for American and British researchers referring to individuals from the Indian sub-continent for British researchers and people from East and South East Asia for American researchers. Bhopal, Phillimore and Kohli (1991) reported that in *Contributions to Indian Sociology*, an academic journal of sociology and social anthropology produced in India, "South Asian" is the preferred term to describe individuals from India, Pakistan, Nepal, Bhutan, Bangladesh and Sri Lanka. However there is no consensus in the literature on the geographical, political, religious or cultural boundaries of "South Asian". There is also evidence to suggest that researchers use this term to describe different groups. Lambert and Sevak (1995) described the national boundaries of South Asia as including Pakistan, Indian, Bangladesh and Sri Lanka, but not Nepal or Bhutan. The heterogeneity of "South Asian" may be also be problematic as it includes national boundaries which include countries which potentially encompass a diversity of languages, food habits and religion (cultural elements). Similar complexities have also been found for other ethnic groups. McAuley et al., (1996) asked n=297 patients with LBP to self-define their ethnicity. Out of n=104 respondents that were researcher defined as "British", n=16 separate self-definitions were found. The three most common responses were "English", "British" and "White" with a further n=13 groups comprising n=16 patients. McAuley et al., (1996) concluded the utility of self-defined ethnicity as a variable in health research may be limited by the heterogeneity of self-definitions.

A precise definition of a specific ethnic group is difficult as they can be dynamic, fluid and evolving concepts (Senior and Bhopal, 1994; Nagel 1994). Generally, common ethnicity (i.e. shared membership of specific ethnic group) implies shared origins or social background that may or may not be based on geographical distribution (Senior and Bhopal, 1994). An ethnic group may also include individuals who share language, religion, appearance or ancestry and it is a description of individual identity as well as group organisation.

Thomas (1986), Nagel (1994) and Aspinall (1995) argued that ethnic group is most appropriately measured by self-definition.

Research on Health and Ethnicity.

Bhopal (1997) argued that despite its controversial history, there has been a marked increase in research on ethnicity and health (e.g. Pearson 1989 – Ethnic Factors in Health and Disease: Cruickshank). Sheldon and Parker (1992) reported that research retrieved from a Medline search that included the terms "ethnic group" or "ethnicity" doubled from 99 to 202 occurrences for the years 1985 to 1990. Greenwald (1991) suggested that the belief that ethnic group membership affects pain perception is widespread among health professionals and lay people alike and Bates (1987) commented that in general healthcare providers assume that sociocultural and psychological variables play a major role in defining pain and responses to it. However Senior and Bhopal (1997) argued that much of the available research has done little to increase understanding of disease aetiology and public health (Sheldon and Parker 1992). Bhopal (1997) and Francis (1993 – from Smaje 1995; p193) argued that much of the recently published research has perpetuated racial stereotypes and obscured the influence of social class or poverty. However Hillier and Kelleher (1995 p1) argued that an examination of ethnicity as a "heuristic device for considering inequality or simply for the articulation of difference by which modes of domination or empowerment are produced under certain social conditions is a defensible research position". Keats (1986) also pointed out that researching ethnicity and health was also useful to increase the generalisability of common findings whilst at the same time discovering cultural effects (main effects and interaction effects). Although Sheldon and Parker (1992, p109) rejected the centrality of ethnicity as an independent variable in epidemiological research they acknowledged that "it would be foolish to suggest that all use of race and ethnicity as a biomedical or social research tool is misplaced". Sheldon and Parker (1992) suggested that careful consideration should be applied to the use of the ethnic terms in research. They also pointed out that research on ethnicity and health has potential socio-political implications and that attention should be applied to the likely impact of study findings (Sheldon and Parker, 1992).

Approaches to Researching Ethnic influences on Health.

The relationship between ethnicity and health has been examined by two main approaches, the dominant of which has been from an epidemiological or biomedical framework (Hillier and Kelleher 1995; p3). Bhopal (1997) pointed out that this research focuses either on the analysis of patterns of disease within and between populations (Senior and Bhopal, 1994), or on tracing disease variation with time, place and person to provide explanations for disease aetiology (Marmot 1989).

Smaje (1995) described a second approach to researching ethnicity and health that has recently emerged in the literature where meanings and interpretations of health related issues are investigated. Hillier and Kelleher (1995) argued that a qualitative approach is most suited to the examination of these influences. However Keats (1986) argued that the quantitative approach can also be applied to address important research questions on the meaning of health and the responses to illness for different ethnic groups.

Ethnic Groups in the UK.

Ethnic minority groups comprise approximately 6% of the UK population (OCPS 1993). Members of these groups are not evenly distributed across the UK and are more likely to be found in urban areas (OCPS, 1993). South Asians comprise 3% of the total UK population (OPCS, 1993) while up to 20% of local London populations have been identified as South Asian (Chaturvedi, Raj and Ben-Shlomo, 1994)

Distributions of ethnic groups within urban centres may also be uneven with higher concentrations of ethnic minority communities in particular geographic areas. Lambert and Sevak (in Hillier and Kelleher 1995) reported that the northwest of London has high concentrations of Gujerati South Asians and East London has high concentrations of Bangladeshi South Asians. Webster and Fox (in Cruickshank et al., 1989 p10-11) pointed out that the geographical distribution of ethnic groups largely reflects occupational factors where during initial migration phases areas were favoured which provided employment

opportunities in transport, engineering, labouring, metal manufacturing and wool and textile production.

Literature Review.

Although a number of research studies have examined the effect of various measures of culture on pain (e.g. Faucett et al,. 1994; Greenwald 1991; Koopman et al., 1984; Lambert et al., 1960; Lipton and Marbach 1984; Ng et al., 1996; Thomas and Rose 1991), chronic pain (e.g. Zborowski 1952; Bates and others 1994, 1995; Volinn 1997) and cancer pain (Calvillo 1991; Garro et al., 1990; Kodiath and Kodiath, 1995) relatively few of these studies have been on LBP (Honeyman et al., 1996; Sanders et al., 1992),. A literature search employing computerised datasets MEDLINE, CINHAL, PSYCLIT and HEALTHPLAN for the years 1960 to 2000 and employing the terms BACK PAIN and ETHNIC GROUPS or ETHNICITY, CULTURE, RELIGION or NATIONALITY revealed n>500 references. Inspection of titles and abstracts indicated that only n=7 studies directly addressed cultural influences on LBP (Honeyman and Jacobs 1996; Strassberg et al,. 1992; Sanders et al,. 1992; Tait et al., 1982; Carron et al., 1985; Brena et al., 1990; Strong et al,. 1995). These studies formed the basis of the literature review of the current chapter. The literature search did not uncover any research which examined cultural influences on Low Back Pain in a UK sample of patients. Some additional health related cross cultural work and reviews of the literature on chronic pain were also included in the review.

Early cross cultural studies on non western samples of LBP tended to focus on the degenerative processes of the spine (Fahrni and Trueman 1965; Anderson 1984). Fahrni and Trueman (1965) studied a sample of North Indian "forest-dwellers" and stated that although there was evidence of degenerative processes on the spine similar to that in the west, there was no evidence of LBP or disability per se. Anderson (1984) however suggested that prevelance rate of LBP in a sample of Nepalese patients was similar to that of Western Industrialised countries. However both these studies suffered from methodological flaws and firm conclusions on the basis of their reported findings are not justifiable.

A number of studies examined the cross cultural psychometric properties of measures of LBP. Strassberg et al., (1992) found evidence to confirm the factor structure of the Minesota Multiphasic Personality Inventory (MMPI) (Hathaway and McKinley 1983) in an Australian sample of LBP patients whereas Nelson et al, (1996) found significant inter-ethnic differences of MMPI correlations with the pain experience in a mixed ethnic group of North American chronic pain patients. Main and Waddell (1987) studied the cross cultural properties of the Illness Behaiour Questionnaire (IBQ) (Pilowsky and Spence, 1976) in a British sample of LBP patients. Their findings suggested that there may be important cultural influences on the factors structure of this questionnaire (Main and Waddell, 1987).

Swami et al., (1991) found evidence of a less distinctive factor structure of the McGill Pain Questionnaire (MPQ) (Melzack, 1975) in an Indian sample of chronic LBP patients. However they concluded that these findings may be related to linguistic factors rather than cultural differences in the experience of pain per se (Swami et al,. 1991).

Strong et al., (1994) developed the Integrated Psychosocial Assessment Model (IPAM), which incorporated a set of independent LBP assessment tools that had previously been developed in North American (Coping Strategies Questionnaire (Rosenstiel and Keefe 1983), Survey of Pain Attitudes (Jensen et al, 1987), Pain Disability Index (Tait et al., 1990), the Beck Depression Inventory (Beck 1979) Margolis Pain Drawing (Tait et al,. 1990) or Australian (IBQ, Pilowsky and Spense 1976) LBP or chronic pain samples. In a series of studies, Strong and others (1991, 1992, 1994) confirmed the psychometric properties of these questionnaires in an Austrialian sample of LBP patients. However Strong et al, (1995) found cross cultural differences when they attemped to replicated the IPAM model in a New Zealand sample of LBP patients. They suggested that New Zealand LBP patients were less likely to use pain coping strategies and had a lower belief in their ability to control pain than Australian LBP patients (Strong et al,. 1995).

Significant cross cultural differences were also found for control beliefs by Tait et al, (1982) who found evidence to suggest that New Zealand LBP patients had stronger beliefs abouth internal control than American LBP patients. These differences were apparent for one questionnaire item "only do what my doctor wants me to do", and were not specific to pain or LBP. This item is similar to the Pain Responsibility (PR) subscale of the Pain Locus of Control subscale (PLC) (Main and Waddell, 1991) which has been demonstrated to be associated with LBP disability and distress (Main and Waddell, 1991).

In subsequent work, Carron et al,. (1985) found evidence to suggest that compared to American LBP patients, New Zealand LBP patients reported less features of distress and LBP disability. However conclusions from these studies are limited as both patient groups were from highly selected mulitdisciplinary chronic pain clinics whose characteristics may have had significant cross cultural differences due to differences in local referral patterns (Waddell and Waddell, 2000). Furthermore Tait et al., (1985) did not provide evidence for the psychometric properties of the assessment tool that they employed.

Sanders et al,. (1992) found evidence to suggest that compared to American LBP patients, New Zealand LBP patients had fewer clinical findings. They also found evidence to suggest that American LBP patients demonstrated the highest levels of impairment compared to New Zealander, Mexican, Colombian, Italian and Japanese LBP patients (Sanders et al, 1990, Brena et al., 1990). However these study findings were only suggestive of cultural group differences as the group sizes in were small (n=10 per group). Firm conclusions from the Brena et al., (1990) and Sanders et al., (1992) studies were therefore limited.

Varma et al., (1986) reported that rural Indian chronic pain patients were more likely to present to a variety of clinics with more severe pain than urban Indian patients. No other socio-demographic data appeared to account for the observed differences, although other potential factors such as distance from the clinic and cost of treatments were not investigated (Varma et al., 1986).

Honeyman and Jacobs (1996) investigated LBP in a group of Australian Aboriginals in a qualitative investigation. They found that although there were few public displays of back pain, and a reluctance to discuss pain, on close questionning back pain appeared to be widespread. They concluded that back pain was not regarded as a health problem in this group of Aboriginals.

The paucity of avaiable literature on LBP in non-Western countires was highlighted by Volinn (1997) in a review of the LBP epidemiological literature in middle and low income countries. Volinn (1997) pointed out that much of the existing literature was conducted in high income countries, which comprise less than 15% of the world's population. Although comparisions between countries was difficult due to the low methodological quality of much of the available literature, Volinn (1997) concluded that LBP was less prevalent in middle and low income countries, and that there may be important differences between urban and rural populations. In earlier work, Volinn et al., (1988) also found significant differences in LBP disabilty rates between neighbouring counties in a single state of the USA.

The potential confounding effects of social factors on cultural influences were hightlighted by Svensson (1982), Eden et al., (1994) and Hewson et al., (1987) who found that ethnic differences in LBP could largely be accounted for by socio-economic factors related to immigrant status.

In a review of the literature on pain in South Asians in the UK, Njobvu et al., (1999) did not find a single published study which was designed to specifically investigate the report of musculoskeletal conditions by South Asians. An inspection of the literature indicated that ethnic group differences in the prevalence of other diseases have been studied in UK populations. For example Wild and McKeigue (1993) reported that prevalence rates for Ischaemic heart disease were 1.5 times higher for South Asians than for the general population. Differential prevalance rates were also found between immigrant Pakistanis and Pakistan resident Pakistanis (Lea Lawrence, Burden and Pohl, 1994). UK resident Pakistanis were also found to be 2.1 times more likely to report a variety of rheumatic complaints than Pakistanis resident in Pakistan (Hammed and

Gibson, 1997). An examination of differences in the attributional style of the causes of diabetes Sissons-Joshi (1995) found that Indian diabetic patients (primarily Hindu) were less likely to report a causal theory for their illness than English patients. Unlike their English counterparts a causal theory for diabetes was not associated with adjustment for Indian diabetic patients. Differences between UK resident South Asian and British subjects in their health-care-seeking behaviour were found by Chaturvedi, Rai and Ben-Shlomo (1997). Study participants were presented with a fictional case study and asked to describe what they would do if they had an attack of chest pain. Hindu and Sikh patients reported that they were more likely to be "very worried" about an such an attack and more likely to seek immediate medical attention than British patients. Although this finding suggests that South Asian patients are more likely to consult their GP than British born patients, there is also some evidence that South Asians are less likely to use hospital out patient services (Cooper et al., 1998).

Summary and conclusions of Cultural Influences on LBP.

Research on cultural influences on health is complicated by the operationalisation of culture. The most common method of measuring cultural influences is by examining ethnic differences. Once ethnic differences have been demonstrated, then cultural influences can be infered. Much of the available literature research on culture and health does not address operationalisations of culture such as Nationality or Religious influences.

The literature on cultural influences on LBP is sparse and often methodologically flawed. The review of the available literature indicated that although the psychometric properties of some measures of LBP had been exmained, much of the literature on cultual influences on LBP has failed to examine the cross cultural psychometric properties of the measures employed in the studies. Waddell and Waddell (2000) concluded from their review on cultural influences on LBP that the available literature was of little scientific value. The literature that is available suggests that cultural influences on LBP are likley to be mediated by behaviours, pain beliefs and coping strategies, although these influences may be confounded by social economic factors.

3.10 Summary and Conclusions of Literature Review.

LBP appears to be a common and benign health problem with serious economic and personal implications. The epidemiological literature suggests that approximately 25% of people will experience LBP during any one year period, and 60% to 70% during their lifetime. Disability also seems to co-occur with LBP, although this is not always the case and the reasons for this finding although not always clear, appear to by primarily psychological. The research also suggests that particular groups such as occupational or Social Class groups may be at risk for developing LBP and disability. Cross cultural studies have suggested that LBP may be associated with urbanisation and economic development, although changing attitudes and beliefs may be responsible in part for the observed increasing prevalence rates.

The reviewed literature suggests that there are a wide range of potential influences on LBP and LBP disability.

Physical influences have largely been studied in regard to their influence on the pain associated with LBP, whereas psychological influences have been examined in relation to LBP disability. The currently available evidence suggests that the main influences on the pain associated with LBP are largely unknown. The evidence suggests that degenerative spinal or disc changes do not account for a majority of LBP cases and models which emphasise the causal relationship between these processes and LBP do not provide a full account of the condition. The evidence for plastic neurophysiological changes as a cause of chronic LBP is, as yet, incomplete. The literature on biomedical influence on LBP also contains evidence for the importance of psychological factors.

Disability associated with LBP appears to be largely influenced by psychological factors, which appear to be more important than clinical or biomedical findings. The evidence also suggests that the influence of cognitive or behavioural factors are more important than personality factors. However the relationships between specific cognitive factors and psychological distress and LBP disability are currently unclear.

Although there is an abundant literature on ethnicity and health, research on the influences of cultural factors on LBP is largely absent from the literature. The literature that is available appears to be of low quality, is methodologically flawed and is of little scientific value. The influence of cultural factors on LBP is therefore to a large extent currently unknown.

3.11 Investigation Purpose, Research Questions and Hypotheses of the Current Investigation.

The current investigation aimed to examine cultural influences on factors identified as important factors associated with LBP and LBP disability.

Three studies were proposed to address this aim.

Study 1

Title.	An Investigation of a Model of LBP disability.
Purpose.	The purpose of the study was to investigate the relationships between clinical, social and psychological factors and disability associated with LBP.
Research Question.	What are the important factors for a LBP disability Model?
Hypotheses 1.1	1.1a. Social factors are significantly associated with LBP disability. 1.1b. Clinical factors are significantly associated with LBP disability 1.1c Psychological factors are significantly associated with LBP disability.
Hypothesis 1.2.	The strength of relationship between Psychological Factors and LBP disability is stronger than the strength of the relationship between either clinical or social factors and LBP disability.
Hypotheses 1.3.	1.3a Distress is significantly related to the LBP disability Psychological Factor.

1.3b Coping Strategies are significantly related to the LBP disability Psychological Factor .

1.3c Pain Beliefs are significantly related to the LBP disability Psychological Factor.

Hypothesis 1.4. The relationship between LBP Disability and Distress is mediated by Coping Strategies and Pain Beliefs.

Hypothesis 1.5 In the relationship between LBP Disability and Distress, Pain Beliefs mediate the Coping Strategies – Distress relationship.

Study 2.

Title. An Investigation of the Cross Cultural psychometric properties of self reported LBP measures.

Purpose. The purpose of the study was to examine the cross cultural psychometric properties of LBP self report measures.

Research Question. Do commonly employed self report measures which are used to assess patients with LBP have robust cross cultural psychometric properties?

Hypotheses 2.1. 2.1a The Roland and Morris Disability Questionnaire (RMDQ) (Roland and Morris 1983) provides reliable findings across different cultural groups.

2.1b The Modified Zung Self Rating Depression Scale (MZSRDS) (Main et al., 1992) provides reliable findings across different cultural groups.

2.1c The Modified Somatic Perception Questionnaire (MSPQ) (Main et al., 1992) provides reliable findings across different cultural groups.

2.1d The Catastrophising subscale (CAT) of the Coping Strategies Questionnaire (CSQ) (Rosenstiel and Keefe 1983) provides reliable findings across different cultural groups.

2.1e The Praying and Hoping subscale (P&H) of the Coping Strategies Questionnaire (CSQ) (Rosenstiel and Keefe 1983) provides reliable findings across different cultural groups.

2.1f The Pain Control (PC) subscale of the Pain Locus of Control Questionnaire (PLC) (Main and Waddell 1991) provides reliable findings across different cultural groups.

2.1g The Pain Responsibility (PR) subscale of the Pain Locus of Control Questionnaire (PLC) (Main and Waddell

1991) provides reliable findings across different cultural groups.

Hypotheses 2.2

2.2a The relationship between the Modified Zung Self Rating Depression Scale (MZSRDS) (Main et al., 1992) and the Roland and Morris Disability Questionnaire (RMDQ) (Roland and Morris 1983) is not significantly different across cultural groups.

2.2b The relationship between the Modified Somatic Perception Questionnaire (MSPQ) (Main et al., 1992) and the Roland and Morris Disability Questionnaire (RMDQ) (Roland and Morris 1983) is not significantly different across cultural groups.

2.2c The relationship between the Catastrophising subscale (CAT) of the Coping Strategies Questionnaire (CSQ) (Rosenstiel and Keefe 1983) and the Roland and Morris Disability Questionnaire (RMDQ) (Roland and Morris 1983) is not significantly different across cultural groups.

2.2d The relationship between the Praying and Hoping subscale (P&H) of the Coping Strategies Questionnaire (CSQ) (Rosenstiel and Keefe 1983) and the Roland and Morris Disability Questionnaire (RMDQ) (Roland and Morris 1983) is not significantly different across cultural groups.

2.2e The relationship between the Pain Control (PC) subscale of the Pain Locus of Control Questionnaire (PLC) (Main and Waddell 1991) and the Roland and Morris Disability Questionnaire (RMDQ) (Roland and Morris 1983) is not significantly different across cultural groups.

2.2f The relationship between the Pain Responsibility (PR) subscale of the Pain Locus of Control Questionnaire (PLC) (Main and Waddell 1991) and the Roland and Morris Disability Questionnaire (RMDQ) (Roland and

Morris 1983) is not significantly different across cultural groups.

Study 3.

Title. An Investigation of Cultural Influences on LBP.

Purpose. The purpose of the study was to examine the influence of cultural factors on the Biopsychosocial Model of LBP.

Research question. What are the cultural influences on the Biopsychosocial Model of LBP?

Hypotheses 3.

3.1 There are significant ethnic group differences in the experience of LBP.

3.2. There are significant country of birth group differences in the experience of LBP.

3.3 There are significant reported religious group differences in the experience of LBP.

Chapter 4.

Development of Methods

"If the study of pain in people is to have a scientific foundation, it is essential to measure it" (Melzack and Katz, 1992 p153)

4.1 Introduction to Development of Methods.

There is growing consensus in the literature that Low Back Pain (LBP) is a multi-dimensional construct consisting of a complex set of relationships, inter-relationships and interactions between biological, psychological and social dimensions (Waddell, 1998). The present study investigated:

1. A Model of LBP disability.
2. The Cross cultural psychometric properties of measures of LBP.
3. Cultural influences on LBP.

Measures, which assessed the Clinical, Social and Psychological dimensions of Low Back Pain, were reviewed so that the most appropriate could be employed in the investigation.

LBP assessment issues.

The literature describing measures for the assessment of patients with LBP is abundant and diverse (e.g. Waddell and Turk 1992; Polatin and Mayer 1992). Measures employing methodologies derived from qualitative and quantitative approaches are common and include structured (e.g. Philips et al., 1991), semi-structured (e.g. Honeyman and Jacobs 1996) and unstructured (e.g. Bowman 1993; Borkman et al., 1995; Tarasuk and Eakin 1994) interviews, behavioural observations (Keefe and Block 1982), self-reported questionnaires (e.g. Beck 1961; Roland and Morris 1983; Kerns and Turk 1985), functional examinations and tests (Strender et al., 1997), psychophysical (Flor et al., 1985) and anatomical or physical measures (Moneta et al., 1994, Beattie and Meyers 1998, Aprill and Bogduk 1992). The multi-dimensionality of LBP is also reflected in the available measures. Whilst many of these measures are directed at one aspect

of LBP (i.e. the Zung Self Rating Depression Scale (ZSRDS), Zung 1965) several multi-dimensional assessment tools have been developed where several single aspect measures are employed to assess one dimension (e.g. Kerns et al., 1985; Klapow 1993; Strong et al., 1994; Jamison et al., 1994, Main et al., 1992). A comprehensive assessment of the chronic pain patient was developed by Turk and Rudy (1987) and Rucker et al., (1996) where multiple dimensions of chronic pain were assessed by multiple measures.

Chronic Pain and LBP.

Research conducted on heterogeneous chronic pain samples has often included patients with LBP (e.g. Tota-Faucette et al., 1993; Gil et al., 1990; Dolce et al., 1986; Holzberg et al., 1993; De Gagne et al., 1995; Jensen, Turner and Romano 1994). This is particularly apparent in the literature on the psychological characteristics chronic pain (e.g. Wade et al., 1990; Burns et al., 1992; Asmundson and Taylor 1996; Gil, Keefe and Crisson 1987) and includes the development of assessment tools (e.g. Kerns and Turk 1985). The rationale for conducting research on patients with heterogeneous chronic pain complaints is often unclear and rarely explicitly stated but appears to be based on the assumption that different chronic pain conditions share psychosocial characteristics. Yet Turk and Melzack (1992) pointed out that it is unlikely that tools that have been developed on one chronic pain sample can be applied to another without examining its psychometric properties in the new sample.

Psychometric Properties.

Melzack and Katz (1992) regarded the most important requirements of an assessment tool to be reliability and validity. They also regarded usefulness of an assessment tool to be equally important. Streiner and Norman (1995) defined reliability as whether or not measurements obtained can be judged as providing results that are consistent, and validity as the extent to which the tool can be regarded as accurately measuring the target variable. Explicit tests of reliability and validity provide evidence for psychometric properties of the measure. The psychometric properties of a measure are not absolute but are assessed against a priori criteria where a tool is deemed to be sufficiently reliable or valid (Streiner and Norman (1995). The choice of a priori criteria is based on the purpose of the

assessment. Jensen and McFarland (1993) argued that a Numerical Rating Scale (NRS) for pain intensity with a reliability co-efficient of α=0.63 and validity co-efficient of r=0.74 may be appropriate for basic research purposes but may be inadequate for examining treatment effects or on which to base clinical decisions where individual changes in pain ratings over time are important. Streiner and Norman (1995 p7) acknowledged that the literature contains different recommendations for the minimum accepted level of reliability. However they suggested that internal consistency of a tool should exceed α=0.8 and stability measures greater than r=0.5. Alternatively McKennell (1970) argued that if an instrument has a Cronbach's Alpha (Cronbach 1951) score of α<0.6, the reliability of the instrument was questionable. Bland and Altman (1997) suggested that for research purposes Cronbach's Alpha values of between 0.7 and 0.8 could be regarded as satisfactory.

Although the psychometric properties of a measure are often reported during its development, it is not always the case that they are reported during its subsequent use. Often tools are used to assess patients with LBP with either inadequate or absent psychometric data (Carron et al., 1985; Szpalski et al., 1995; Jackson 1994; Linton and Warg 1993; Nagira and Aoyama 1979; Foppa and Noack 1996; Walsh et al., 1992; Weber et al., 1996; Sandstrom and Esbjornsson 1986).

The psychometric properties of a measure may depend on the characteristics of the sample on which the measure was developed. Bradley and Lindblom (1989) argued that it is generally preferable to develop a measure on a homogenous sample of patients and then to examine its psychometric properties in heterogeneous samples, thereby increasing its generalisability. Heterogeneity may be introduced into the sample by either varying the chronic pain conditions present or increasing the diversity of the demographic characteristics (i.e. ethnic group membership, sex, age or social economic status).

An inspection of the literature indicated that many of the available assessment tools had been developed on samples of patients with heterogeneous chronic pain conditions which often included a majority of LBP patients (e.g. Kerns et al., 1985; Jamison et al., 1988; Tait and Chibnall, 1997; McCracken et al., 1996;

Riley et al., 1988; Jensen et al., 1987; Anderson et al., 1995; Williams and Thorn 1989; Jensen et al., 1995; Kerns et al., 1997; Tait and Chibnall 1997; Williams et al., 1994; Schwartz et al., 1985; Shutty and DeGood, 1990; Jensen et al., 1992; Benjamin et al., 1991). However the diversity of the pain conditions present in these study samples varied widely making generalisation of their psychometric properties problematic.

Turk and Melzack (1992 p10) stressed the importance of examining a tool's psychometric properties in the relevant population of interest. They pointed out that it is not sufficient to assume that if an instrument has been demonstrated to have good psychometric properties in one population that it can be applied to another without an examination of those properties in the new population. Bradley and Lindblom (1989) argued that only relatively few measurement technologies can be applied across chronic pain conditions. Turk and Rudy (1990) examined this assumption in a group of 200 LBP, 100 Headache and 200 Temporo-mandibular Disorder (TMD) patients. They found that the LBP patients were more likely to report elevated pain intensity and disability scores than either Headache or TMD patients. LBP patients were also more likely to be classified as 'interpersonally distressed' as determined by the Multi-axial Assessment of Pain (MAP) classification taxonomy (Turk and Rudy, 1987) than the other two patient groups (Turk and Rudy 1990). However the relationships between the MAP factors for each of patient groups were statistically equivalent (Turk and Rudy, 1990). These results were interpreted to suggest that patients with different diagnostic conditions exhibit similar pain response patterns. However Turk and Rudy (1990) acknowledged that these findings may be a function of the choice of measures. It is conceivable that alternate structural relationships for each chronic pain group may have been detected if either different measures of the same constructs or measures of different constructs to those in the study had been used (Turk and Rudy, 1990).

Main and Waddell, (1991) examined the psychometric properties of four cognitive measures (Multidimensional Health Locus of Control (MHLC) Wallston et al., 1978; the Pain Locus of Control (PLC) Main and Waddell 1991; the Coping Strategies Questionnaire (CSQ) Crisson and Keefe 1988; the Pain

Related Self Statements and the Pain Related Control Statements (PRSS/PRCS) Flor and Turk 1988) in a sample of 120 LBP patients referred to an orthopaedic outpatient clinic. Their findings raised doubts over whether cognitive measures that had been developed in a particular subject group could be applied more widely without prior examination of their psychometric properties.

In light of these findings (Turk and Rudy, 1990; Main and Waddell 1991), it was concluded that there was not sufficiently strong evidence available to apply a measure developed on either a specific or a heterogeneous chronic pain population to an alternate or homogeneous chronic pain without prior examination of the measure's psychometric properties in the new population of interest.

There is some evidence that the psychometric properties of a measure may vary dependant upon either the cultural group characteristics or the geographical location of the sample on which the measure was developed (Patrick et al., 1985). Melzack and Katz (1992 p164) stressed the importance of cultural influences in the experience of pain in their definition of pain as "a personal, subjective experience influenced by cultural learning, the meaning of the situation, attention, and other psychological variables".

Much of the cross-cultural work on chronic pain or LBP has been directed towards describing cultural differences (e.g. Bates et al., (1993); Bates et al., (1995); Bates et al., (1994)). The psychometric properties of the measures employed in these cross-cultural investigations are rarely examined for the different groups (e.g. Carron et al., (1985); Sanders et al., (1992); Brena et al., (1990)), although this is not always the case (e.g. Strassberg et al., 1992). Reported cultural differences may be a function of the psychometric properties of the relevant measure in a culturally distinct sample. Bates et al., (1993) found that in a culturally varied group of chronic pain patients in the USA that Locus of Control (LOC) (Rotter 1966) style varied by reported ethnic group affiliation. However Bates et al., (1993) failed to report the psychometric properties of the LOC scale for the different ethnic groups. It was therefore unclear whether the measure employed by Bates et al., (1993) to assess LOC had cross culturally

robust psychometric properties. Bates et al., (1993) did not provide evidence that the items, which comprised the measure of LOC, were valid or reliable for the particular ethnic groups on which the study was conducted.

Evidence for the cross-cultural validity or reliability of a LBP assessment tool can be determined from research which has either directly and explicitly reported the psychometric properties in different cultural or ethnic groups (reliability), or from cross-cultural investigations where relationships between the multi-dimensional constructs of LBP have been examined (validity).

Generic depression measures have been employed for the assessment of LBP patients, the most common of which are the Beck Depression Inventory (BDI) Beck et al., 1961; the Zung Self Rating Depression Scale (ZSRDS) Zung 1965; the General Health Questionnaire (GHQ) Goldbeg 1973, and the Center for Epidemiological Studies – Depression (CES-D) Radloff 1977. Naughton and Wiklund (1993) conducted a selected review on cross-cultural applications of these measures and concluded that while there were clear similarities in the psychometric properties of the USA and European samples, the performance of these measures varied in Asian groups. Naughton and Wiklund (1993) concluded that the perception of depressive symptomology may be distinct in Asian populations. The studies reviewed by Naughton and Wiklund (1993) did not include either patients with chronic pain or LBP and therefore it remains unclear whether their findings of ethnic differences can be generalized to specific condition such as LBP. However research has suggested that the application of generic depression measures such as the BDI (Beck 1961) or the ZSRDS (Zung 1965) to chronic pain (Williams et al., 1993) or LBP (McAuley et al., 1999; Estlander et al., 1995) samples may result in novel psychometric structures.

Nelson et al., (1996) found that in the USA the inter-relationships between sub-scales of the MMPI differed significantly by ethnic group for patients with predominately chronic myofascial pain. However the authors acknowledged that their findings may be a function of the sample characteristics and that other factors such as social economic status factors may have confounded their results. Naughton and Wicklund (1993) also acknowledged that socio-economic

variables may have accounted for differences in depressive symptomology between USA and European samples over and above the effects of ethnicity.

Of the available multi-dimensional measures employed for the assessment of pain, the McGill Pain Questionnaire (MPQ, Melzack 1975) has been reported to be the most widely employed and intensively studied (Melzack and Katz 1992). The "Handbook of Pain Assessment" (Turk and Melzack 1992) devoted a chapter to the discussion of its development, psychometric properties and applications. Melzack and Katz (1992) cited several studies that confirmed its psychometric properties (Turk, Rudy and Salovey, 1985; Lowe Walker and McCallum 1991; Chen, Dworkin, Haug and Gerhig 1989; Pearce and Morley 1989). However these studies were conducted on samples from either the USA or the UK and do not provide evidence for the cross-cultural psychometric properties of the MPQ. In a recent study De Souza (2000) found ethnic differences in words and phrases employed to describe the pain associated with LBP. Pugh (1991) provided a taxonomy of "North Indian" pain descriptors which were largely located on an axis with end points of "fast" or "slow" and in which mind and the body were regarded as a holistic unit. Naughton and Wicklund (1993) reviewed the cross-cultural literature on the MPQ and concluded that most of the European non-English versions of the MPQ had at least similar dimensions to those of the original measure. However the development of an Arabic version of the MPQ (Harrison 1988) was more problematic with less agreement amongst the study raters of which of the 100 pain words were associated with the affective, sensory and evaluative categories. Naughton and Wicklund (1993) concluded that cross cultural comparisons of the MPQ (including its psychometric properties) were made difficult by cultural differences in the way that pain was perceived and verbalised. Swami et al., (1991) examined the factor structure of the MPQ in a sample of 100 Indian LBP patients and were unable to replicate Melzack's (1975) 3 factor solution of pain (sensory, affective, evaluative). Swami et al., (1991) findings support Pugh's (1991) conclusions that the sensory and affective dimensions of pain are indistinguishable for individuals from a North Indian culture.

The evidence on cross cultural adaptations of the MPQ suggested that this tool may be appropriate for some cross cultural investigations, particularly those which are conducted on European samples, but may be inappropriate for others such as North Indian (Swami 1991) or Arabic (Harrison 1988) samples. Similarly Butcher and Pancheri (1976 p.124) suggested that when using the MMPI in non-USA based populations "for populations with similar (to the USA) cultural backgrounds...the differences (between norms across countries) are likely to be very slight or irrelevant".

This evidence appears to suggest that cultures that are 'similar' (North American/English) present fewer psychometric problems for LBP assessment tools than cultures that are 'different' (North American/North Indian). However there are apparent difficulties in attempting to define "similar" and "dis-similar" in this context and therefore to describe what cultural elements contribute to "similarity" or "dis-similarity".

There is also some evidence that psychometric properties do not hold across cultures that may share some cultural elements such as language and religious backgrounds and sociopolitical environments.

The Integrated Psychosocial Assessment Model (IPAM) was developed on an Australian sample of LBP patients (Strong et al., 1995). A partial replication of the original IPAM clusters was found in a sample of New Zealand LBP patients (2 out of 3 of the original cluster were replicated) (Strong et al., 1995) indicating some cross cultural differences. However Strong et al.,'s (1995) findings may be a function of their choice of statistical methods. Cluster analysis is primarily an exploratory technique and not ideally suited to confirmation of structure (Tabachnick and Fidell 1996). Factors other than statistical or broad based cultural factors may also have been responsible for Strong et al.,'s (1995) findings (i.e. either model inadequacies or other sample characteristics). However failure to confirm the IPAM structure in a sample that could be regarded as sharing some cultural characteristics with the sample on which the model was developed, illustrates the difficulties of employing measures of LBP

in samples which diverge from the original sample without first examining the psychometric properties of that measure in the new sample.

Main and Waddell (1987) examined the psychometric properties of the Illness Behaviour Questionnaire (IBQ) (Pilowsky et al., 1983) in a sample of n=200 native British born LBP patients. They concluded that the original tool, which had been developed on an Australian sample of chronic pain patients, demonstrated major psychometric weaknesses when examined in the British sample. However it is unclear whether these weaknesses were related to the tool or the cross cultural differences.

The reviewed literature suggests that a cautious approach should be adopted towards the cross-cultural use of a LBP assessment tool. Whilst there appears to be some evidence that "similar" ethnic or cultural groups present fewer psychometric problems than "dissimilar" groups, there is currently no reliable method available for determining "similarity" or "dissimilarity". A cautious approach may include the selection of measures of LBP which had either been developed or psychometrically examined in the relevant population of interest or, if no such relevant measure is available, to examine the psychometric characteristics of a pre-existing measure in the new population sample.

In light of the available evidence it was concluded that a cautious approach to the evaluation of measures was indicated. Assessment tools of LBP that had been either developed on or had their psychometric properties examined in a British sample of patients with LBP were reviewed for their potential suitability for the present study.

A literature review was conducted to determine potential measures that assessed clinical, psychological, social and cultural dimensions of LBP.

A priori Criteria

Inclusion criteria

A measure was considered for inclusion in the study if it assessed dimensions of LBP that had been described in the Biopsychosocial Model of Low Back Pain (Waddell, 1992). All measures were therefore potentially included which assessed biomedical or clinical, psychological, social or cultural aspects of LBP. Both single and multiple measures of either single or multiple dimensions of LBP were also considered. A potential measure may have been designed specifically for use with LBP patients, developed on patients with other chronic pain conditions and adapted for use with LBP patients, or developed on non-pain samples and adapted for use and psychometrically examined in a LBP sample. Furthermore details of psychometric properties of the potential measure had to be available for a UK LBP sample. Practically therefore, published psychometric data had to be available on the development or subsequent testing of a measure in a UK sample of patients with LBP. The demand characteristics of the setting, in particular the limited time constraints (the entire test battery had to be completed in the busy waiting room of the doctor's surgery within a maximum of 30 minutes) dictated that a single measure of a single dimension of LBP had to be completed within a maximum of 10 minutes. Multiple measures of multiple dimensions had therefore to be completed within the maximum time available (30 minutes).

Exclusion criteria.

The demand characteristics of the study dictated that tools that required research assistant resources greater than the provision of general assistance (other than help with simple translation) or which required specialist training to conduct or score were excluded. General assistance in this instance referred to simple requests for help with word meanings including literal translations when required, instruction on completion of self-completed questionnaires including instruction on the use of response formats and assistance with reading if required. General assistance was not regarded as referring to full translations or readings of the questionnaires. Tests or measures that required specialist training or resources over and above that required by a routine examination were also excluded from the study. Effectively this led to the exclusion of tests that

required the assessment of psychophysical, anatomical, structural or functional measurements.

4.2 Results.

The results of the literature search revealed a number of potentially suitable measurement tools that assessed biological or medical (clinical), psychological and social aspects of LBP.

Measures of Clinical or Biomedical Influences on LBP.

Imaging

Imaging techniques that are not part of a routine physical examination in a Rheumatological back pain clinic were excluded from the study. This resulted in the exclusion of CT, MRI, and related investigations such as provocation discography techniques (Moneta 1994).

Physical examination

Polatin and Mayer (1992 p38) argued that functional quantification measures are an important component of a test battery in that they introduce objectivity into the clinical assessment of low back pain patients. A number of tests of physical function have been suggested for the evaluation of low back pain (e.g. Polatin and Mayer 1992; Strender et al., 1997), however the reliability of these tests has been generally found to be poor. Strender et al., (1997) pointed out that that this may be in part due to inadequate standardisation of technique or evaluation of results rather than the unreliability of the relevant test. Strender et al., (1997) examined the inter-rater reliability of a range of commonly performed physical examination tests (movement, posture and tenderness tests; sacroilliac and hip joint tests; muscle tightness tests; neurological tests and intersegmental tests). Their results suggested that even when using rather liberal statistical criteria (kappa > 0.4) the standardisation and interpretation of functional test measurement was only maximised by employing two highly trained physiotherapists. Even in this 'ideal situation' the inter-rater reliability of approximately half of the functional tests examined remained unreliable. In a

non-ideal situation (i.e. two physicians who had never worked together) significant inter-rater bias was found on all the physical functioning tests except reproduction of pain on flexion or extension. Strender (1997) concluded that many routine physical examination tests may be unreliable when not performed by highly, specially trained professionals who had been allowed sufficient time to standardise their techniques by working together.

The exclusion criteria of the present study precluded tests or assessments of LBP that required specialist training or interpretation over that included in a routine physical examination by a physician. In light of the reviewed evidence, functional tests were not included in the present study.

Pain location/extent

Jensen and Karoly (1992) argued that pain location and pain extent are important dimensions of the subjective experience of pain. They suggested that the pain drawing was the most widely employed tool for the assessment of pain location or extent. The relationship between characteristics of the pain drawing and psychological state (Ginzburg et al., 1988, Tait et al., 1990) or disability (Tait et al., 1990) has been examined in heterogeneous chronic pain and LBP samples. Although several scoring methods (Margolis et al., 1988) have been employed, generally the validity of the pain drawing in determining psychological distress has been questioned (Ginzburg et al., 1988; Tait et al., 1990; Parker et al., 1995). Similarly the relationship between the pain drawing and disability (Tait et al., 1990) in a chronic pain population with primarily low back pain has been found to be not significant (Tait et al., 1990).

For the assessment of the LBP, Waddell (1998) and Selim et al., (1998) suggested that pain that radiates distally to the leg may be an important diagnostic category. Spitzer et al., (1987) provided a simple LBP patient classification system based on the radiating pattern of the pain. In a review of the literature, Frank et al., (1998) argued that although few studies on low back pain defined their cohort in such terms, the Quebec Task Force classification (QTF) (Spitzer et al., 1987) may be useful for defining the level of impairment associated with LBP. McAuley et al., (1998) examined the Quebec Task Force

(Spitzer et al., 1987) classification system in a group of LBP patients and found that it had significant associations with disability. In more recent work Frank et al., (2000) examined the QTF (Spitzer et al., 1987) in a UK sample of LBP patients and provided further evidence for its validity. They concluded that it was a helpful descriptor related to both physical and psychological disability and handicap in employment (Frank et al., 2000). These findings provide evidence for the validity of the QTF (Spitzer et al., 1987) classification system as a measure of LBP impairment

Pain location or extent is regarded as important dimensions of LBP (Waddell, 1998). However there is no consensus in the literature on the most appropriate measure for these constructs. Important questions remain regarding the psychometric properties of the QTF classification system (Spitzer 1987) as a measure of impairment associated with LBP (McAuley 1998). However, partly due to the lack of available literature, it was concluded that this measure may be less controversial than the pain drawing.

Pain Intensity.

Turk and Melzack (1992,) argued that pain intensity was the most salient dimension of pain. They pointed out that the most common method for quantifying pain intensity is often by a single general rating where the patient is required to rate his or her usual level of pain intensity on a scale from 0 to 10 where 0 is equal to no pain and 10 the worst pain imaginable. Strong et al., (1991) reviewed the literature on pain intensity measurements and found descriptions of 22 pain intensity rating scales that have been used in clinical and research work. Although the psychometric properties of many of the measures were described in the literature, Strong et al., (1991) concluded that it remained difficult to compare the results due to a lack of consensus on the definition of terms, the use of heterogeneous or markedly different pain samples, the use of scales with different lengths or descriptor words or research conducted on small sample sizes. Strong et al., (1991) examined the psychometric properties of eight of the most common pain intensity measures (100mm Horizontal Visual Analogue Scale (VASH), 100mm Vertical Visual Analogue Scale (VASV), 6 point Behavioural Rating Scale (BRS), 4 point Verbal Rating Scale (VRS), 101

point Numeric Rating Scale (NRS), 11 point Box Scale (BS), 5 point Present Pain Intensity (PPI) and the ranked works Pain Rating Index (PRI) from the McGill Pain Questionnaire (MPQ) in an Australian sample of n=92 LBP patients. Their findings suggested that the NRS or the BRS were the most easily understood and most valid measures of pain intensity for patients with LBP (Strong et al., 1991).

Jensen and McFarland (1993) suggested that the most helpful or appropriate measure of pain intensity was a measure of "usual" as opposed to "current" pain intensity. Noting that many patients reported daily fluctuations in their pain intensity levels and that there was evidence that recall of past pain may be subject to recall bias (Linton and Gotestam, 1983), Jensen et al., (1993) studied the NRS pain ratings of 200 chronic pain patients (36% low back) to determine the sufficient number of ratings required to obtain an adequately reliable measure of usual pain intensity. Their results confirmed that increasing the number of pain assessments resulted in an increase in the reliability of the NRS. They also found that an 'adequate' level of reliability (stability co-efficient of >0.90) and good validity and internal consistency scores (>0.95) could be achieved by taking 3 assessments per day across 4 days. Increasing the number of assessments only marginally increased the reliability and validity co-efficients of the measure and fewer assessments resulted in an unreliable or invalid measure. A single rating of pain intensity was found to be the least reliable and valid measure of usual pain intensity. Jensen et al., (1993) acknowledged that although the general principle that increased numbers of assessments are likely to result in increased reliability (Cronbach, 1970) is likely to hold across different chronic pain populations, their specific findings may not generalise to other chronic pain patient groups. They suggested that replication of their study in these different samples was required. Jensen et al., (1993) concluded that a single rating of self-reported pain intensity was not a valid or reliable measure of usual pain intensity. However more recent evidence provided by Bolton (1999) in a recent study of n=200 LBP patients suggested that a single pain rating of "average pain" was strongly correlated with actual average (4 measurements of pain per day over a 7 day period).

Melzack (1975) argued that the major disadvantage of a pain intensity VAS or NRS was its assumption that pain is a uni-dimensional construct. Melzack and Katz (1992 p154) noted, "Although intensity is, without a doubt, a salient dimension of pain, it is clear that the word 'pain' refers to an endless variety of qualities that are categorised under a single linguistic label, not to a specific, single sensation that varies only in intensity". However there is no clear consensus in the literature on what these other dimensions of pain are (Turk 1989; Cleeland 1989). Gramling and Elliot (1992) suggested that the presence of these other dimensions may account for the variability in relationships between a single VAS and other measurements of the pain experience.

Williams et al. (2000) found some evidence in a study of n=78 chronic pain patients with multiple pain sites that patient responses to apparently simple pain ratings were made up of a series of complex pain experiences and responses that varied according to social and private context and patient expectations.

Due to the psychometric and conceptual difficulties with the assessment of pain intensity, it was concluded that a measure of pain intensity was not to be included in the present study.

Pain Duration.

The length of time that a patient reports symptoms of LBP has been shown to be important for the assessment and treatment of the patient (Frank et al., 1998). Frank (1993) argued that there were two main ways of describing pain duration; as a continuous variable measured in days, weeks, months or years, or as discrete categories such as acute, sub-acute, chronic or acute on chronic. There is no consensus in the literature on the precise definition of the pain duration categories, however Vasudevan (1992) differentiated between acute and chronic pain by suggesting that *acute pain* should be regarded as 'biologically meaningful, useful and time-limited' and *chronic pain* as pain that lasted 'beyond the usual healing period'. Frank (1993) specified the duration of *acute pain* as lasting less than 7 days, *sub-acute pain* as more than 7 days but less than 3 months and *chronic pain* as 3 months or more. Three months is commonly employed as the threshold for the definition of CLBP (Strong et al., 1994;

Gronblad et al., 1993). However, Turk and Melzack (1992) criticised this approach. They argued this approach implied a continuum and is therefore inadequate as it does not include acute recurrent pain, pain associated with progressive illness, or laboratory induced pain. They suggested five discrete categories of pain (acute, acute recurrent, chronic, chronic progressive and laboratory-induced).

The present study measured duration of LBP by 2 methods; absolute duration in years and Chronic, acute or acute on chronic (Frank 1993).

Co-morbidity.

A number of studies have demonstrated that LBP is often not a discrete clinical problem but is also associated with other clinical conditions (e.g. Svensson et al., 1983). Makele (1993) reported the common co-occurrence of chronic musculoskeletal pains, suggesting that low back pain was often associated with neck pain and osteoarthritis of the hips and knees. Frank et al, (2000) also found that musculoskeletal co-morbidity was common in a LBP secondary care clinic.

The presence of a co-morbidity that was assessed as likely to affect management by the clinician was documented in the present investigation.

Measures of Psychological Influences on LBP.

An inspection of the literature indicated that a wide and diverse range of psychological measures have been used for the assessment of LBP. Some of these measures have been developed on non-pain populations and used in chronic pain samples (e.g. Minnesota Multiphasic Personality Inventory (MMPI) Hathaway and McKinley 1983) or adapted for use with LBP patients (e.g. Modified Somatic Perception Questionnaire (MSPQ) Main 1983). Other measures have been developed specifically for the assessment psychological aspects of chronic pain (e.g. Survey of Pain Attitudes (SOPA) Jensen et al., 1987; Pain Beliefs and Perceptions Questionnaire (PBPI) Williams et al., 1989) or LBP patients (e.g. Pain Locus of Control (PLC) Main and Waddell, 1991; Coping Strategies Questionnaire (CSQ) Rosenstiel and Keefe, 1983).

Self report measures are used widely for the assessment of psychological factors of LBP, although other methods such as clinical interview (The Structured Clinical Interview for DSM-IV Axis I Disorders (SCID) First et al., 1997) or observational methods (Keefe and Block 1982) have also been used.

Assessment of Psychopathology.

Psychological or psychiatric interviews such as the Diagnostic Interview Schedule (DIS) (Helzer and Robins, 1987) or the Structured Clinical Interview for DSM-IV Axis I Disorders (SCID) (First et al., 1997) used by Bishop et al., 1993) required specialist knowledge or training to conduct and interpret. Weisberg and Keefe (1997) also pointed out that in many cases semi structured interviews took up to 5 hours to administer and score. Semi structured psychological interviews that required specialist knowledge to conduct or interpret were therefore not included in the present study.

Assessment of Pain Behaviour.

Although the assessment of pain behaviour has been demonstrated to be salient for the evaluation of chronic low back pain patients (Keefe and Block 1982) and chronic pain patients (Romano et al., 1988), most currently available methods for the assessment of pain behaviour include an observational component (Keefe and Williams 1992). Keefe and Williams (1992) pointed out that the available published reports usually provide only a brief description of the observational methods used and generally fail to provide detailed information on either the basic features of these methods or the procedures used for recording or scoring the pain behaviours. Furthermore, Keefe et al., (1982) argued that practical difficulties of the assessment of pain behaviours that include cost and availability of training may preclude their use in the routine assessment of chronic low back pain patients.

Assessment of Personality Influences.

The Minnesota Multiphasic Personality Inventory (Hathaway and McKinley 1983) has been commonly employed for the assessment of personality factors in LBP (e.g. Waddell et al., 1979; Hansen et al., 1995; O'Farrell et al., 1993; Riley and Robinson 1998; Strassberg et al., 1992; Chapman and Brena 1990; Main et

al., 1992; Turk and Rudy 1990; Lawson et al., 1990). Other personality measures such as the Illness Behaviour Questionnaire (IBQ) (Pilowsky and Spence 1983), or the Eysenck Personality Inventory (EPI: Eysenck and Eysenck 1964), (e.g. Klaber Moffett et al., 1993; BenDebba et al., 1997; O'Farrell, Tate and Aitken 1993) have also been employed for the assessment of LBP patients, although less commonly. The psychometric properties of the MMPI have been widely studied and generally reported to be good. However the predictive validity of this measure has received some criticism with some researchers finding little association between MMPI profiles and outcome (Main and Spanswick 1991) and others finding novel MMPI clusters for LBP patients (Costello et al., 1987). There may also be cultural considerations with the use of the MMPI (Strassberg et al., 1992) and Main and Spanswick (1991) argued that routine assessment of personality structures does not assist clinical management of LBP patients.

Therefore tools that assessed Personality factors were not included in the present investigation.

Assessment of Psychological Distress.

The assessment of negative emotions associated with LBP and chronic pain has included the assessment of symptoms of depression, anxiety and anger (Fernandez and Turk 1995). Of these measures of psychological distress, depression has been the most widely studied (Romano and Turner 1985). Two of the most commonly used self reported questionnaires for the assessment of depression or depressive symptoms of LBP patients are the Beck Depression Inventory (BDI) (Beck 1979) and the Zung Self Rating Depression Scale (ZSRDS) (Zung 1965). These measures were developed on psychiatric populations and validated for use with chronic pain patients (Beck 1979; Zung 1965). Turner and Romano (1984) concluded that on the basis of their psychometric properties it was difficult to choose between the BDI and the ZSRDS. However although recently some research has suggested that there may be factor structure and validity problems with these questionnaires (Estlander et al., 1995; McAuley et al., 1998; Williams and Richardson), the ZSRDS has been employed widely to assess depressive symptoms of British samples of LBP

patients (e.g. Main and Waddell, 1992; Burton et al., 1995; Greenough et al., 1992; Hope and Forshaw 1999), whereas the BDI has primarily been employed to assess depression and depressive symptoms in heterogeneous British chronic pain populations (e.g. Williams et al., 1995). The psychometric properties of the BDI have been examined in an Indian population of CLBP patients (Swami et al., 1991).

Symptoms of anxiety related to chronic pain have been examined using the Speilberger Trait Anxiety Index (Spence and Sharpe 1993) or the Pain Anxiety Symptoms Scale (Larsen et al., 1996). However research on LBP has suggested that specific rather than general types of anxiety are important for the assessment of LBP (Main and Waddell 1992; Waddell et al., 1993). Main (1983) developed the MSPQ in a UK sample of LBP patients. This questionnaire assesses somatic concern, which is usually regarded as particular type of anxiety common in LBP patients and often associated with poor outcome (Main 1983; Main and Waddell, 1992). Recent applications of psychological theories of anxiety to LBP (Phillps et a., 1987; Waddell et al., 1993; Asmundson et al., 1996; 1997) have resulted in the development of a number of self reported instruments that assess the Fear-Avoidance construct (Phillips et al., 1987; Waddell et al., 1993; Vlaeyen et al., 1995; McCracken et al., 1996). However much of the work on this construct was developed subsequent to the design of the present investigation and therefore they were not included.

Although Fernandez and Turk (1995) reported that the Multidimensional Anger Inventory (Siegel 1986) has been used to assess the distress of chronic pain patients, this concept has received less attention in the literature on chronic pain and LBP (Fernandez and Turk 1995).

Psychological distress associated with LBP was assessed in the present investigation by a modified ZSRDS (Main et al., 1992) and the MSPQ (Main 1983).

The Assessment of Pain Beliefs.

Following the application of cognitive-behavioural techniques to the management of chronic pain (Turk et al., 1983) a number self reported questionnaires that assessed beliefs or cognitions of chronic or LBP patients were developed (e.g. Lefebvre 1981; Schwartz et al., 1985; Jensen et al., 1987; Riley et al., 1988; Williams and Thorn, 1989; Main et al., 1991).

Lefebvre (1981) developed a questionnaire that assessed some of the common cognitive errors made by chronic pain patients (Cognitive Errors Questionnaire (CEQ) Lefebvre 1981). Smith et al., (1986) found that cognitive distortion was associated with depression in a group of LBP patients. However Moreno et al., (1991) questioned its' internal structure and Main and Waddell (1991) concluded that there was limited evidence available on its psychometric properties.

Specific beliefs about control for LBP patients have received particular attention (Main and Waddell, 1991) and questionnaires that assess pain beliefs often include items that assess beliefs about control (e.g. Rosenstiel and Keefe, 1983; Jensen et al., 1987). Main et al., (1991) and Flor et al., (1993) developed dedicated control belief questionnaires (Pain Locus of Control scale (PLC) (Main and Waddell, 1991) and the Pain Related Control Statements (PRCS) (Flor et al., 1993). The psychometric properties of the PLC and the PRCS were examined and compared in a study of LBP patients (Main and Waddell, 1991). Main and Waddell (1991) concluded that the PLC had robust psychometric properties and that it provided useful information of the beliefs of LBP patients.

Although questionnaires which assess the Pain Belief of chronic and LBP patients have been developed and reported in the literature (e.g. Schwartz et al., 1985; Jensen et al, 1987; Williams and Thorn 1989; Riley et al., 1987) their psychometric properties have been largely examined in North American (e.g. Slater et al., 1991) or Australian samples (Strong et al., 1992). However other than one recent study (Morley and Wilkinson, 1995) which examined the psychometric properties of the Pain Beliefs and Perception Inventory (PBPI) (Williams and Thorn 1989), these questionnaires have received scant attention in research on British samples of LBP patients to date.

Pain beliefs were assessed in the present investigation by the PLC (Main and Waddell, 1991).

Assessment of Cognitive Coping strategies.

A number of self report questionnaires have been used to assess frequency of cognitive coping strategies (Jensen et al., 1991). Main and Waddell (1991) reported that the most widely used tool for assessing cognitive coping strategies was the Coping Strategies Questionnaire (CSQ) (Rosenstiel and Keefe, 1983) which was developed specifically for the assessment of coping strategies associated with LBP. The CSQ includes 7 sub scales: diverting attention, reinterpreting pain sensations, use of coping self statements, ignoring pain sensations, praying and hoping, catastrophising and increasing activity levels. Two additional items included in the questionnaire ask patients to rate their ability to control and decrease their pain (Rosenstiel and Keefe, 1983). The factor structure of the CSQ subscales has been examined and found to vary across chronic pain samples (Tuttle et al., 1991; Swartzamn et al., 1993; Riley et al., 1997). Researchers have therefore examined the utility of the individual rather than composite subscales (Dozois et al, 1996). However not all CSQ subscales have been found to have robust psychometric properties. Main and Waddell (1991) examined the psychometric properties of the CSQ in a British sample of LBP patients and concluded that may of the subscales had low reliability and validity. However they provided evidence that CSQ Catastrophising subscale had good stability and validity coefficients. Dozois et al., (1996) and Jensen et al., (1992) confirmed these findings in a North American sample of LBP patients and chronic pain patients. Although the Praying and Hoping subscale was not related to disability in chronic pain samples (Lawson et al., 1990; Jensen et al., 1992) Dozois et al., (1996) found evidence to suggest that the Praying and Hoping subscale was associated with disability for a North American LBP sample and Burton et al., (1995) found that this subscale was predictive of disability at one year for a British sample of LBP patients.

Cognitive coping strategies were assessed for the current study by the Catastrophising (CAT) and Praying and Hoping (P&H) subscales of the CSQ (Rosenstiel and Keefe, 1983).

The Assessment of Disability.

Disability associated with LBP is commonly assessed by self report measures of activities of daily living (Waddell and Turk, 1992). Several self report measures have been developed and employed for the assessment of disability (e.g. Oswestry Disability Scale (OSW) (Fairbank et al,. 1980), Roland and Morris Disability Questionnaire (RMDQ) (Roland and Morris, 1983; Pain Disability Index (PDI) Tait et al., 1990). Some of these questionnaires have been developed for chronic pain populations (PDI) and others specifically for the assessment of disability associated with LBP (RMDQ and OSW). Initial work on the RMDQ indicated that it was a sensitive and reliable measure of disability in patients with LBP (Roland and Morris 1983). In reviews of the literature Deyo (1988) and Beurskens et al., (1995) concluded that, compared to other disability questionnaires, most was known on the psychometric properties of the RMDQ and the OSW and that they had similar psychometric properties. Stratford et al., (1994) concluded that the RMDQ was more responsive than the OSW in sample of Canadian LBP patients. Guyatt et al., (1987) proposed an alternate method for assessing disability of LBP patients where the severity of the main complaint was assessed. This method had most often been used for the assessment change during clinical trials (e.g. Beurskens et al., 1995; Koes et al., 1992). However in a direct comparison of the responsiveness of the OSW, the RMDQ, and the severity of the main complaint Beurskens et al., (1995) concluded that the OSW was not as responsive as the RMDQ and the severity of the main complaint was not as sensitive as the RMDQ. Wiesinger et al., (1999) also adapted the RMDQ for use with German speaking LBP patients and reported that the German language version of the RMDQ had good psychometric properties.

LBP Disability was assessed in the present study by the RMDQ (Roland and Morris 1983).

The Assessment Social Factors.

A variety of social influences on LBP, incorporating a range of variables, have been reported in the literature (Waddell and Waddell 2000). These factors are often used for descriptive purposes only (e.g. marital status; Sandstrom 1986; Kerns et al., 1997; Lehmann et al., 1993). The main social influences on chronic pain and LBP that have been studied include: work related influences such as job perceptions (e.g. Fishbain et al., 1995; Rosomoff et al., 1995; Fishbain et al., 1997) and employment status (e.g. Jackson et al., 1998) or Family and Social Support influences (Turk et al., 1987) which include social support (e.g. Gill et al., 1987; Trief et al., 1995) and spouse solicitousness (e.g. Lousberg et al., 1992; Romano et al., 1995; Saarijarvi et al., 1990). Family influences including social support and spouse solicitousness have been assessed using a variety of methods including behavioural observations and self report. Turk et al., (1987) criticised the methodology of much of the research on family influences on LBP and suggested that there were severe measurement problems with the methods that had been used in much of the research. In a review of the literature, Waddell and Waddell (2000) pointed out that Social Economic Status had also been employed to measure social influences on LBP and disability. This factor has been assessed in a number of ways including years in education (Foppa and Noack 1996; Burns et al., 1995), employment or job characteristics (Foppa and Noack 1996; Roland and Morris 1983), or Social Class (Walsh et al., 1992).

The present study used the Standard Occupational Classification Volumes 1 & 3 (1990) to determine the Social Class of each patient from his or her self reported current or previous (if currently out of work) occupation.

The Assessment of Culture.

The literature on LBP often reports frequencies of ethnic or racial groups that have included in the study sample, however it is often difficult to determine how this data was derived as a description of the measure is usually not included in the report (e.g. Main and Waddell, 1991; Waddell et al., 1993; Burton et al., 1995; Kerns et al., 1997). Spector (1985) described a method for the assessment of culture that was employed by Bates and others (1993, 1994, 1995) in a series of studies examining cultural influences on chronic pain. Spector (1985) argued

that "Heritage Consistency" could be measured by 12 factors that were regarded as indicating the extent to which a person had been acculturated into the host community. These items ranged from whether or not the childhood development had occurred within the country of origin or an immigrant neighbourhood of like ethnic group, to possession of knowledge of the culture and language of origin and elements of pride about heritage. However there are no published data on the validity or reliability of this method. Furthermore Bates et al., (1993) suggested that it was time consuming for the respondent and there were no clear guidelines for interpretation of results. Other researchers have employed simpler methods for determining ethnicity. Nicoll et al., (1986) found that a classification system based on first and second Asian names had a high reliability and specificity. Nicoll et al., (1986) also suggested that it may be possible to identify sub-groups within the South Asian ethnic group with this method. However it is unlikely that this method is valid for ethnic groups other than South Asian i.e. Afro-Caribbean. Nicoll et al., (1986: p367) concluded, "this technique is of minimal value beyond the Asian population".

Senior and Bhopal (1994) and Bhopal (1997) pointed out that the current preference in the UK for assessing cultural influences on health is by the self-assessment of ethnicity. In 1995 the UK Department of Health introduced mandatory collection of ethnic group data on all hospital inpatients (Aspinall, 1995). The classification scheme was derived from the categories used in the 1991 UK Census (Sillitoe and White, 1992), although these categories have had a controversial history (Bulmer 1986). Aspinall (1995) pointed out that in the 1991 UK Census 25% of people from ethnic groups other than "white" expressed a desire to self describe their ethnic group by using the free text field.

McAuley et al., (1996) questioned the reliability of self defined ethnic group to investigate the impact of cultural differences on health and suggested that other variables such as religion, languages spoken, country of origin and length of residence in the UK should be employed.

The present investigation used free text fields to determine self defined ethnic group, religion and nationality.

Conclusion of Development of Methods.

The measures of LBP included in the present study are presented in table 4.1

Table 4.1 Measures of LBP included in the Study

LBP Factor	*Measure*	*Acronym*	*Reference*
Clinical	Quebec Task Force Classification	QTF	Spitzer et al, 1987
	Duration of LBP	Duration	Frank 1993
	Chronic or Acute LBP	Chronic LBP	Frank 1993
	Co-morbidity	Co-morbidity	Frank et al., 2000
Social	Social Class	SC	Standard Occupational Classification Volumes 1 & 3, (1990)
Culture	Self defined Ethnic group	Ethnic group	McAuley et al., 1996
	Self defined Religion	Religion	McAuley et al., 1996
	Self defined Nationality	Nationality	McAuley et al., 1996
Disability	Roland and Morris Disability Questionnaire	RMDQ	Roland and Morris, 1983
Psychological Distress	Modified Somatic Perception Questionnaire	MSPQ	Main et al., 1992
	Modified Zung Self Rating Depression Scale	MZSRDS	Main et al,. 1992
Coping Strategies	Catastrophising subscale of the Coping Strategies Questionnaire	CAT	Rosenstiel and Keefe, 1983
	Praying and Hoping subscale of the CSQ Coping Strategies Questionnaire	P&H	Rosenstiel and Keefe, 1983
Pain Beliefs	Pain Control subscale of the Pain Locus of Control	PC	Main and Waddell, 1991
	Pain Responsibility subscale of the Pain Locus of Control	PR	Main and Waddell, 1991

4.3 Development of Statistical Methods.

Aim of the Statistical Analysis.

The aim of statistical analysis for the present study was to:

1. Screen the data prior to the main analyses.
2. Provide a description of the study sample.
3. Investigate the relationships between independent variables and self-reported disability.
4. Provide evidence for the cross-cultural psychometric properties of a range of measures employed for the assessment of LBP.
5. Examine the cultural influences on the experience of LBP.

Issues related to Data Screening (accuracy of data input, missing data, normality, outliers) examination of psychometric properties (reliability and validity) and multivariate statistical tests (multiple regression) are reviewed below. A method for statistical analysis of the present study is outlined.

4.4 Data Screening.

The reliability of a statistical analysis is predicated on the data meeting a range of underlying assumptions required by the particular statistical test used. Most of these assumptions are well known and uncontroversial. Tabachnick and Fidell (1996) referred to the process of examining the data against these assumptions as "Data Screening" and for the present study the data was screened according to the method outlined by Tabachnick and Fidell (1996).

Accuracy of the Data Set.

The data file was examined to determine the accuracy of the data set in relation to how it was recorded in the raw data.

The hospital notes of patients who met the exclusion criteria were inspected to confirm their exclusion from the study.

For all patients potentially included in the study the accuracy of data input was tested by inspecting descriptive statistics, frequency tables and plots (Tabachnick and Fidell, 1996). Minimum and maximum values, means and standard deviations of continuous variables were also inspected for out of range values and plausibility. Furthermore n=25 (5%) self completed questionnaires and their associated clinical interview forms were identified by random number tables, proof read and compared against their record in the data file to test the of accuracy of data input.

Missing Data.

Recent developments in the theory of statistical analyses with missing data (Graham and Hofer 1989) and in the accessibility of computer software for conducting these analyses (Schafer 1997) has increased the choice missing data strategies to the researcher.

A discussion of the main issues that require addressing for the choice of an appropriate missing data strategy is provided in Appendix A (pages i-vi). Patterns of missing data are described along with their implications for the statistical analysis and the main currently available missing data methods are reviewed.

Missing Data Considerations.

Where the missing data analysis indicated that the number of cases with missing data was >15 (Cohen and Cohen 1983), and there was evidence that the data were not Missing Completely At Random (Little and Rubin 1987), the increased statistical efficiency over complete case analysis, available case analysis, mean substitution and regression methods (Appendix A) indicated that the Expectation Maximisation (EM) (Little and Rubin 1987) approach for handling missing data (Little and Rubin 1987) was the most appropriate method for handling missing data in the present study.

Normality

Skew and Kurtosis were computed for each quantitative variable. Tabachnick and Fidell (1996) suggested conventional and conservative alpha levels of

p=0.01 or p=0.001 were employed for the evaluation of significance with small to moderate sized samples. Probability plots for significantly skewed or kurtotic variable were also examined (Tabachnick and Fidell, 1996).

Transformations.

If a distribution is significantly skewed Tabachnick and Fidell (1996) argued that unless there is some compelling reason not to transform the variable, then it is better to transform it. However they acknowledged that some linear combinations of normally distributed variables may not conform to normality. In this instance an examination of residuals from the multiple regression can be inspected to determine multivariate normality.

A variable with a non-normal distribution that was indicated by significant skew or kurtosis was assessed against the following a priori criteria to determine suitability for transformation. A significantly skewed or kurtotic variable was transformed if it was:

1. not meaningfully scaled and a transformation was not likely to hinder interpretation.
2. not a substantive research variable which was directly addressed by the study research questions.

Outliers

Generally outliers are problematic for a statistical analysis as they exert undue influence on the solution.

Univariate Dichotomous Outlier Variables.

Tabachnick and Fidell (1996) suggested that as a rule of thumb, variables with a case split of greater or equal to 90% to 10% should be considered for elimination from statistical analyses. They pointed out that truncated correlations co-efficients can be produced with unevenly split variables where the scores in the 10% category are likely to be more influential in the solution than the scores in the 90% category (Tabachnick and Fidell 1996).

Univariate Continuous Variable Outliers.

Tabachnick and Fidell (1996) suggested that cases with standardised scores (z) greater than z=3.29 ($p<0.001$) should be considered outliers. However they noted that in large samples some standard scores greater than z=3.29 are to be expected.

Multivariate Outliers.

Mahalanobis distance values were obtained through a multiple regression run (dummy DV = Subject number and IVs = all other potential variables (table 4.i page 86). Values greater than the critical value were defined as multivariate outliers (Tabachnick and Fidell, 1996).

Tabachnick and Fidell (1996) suggested that the treatment of outliers should be guided by the Cook's D statistic which determines the impact on the solution of a regression run (with a dummy dependent variable) of excluding any of the multivariate or univariate outliers from the analysis.

To determine the influence of a multivariate outlier in the present data set, Mahalanobis distance scores were calculated to identify potential outliers and Cooks' leverage statistics were calculated and evaluated to determine the influence of such cases on the dummy regression run. Cases with large statistics were considered candidates for exclusion.

4.5 Reliability and Validity of the self report Psychological and Disability Questionnaires.

Reliability.

The internal consistency of the psychological (MSPQ, MZSRDS, P&H, CAT, PC and PR) and disability (RMDQ) questionnaires was examined for the total sample and each cultural group using Cronbach's Alpha (α) (Cronbach 1951) statistic. This statistic assesses the extent to which the individual items of the questionnaire are correlated with each other and therefore whether they are

measuring the same construct. High correlations among the items indicate that the measure is likely to be measuring the same construct and that it will yield consistent results. Dworkin and Whitney (1992) suggested that generally acceptable levels for internal consistency measures should be approximately α=0.85, although they pointed out that it may be difficult to achieve these higher values when assessing pain at the level of dysfunctional behaviours. A questionnaire was regarded to have sufficient internal consistency with Cronbach's Alpha scores greater than α=0.7 (Bland and Altman 1997).

Validity.

Dworkin and Whitney (1992) argued that the most common method for determining the validity of a measure is to compare the scores on the measure under investigation to external criteria or standards.

For the purposes of the present investigation, the cross cultural validity of the psychological questionnaires was examined according to the method outlined by Cohen and Cohen (1983). The RMDQ was defined as the criterion measure and evidence for the cross cultural validity of psychological measures was obtained by regressing the RMDQ on interactions of psychological variables and cultural group variables. A non significant finding indicated that the psychological questionnaires functioned similarly for each cultural group. A statistically significant finding indicated that the cross cultural validity of the measures was questionable.

4.6 Statistical Tests

The substantive research questions of the present study explored relationships between two or more variables: specifically the relationships between several independent variables or sets of independent variables and a single dependent variable. There are a variety of widely available methods for assessing the strength of relationship between variables (i.e. canonical regression, multiway frequency analysis, structural equation modelling), however Tabachnick and Fidell (1996) suggested that when a single dependent variable is measured on an interval scale the most appropriate set of statistical techniques is multiple

regression, a general data analytic system. Furthermore Cohen and Cohen (1983) demonstrated the generality of multiple regression techniques and pointed out that other common multivariate statistical techniques such as the Analysis of Variance (ANOVA) are special cases of multiple regression.

Multiple regression.

Cohen and Cohen (1983 p4) described multiple regression is "a versatile, all purpose system for analysing the data of the behavioural, social and biological sciences and technologies". Its generality and flexibility make it suited to examining relationships between a single quantitative dependent variable and any other independent variables of interest. Multiple Regression is the multivariate extension of the bivariate regression and takes the form of the general regression equation ($y=ax_1+bx_{2+...}+c$) where an estimation of scores on a single dependent variable (y) are predicted from a linear combination of more than one independent variables (x_1, x_{2+} ...), plus a constant (c) (Tabachnick and Fidell, 1996). The errors (or the sum of the squares of the errors in estimation) are minimised by the Least Squares criterion which produces the best possible estimate of the dependent variable (Cohen and Cohen 1983).

The study hypotheses explored the simple, complex or interactive relationships between a range of quantitative and qualitative independent factors and a series of quantitative dependent variables. The following sections describe aspects of the regression yield that were suited to addressing these hypotheses.

Type of information.

Multiple regression is not constrained by the type information represented by the research factor(s) under investigation. Information in the form of nominal (qualitative) scales or interactions (conditional relationships) among research factors can be expressed as sets of quantitative variables (Cohen and Cohen 1983). Research factors, expressed as functional sets of variables, are the primary units of analysis in multiple regression.

Qualitative independent variables.

A number of variables chosen for the present study, such as ethnic group affiliation, social economic group etc., were qualitative, form discrete categories and are therefore most appropriately measured at the nominal level (Stevens 1951). Cohen and Cohen (1983) demonstrated that in the general form of multiple regression, qualitative scales (Stevens 1951) can be represented by three methods of coding: dummy variable coding, contrast coding and nonsense coding. Although each is statistically equivalent, Tabachnick and Fidell (1996) pointed out that the most common method of representing qualitative data in multiple regression is by dummy variable coding.

Partialling.

Partial coefficients (correlations and Beta weights) can be determined for the subset of data in which the other independent variables do not vary (Cohen and Cohen 1983). Partialling procedures can be generalised to functional sets of variables and were used in the present study to statistically control irrelevant or spurious sources of variance and to represent interactions and the analysis of particular contrasts among means. Partialling procedures have been referred to as "control" (Cohen and Cohen, 1983) or 'co-variate' analyses (Tabachnick and Fidell, 1996).

Residuals.

Inspection of the residuals of a regression run can determine whether the data meets the assumptions of the statistical test e.g. absence of multivariate outliers required by the multiple regression (Tabachnick and Fidell, 1996).

Effect Size.

The strength of the relationship between the independent variables and the dependent variable can be determined by the R^2 statistic. R^2 is a standardised measure of the amount of variance in the dependent variable which is shared with or accounted for by the independent variables (Cohen and Cohen, 1983, Tabachnick and Fidell, 1996). R^2 Change is the amount of unique variance accounted for in the dependent variable by the addition of an independent or set of independent variables, over and above the variance accounted for by those variables already in the model.

Interactions.

Although the general linear equation dictates that relationships between the independent variables in multiple regression are linear, Cohen and Cohen (1983) pointed out that in the general case the *form* of the independent variables is unconstrained. An interaction, the cross product of two independent variables, is therefore interpreted as the additional variance accounted for in the dependent variable after the effects of the independent variables have been partialled. An significant interaction between independent research factors suggests that the relationship between one independent research factor and the dependent variable varies for different values of a second independent research factor.

Significance.

R^2, R^2 change, regression co-efficients (including partial and semi-partial), can be tested for significance. The probability that the variance shared between each independent variable, sets of independent variables or total variance, and the dependent variable is due to chance can be determined by standard T and F tests. T statistics and their associated p values are also available for regression and partial regression coefficients (Tabachnick and Fidell, 1996).

Cohen and Cohen (1983) noted that when testing multiple hypotheses for the pairwise comparison of group means the probability that one or more will be found to be significant when all population means are equal (investigationwise Type I error rate) increases with increases in the number of comparisons. They argued that protection against inflated investigationwise Type I error rate can be afforded by an adaptation of Fischer's Protected t Test for the special case of multiple regression where the research factor is a nominal scale. This strategy permits pairwise comparisons of means only when the F test for the set of means, or a partialled set of means in the hierarchical sense, is significant. This strategy protects the t tests from the accumulation of small per-comparison alphas to large investigationwise error rates. The Protected t Test strategy (Cohen and Cohen 1983) was adopted for the present study.

Independent Variables to Cases Ratio.

Altman (1991) suggested that the maximum number of variables that can be tolerated by any given regression model can be determined by $\sqrt{n}$.

Comparative Model Testing.

For the purposes of the present investigation, multiple regression techniques were employed to test a series of a priori statistical models that were derived from theory. These models were compared by how well they 'fit' the data. Although similar in principle to a Structural Equation Modelling (Dunn et al., 1993) approach, multiple regression does not permit a formal assessment of data fit to the a priori model in the form of the chi square statistic. Therefore for the present investigation the assessment of competing models was made by comparison of the R^2 statistic and the amount of residual variance associated with the dependent variable remaining in the model. Models which resulted in higher R^2 values and reductions in residual DV variance were regarded as better fit models for the current data set.

Chapter 5.

Methods

5.1 Research Questions.

The study was designed to address three research questions.

1. What are the important factors for a Model of LBP disability?
2. Do measures, which are commonly used to assess patients with LBP, have robust cross cultural psychometric properties?
3. What are the cultural influences on the experience of LBP?

5.2 Study Design.

The study design consisted of two parts:

1. A cross-sectional survey with self-completed questionnaires. The nature of the subjective psychological, self-reported disability, ethnicity and demographic information elicited from the study participants indicated that self completed questionnaires were ideally suited the study. The questionnaires were completed by study participants in the clinic waiting room immediately prior to seeing the doctor (see Setting)
2. A clinical interview. Clinical history taking and associated data gathering techniques required some specialist training and therefore this data was collected by the physician or his medical assistant on a clinic pro-forma. Data collected by the clinical interview included pain and disability history, pain location and duration. Each potential patients was assessed against study inclusion and exclusion criteria at the clinical interview.

Ethical Approval.

Ethical approval for the study was obtained from the Ethical Committee of Northwick Park Hospital on 10th May 1994.

Population and Sample.

The study population consisted of patients with chronic low back pain, defined as non specific, mechanical or degenerative pain in the lumbar region of the spine with or without radiating leg pain that had been present for at least 3 months (Frank 1993). Therefore the population of interest was defined as all patients with non-specific LBP. The study sample was a consecutive cohort of LBP patients derived from all primary referrals to a specialist low back pain clinic of a large metropolitan hospital in north-west London. The sample characteristics are described in Results section 6.2.

Setting.

The study was conducted in Northwick Park Hospital, a large metropolitan district general hospital managed by Brent and Harrow Local Health Authority. The hospital served an urban area of approximate radius 5 miles that comprised most of the local population of Harrow. This northwest London suburb was a multi-cultural London Borough, with a population of 210,000, making it the 19th largest of the 33 London local authorities. Thirty per cent of the population was from a non-UK ethnic background (OCPS 1991).

The Northwick Park Hospital specialist back pain clinic was run on a weekly basis by a consultant rheumatologist with a special interest in low back pain. Over the study period the consultant was assisted by at least one other physician, who was at least Senior House Officer grade.

The self-completed questionnaires were completed in the clinic waiting room prior to seeing the doctor and the clinician collected the clinic data during the consultation in the consultation room.

Instrumentation.

The instrumentation consisted of a self-completed booklet which was employed to elicit demographic and self reported psychological and disability data. A clinic pro-forma was employed by the clinician to record clinic related data.

Research Assistant.

A research assistant was available to enrol patients on the study, obtain consent, distribute study self-completed booklets and provide assistance with the self-completed questionnaires when required. The research assistant was also trained to provide literal translations of English language questionnaire words and phrases into Gujerati, Hindi or Urdu.

Procedure.

Along with a letter informing patients of their appointment date and time, patients received a research letter that described the study aims and objectives. Patients were invited to participate in the study, assured that their participation was voluntary and confidential and that any treatment that they were to receive did not in any way depend upon their involvement with the study. The letter also indicated that if they agreed to participate they should attend clinic half an hour before their clinic appointment time when a research assistant would provide them with a self-completed research booklet that would take between 25 to 30 minutes to complete. It was re-emphasised that all information provided by the patient as part of the study was to be treated confidentially. Furthermore any discussions about the information gathered with any third party would be treated in such a way as to guarantee anonymity of the patients. Study participants were also informed that the research assistant would be available to provide assistance if required.

When a patient arrived for his or her appointment they were booked into the clinic and the research assistant introduced and explained the study requirements. It was made clear that neither participation nor non-participation affected the clinical management of the patient or their low back pain. The research assistant also re-emphasised that all the information collected during the course of the study was confidential and was not to be used for the clinical management of the patient. Each potential study participant was asked whether he or she understood what was required of them by their participation in the study and then if they would agree to participate. Patients who did not consent to participate in the study were thanked for their time and asked to wait to see the doctor. Patients who agreed to participate were provided with the study self-completed booklet

attached to a clip-board and a pen, if required. Participants were then asked to self-complete the study booklet. Study participants were also informed that the research assistant would be available to provide help or assistance if required, and that this help could include some simple literal translations of English words into Hindi, Urdu or Gujarati.

In the instance where a questionnaire was incomplete at the time of seeing the doctor, the patient was asked to take the study booklet into the consulting room and complete it whilst waiting to be examined by the doctor or whilst being sent for further examinations or scans if required. If the questionnaire was still incomplete at the completion of the consultation, the participant was asked to complete it in the waiting room before leaving the clinic. When a patient was either unable or unwilling to wait to complete the questionnaire he or she was provided with a stamped addressed envelope (addressed to the research assistant c/o the doctor at NWP Hospital) and asked to take the booklet home, complete it as soon as possible on the same day and then to return it to the research assistant by post.

Study booklets were collected from study participants when completed. Each participant was given a unique study identification number, recorded in the top right hand corner of the study booklet. At the end of the clinic, clinic pro-formas were collected by the research assistant and the relevant study participant number recorded on the top right hand corner.

Completed study booklets and clinic pro-formas were stored securely in box files in the consultant physician's private rooms.

Exclusion Criteria.

All patients attending a specialist LBP clinic were potential candidates for the study. Patients were not included in the study if they were inappropriate for the study (under 18yrs, had profound depression or dementia, were inappropriately referred to the back pain clinic) or had:

1. another dominant spinal pain (neck or thoracic).
2. another dominant medical problem.
3. Metabolic Bone Disease.
4. Peripheral Osteoarthritis.
5. another specific cause of low back/neck pain (e.g. renal pain, haematoma, Multiple Sclerosis, restless leg syndrome, vascular claudication)
6. another musculoskeletal disorder
7. Ankylosing Spondylitis
8. a Malignancy
9. Non-specific knee pains
10. Radiation neuritis
11. Painful heel syndrome
12. back pain secondary to disability (e.g. Polio)

Retrieval of Missing Data

All study forms were examined for missing or incomplete data. An attempt was made to retrieve missing or incomplete data by either telephoning the patient at home in the first instance, or inspection of the study participant's hospital notes. These retrieval strategies were only employed for clinical, demographic or cultural data due to the subjective and time-bound nature of the self report psychological and disability questionnaires. Missing or incomplete cultural data was only retrieved from the hospital notes if self-defined responses were available.

5.3 Data Handling

Scoring of Self Completed Questionnaires.

Items on the self completed questionnaires were scored and totalled according to the scoring methods outlined in Main and Waddell, (1992), Waddell et al., (1991), Crisson and Keefe (1988), Roland et al., (1983), and described in Development of Methods chapter. The total questionnaire/scale scores or total subscale scores were used in all subsequent analyses.

Cultural Variables.

An initial inspection of the raw data suggested that the responses to the three self reported cultural questions (McAuley et al., 1996) were rich, varied and complex. This data was used to determine a self reported ethnic group, a country of birth group and a religious group for each patient. A review of the literature indicated that no standardised method for classifying self reported ethnicity, country of birth or religion into discrete groups suitable for the multivariate statistical analyses of the present study, had been published. A two stage method was proposed to meet the requirement of the present study; a content analysis to determine the cultural groups present in data and a classification stage where the self reported responses were classified into the cultural groups identified by the content analysis.

Data preparation.

All responses were entered on to a Microsoft Excel Data file along with the respective subject number for identification purposes and sorted alphabetically for ease of inspection. Similarly self-defined responses (i.e. similar words, alternate spellings etc) were taken to indicate a common ethnic group, religious affiliation or country of birth.

The following method was employed for all three cultural variables: self defined ethnicity, country of birth and religion.

Content Analysis.

The responses to the self defined cultural questions were examined to identify the main cultural groups present in the raw data. The data were read through once

and initial impressions of the cultural groups present in the data were noted. The responses were compared to these codes during a second reading and changes to the codes were made if required. The main cultural groups present in the data were identified at this stage.

Cultural Classification.

Each self defined response to the cultural questions was compared to the cultural groups identified in the content analysis to determine similarity or dissimilarity. Those that were assessed to be similar were assigned the relevant cultural group. Those that were assessed as dissimilar from the groups were assigned an 'unclassified' group. For those responses with an unclassified group, the responses to the other cultural questions were inspected to assist the classification.

Due to the subjective nature of the content analysis and the cultural classification, both stages were performed separately and independently by the main researcher and a second researcher who was both familiar with the literature and had experience with the main issues regarding research on ethnic groups and health. The results were compared at the end of each stage and an attempt was made to reach consensus on any disagreements. Where consensus was not possible the opinion of an independent adjudicator not involved with the study was sought.

Proportion of Life Spent in UK.

The proportion of life that each patient had spend in the UK was derived from responses to the ethnic question "how long have you lived in the UK?". The reported length of time in years was divided by the age of the patient.

Derivation of Social Class (SC) Groups.

The Standard Occupational Classification Volumes 1 & 3, (1990) was used to determine the Social Class of each patient from his or her self reported current or previous (if currently out of work) occupation.

The Social Class variable followed the following scheme (Waddell and Waddell in Nachemson, 2000).

I	Professional groups such as doctors, lawyers, and scientists.
II	"Intermediate" groups such as teachers, nurses, and self-employed shop keepers.
III Non Manual	Skilled occupations: non-manual groups such as clerical workers.
III Manual	Skilled occupations: manual groups such as tradesmen.
IV	Partly skilled groups such as process workers in industry or transport workers.
V	Unskilled groups such as labourers and cleaners.

Clinic Data.

Standard clinical interviews were conducted by the doctor, from which information was obtained to complete the clinic pro-forma and to exercise the study exclusion criteria.

Extent of LBP

The extent of LBP was determined by QTF classification (Spitzer 1987). A diagnosis of Chronic Pain Syndrome was not used due to its subjectivity (Frank et al., 2000).

Duration of LBP

Duration of LBP was determined by responses to the first time that the patients could remember experiencing LBP and if pain free periods of at least one week had been experienced since that time. If the patient had been pain free since the first LBP, the date of the onset of the current symptoms was determined and the duration of LBP was derived. Each patient was classified as having Chronic LBP, Acute LBP, or Acute on Chronic LBP according to the definitions provided by Frank (1995).

Co-morbidities.

Patients were asked if they were aware of other morbidities for which they may or may not have been receiving treatment. Available hospital notes were also inspected to determine patient co-morbidities.

5.4 Data analytic strategy.

The data analysis was planned to proceed in a series of sequential steps that covered the areas outlined in the preceding Development of Statistical Analysis Chapter.

Derivation of Cultural Groups.

The cultural groups were derived according to the scheme outlined above.

Data Screening

After an initial examination of the data to determine accuracy, a missing data analysis was performed to determine the amount and pattern of missing data in the data matrix. The results of the missing data analysis determined how the missing data was handled.

Following analysis of the missing data, all quantitative variables were examined for skew and/or kurtosis according to the formulas outlined in the Development of Statistical Methods Chapter. Variables that did not meet the criteria for normally distributed variables were considered likely candidates for transformation.

Descriptive statistics and graphs were also examined to detect the presence of univariate qualitative or quantitative outliers. Quantitative outlying categories were collapsed to form composite groups.

A dummy multiple regression run was conducted with all the quantitative independent variables included so that the residuals could be inspected to identify multivariate outliers. Subject number served as the dummy dependent variable as suggested by Tabacknick and Fidell (1996). A decision on the

treatment of multivariate outliers was guided by Mahalanobis distance and Levene's Leverage statistics (SPSS 1999).

Description of the Study Sample.

Frequencies, means, standard deviations and percentages were calculated to describe the study sample. Results were presented in tables and explanatory text.

A Model of LBP disability.

A model of LBP disability was explored by regressing self reported disability onto measures of clinical, social and psychological factors. The inter-relationships between these factors were explored by examining their unique and mediational associations with disability.

Cross Cultural Reliability and Validity of the Disability and Psychological Questionnaires.

The Disability (RMDQ) and Psychological (MSPQ, MZSRDS, CSQ – P&H, CSQ – CAT, PC, PR) questionnaires were examined to determine their cross cultural psychometric properties. Cronbach's Alpha (α) statistic (Cronbach 1951) was employed to determine reliability and multiple regression models which included psychological questionnaires by cultural group interaction terms with RMDQ as the criterion measure to determine cross cultural validity (Cohen and Cohen, 1983).

Cultural Influences on LBP

The contribution of culture to the experience of LBP was explored by a series of independent regression analyses where dependent psychological (MSPQ, MZSRDS, CSQ – P&H, CSQ – CAT, PC, PR) and disability (RMDQ) factors were regressed onto independent cultural factors (Ethnicity, Region of Birth and Religion), after controlling for demographic (age and sex), social (SC), and clinical (QTF classification, co-morbidity, Chronic LBP) factors.

Cultural factors were represented and interpreted according to the scheme outlined below.

Ethnicity. 3 ethnic groups (G) are represented by G=3 dummy variables: "British", "South Asian" and "Other". The variables were coded so that for each case a value of "1" indicated that the ethnic quality ("British-ness", "South Asian-ness" or "other-ness") was present, and "0" not present. Each regression model contained 2 dummy variables (g – 1) as this is all that was required to fully represent the factor "ethnicity" (Cohen and Cohen, 1983). The third variable was not entered into the equation as it was wholly redundant (each case was coded 0 and 0), but served as the "reference" group (Cohen and Cohen 1983). The constant (c) for each regression analysis was equivalent to the mean dependent variable score for the reference group i.e. the score on the dependent variable when all other independent variables are scored "0". The regression coefficients therefore represented the differences between the reference group mean and the dummy variable mean on the dependent variable i.e. the average amount of change in the dependent variable for a unit increase in the independent variable.

Significance of mean differences between a dummy variable the reference group was tested by deriving the T score for the regression coefficient (B). Pairwise comparisons of group means were determined by running the regression model with a rotated reference group. Standard errors (SE) and Confidence Intervals (CI) associated with the regression coefficient represented the relevant statistics for the mean differences between the dummy variable and the reference group. Associated zero order and partial correlation coefficients were interpreted according to Cohen and Cohen (1983) as either the absolute point-biserial correlation between the dummy variable and the dependent variable or the correlation between the dummy variable - reference group dichotomy and the dependent variable.

Region of Birth. G=4 dummy variables represented the 4 Region of Birth groups: "British Isles", "South Asia" "Africa" and "Other". The variables were coded so that for each case a value of "1" indicated that the Region of Birth quality ("British Isles-ness", "South Asia-ness", "Africa-ness" or "other-ness") was present, and "0" not present. Each regression model contained 3 dummy

variables (g – 1) as this is all that was required to fully represent the factor "ethnicity" (Cohen and Cohen, 1983). The reference variable was rotated through a series of regression runs so that mean dependent variable scores, the significance of the differences between them, their SE and CI could be determined. Zero-order and partial correlations were obtained and interpreted according to the method outlined by Cohen and Cohen (1983).

Religion. G=4 dummy variables represented the 4 Religion groups: "Christian", "Hindu" "Muslim" and "Other". The variables were coded so that for each case a value of "1" indicated that the Religion quality ("Christian-ness", "Hindu-ness", "Muslim-ness" or "other-ness") was present, and "0" not present. Each regression model contained 3 dummy variables (g – 1) as this is all that was required to fully represent the factor "ethnicity" (Cohen and Cohen, 1983). The reference variable was rotated through a series of regression runs so that mean dependent variable scores, the significance of the differences between them, their SE and CIs could be determined. Zero-order and partial correlations were obtained and interpreted according to the method outlined by Cohen and Cohen (1983).

The total independent contribution that each cultural factor made to each dependent variable measure of LBP was determined by the R^2 Change statistic. The significance of the contribution was determined by the relevant F test.

The means, mean differences, R^2 and R^2 change statistics were derived from the partial regression coefficients, after controlling for the independent variables or sets of variables already in the model (demographic, social and clinical). The relevant statistics were interpreted as belonging to the sub set of data for which demographic, social or clinical variables did not vary.

Chapter 6.

Results.

6.1 Data Screening

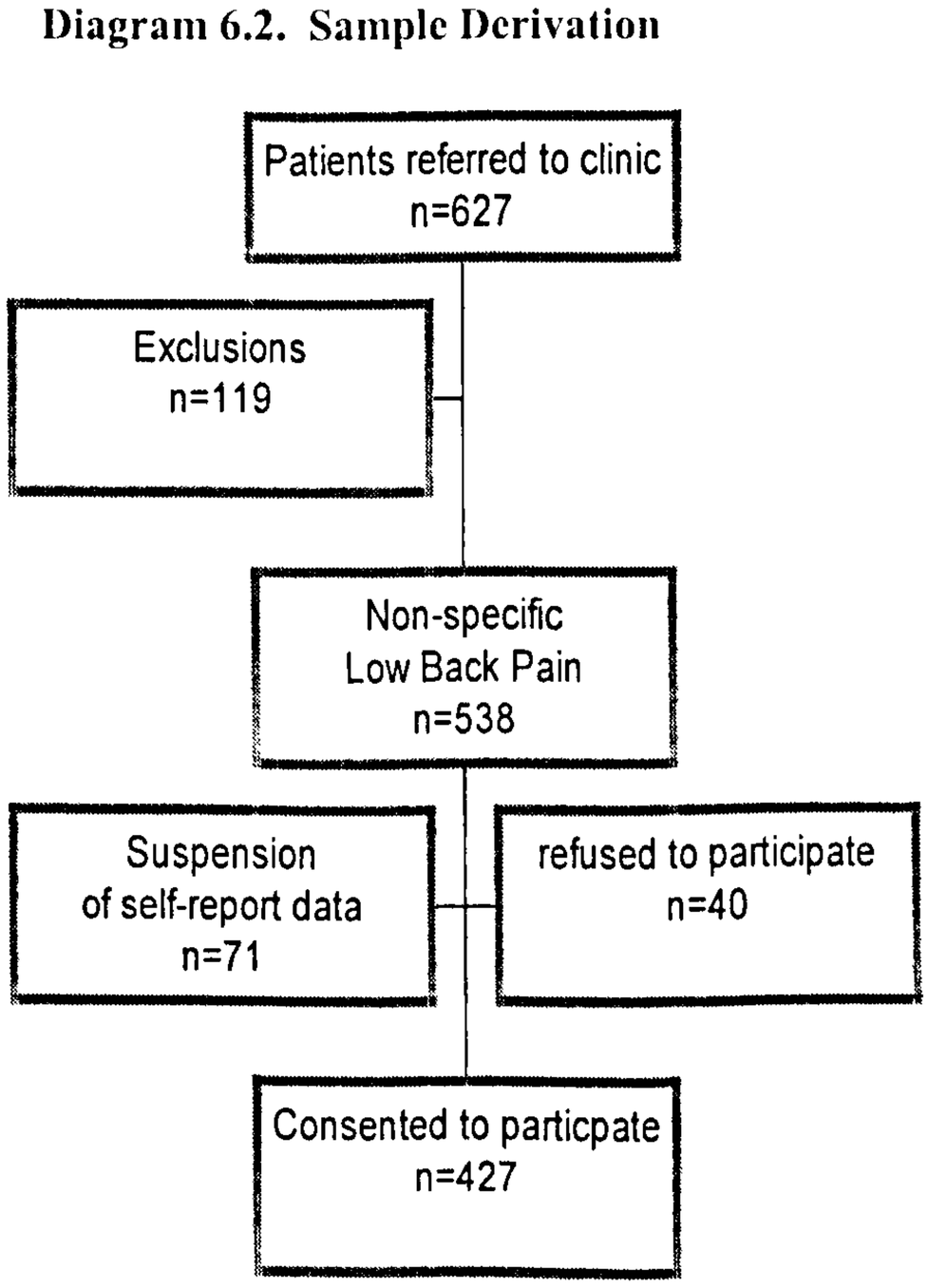
The results of the data screening are presented in Appendix B (pages vii-xvii). Following successful screening of the data, the cleaned data set (n=427) was employed for in all subsequent statistical analyses.

6.2 Description of Study Sample

Sample Derivation.

N=657 patients attending their first appointment at a specialist low back pain clinic over a 2 year period were screened for eligibility in the research study. The sample derivation scheme is presented below (diagram 6.2 p108).

Diagram 6.2. Sample Derivation



N=119 patients were excluded from the study, primarily due to back pain not being the main presenting problem.

Suspension of self-report data collection *during* a 2 month *period* resulted in an absence of data for n=71 patients.

N=467 patients with a primary diagnosis of Low Back Pain (Frank 1993) were asked for consent to participate in the research study. N=40 patients (8.6%) did not consent.

Those patients who did not consent to complete the self-completed questionnaires (n=40, mean age=56.7yrs, sd=16.7yrs) were significantly older than those who agreed to participate (n=427, mean age=47.6, sd=14.9) in the study ($p<0.00$, t=-3.64, df=465, mean diff=-9.1yrs, 95% CI –14yrs to –4yrs).

Description of Sample Characteristics.

The study sample comprised n=427 patients with low back pain who attended for a first appointment to a specialist clinic over a two-year period.

Home Postcodes.

Table 6.2a p109 provides frequencies for home postcodes and their associated districts. Inspection of table 6.2a indicated that n=413 (97%) of the study sample lived in west/north-west London and were local to Northwick Park Hospital.

Table 6.2a. Patient Home Districts.

District	*Frequency*	*Percent*
Harrow	350	81.97
Southall	42	9.84
Northwest London	16	3.75
Watford	7	1.64
West London	4	0.94
Hemel Hempstead	2	0.47
Slough	1	0.23
South east London	1	0.23
South west London	1	0.23
Twickenham	1	0.23
Birmingham	1	0.23
St. Albans	1	0.23
Total	427	100.00

Patient Referral Characteristics.

Table 6.2b p110 provides the nested frequencies for the patient referral characteristics. The study sample comprised n=420 (98%) NHS patients and n=7 (1.6%) Private Health patients. N=364 (85.2%) of patients were referred by their General Practitioner (GP) and n=407 (95.3%) were given a follow up outpatient appointment.

Table 6.2b. Patient Referral Characteristics

Patient Referral Characteristic		*Frequency*	*Percent*
NHS or Private Patient	NHS Patient	420	98.36
	Private Patient	7	1.64
Source of referral	GP	364	85.25
	Northwick Park Hospital	46	10.77
	Other Hospital	11	2.58
	Physiotherapy	3	0.70
	Other	3	0.70
Outcome following Clinic	Outpatient care	407	95.32
	Inpatient care	8	1.87
	Further consultant opinion	5	1.17
	Discharged	7	1.64
Total		427	100.00

N=379 (88%) study participants were NHS patients from the district local to Northwick Park Hospital who were referred by either a General Practitioner (GP) or a Northwick Park Hospital doctor and who were given a follow up outpatient appointment at the end of the consultation. The remaining patients in the study sample were primarily non local NHS patients treated in the outpatient clinic or local NHS patients either treated as inpatients (n=4), referred on to another consultant (n=4) or discharged (n=5).

Demographic Characteristics

Frequencies for Sex, Marital Status and Occupational Status are nested in table 6.2c p111.

Table 6.2c. Patient Demographic Characteristics.

Demographic Characteristic	*Group*	*Frequency*	*Percent*
Sex	male	154	36.07
	female	273	63.93
Occupational status	employee	145	33.96
	self-employed	29	6.79
	unemployed	43	10.07
	housewife	70	16.39
	student	6	1.41
	retired	56	13.11
	work disabled	78	18.26
Marital Status	single	61	14.29
	married	288	67.45
	divorced/separated	47	11.01
	widow/widower	31	7.26
Total		427	100.00

Descriptive statistics for Age are presented in table 6.2g p114.

There were significantly more women than men in the study (chi square = 43.16, df=1, p<0.001) and the most frequent marital status was "married" (n=288, 67.4%). The most frequent occupational status was "employee" (n=145, 34%) and a minority of patients reported that they were not working due to their low back pain (n=77, 18%). The minimum age of the sample was 19 years and the maximum was 83 years. The mean age of the study participants was 47.5 (sd 14.9) years.

Description of Cultural Factors.

Frequencies of Ethnic, Religion and Region of Birth groups are presented in table 6.2d p112. Descriptive statistics for proportion of life spent in the UK are presented in table 6.2g p114.

Table 6.2d. Cultural Group Frequencies

Cultural Group		*Frequency*	*Percent*
Ethnicity			
	South Asian	147	34.43
	British	181	42.39
	Other	99	23.19
Religion			
	Hindu	102	23.89
	Muslim	42	9.84
	Christian	230	53.86
	Other	53	12.41
Region of birth			
	South Asia	90	21.08
	British Isles	211	49.41
	Africa	69	16.16
	Other	57	13.35
Total		427	100.00

The most common Ethnic group was "British" (n=181, 42%). The "British Isles" was the most frequently reported Region of Birth (n=211, 49.4%) and "Christian" was the most commonly reported Religion (n=230, 53.9%). The most common ethnic profiles present in the study sample were "British" "Christians" who were born in the "British Isles" (n=154, 36.1%), followed by "South Asian" "Hindus" born in either "South Asia" (n=46, 10.8%) or "Africa" (n=46 10.8%). The median proportion of life spent in the UK was 0.67.

Social Class Groups.

Frequencies for Social Class groups are presented in table 6.2e p113. The most common Social Class Group was 1&2 (n=104, 24.4%).

Table 6.2e. Social Class Group Frequencies

Social Class (SC)	*Frequency*	*Percent*
SC 1 & 2	104.00	24.36
SC 3 Manual	76.00	17.80
SC 3 Non Manual	92.00	21.55
SC 4 & 5	74.00	17.33
Other	81.00	18.97
Total	427.00	100.00

Description of Clinical Characteristics.

Frequencies for Chronic LBP, QTF Classification, co-morbidity and CT or MRI scan are nested in table 6.2f p113. Descriptive statistics for Duration of LBP are presented in table 6.2g p114.

Table 6.2f. Clinical Characteristics.

Clinical Characteristic		*Frequency*	*Percent*
Chronic LBP			
	chronic	366	85.71
	acute on chronic	61	14.29
QTF Classification			
	Pain does not radiate	110	25.76
	Pain radiates leg, not below knee	116	27.17
	Pain radiates below knee	119	27.87
	Pain radiates below knee with neurological signs	82	19.20
Co-morbidity			
	no	171	40.05
	yes	256	59.95
CT or MRI Scan			
	no	315	73.77
	yes	112	26.23
Total		427	100.00

The most common classification was LBP (n=366, 85.7%) and most study participants had a co-morbidity (n=256, 60.9%). The study sample was almost

evenly distributed between the four QTF groups (chi square = 8.04, df=3, p=0.05), although there were fewer participants in QTF group 4 (pain radiates below the knee with neurological signs). The median duration of symptoms of LBP was 0.8 years (range 41 years).

Co-morbidities.

N=106 (41.4%) participants with a co-morbidity reported more than one (min=2, max=7). Musculoskeletal conditions were the most common co-morbidity (n=228, 53.4%), comprising: Neck pain (n=110, 25.8%), Thoracic Pain (n=44, 10.8%), Peripheral Joint Arthritis (n=67, 15.7%) and miscellaneous musculoskeletal conditions (n=7, 1.6%). Non-musculoskeletal co-morbidities such as Heart Disease (n=40, 9.4%), Chest Disease (n=14, 3.3%), Dyspepsia (n=39, 9.1%), other abdominal conditions (n=11, 2.6%) and miscellaneous other (n=75, 1.6%) were also present in the study sample.

Description of Study Sample Disability and Psychological Characteristics.

Descriptive statistics for the RMDQ, transformed MSPQ, MZSRDS, CSQ – CAT, CSQ – P&H, PC and PR are presented in table 6.2g 114.

Table 6.2g. Description of Study Sample – Quantitative Variables

	Mean	*SE*	*Median*	*SD*	*Range*	*Min*	*Max*
Age	47.59	0.72	47.00	14.94	64.00	19.00	83.00
Prop in UK	0.69	0.01	0.67	0.30	0.96	0.04	1.00
Duration	2.71	0.26	0.80	5.43	41.29	0.01	41.30
RMDQ	11.77	0.31	12.00	6.40	24.00	0.00	24.00
MSPQ transformed	2.81	0.05	2.83	1.02	4.48	1.00	5.48
MZSRDS	25.59	0.52	25.00	10.73	62.00	0.00	62.00
P&H	20.72	0.43	22.00	8.94	36.00	0.00	36.00
CAT	13.00	0.45	11.00	9.22	36.00	0.00	36.00
PC	11.52	0.22	11.34	4.60	30.00	0.00	30.00
PR	6.41	0.13	6.00	2.60	18.00	0.00	18.00

Key: Age = Age in years; RMDQ = Roland and Morris Disability Questionnaire; MZSRDS = Modified Zung Self Rating Depression Scale; MSPQ = Modified Somatic Perception Questionnaire; CAT = Catastrophising subscale of the Coping Strategies Questionnaire; P&H = Praying and Hoping subscale of the Coping Strategies Questionnaire; PC = Pain Control subscale of the Pain Locus of Control; PR = Pain Responsibility subscale of the Pain Locus of Control; Duration = Duration of LBP; Prop in UK = Proportion of Life spent in the UK

6.3 Study 1. An Investigation of a Model of LBP Disability.

A model of LBP disability was explored by testing n=6 hierarchical regression models where the RMDQ was regressed onto demographic, social, clinical and psychological research factors. The research factors were forced into the regression models at each step.

For each step of the six regression models the order of the demographic, social and clinical factors was fixed. Step 1 contained the demographic factor (age and sex), step 2 the social factor (Social Class (SC)) and step 3 the clinical factor (QTF classification, Chronic LBP, co-morbidity).

Psychological influences were represented by 3 research factors; distress (MSPQ, MZSRDS), coping strategies (P&H and CAT) and pain beliefs (PC and PR). The entry order of the 3 psychological factors were rotated through steps 4, 5 and 6 so that mediational relationships of these factors could be explored.

The model summaries are presented in Table 6.3a p118 (summaries for Demographic, Social and Clinical factors are only presented for Model 1 as they are the same for all subsequent models). Table C1 in Appendix C (page xvii-xxiv) provides the unstandardised and standardised regression co-efficients, their associated t tests and 95% confidence intervals, and the zero order and partial correlations for each of independent variable in the regression model.

Hypothesis 1.1a Social factors are significantly associated with LBP disability.

The Social factor was not significantly associated with the RMDQ, after controlling
demographic factors (adjusted R^2 change = 0.02, p=0.09), therefore hypothesis 1.1a
was rejected.

Hypothesis 1.1b Clinical factors are significantly associated with LBP disability.

The Clinical factor was significantly associated with the RMDQ, after controlling for demographic and social factors (adjusted R^2 change = 0.11, $p<0.00$), therefore hypothesis 1.1b was accepted.

Hypothesis 1.1c Psychological factors are significantly associated with LBP disability.

The Psychological factor was significantly associated with LBP disability after controlling for the demographic, social and clinical factor (adjusted R^2 change = 0.38, $p<0.00$), therefore hypothesis 1.1c was accepted.

Hypothesis 1.2 The strength of relationship between Psychological Factor and LBP disability is stronger than the strength of the relationship between either clinical or social factors and LBP disability.

The strength of the relationship between the Psychological factor and the RMDQ was stronger (adjusted R^2 change = 0.38, $p<0.00$) than the strength of the relationship between the clinical (adjusted R^2 change = 0.11, $p<0.00$) or social (adjusted R^2 change = 0.04, $p=0.09$) factors and the RMDQ. Therefore hypothesis 1.2 was accepted.

Hypothesis 1.3a Distress is significantly related to the LBP disability psychological factor.

Distress accounted for a significant portion of the RMDQ variance (adjusted R^2 = 0.29, $p<0.00$) after controlling for demographic, social and clinical factors. Hypothesis 1.3a was therefore accepted.

Hypothesis 1.3b Coping Strategies are significantly related to LBP disability.

Coping Strategies accounted for a significant portion of the RMDQ variance (adjusted R^2 = 0.31, $p<0.00$) after controlling for demographic, social and clinical factors. Hypothesis 1.3b was therefore accepted.

Hypothesis 1.3c Pain Beliefs are significantly related to LBP disability.

Pain Beliefs accounted for a significant portion of the RMDQ variance (adjusted $R^2 = 0.16$, $p<0.00$) after controlling for demographic, social and clinical factors. Hypothesis 1.3b was therefore accepted.

Hypothesis 1.4 The relationship between LBP Disability and Distress is mediated by Coping Strategies and Pain Beliefs.

The mediating relationships between pain beliefs, coping strategies and distress was explored in 6 regression models where the order of entry of the factors was rotated (table 6.3a p118).

Inspection of Models 1 & 2 in Table 6.3a p118 suggested that after controlling for demographic, social and clinical factors, Distress was significantly and strongly related to the RMDQ (R^2 Change = 0.29). When Coping Strategies and Pain Beliefs were entered into the regression model prior to Distress (models 6) the relationship between Distress and Disability, although still significant, was weak (R^2 Change = 0.04). When Coping Strategies were entered into the regression model after Distress the mediating role of Pain Beliefs on the Distress - LBP disability relationship was determined (Model 4). In this model Distress still accounted for a significant portion of the RMDQ variance (R^2 Change = 0.18). In model 5 the effect of Pain Beliefs on the relationship between Distress and Disability was removed and the mediating role of Coping Strategies on this relationship was examined. Although the relationship was still significant, the portion of shared variance between the Distress factor and disability was reduced to a greater extent than in Model 4 (R^2 Change = 0.06). Therefore hypothesis 1.4 was retained.

Hypothesis 1.5 In the relationship between LBP Disability and Distress, Pain Beliefs mediate the Coping Strategies – Distress relationship.

The relationship between Coping Strategies and Pain Beliefs was explored in Models 3 and 6 (table 6.3a p118). Inspection of model 3 indicated that Coping Strategies added significantly and moderately to the RMDQ after controlling for Pain Beliefs (R^2 Change = 0.18) whereas Model 6 suggested that Pain Beliefs added significant but only weakly to Disability after controlling for Coping

Strategies (R^2 Change = 0.03). This finding suggests that while the Pain Belief and the Coping Strategies factors are related, in the LBP Disability/Distress relationship Pain Beliefs mediate the Coping Strategies/Distress relationship and therefore hypothesis 1.5 was accepted.

Table 6.3a. Disability Model Summary

			R	R^2	*Adj* R^2	*SE*	*Change Statistics*			
Model	*Step*	**Independent Variable**					R^2	*F*	*df1*	*df2*	*Sig. F*
1	1	Demographics	0.18	0.03	0.03	6.31	0.03	7.08	2	424	0.00
	2	Social Factor	0.23	0.05	0.04	6.28	0.02	2.06	4	420	0.09
	3	Clinical Factor	0.40	0.16	0.14	5.94	0.11	10.95	5	415	0.00
▼		▼		▼			▼				▼
	4	Distress	0.67	0.45	0.44	4.80	0.29	110.66	2	413	0.00
	5	Coping Strategies	0.73	0.53	0.52	4.44	0.08	35.61	2	411	0.00
	6	Pain Beliefs	0.74	0.55	0.53	4.39	0.01	5.80	2	409	0.00
2	4	Distress	0.67	0.45	0.44	4.80	0.29	110.66	2	413	0.00
	5	Pain Beliefs	0.70	0.49	0.47	4.66	0.04	14.12	2	411	0.00
	6	Coping Strategies	0.74	0.55	0.53	4.39	0.06	26.38	2	409	0.00
3	4	Pain Beliefs	0.57	0.32	0.30	5.35	0.16	48.82	2	413	0.00
	5	Coping Strategies	0.71	0.50	0.49	4.59	0.18	75.06	2	411	0.00
	6	Distress	0.74	0.55	0.53	4.39	0.04	20.00	2	409	0.00
4	4	Pain Beliefs	0.57	0.32	0.30	5.35	0.16	48.82	2	413	0.00
	5	Distress	0.70	0.49	0.47	4.66	0.17	67.31	2	411	0.00
	6	Coping Strategies	0.74	0.55	0.53	4.39	0.06	26.38	2	409	0.00
5	4	Coping Strategies	0.69	0.48	0.46	4.71	0.31	123.69	2	413	0.00
	5	Distress	0.73	0.53	0.52	4.44	0.06	26.09	2	411	0.00
	6	Pain Beliefs	0.74	0.55	0.53	4.39	0.01	5.80	2	409	0.00
6	4	Coping Strategies	0.69	0.48	0.46	4.71	0.31	123.69	2	413	0.00
	5	Pain Beliefs	0.71	0.50	0.49	4.59	0.03	11.45	2	411	0.00
	6	Distress	0.74	0.55	0.53	4.39	0.04	20.00	2	409	0.00

Key: Dependent variable = RMDQ (Roland and Morris Disability Questionnaire) Independent variables = Demographic factor (age, sex) Social factor (Social Class), Clinical factor (Quebec Task Force Classification; Duration of LBP), Distress Factor (Modified Zung Self Rating Depression Scale, Modified Somatic Perception Questionnaire); Coping Strategies Factor (Catastrophising subscale of the Coping Strategies Questionnaire, Praying and Hoping subscale of the Coping Strategies Questionnaire), Pain Beliefs factor (Pain Control subscale of the Pain Locus of Control, Pain Responsibility subscale of the Pain Locus of Control).

6.4 Study 2. An Investigation of the Cross Cultural psychometric properties of self reported LBP measures

6.4a Reliability.

Cronbach's Alpha (α) (Cronbach 1951) statistics for each psychological or disability questionnaire for the total sample and by cultural group are presented in table 6.4a p121.

Hypothesis 2.1a The Roland and Morris Disability Questionnaire (RMDQ) (Roland and Morris 1983) provides reliable findings across different cultural groups.

The RMDQ demonstrated Cronbach Alpha scores of between α=0.90 and α=0.93 across the ethnic, region of birth and religious groups, indicating that this questionnaire provided consistent findings across these groups. Therefore hypothesis 2.1a was accepted.

Hypothesis 2.1b The Modified Zung Self Rating Depression Scale (MZSRDS) (Main et al., 1992) provides reliable findings across different cultural groups.

The MZSRDS demonstrated Cronbach Alpha scores of between α=0.78 and α=0.84 across the ethnic, region of birth and religious groups, indicating that this questionnaire provided consistent findings across these groups. Therefore hypothesis 2.1b was accepted.

Hypothesis 2.1c The Modified Somatic Perception Questionnaire (MSPQ) (Main et al., 1992) provides reliable findings across different cultural groups.

The MSPQ demonstrated Cronbach Alpha scores of between α=0.81 and α=0.87 across the ethnic, region of birth and religious groups, indicating that this questionnaire provided consistent findings across these groups. Therefore hypothesis 2.1c was accepted.

Hypothesis 2.1d The Catastrophising subscale (CAT) of the Coping Strategies Questionnaire (CSQ) (Rosenstiel and Keefe 1983) provides reliable findings across different cultural groups.

The CAT subscale of the CSQ demonstrated Cronbach Alpha scores of between α=0.83 and α=0.92 across the ethnic, region of birth and religious groups, suggesting that although this questionnaire had adequate internal consistency across these groups, the degree of internal consistency varied dependent upon the group. Therefore hypothesis 2.1d was rejected.

Hypothesis 2.1e The Praying and Hoping subscale (P&H) of the Coping Strategies Questionnaire (CSQ) (Rosenstiel and Keefe 1983) provides reliable findings across different cultural groups.

The P&H subscale of the CSQ demonstrated Cronbach Alpha scores of between α=0.58 and α=0.78 across the ethnic, region of birth and religious groups. This finding suggested that the British (α=0.71), British Isles (α=0.71), Christian (α=0.75) and Other (α=0.71 to α=0.78) cultural groups had adequate internal consistency whereas the South Asian (α=0.65), South Asia (α=0.69), Africa (α=0.58), Hindu (α=0.65) and Muslim (α=0.60) cultural groups did not. Therefore hypothesis 2.1e was rejected.

Hypothesis 2.1f The Pain Control (PC) subscale of the Pain Locus of Control Questionnaire (PLC) (Main and Waddell 1991) provides reliable findings across different cultural groups.

The PC subscale of the PLC demonstrated Cronbach Alpha scores of between α=0.78 and α=0.91 across the ethnic, region of birth and religious groups indicating that this questionnaire provided adequately consistent findings across ethnic, country of birth and religious groups. Therefore hypothesis 2.1f was accepted.

Hypothesis 2.1g The Pain Responsibility (PR) subscale of the Pain Locus of Control Questionnaire (PLC) (Main and Waddell 1991) provides reliable findings across different cultural groups.

The PR subscale of the PLC demonstrated Cronbach Alpha scores of between α=0.35 and α=0.75 across the ethnic, region of birth and religious groups. This finding suggested that for patients who reported an African (α=0.7) or other (α=0.71) region of birth, or Hindu (α=0.70) and Muslim (α=0.75) patients had adequate PR internal consistency scores whereas British (α=0.58), British Isles (α=0.6), Christian (α=*0.6*) *and* Other ethnicity (α=0.67) or Other religion (α=0.35) cultural groups had inadequate internal consistency scores. Therefore hypothesis 2.1g was rejected.

Table 6.4a. Cross Cultural Reliability

(Cronbach's Alpha α) of Self Reported Questionnaires

		RMDQ	*MSPQ*	*MZSRDS*	*P&H*	*CAT*	*PC*	*PR*
Ethnicity	South Asian	0.91	0.85	0.83	0.65	0.83	0.86	0.66
	British	0.90	0.85	0.80	0.71	0.86	0.84	0.58
	Other	0.92	0.86	0.84	0.78	0.91	0.89	0.67
Region of Birth	South Asia	0.92	0.86	0.83	0.71	0.82	0.86	0.60
	British Isles	0.90	0.85	0.81	0.69	0.87	0.88	0.60
	Africa	0.90	0.87	0.84	0.58	0.85	0.88	0.70
	Other	0.92	0.81	0.79	0.78	0.92	0.78	0.71
Religion	Hindu	0.91	0.87	0.84	0.65	0.84	0.83	0.70
	Christian	0.90	0.85	0.82	0.75	0.87	0.87	0.60
	Muslim	0.93	0.86	0.78	0.60	0.85	0.91	0.75
	Other	0.92	0.82	0.83	0.71	0.91	0.84	0.35
Total Group		0.91	0.85	0.82	0.75	0.87	0.86	0.62

Key: RMDQ = Roland and Morris Disability Questionnaire; MZSRDS = Modified Zung Self Rating Depression Scale; MSPQ = Modified Somatic Perception Questionnaire; CAT = Catastrophising subscale of the Coping Strategies Questionnaire; P&H = Praying and Hoping subscale of the Coping Strategies Questionnaire; PC = Pain Control subscale of the Pain Locus of Control; PR = Pain Responsibility subscale of the Pain Locus of Control

6.4b Validity.

Table 6.4b p122 provides the change statistics from a series of regression models where the cross cultural validity of the psychological questionnaires (MSPQ, MZSRDS, P&H, CAT, PC and PR) was tested. The regression models regressed the RMDQ onto a set of variables made up of cultural group by psychological questionnaire interaction terms after controlling for cultural group and psychological questionnaire (Cohen and Cohen 1983).

None of the interaction terms contributed significantly to the RMDQ variance for any of the regression models ($p>0.05$) therefore hypotheses 2.2a to 2.2f (page 58) were accepted.

Table 6.4b. Cross Cultural Validity of Self-Reported Questionnaires.
Change Statistics.

Psychological Questionnaire	*Cultural Group*	*Change Statistics for axb interaction*				
a	*b*	R^2	*F*	*df1*	*df2*	*Sig. F*
MSPQ						
	Ethnic Group	0.00	0.19	2	421	0.83
	Region of Birth	0.00	0.31	3	419	0.82
	Religion	0.00	0.11	3	419	0.95
MZSRDS						
	Ethnic Group	0.00	0.57	2	421	0.56
	Region of Birth	0.00	0.55	3	419	0.65
	Religion	0.00	0.09	3	419	0.97
P&H						
	Ethnic Group	0.00	0.25	2	421	0.78
	Region of Birth	0.00	0.34	3	419	0.80
	Religion	0.00	0.65	3	419	0.58
CAT						
	Ethnic Group	0.00	0.51	2	421	0.60
	Region of Birth	0.00	0.26	3	419	0.85
	Religion	0.00	0.29	3	419	0.83
PC						
	Ethnic Group	0.00	1.06	2	421	0.35
	Region of Birth	0.00	0.64	3	419	0.59
	Religion	0.01	1.05	3	419	0.37
PR						
	Ethnic Group	0.00	0.17	2	421	0.84
	Region of Birth	0.00	0.14	3	419	0.94
	Religion	0.00	0.18	3	419	0.91

Key: MZSRDS = Modified Zung Self Rating Depression Scale; MSPQ = Modified Somatic Perception Questionnaire; CAT = Catastrophising subscale of the Coping Strategies Questionnaire; P&H = Praying and Hoping subscale of the Coping Strategies Questionnaire; PC = Pain Control subscale of the Pain Locus of Control; PR = Pain Responsibility subscale of the Pain Locus of Control

6.5 Study 3. Cultural Influences on the experience of LBP.

Cultural influences on LBP were investigated by examining the relationships between Cultural factors ("Ethnic Group", "Region of Birth" and "Religion") and Psychological (MSPQ, MZSRDS, P&H, CAT, PC and PR) and Disability factors (RMDQ) after controlling for demographic (age and sex), social (Social class) and clinical factors (QTF classification, Chronic LBP and the presence of a co-morbidity).

Ethnic Group Differences

Hypothesis 3.1 There are significant ethnic group differences in the experience of LBP.

After controlling for demographic (Step 1), social (Step 2) and clinical (step 3) factors, Ethnic group membership (step 4) did not account for significant variance in the RMDQ (R^2 change = 0.01, F change = 1.94, df = 2 and 413, p = 0.15) or the MZSRDS (R^2 change = 0.00, F change = 0.64, df = 2 and 413, p = 0.53). Significant variance was accounted for by ethnic group in the MSPQ (transformed) (R^2 change = 0.02, F change = 4.95, df = 2 and 413, p = 0.01), P& H (R^2 change = 0.15, F change = 40.75, df = 2 and 413, p < 0.001), CAT (R^2 change = 0.04, F change = 8.71, df = 2 and 413, p < 0.001), PC (R^2 change = 0.03, F change = 4.09, df = 2 and 413, p = 0.02) and PR (R^2 change = 0.02, F change = 3.84, df = 2 and 413, p = 0.02).

Table 6.5a p124 presents the results of the regression models where the RMDQ, the MSPQ, MZSRDS, P&H, CAT, PC and PR were regressed onto ethnicity (step 4), after controlling for demographic (age and sex), social (Social Class) and clinical (QTF classification, chronic LBP and co-morbidity) factors. Significant p-values for R^2 change statistics at step 4 were indicated by bold text.

Table 6.5a Regression Models for Ethnicity

Dependent Variable	*Step*	*R*	R^2	*Adj* R^2	*SE*	***Change Statistics***			
						R^2	*F*	*df1*	*df2*	*p=*
RMDQ										
	1	0.18	0.03	0.03	6.31	0.03	7.08	2	424	0.00
	2	0.23	0.05	0.04	6.28	0.02	2.06	4	420	0.09
	3	0.40	0.16	0.14	5.94	0.11	10.95	5	415	0.00
	4	0.41	0.17	0.14	5.92	0.01	1.94	2	413	0.15
MSPQ transformed										
	1	0.16	0.02	0.02	1.01	0.02	5.39	2	424	0.00
	2	0.21	0.04	0.03	1.00	0.02	2.19	4	420	0.07
	3	0.39	0.15	0.13	0.95	0.11	10.54	5	415	0.00
	4	0.41	0.17	0.15	0.94	0.02	4.95	2	413	**0.01**
MZSRDS										
	1	0.13	0.02	0.01	10.66	0.02	3.79	2	424	0.02
	2	0.20	0.04	0.02	10.60	0.02	2.29	4	420	0.06
	3	0.33	0.11	0.08	10.28	0.07	6.31	5	415	0.00
	4	0.33	0.11	0.08	10.29	0.00	0.64	2	413	0.53
P&H										
	1	0.18	0.03	0.03	8.81	0.03	7.49	2	424	0.00
	2	0.25	0.06	0.05	8.71	0.03	3.41	4	420	0.01
	3	0.32	0.10	0.08	8.57	0.04	3.75	5	415	0.00
	4	0.50	0.25	0.23	7.85	0.15	40.75	2	413	**0.00**
CAT										
	1	0.14	0.02	0.01	9.15	0.02	4.03	2	424	0.02
	2	0.25	0.06	0.05	9.00	0.04	4.75	4	420	0.00
	3	0.34	0.12	0.09	8.78	0.06	5.24	5	415	0.00
	4	0.39	0.15	0.13	8.62	0.04	8.71	2	413	**0.00**
PC										
	1	0.14	0.02	0.02	4.56	0.02	4.31	2	424	0.01
	2	0.16	0.03	0.01	4.57	0.01	0.63	4	420	0.64
	3	0.20	0.04	0.01	4.56	0.01	1.24	5	415	0.29
	4	0.24	0.06	0.03	4.53	0.02	4.09	2	413	**0.02**
PR										
	1	0.21	0.04	0.04	2.54	0.04	9.97	2	424	0.00
	2	0.25	0.06	0.05	2.53	0.02	1.70	4	420	0.15
	3	0.30	0.09	0.07	2.51	0.03	2.82	5	415	0.02
	4	0.33	0.11	0.08	2.49	0.02	3.84	2	413	**0.02**

Key: RMDQ = Roland and Morris Disability Questionnaire; MZSRDS = Modified Zung Self Rating Depression Scale; MSPQ = Modified Somatic Perception Questionnaire; CAT = Catastrophising subscale of the Coping Strategies Questionnaire; P&H = Praying and Hoping subscale of the Coping Strategies Questionnaire; PC = Pain Control subscale of the Pain Locus of Control; PR = Pain Responsibility subscale of the Pain Locus of Control

Significant differences between the ethnic groups were investigated for the dependent variables that demonstrated overall group differences (F =< 0.05) using the Protected T method described by Cohen and Cohen (1983). Results of the pairwise comparisons are summarised below and presented in table 6.5b p126. Significant differences were highlighted in bold.

Distress. South Asian patients reported significantly higher MSPQ scores than British patients.

Coping Strategies. P&H mean scores were significant different between each of the ethnic groups. The Other ethnic group had the highest mean score followed by the South Asian group. The British ethnic group had the lowest mean P&H score. South Asian patients had significantly higher CAT mean scores than British patients. "Other" ethnicity patients had mean scores that were not significantly different from South Asian or British patients for the CAT subscale.

Control Beliefs. South Asian patients had significantly lower PC and higher PR mean scores than British patients. "Other" ethnicity patients had mean scores, which were not significantly different from South Asian or British patients for either the PC or PR subscales.

Appendix C table C2 (page xxv-xxvi) presents the regression coefficients from the regression model where Disability and Psychological factors were regressed onto the South Asian and British dichotomies after controlling for demographic, social and clinical factors. Partial mean dependent variable values (mean) for each independent variable, the constant for each regression model (*constant*) (which represents the mean for the reference group "other" ethnicity for the sub set of data where the clinical, social and demographic factors do not vary), the Beta (B) coefficients (which represent the partialled difference in dependent variable means between the reference group and dummy variable) the associated Standard Errors (SE), t-values (t) p values (sig) and 95% Confidence Intervals for the Regression coefficient (B) are also presented. Regression coefficients for Age are not presented. Correlations (zero-order and partial) for each dummy variable are presented.

Findings indicated that there were significant ethnic group differences in the experience of LBP therefore hypothesis 3.1 was accepted.

Table 6.5b Ethnic Group Mean Differences

DV	*Independent Variable*		*Mean diff*	*SE*	*df*	*t*	*Sig.*	*95% CI for Mean Diff*	
	I	*J*	*(I-J)*					*Lower*	*Upper*
MSPQ transformed									
	Other	South Asian	0.15	0.12	424	1.22	0.23	-0.09	0.40
	Other	British	-0.18	0.12	424	-1.53	0.13	-0.42	0.05
	South Asian	British	0.32	0.11	424	3.03	**0.00**	0.11	0.53
P&H									
	Other	South Asian	2.89	1.04	424	2.77	**0.01**	0.84	4.93
	Other	British	-5.03	1.00	424	-5.05	**0.00**	-6.99	-3.07
	South Asian	British	7.86	0.89	424	8.86	**0.00**	6.12	9.61
CAT									
	Other	South Asian	2.01	1.14	424	1.76	0.08	-0.24	4.26
	Other	British	-2.07	1.09	424	-1.89	0.06	-4.22	0.08
	South Asian	British	4.00	0.97	424	4.10	**0.00**	2.08	5.91
PC									
	Other	South Asian	0.87	0.60	424	1.44	0.15	-0.31	2.05
	Other	British	-0.61	0.57	424	-1.05	0.29	-1.73	0.52
	South Asian	British	1.45	0.51	424	2.82	**0.00**	0.44	2.45
PR									
	Other	South Asian	-0.42	0.33	424	-1.29	0.20	-1.07	0.22
	Other	British	0.36	0.32	424	1.14	0.26	-0.26	0.98
	South Asian	British	-0.77	0.28	424	-2.72	**0.01**	-1.32	-0.21

Key: MSPQ = Modified Somatic Perception Questionnaire; CAT = Catastrophising subscale of the Coping Strategies Questionnaire; P&H = Praying and Hoping subscale of the Coping Strategies Questionnaire; PC = Pain Control subscale of the Pain Locus of Control; PR = Pain Responsibility subscale of the Pain Locus of Control

Region of Birth Group Differences.

Hypothesis 3.2. There are significant country of birth group differences in the experience of LBP

After controlling for demographic (step 1), social (step 2) and clinical factors (step 3), Region of Birth group membership (step 4) did not account for significant variance in the MZSRDS (R^2 change = 0.01, F change = 0.07, df = 3 and 412, p = 0.55).

Significant variance was accounted for by the Region of Birth factor in the RMDQ (R^2 change = 0.02, F change = 3.61, df = 3 and 412, p = 0.01), MSPQ (transformed) (R^2 change = 0.02, F change = 3.91, df = 3 and 412, p = 0.01), CSQ – P& H (R^2 change = 0.17, F change = 31.81, df = 2 and 413, p < 0.001), CSQ – CAT (R^2 change = 0.06, F change = 9.36, df = 2 and 413, p < 0.001), PC (R^2 change = 0.02, F change = 2.77, df = 2 and 413, p = 0.04) and PR (R^2 change = 0.02, F change = 3.11, df = 2 and 413, p = 0.03).

Regression model summary results are presented in table 13. Significant R^2 change statistics at step 4 are highlighted by bold text.

The results of investigations into differences between mean dependent variable scores for the Region of Birth Groups are presented in Table 6.5c p128 and summarised below. The Protected T procedure described by Cohen and Cohen (1983) was used to protect against inflated type II error where significant differences between the Region of Birth groups were only investigated for the dependent variables which demonstrated overall group differences (F =< 0.05). Significant differences are highlighted in bold text.

Disability. Patients born in the British Isles had significantly lower RMDQ scores than patients born in Africa.

Distress. There were no significant differences between Region of Birth groups for the mean MZSRDS scores. Patients from the British Isles had significantly greater MSPQ scores than patients from Africa.

Table 6.5c. Regression Models for Region of Birth

DV	*Model*	*R*	*R^2*	*Adj R^2*	*SE*	*Change Statistics*				
						R^2	F	df1	df2	p=
RMDQ	1	0.18	0.03	0.03	6.31	0.03	7.08	2	424	0.00
	2	0.23	0.05	0.04	6.28	0.02	2.06	4	420	0.09
	3	0.40	0.16	0.14	5.94	0.11	10.95	5	415	0.00
	4	0.43	0.18	0.16	5.88	0.02	3.61	3	412	**0.01**
MSPQ transformed	1	0.16	0.02	0.02	1.01	0.02	5.39	2	424	0.00
	2	0.21	0.04	0.03	1.00	0.02	2.19	4	420	0.07
	3	0.39	0.15	0.13	0.95	0.11	10.54	5	415	0.00
	4	0.42	0.18	0.15	0.94	0.02	3.92	3	412	**0.01**
MZSRDS	1	0.13	0.02	0.01	10.66	0.02	3.79	2	424	0.02
	2	0.20	0.04	0.02	10.60	0.02	2.29	4	420	0.06
	3	0.33	0.11	0.08	10.28	0.07	6.31	5	415	0.00
	4	0.33	0.11	0.08	10.29	0.00	0.71	3	412	0.55
P&H	1	0.18	0.03	0.03	8.81	0.03	7.49	2	424	0.00
	2	0.25	0.06	0.05	8.71	0.03	3.41	4	420	0.01
	3	0.32	0.10	0.08	8.57	0.04	3.75	5	415	0.00
	4	0.52	0.27	0.25	7.75	0.17	31.81	3	412	**0.00**
CAT	1	0.14	0.02	0.01	9.15	0.02	4.03	2	424	0.02
	2	0.25	0.06	0.05	9.00	0.04	4.75	4	420	0.00
	3	0.34	0.12	0.09	8.78	0.06	5.24	5	415	0.00
	4	0.42	0.17	0.15	8.52	0.06	9.36	3	412	**0.00**
PC	1	0.14	0.02	0.02	4.56	0.02	4.31	2	424	0.01
	2	0.16	0.03	0.01	4.57	0.01	0.63	4	420	0.64
	3	0.20	0.04	0.01	4.56	0.01	1.24	5	415	0.29
	4	0.24	0.06	0.03	4.53	0.02	2.77	3	412	**0.04**
PR	1	0.21	0.04	0.04	2.54	0.04	9.97	2	424	0.00
	2	0.25	0.06	0.05	2.53	0.02	1.70	4	420	0.15
	3	0.30	0.09	0.07	2.51	0.03	2.82	5	415	0.02
	4	0.33	0.11	0.08	2.49	0.02	3.12	3	412	**0.03**

Key: RMDQ = Roland and Morris Disability Questionnaire; MZSRDS = Modified Zung Self Rating Depression Scale; MSPQ = Modified Somatic Perception Questionnaire; CAT = Catastrophising subscale of the Coping Strategies Questionnaire; P&H = Praying and Hoping subscale of the Coping Strategies Questionnaire; PC = Pain Control subscale of the Pain Locus of Control; PR = Pain Responsibility subscale of the Pain Locus of Control

Coping Strategies. Patients from South Asia and patients from Africa did not have significantly different mean P&H scores. "Other" Region of Birth and the British Isles had significantly lower P&H means than African or South Asian born patients. The British Isles born patients had the significantly lowest group P&H means. African born patients reported the highest mean CAT scores. South Asian born patients and "Other" patients reported significantly lower CAT mean scores but were not significantly different from each other. British Isles born patients reported the significantly lowest CAT scores.

Control Beliefs. British Isles born patients had lower mean scores for PC and PR than African and South Asian born patients. Patients reporting "Other" Regions of Birth were not significantly different from any of the other Region of Birth groups for either the PC or PR sub scales.

Partialled group means and regression coefficients for the Psychological and Disability factors regressed on Region of Birth Groups are presented in Appendix C table C3 (page xxvii-xxix). The constant for each regression model (*constant*) (which represents the mean for the reference group "other" Region of Birth for the sub set of data where the clinical, social and demographic factors do not vary), the Beta (B) coefficients (which represent the partialled difference in dependent variable means between the reference group and dummy variable) the associated Standard Errors (SE), t-values (t) p values (sig) and 95% Confidence Intervals for the Regression coefficient (B) are also presented. Correlations (zero-order and partial) for each dummy variable are included in the table. Regression coefficients for age are not presented in the table.

Findings indicated that there were significant country of birth group differences in the experience of LBP therefore hypothesis 3.2 was accepted.

Table 6.5d Mean Differences for Region of Birth Groups

DV	*Independent Variable*		*Mean Diff*	*SE*	*df*	*t*	*Sig.*	*95% CI for Mean Diff*	
	I	*J*	*(I-J)*					*Lower*	*Upper*
RMDQ									
	Other	South Asia	-0.36	1.01424	-0.35	0.73		-2.35	1.64
	Other	British Isles	-1.56	0.90424	-1.73	0.08		-3.33	0.21
	Other	Africa	0.99	1.08424	0.91	0.36		-1.13	3.10
	South Asia	British Isles	1.14	0.75424	1.52	0.13		-0.33	2.62
	South Asia	Africa	1.27	0.96424	1.33	0.19		-0.61	3.16
	British Isles	Africa	-2.51	0.83424	-3.01	**0.00**		-4.14	-0.87
MSPQ transformed									
	Other	South Asia	-0.01	0.16424	-0.08	0.94		-0.33	0.31
	Other	British Isles	-0.22	0.14424	-1.53	0.13		-0.50	0.06
	Other	Africa	0.21	0.17424	1.23	0.22		-0.13	0.55
	South Asia	British Isles	0.20	0.12424	1.63	0.10		-0.04	0.43
	South Asia	Africa	0.21	0.15424	1.37	0.17		-0.09	0.51
	British Isles	Africa	-0.42	0.13424	-3.19	**0.00**		-0.68	-0.16
P&H									
	Other	South Asia	3.22	1.34424	2.41	**0.02**		0.59	5.85
	Other	British Isles	-4.44	1.19424	-3.74	**0.00**		-6.77	-2.11
	Other	Africa	4.16	1.42424	2.93	**0.00**		1.37	6.95
	South Asia	British Isles	7.59	0.99424	7.67	**0.00**		5.65	9.54
	South Asia	Africa	1.05	2.27424	0.83	0.41		-1.44	3.53
	British Isles	Africa	-8.60	1.09424	-7.86	**0.00**		-10.75	-6.45
CAT									
	Other	South Asia	0.34	1.47424	0.23	0.82		-2.55	3.24
	Other	British Isles	-2.62	1.30424	-2.00	**0.05**		-5.18	-0.05
	Other	Africa	3.52	1.56424	2.25	**0.02**		0.45	6.59
	South Asia	British Isles	2.87	1.09424	2.63	**0.01**		0.73	5.01
	South Asia	Africa	-3.10	1.39424	-2.23	**0.03**		-5.83	-0.37
	British Isles	Africa	-6.08	1.21424	-5.04	**0.00**		-8.45	-3.71

Table 6.5d cont.,

DV	*Independent Variable*		*Mean Diff*	*SE*	*df*	*t*	*Sig.*	*95% CI for Mean Diff*	
	I	*J*	*(I-J)*					*Lower*	*Upper*
PC									
	Other	South Asia	0.82	0.78424	1.05	0.29		-0.71	2.36
	Other	British Isles	-0.64	0.69424	-0.91	0.36		-2.00	0.73
	Other	Africa	0.69	0.83424	0.83	0.41		-0.95	2.32
	South Asia	British Isles	1.43	0.58424	2.47	**0.01**		0.29	2.57
	South Asia	Africa	-0.16	0.74424	-0.22	0.83		-1.61	1.29
	British Isles	Africa	-1.31	0.64424	-2.04	**0.04**		-2.57	-0.05
PR									
	Other	South Asia	-0.53	0.43424	-1.22	0.22		-1.37	0.32
	Other	British Isles	0.18	0.38424	0.46	0.64		-0.57	0.92
	Other	Africa	-0.74	0.46424	-1.62	0.11		-1.64	0.16
	South Asia	British Isles	-0.69	0.32424	-2.16	**0.03**		-1.31	-0.06
	South Asia	Africa	-0.20	0.41424	-0.49	0.63		-0.99	0.60
	British Isles	Africa	-0.91	0.35424	-2.57	**0.01**		-1.60	-0.21

Key: RMDQ = Roland and Morris Disability Questionnaire; MSPQ = Modified Somatic Perception Questionnaire; CAT = Catastrophising subscale of the Coping Strategies Questionnaire; P&H = Praying and Hoping subscale of the Coping Strategies Questionnaire; PC = Pain Control subscale of the Pain Locus of Control; PR = Pain Responsibility subscale of the Pain Locus of Control

Religious Group Differences.

Hypothesis 3.3 There are significant reported religious group differences in the experience of LBP.

After controlling for demographic, social and clinical factors, Religious group membership (Step 4) accounted for a significant proportion of the variance of the RMDQ (R^2 change = 0.04, F change = 6.36, df = 3 and 412, p < 0.00) MSPQ (transformed) (R^2 change = 0.03, F change = 4.09, df = 3 and 412, p = 0.07), MZSRDS (R^2 change = 0.02, F change = 24.90, df = 3 and 412, p = 0.01), P& H (R^2 change = 0.14, F change = 6.36, df = 3 and 412, p < 0.00) CAT (R^2 change = 0.05, F change = 8.54, df = 3 and 412, p < 0.00), PC (R^2 change = 0.02, F change = 2.92, df = 3 and 412, p = 0.03) and PR (R^2 change = 0.03, F change = 5.12, df = 3 and 412, p < 0.02).

Model summary statistics are presented in Table 6.5e p133. Significant changes in R^2 at step 4 are highlighted in bold.

Significant differences between the religious groups and the dependent variable measures of LBP were investigated using the Protected T method outlined by Cohen and Cohen (1983). Results are summarised below and presented in Table 6.5f p135-136. Significant pairwise comparisons are highlighted in bold.

Disability. Muslim patients had the highest mean RMDQ scores. Hindu and "Other" religion patients did not have significantly different RMDQ scores and "Other" and Christian Religions did not have significantly different RMDQ scores. Hindu patients had significantly higher RMDQ mean scores than patients reporting a Christian religion.

Distress. Muslims reported the highest MSPQ scores that were significantly higher than Christian patients. Christian patients reported the lowest MSPQ scores that were significantly lower than both Muslim and Hindu patients. Patients reporting "other" religion were not significantly different from any other religious group. Muslims reported significantly higher mean MZSRDS scores than any other religious group. Hindu patients did not have significantly different MZSRDS mean scores than Christian patients or "other" religion patients.

Table 6.5e. Regression Models for Religion

Dependent Variable	*Model*	*R*	R^2	*Adj* R^2	*SE*	***Change Statistics***				
						R^2	F	df1	df2	p=
RMDQ	1	0.18	0.03	0.03	6.31	0.03	7.08	2	424	0.00
	2	0.23	0.05	0.04	6.28	0.02	2.06	4	420	0.09
	3	0.40	0.16	0.14	5.94	0.11	10.95	5	415	0.00
	4	0.45	0.20	0.17	5.83	0.04	6.36	3	412	**0.00**
MSPQ transformed	1	0.16	0.02	0.02	1.01	0.02	5.39	2	424	0.00
	2	0.21	0.04	0.03	1.00	0.02	2.19	4	420	0.07
	3	0.39	0.15	0.13	0.95	0.11	10.54	5	415	0.00
	4	0.42	0.18	0.15	0.94	0.02	4.09	3	412	**0.01**
MZSRDS	1	0.13	0.02	0.01	10.66	0.02	3.79	2	424	0.02
	2	0.20	0.04	0.02	10.60	0.02	2.29	4	420	0.06
	3	0.33	0.11	0.08	10.28	0.07	6.31	5	415	0.00
	4	0.36	0.13	0.10	10.18	0.02	3.69	3	412	**0.01**
P&H	1	0.18	0.03	0.03	8.81	0.03	7.49	2	424	0.00
	2	0.25	0.06	0.05	8.71	0.03	3.41	4	420	0.01
	3	0.32	0.10	0.08	8.57	0.04	3.75	5	415	0.00
	4	0.49	0.24	0.22	7.91	0.14	24.89	3	412	**0.00**
CAT	1	0.14	0.02	0.01	9.15	0.02	4.03	2	424	0.02
	2	0.25	0.06	0.05	9.00	0.04	4.75	4	420	0.00
	3	0.34	0.12	0.09	8.78	0.06	5.24	5	415	0.00
	4	0.41	0.17	0.14	8.55	0.05	8.54	3	412	**0.00**
PC	1	0.14	0.02	0.02	4.56	0.02	4.31	2	424	0.01
	2	0.16	0.03	0.01	4.57	0.01	0.63	4	420	0.64
	3	0.20	0.04	0.01	4.56	0.01	1.24	5	415	0.29
	4	0.25	0.06	0.03	4.53	0.02	2.92	3	412	**0.03**
PR	1	0.21	0.04	0.04	2.54	0.04	9.97	2	424	0.00
	2	0.25	0.06	0.05	2.53	0.02	1.70	4	420	0.15
	3	0.30	0.09	0.07	2.51	0.03	2.82	5	415	0.02
	4	0.35	0.12	0.09	2.47	0.03	5.11	3	412	**0.00**

Key: RMDQ = Roland and Morris Disability Questionnaire; MZSRDS = Modified Zung Self Rating Depression Scale; MSPQ = Modified Somatic Perception Questionnaire; CAT = Catastrophising subscale of the Coping Strategies Questionnaire; P&H = Praying and Hoping subscale of the Coping Strategies Questionnaire; PC = Pain Control subscale of the Pain Locus of Control; PR = Pain Responsibility subscale of the Pain Locus of Control

Coping Strategies. Muslim and Hindu, and Christian and "Other" religions groups did not have significantly different mean P&H or CAT scores. Muslims and Hindus had significantly higher P&H and CAT mean scores than Christian or "Other" religious groups.

Control Beliefs. Muslim and Hindu patients did not have significantly different PC mean scores but Hindus had higher mean PR scores than either "Other" or Christian religious groups. Muslim and Hindu, and Christian and "Other" religions groups did not have significantly different mean PC scores. Muslims and Hindus had significantly lower PR mean scores than Christian or "Other" religious groups.

Except for age, partialled group means and regression coefficients for the Psychological and Disability factors regressed on Religious Groups (Model 4) are presented in Appendix C table C4 (page xxx-xxxii). The constant for each regression model (*constant*) (which represents the mean for the reference group "other" Religion for the sub set of data where the clinical, social and demographic factors do not vary), the Beta (B) coefficients (which represent the partialled difference in dependent variable means between the reference group and dummy variable), the associated Standard Errors (SE), t-values (t) p values (sig) and 95% Confidence Intervals for the Regression coefficient (B) are also presented. Correlations (zero-order and partial) for each dummy variable are also presented.

Findings indicated that there were significant religious group differences in the experience of LBP therefore hypothesis 3.3 was accepted.

Table 6.5f Mean Differences for Religious Groups

DV	*Independent Variable*		*Mean diffs*		*df*	*t*	*Sig.*	*95% CI for Mean Diff*	
	I	*J*	*(I-J)*	*SE*				*Lower*	*Upper*
RMDQ									
	Other	Hindu	-1.52	1.00424	1.52	0.13		-3.49	0.45
	Other	Muslim	-4.23	1.23424	3.44	**0.00**		-6.64	1.81
	Other	Christian	0.09	0.90424	0.10	0.92		-1.68	1.86
	Hindu	Muslim	-2.71	1.08424	-2.50	**0.01**		-4.83	-0.58
	Hindu	Christian	1.43	0.71424	-2.02	**0.04**		-2.81	-0.04
	Muslim	Christian	4.13	1.01424	-4.10	**0.00**		2.15	6.11
MSPQ transformed									
	Other	Hindu	-0.12	0.16424	-0.73	0.46		-0.44	0.20
	Other	Muslim	0.22	0.20424	1.11	0.27		-0.17	0.61
	Other	Christian	-0.20	0.14424	-1.41	0.16		-0.49	0.08
	Hindu	Muslim	-0.10	0.17424	-0.59	0.56		-0.44	0.24
	Hindu	Christian	0.32	0.11424	2.83	**0.00**		0.10	0.55
	Muslim	Christian	0.42	0.16424	2.62	**0.00**		0.11	0.74
MZSRDS									
	Other	Hindu	-3.01	1.75424	-1.72	0.09		-6.46	0.43
	Other	Muslim	-6.89	2.15424	-3.21	**0.00**		-11.11	-2.67
	Other	Christian	2.06	1.57424	1.31	0.19		-1.03	5.15
	Hindu	Muslim	-3.88	1.89424	-2.05	**0.04**		-7.59	-1.58
	Hindu	Christian	0.95	1.23424	-0.77	0.44		-1.47	-3.38
	Muslim	Christian	4.83	1.76424	2.74	**0.01**		1.37	8.29
P&H									
	Other	Hindu	8.20	1.36424	6.02	**0.00**		5.52	10.87
	Other	Muslim	9.32	1.67424	5.58	**0.00**		6.04	12.61
	Other	Christian	1.76	1.22424	1.44	0.15		-0.64	4.16
	Hindu	Muslim	1.13	1.47424	0.77	0.44		-1.76	4.01
	Hindu	Christian	-6.44	0.96424	-6.71	**0.00**		-8.32	-4.55
	Muslim	Christian	7.56	1.37424	5.52	**0.00**		4.87	10.25
CAT									
	Other	Hindu	3.33	1.47424	2.26	**0.02**		0.44	6.22
	Other	Muslim	4.51	1.80424	2.50	**0.01**		0.96	8.05
	Other	Christian	-0.99	1.32424	-0.75	0.45		-3.59	1.60
	Hindu	Muslim	1.18	1.59424	0.74	0.46		-1.94	4.30
	Hindu	Christian	-4.32	1.00424	-4.17	**0.00**		-6.36	-2.29
	Muslim	Christian	5.50	1.48424	3.72	**0.00**		2.60	8.41

Table 6.5f continued..

DV	Independent Variable		Mean diffs		df	t	Sig.	95% CI for Mean Diff	
	I	J	(I-J)	SE				Lower	Upper
PC									
	Other	Hindu	1.75	0.78424	2.24	**0.03**		0.21	3.28
	Other	Muslim	1.73	0.96424	1.81	0.07		-0.15	3.61
	Other	Christian	0.44	0.70424	0.63	0.53		-0.94	1.82
	Hindu	Muslim	-0.02	0.84424	-0.02	0.99		-1.67	1.64
	Hindu	Christian	-1.31	0.55424	-2.38	**0.02**		-2.38	-0.23
	Muslim	Christian	1.29	0.78424	1.64	0.10		-0.25	2.83
PR									
	Other	Hindu	-1.08	0.43424	-2.53	**0.01**		-1.91	-0.24
	Other	Muslim	-1.73	0.52424	-3.31	**0.00**		-2.75	-0.70
	Other	Christian	-0.44	0.38424	-1.16	0.25		-1.19	0.31
	Hindu	Muslim	-0.65	0.30424	2.12	0.34		0.05	1.22
	Hindu	Christian	0.64	0.30424	2.12	**0.03**		0.05	1.22
	Muslim	Christian	-1.29	0.43424	-3.01	**0.00**		-2.13	-0.45

Key: RMDQ = Roland and Morris Disability Questionnaire; MZSRDS = Modified Zung Self Rating Depression Scale; MSPQ = Modified Somatic Perception Questionnaire; CAT = Catastrophising subscale of the Coping Strategies Questionnaire; P&H = Praying and Hoping subscale of the Coping Strategies Questionnaire; PC = Pain Control subscale of the Pain Locus of Control; PR = Pain Responsibility subscale of the Pain Locus of Control

Chapter 7. Discussion

7.1 Data Screening.

Tabachnick and Fidell (1996) pointed out that the success of any statistical analysis is predicated on a successful prior screening of the data.

Data screening for the present study addressed the following issues: the accuracy of the data input onto the data file, consideration of missing data issues and the testing of the data against the assumptions required by the multiple regression statistical model.

Accuracy of the Data input.

Tabachnick and Fidell (1996) pointed out that errors could be made when copying data from raw data sheets onto a computer data file. They recommended that the best method for determining the accuracy of the data entry was to perform a complete check of the raw data against their values in the computer data file (Tabachnick and Fidell, 1996). For large data sets they suggested an inspection of descriptive statistics and frequency charts for out of range or implausible values.

Diagram 6.2 p106, provides a representation the sample derivation. The reliability of the application of the exclusion criteria was confirmed by an examination of the hospital notes of all patients who met the study a priori exclusion criteria (n=119). The cases where self-reported data collection was suspended due to staff changes (n=71) and for those who refused to participate (n=40) were confirmed by inspection of the raw data.

It was concluded that a proof reading of the raw data for all those cases included in the study (n=427) was impractical for the present investigation. An inspection of the descriptive statistics and frequency charts was not considered to provide sufficient evidence for the accuracy of the data set as inaccurately recorded but plausible in-range data could not be identified by this method.

The accuracy of the data input for cases included in the study (n=427) was therefore investigated by comparing a randomly selected n=25 (5%) data cases with their original data and by inspection of the descriptive and frequency distribution charts and statistics.

No inaccurate, out of range or implausible values were detected. It was concluded from this evidence that the data had been recorded accurately in the data file.

Missing Data

Missing data can threaten the validity of a study's findings and result in biased estimates of population parameters (Little and Rubin 1987). Caution was applied to the choice of a missing data strategy for the present study as the success of the main analysis was dependent upon the successful handling of the missing data. Consideration was applied to the proportion and the pattern of missing data and to practical issues concerning the availability of suitable computer software (Appendix A).

Choice of Missing Data Handling Method

Roth (1994) and Wothke (1998) reviewed the available literature on missing data handling techniques. They concluded that, compared to other widely available methods, Multiple Imputation (MI) was the superior method on the basis that results of statistical simulations had demonstrated that the estimates produced by this method were less biased than those produced by other available missing data methods (Roth 1994, Wothke 1998). Recently Schafer (1997) wrote general-purpose MI software for incomplete multivariate data (NORM or CAT: Schafer 1997) however this model was not available during the course of the current study. An inspection of the available literature suggested that there were no other widely available computer software programmes for the use of either Multiple Imputation or Hot Deck procedures (Lessler and Kalsbeck 1992). Practical considerations therefore dictated that Multiple Imputation methods and the Hot Deck procedure were not considered as appropriate strategies for handling the missing data for the current study.

Missing data was found on all quantitative variables except age (Appendix B table B1 page viii). A complete case analysis had practical advantages over the Estimation Maximisation (EM) (Little and Rubin (1987) model and statistical advantages over the available cases method when only a few cases were missing. The data were examined to determine whether they met the a priori criteria for a complete case analysis outlined in Appendix A. An analysis with complete cases only would have been conducted on n=302 (70.7%) of the cases. Cohen and Cohen's (1983) rule of thumb suggested that a multiple regression model conducted on several hundred cases would be robust to dropping 15 cases due to missing data.

No single variable or combination of variables could be identified whose exclusion would have substantially increased the availability of cases for analysis (Appendix B table B2 page viii). For example an additional number of cases (n=13) was made available if the MZSRDS and the MSPQ were not included in the analysis. However distress associated with LBP was an important element of the experience of LBP and therefore excluding MZSRDS and the MSPQ from the analysis would have reduced the validity of the study.

The pattern of missing data was examined to determine whether the data was Missing Completely at Random (MCAR) (Little and Rubin 1987: Appendix A). The data was found to be MCAR if no significant differences were found between the mean scores of groups made up of missing data and complete data on the available quantitative variables. However there appeared to be a pattern in data where patients who did not complete their self completed questionnaires were either significantly older than patients who completed their questionnaires ($p<0.05$: MZSRDS, P&H), or the differences between their mean ages approached significance ($p<0.07$: MSPQ, CAT, PC, PR). Patients who did not complete their CAT, P&H, and PR questionnaires were also significantly more likely to have higher MZSRDS scores than those patients who did (Appendix B table B3 page ix). Although mean differences did not always reach the a priori threshold for significant ($p=<0.05$), the evidence against the null hypothesis was sufficiently strong for both age (AGE) and depressive symptoms (MZSRDS) to conclude in the current study, that the missing data mechanism was at least partly

systematic. The finding that missing data was dependent upon age and depressive symptoms suggested that the missing data were not MCAR but at least Missing At Random (MAR), and perhaps Non-Ignorable Missing Data (Little and Rubin 1987). Little and Rubin (1987) argued that there was no currently available explicit test for Non-Ignorable missing data and that missing data that was Non-Ignorable was catastrophic for a main analysis. In light of this, the data was assumed to be MAR.

Missing data handling methods appropriate for handling data that was MAR were examined for suitability for the present study.

A complete case analysis was rejected. This method was not robust to proportions of missing data found in the current study, nor missing data that was MAR. Multiple Imputation (MI) and Hot Deck procedures had been excluded due to practical difficulties with suitable and available computer software. The EM model appeared to be the most appropriate method for handling missing data in the present study due to its practical advantages over the MI and Hot Deck procedures and it's robustness for the proportions of missing data found in the current study.

The data file with the EM imputed values was used for all subsequent statistical analyses.

Tachachnick and Fidell (1996) suggested that with any imputed data set, a sensitivity analysis should be conducted to determine whether the results differed markedly from a complete or available case analysis. Appendix B tables B4 (page xi), B5 (page xii) and B6 (page xii) provided results of a sensitivity analysis suggested by Tabachnick and Fidell (1996). Inspection of Appendix B table B4 provided evidence for the appropriateness of the EM model for the current study as only marginal differences were found between the means and standard deviations of the quantitative independent variables for the EM, a complete case and an available case analysis. Inspection of Appendix B tables B5 (page xii) and B6 (page xiii) suggested that only marginal differences were also found between the correlation matrices of the EM analysis and a complete case analysis. The mean difference between the correlation estimates for the EM

correlation matrix and the Complete Cases correlation matrix was r=0.01 (sd 0.01). Further evidence for the appropriateness of the EM model was obtained by comparison of the estimates for the available case analysis and the EM analysis. As all the available data was used in the calculation of the estimate, the available case analysis was a statistically efficient method (Little and Rubin 1987). However this method is generally inappropriate as a missing handling technique as out of range correlation estimates (with r>1 or r<-1) and negative eigenvalues (akin to negative variance) (Tabachnick and Fidell 1996) can be produced (Graham and Hofer, 1996). The means and standard deviations produced by the EM model the available case analysis were almost exactly equal leading to the conclusion that the EM model employed in the present analysis was a statistically efficient method (Appendix B table B4 page xi).

An Alternative Missing Data Handling Method.

The choice between missing data handling strategies appropriate for the current investigation was between a complete case analysis and the EM algorithm. An analysis with complete cases only would have been conducted on 70.9% of the study sample and therefore the power of the study would have been reduced. Reduced power increased the risk of a type I error, the successful detection of difference when one exists. Examination of the pattern that the missing data formed in the data matrix suggested a systematic cause. Investigations indicated that missing data was in part related to two measured variables: age and MZSRDS, although this relationship did not appear to be strong. This finding suggested that a complete case analysis may have produced biased estimates as the data was not Missing Completely at Random. Missing Completely at Random was the only pattern of missing data for which a complete case analysis did not produce biased estimates. Biased estimates can affect the generalisability of the study findings.

Implications of missing data.

Except for age, missing data was found on all quantitative variables included in the study. The proportion of missing data ranged from 1.9% for Duration of LBP and Years in the UK to 15.9% for the MSPQ and 15.22% for the MZSRDS. This finding suggested that missing data was not distributed at random through the

questionnaires. Inspection of table B1 in Appendix B (page viii) indicated that single item questions that required factual responses (age, Duration of LBP, Years in the UK) had the lowest proportion of missing data whereas multi-item questionnaires with multi-response categories which required subjective responses (P&H, CAT, PC, PR, MSPQ, MZSRDS) had the highest proportion of missing data. The RMDQ, a self reported multi-item questionnaire with dichotomous response categories had a 4.5% missing data. Inspection of the self completed questionnaires suggested that the content may have been a factor in the differential completion rates. The two questionnaires which had the highest rates of missing data were the MZSRDS and the MSPQ, both of which addressed negative mood or distress. The PLC sub-scales assessed beliefs about the controllability of pain (10 item PC subscale) and responsibility for the management of pain (5 item PR subscale). The items of these subscales were contained within a single 20 item questionnaire that also included 5 items not included in the two sub-scales (Main and Waddell, 1991). The proportion of missing data was similar for each PLC subscales (12.6% and 13.4% respectively) with only n=3 more cases failing to complete the PC than the PR. This finding may be expected for subscales for whose items were contained within a larger questionnaire. Similarly the 6 items of the P&H, which assessed the frequency of using Praying and Hoping as a coping strategy, and 6 items of the CAT, which assessed using Catastrophising as a coping strategy, were distributed randomly in a single 12 item questionnaire (Rosenstiel and Keefe, 1983). The rates of missing data for each CSQ subscale were similar (10.3% and 9.8% respectively) and n=2 more respondents completed the P&H compared to the CAT. The self completed questionnaire with the lowest rate of missing data was the RMDQ (4.5%). The rates of missing data for the self completed questionnaires suggested the following structure (in order of increasing missing data rates): the RMDQ (disability), the CSQ (coping strategies), PLC (pain beliefs) and the MSPQ and MZSRDS (negative mood). The finding that missing data rates were not consistent across the self completed questionnaires suggested a systematic cause. A potential systematic cause, the influence of a fatigue effect, was examined by comparing the order of the rates of missing data with the order in which the questionnaires appeared in the study booklet. Other than for the questionnaires that assessed mood, there did appear to be some evidence for a

fatigue effect where the increasing rates of incomplete questionnaires was associated with the order of the questionnaire in the study booklet. However it appeared that the questionnaires that assessed mood (MSPQ and MZSRDS) demonstrated the highest rates of non response and this was unrelated to their order in the study booklet.

These findings indicated that in the present study patients demonstrated a preference to complete questionnaires that addressed cognitive factors or self reported disability rather than questionnaires that addressed their negative mood. Although further work would be required on the potential causes of these findings, it was concluded that patients with LBP may require extra assistance, above that provided in the present study, when completing questionnaires which addressed their self reported negative mood.

Evidence of a trend was also found where patients who did not complete their self-reported questionnaires were older and reported more symptoms of depression. Although this trend did not reach the a priori threshold for significance ($p=<0.05$) for all of the available quantitative variables, the evidence against the null hypothesis was significantly strong to suggest that in a busy clinic setting older LBP patients and those with more symptoms of depression may also require additional assistance to complete their self assessment questionnaires.

The findings of the present study suggested that missing data can be problematic for cross-sectional studies that employ self completed questionnaires and that certain questionnaires such as those which addressed the mood of LBP patients (MSPQ and MZSRDS) may be particularly problematic. An inspection of a randomly selected sample of the literature which employed the MSPQ or the MZSRDS, suggested that issues related to missing data were rarely explicitly addressed (Burton et al., 1995, Greenough and Fraser 1991, Sikorski et al., 1996, Hope and Forshaw 1999, Parker et al., 1995, Main and Waddell 1987, Main et al., 1992, Rose et al., 1995). Although the extent of the problem was not discussed, Burton et al., (1995) reported that uncompleted questionnaires resulted in different groups used to derive the sample descriptive statistics. No evidence

of investigations of the impact of missing data was provided (Burton et al., 1995). Main and Waddell (1991) reported a low proportion of missing data in a large test battery of self completed questions that included the MSPQ, MZSRDS, P&H, CAT, PC and PR. Little and Rubin (1987) demonstrated that if the pattern of the missing data has not been determined as MCAR then an analysis with complete cases only can lead to biased estimates, reduced power and potentially unreliable results. Although Main et al., (1991) did not address the pattern of missing data a complete case analysis resulted in the exclusion of only n=4 out of n=120 patients and therefore the impact on the study findings was likely to be marginal. Biased findings due to inappropriate handling of missing data has not been investigated in the literature on LBP and the scale of the problem therefore remains unknown. However even if missing data is assumed to be MCAR, an analysis of complete cases only is likely to result in less precise estimates due to reduced power. In light of the findings from the present study, it was concluded that careful attention should be applied to the method employed for handling missing data in research studies on LBP to ensure that unbiased and precise estimates can be produced from a multivariate statistical analysis.

Normality.

Parametric statistical tests produce unbiased estimates if the data meets the assumptions of univariate and multivariate normality (Tabachnick and Fidell, 1996).

The normality of a variable can be described in terms of its skew and kurtosis where skew determines the extent to which the distribution is symmetrical about the mean and kurtosis describes the flatness of the distribution. Comparing skew and kurtosis to the z-distribution can assess the likelihood that the distribution departs from normality. Although Tabachnick and Fidell (1996) pointed out that departures from normality are not always catastrophic for an analysis they suggested that a multivariate analysis conducted on normally distributed data is often "better" than one conduced on non-normal data.

The quantitative variables included in the study were explicitly tested for univariate normality (Appendix B table B7 xiii). Two variables were found to be

significantly skewed: the MSPQ and Duration of LBP. Inspection of the distributions for these variables (Appendix B graphs B1 & B2 page xiii) confirmed that they were significantly skewed. Duration of LBP also demonstrated significantly kurtosis. Tabachnick and Fidell (1996) suggested that the decision over possible solutions to significant departures from normality should be informed by whether or not the variable was arbitrarily scored. A transformation of a non-arbitrarily scored variable was likely to hinder interpretation. The MSPQ was an arbitrarily scored variable and was therefore a candidate for transformation. An inspection of the available literature that had employed the MSPQ suggested that a transformation of this variable had never been reported (Main et al., 1983; Main et al., 1992; Parker et al., 1995; Burton et al., 1995; Rose et al., 1995; Hope and Forshaw, 1999). This finding may be related to the fact that scores from the MSPQ were commonly combined with scores from the MZSRDS to derive cut-off scores to screen for risk for poor outcome (The Distress and Risk Assessment Method (DRAM), Main et al., 1992). In this context, a transformation of the MSPQ was likely to hinder interpretation. However it was not the intention of the present study to form dichotomous "at risk" groups and therefore interpretation of the variable was not likely to hinder interpretation. Tabachnick and Fidell (1996) argued that a normally distributed variable was also more likely to produce unbiased estimates. Inspection of the graph B2 (Appendix B page xiii) suggested that a root mean square transformation was the most appropriate transformation for the MSPQ. The skew statistic and Appendix B graph B3 (page xiii) suggested that the distribution of the transformed MSPQ did not depart from normality. This suggested that the root mean transformation had been successful.

It was concluded that normalising the distribution of the MSPQ study resulted in unbiased co-efficients for any statistical analyses in which the transformed MSPQ was a variable.

An inspection of the literature indicated that this procedure was uncommon for studies that employed the MSPQ (Main and Waddell 1991, Burton et al., 1995, Greenough and Fraser 1991, Sikorski et al., 1996, Hope and Forshaw 1999; Parker et al., 1995, Main and Waddell 1987, Main et al., 1992, Rose et al., 1995).

However no evidence was provided in the reviewed studies that the distribution of scores of the MSPQ had been investigated. The transformation conducted in the present study was designed so that distribution of the MSPQ met the assumptions of a multivariate quantitative statistical analysis. However this procedure precluded comparisons of the present study MSPQ mean score with mean scores of previous published research, an important feature of external validity of the study sample (Streiner and Norman, 1995). A review of the literature suggested that other than Sikorski et al., (1996), research studies that employed the MSPQ often employed it in association with the MZSRDS to form a screening tool for psychological distress, the Distress and Risk Assessment Method (DRAM) (Main et al., 1992). The primary function of the MSPQ in the DRAM was to distinguish between the Distressed Depressed (DD) and Distressed Somatic (DS) groups (Main et al., 1992). However Burton et al., (1995) did not distinguish between these two groups in a study of 252 consecutive referrals of new back pain episodes to an osteopath clinic, and reported that patients who had a MZSRDS score greater than 33 were distressed. Greenough et al., (1991) on the other hand, re-scored the MZSRDS and added the total to the MSPQ total to produce a total score for distress with a 0-99 range of possible scores. Evidence for the external validity of the present study was therefore obtained by comparing the mean score of the MZSRDS with those of other research studies, rather than mean MSPQ score.

The variable "Duration of LBP" was also found to be significantly different from normal on the basis of significant positive skew and significant positive kurtosis (Appendix B table B7 page xiii). An inspection of the histogram with normal curve overlay (Appendix B graph B1 page xiii) confirmed that this variable was not normally distributed. Further evidence for the non-normal distribution of the Duration of LBP variable was obtained by comparison of the mean and standard deviation provided in Appendix B graph B1. A standard deviation that included the zero point in its range from the mean indicated a positively skewed distribution. As negative values for Duration of LBP were not logically possible, the distribution for this variable and any correlations based on it, were likely to be truncated. Duration of LBP was therefore a candidate for transformation. However when assessed against the a priori criteria for transformation it was

noted that Duration of LBP was a logically scored variable in that each value represented the self reported amount of time in years that the symptoms of LBP had been present. A transformation was therefore likely to hinder interpretation. Furthermore Duration of LBP was not included as substantive variable in the current research and relationships between this variable and other substantive variables of interest were not addressed in the primary research questions. For the purposes of the present research, Duration of LBP was used for descriptive purposes. Non-parametric statistics were employed for inferential purposes (Siegel, 1956).

Prior knowledge of the data set suggested that "Proportion of Life Spent in the UK" was not likely to be a normally distributed variable. However inspection of the skew and kurtosis statistics and their associated z-scores indicated that the distribution of this variable did not depart from normality. Similarly the relationship between the mean and standard deviation did not suggest a non-normal distribution. Inspection of the variable histogram with normal curve overlay (Appendix B graph B4 page xiv) however revealed a mixed model dichotomous distribution where one aspect of the dichotomy appeared to be normally distributed. Proportion of life spent in the UK was a self reported cultural variable derived from a cultural question that asked respondents to describe how many years they had lived in the UK. The reported value was divided by the age in years of the patients to derive the proportion of their life that each patient had lived in the UK. It was expected that in the study sample there would be a group of patients for whom Proportion of life spent in the UK would be equal to, or approach p=1. Inspection of Appendix B graph B4 indicated that this group comprised approximately n=180 patients. Inspection of graph B4 also indicated that patients who had not spend p=1 of their lives in the UK had normally distributed data for the variable "Proportion of life spent in the UK". This variable was not considered for transformation as it represented 2 aspects of the study sample and a transformation was unlikely to normalise the distribution. Descriptive statistics were used to analyse Proportion of Life spent in the UK.

Outliers.

Outliers present problems for a statistical analysis in that their influence on the analysis is greater than non-outlying cases. Tabachnick and Fidell (1996) demonstrated that for a regression model, multi or univariate outliers could determine the choice between several best fitting regression lines.

The main multivariate statistical test used by the present study was multiple regression and therefore the data set was examined to determine the presence of univariate and multivariate outliers.

Univariate Dichotomous Outliers and Classification of Cultural Groups.

Dichotomous variables were defined as univariate outliers where one of the dichotomies had 10% or less of the cases (Rummel, 1970). Tabachnick and Fidell (1996) and Cohen and Cohen (1983) pointed out that dichotomous variables which demonstrated uneven splits of this magnitude produced truncated correlation coefficients as the scores in the category with 10% of the cases were more influential than those in the category with 90% of the cases.

A number of dichotomous variables that met the criteria for univariate outliers were found in the data set. These variables were primarily cultural variables and included ethnic, country of birth and religious groups. Dichotomous SC group outliers were also found. The present study adopted the method described by Tachachnick and Fidell (1996) for dealing with dichotomous outliers. Groups with fewer than 10% of the case were collapsed to increase the proportion of cases above the univariate outlier criteria. This pragmatic approach had practical and statistical advantages in that all of the data was made available for analysis and the group influences on the regression solution were not weighted in favour of the groups that were under-represented in the study. However the interpretation of the results of the analysis were dependent upon the logic that underlay of choice of the groups to collapse into a newly formed "mixed" cultural group. Collapsing of n>1 cultural groups into a single group implied that the newly formed cultural group was likely to exhibit increased heterogeneity compared to the donor groups. The present study investigated cultural influences on LBP by examining the differences between cultural groups and the measures

designed to assess the experience of LBP. Discrete and homogeneous cultural groups were required for this purpose. For the present study a pragmatic approach was employed to identifying the cultural groups to collapse. All cultural groups that comprised less than 10% of the cases were collapsed into single mixed cultural group; "other ethnicity", "other country of birth" and "other religions". These groups differed systematically from the other cultural groups in the study as they were identified by a priori statistical criteria and not by the Cultural group derivation content analysis on the basis of cultural similarity. The similarity implied by a self-definition was of less importance for these groups. Alternative methods of identifying the groups for collapsing such as by presumed similarities such as shared languages, socio-political backgrounds, race etc, were rejected due to the lack of available supporting data. Comparisons between "other" groups and homogenous cultural groups were therefore interpreted with care.

SC had been used to measure social influences on LBP (Croft and Rigby, 1994; Papageorgiou et al., 1997). Waddell and Waddell (2000) described SC a simple and crude classification system derived from occupation. They argued that SC provided information on 2 aspects of social factors: type of work (manual vs. non-manual) and social disadvantage (Waddell and Waddell (2000). The higher SC groups were more likely to be engaged in non-manual occupations (SC groups I, II, and III non-manual) and the lower groups were more likely to be engaged in manual occupations (SC groups, III manual, IV and V). Lower SC groups were also at increased risk for social disadvantage.

A theoretical rather than a pragmatic approach was taken to determine the SC groups to collapse. SC groups I and II were collapsed to form a single SC group I&II and SC IV and V were collapsed to form a single SC group IV&V, thereby retaining the distinction between manual and non-manual and the relationship between SC group and social disadvantage. The other groups not usually contained in the SC classification system (unemployed, housewife, retired, student) were collapsed to form a single group "other".

Univariate and multivariate Continuous Outliers

Univariate and multivariate outliers were detected according to the method outlined in the development of methods section and proposed by Tabachnick and *Fidell (1996).* Standardised scores greater than z=3.29 were found for the MZSRDS (n=1), the PC (n=4) and the PR (n=3). Additionally n=6 cases were identified as multivariate outliers by Mahalanobis distance statistics. This finding suggested that these cases demonstrated unusual or discrepant patterns of scores. Cook's Distance (D) was used to determine the influence that each identified outlier had on the solution of a dummy regression run. Influence was defined by Fox (1991) as the product of leverage and discrepancy and determines the change in regression coefficients when a case is deleted. Tabachnick and Fidell (1996) suggested that cases with Cook's Distance scores greater than D=1 had undue influence on the solution. It was concluded from an inspection of Cook's Distance scores for the identified univariate and multivariate outliers that these scores had only marginal influences on the solution of the regression (D<1). Therefore all univariate and multivariate outliers were retained untransformed in the data set.

Summary and Conclusions of Data Screening.

A successful statistical analysis is dependent upon successfully addressing issues arising from the data screening. The data for the present study was screened according to the method outlined in Tabachnick and Fidell (1996). The issues that arose from the data screening were addressed and their potential impact on the study findings discussed.

The most important data screening issue for the present study was the identification of an appropriate missing data method, determined by the evaluation of missing data handling methods against the amount and pattern of the missing data present in the study. The proportion of missing data in the present study was found to be high and there was enough evidence to suggest that it was Missing At Random (MAR) as defined by Little and Rubin (1987). In light of these findings it was concluded that the EM model was the most appropriate missing data handling method for the present study. Analysis of the pattern of missing data suggested that for patients with LBP questionnaires that

assessed distress were likely attract higher rates of missing data than non distress related self completed questionnaires. This finding has not been previously reported in the literature on the use of the MSPQ and MZSRDS with LBP patients which has generally failed to address missing data issues. It is concluded that more work is required to determine the cause of these findings and suggested that future research should carefully consider issues related to missing data.

The distribution of MSPQ scores was found to be significantly skewed and therefore scores were transformed to normalise the distribution. Normalising the distribution was necessary so that truncated correlations for the MSPQ were not produced (Tabachnick and Fidell, 1996). A disadvantage of performing the transformation of the MSPQ was that comparisons of mean MSPQ scores with other reported research study samples was not possible. However it was concluded that this was not a serious drawback to transforming the variable as comparisons could be made on the basis of MZSRDS mean scores alone.

It was concluded that the results of the screening investigations produced a data set that was accurate, unbiased and met the assumptions required by a quantitative multivariate statistical analysis.

7.2 Description of Study Sample.

The Study Sample.

Research conducted on patients with LBP has been criticised for being conducted on highly selected groups of patients (Crombie and Davies 1998). Generalisation of findings from these studies is often problematic due to their unique characteristics (Dworkin and Gitline 1991; Sullivan et al., 1992) that can result in novel relationships among variables (Holzman et al., 1985). Crombie and Davies (1998) argued that research findings that cannot be generalised are of little scientific value. The present study attempted to provide an unbiased sample of LBP patients referred to secondary care in the UK. It was hoped that this would be more likely to lead to generalisations of the study findings and conclusions to the population of adult LBP patients who were referred to secondary care.

Crombie and Davies (1998) suggested that a study sample should be explored for evidence of bias. An assessment could then be made on whether the study findings and conclusions could be generalised. Two main issues were identified as important considerations for the generalisability of the study findings: the study sample derivation and description.

Derivation of the study sample.

All consecutive patients referred to the specialist LBP clinic over a two year period were assessed for eligibility in the study. The primary reason for a patient who attended the clinic not to be included in the study sample was that he or she did not have simple or mechanical LBP (Frank et al., 2000). Other reasons included being less than 18 years old at the time of assessment and LBP of a specific aetiology such as malignancy. The exclusion criteria produced a study sample that potentially included all adult patients with LBP referred to the secondary care LBP clinic.

The integrity of the study sample was potentially compromised by n=71 patients who were not included in the sample due to suspension of data collection during a 2 month period and n=40 patients who failed to consent to participate. These potential threats to the integrity of study sample were investigated by examining

whether those patients who were not included in the study sample or refused to participate were systematically different from the patients included in the final sample. Research staffing changes caused the suspension of data during a random 2 month period in the course of the study. The systematic reason for patients (n=71) who attended the clinic during this period not to be included in the study was therefore organisational. Although no data was available to explicitly test for group differences, it was concluded that these patient's characteristics were likely to be random and unlikely to compromise the sample integrity. Clinical variables were available for those patients who refused to participate in the study (Frank et al., 2000). Investigations of these patients (n=40) indicated that they were significantly older than patients who consented (n=427) suggesting that patients who did not consent to participate in the study differed systematically from those who did. Older patients are often not included research studies conducted on patients with LBP (Parker et al., 1995; Wand et al., 2001; Main and Waddell, 1991; Main et al, 1992; Waddell et al., 1993), although this is not always the case (Burton et al., 1995). The present study was designed to examine a representative and less selective sample of LBP patients attending secondary care and therefore older patients were not excluded. However the evidence suggests that this was not wholly successful. The group who refused to participate, n=40 (8%), were on average 9 years older (mean age = 56yrs) than those who did consent (mean age = 47). This finding suggested that the group that refused to participate were significantly, and meaningfully, older than those who did and indicated that the generalisability of the study findings may be limited to younger LBP patients.

Investigations of the home postcodes and the referral pattern of the study sample provided further evidence that the study sample was not highly selected and was representative of the local population. 88% (n=379) of the study sample were local patients who were referred to the clinic by either their NHS General Practitioner (GP) or a hospital doctor. These findings indicated that the study sample lived primarily in the district local to the hospital and were referred by their GP for specialist advice and management. The potential biasing effect on the study sample of referrals from non-local LBP populations was therefore limited. It was concluded that as the study participants were drawn primarily

from the local district population, generalisations of the study findings to the population of local referrals to secondary care were appropriate.

Description of Study Sample.

Generalisation of the study findings to other secondary care populations was also in part dependent upon the similarities of the present study sample to other secondary care samples. A number of studies reported in the literature employed the same self reported disability or psychological measures as the present study which potentially allowed for comparisons (Main et al., 1992; Burton et al., 1995; Wand et al., 2001; Rose et al., 1995; Parker et al., 1995; Hope and Forshaw 1999; Symonds et al., 1995, 1996; Greenough and Fraser 1992; Main and Waddell, 1987, 1991; Waddell et al., 1993). However comparisons were often problematic due to differing statistical methods (Rose et al., 1995), non-standard uses of the questionnaires (Rose et al., 1995; Symonds et al., 1995, 1996; Greenough and Fraser 1991) and the failure to report questionnaire descriptive statistics (Waddell et al., 1993; Rose et al., 1995; Hope and Forshaw 1999; Main and Waddell 1987).

Burton et al., (1995) examined n=252 patients with a first episode of LBP consecutively referred to an osteopath clinic. At presentation the Burton et al., (1995) sample had a higher proportion of acute and subacute LBP patients than the present study (ALBP/sub ALBP = 65% (Burton et al, 1995) vs Acute on LBP = 14% (present study)), and lower proportions of chronic LBP patients (LBP = 18.5% (Burton et al., 1995) vs LBP = 86% (present study)). Disability scores were also lower than in the present study (Mean RMDQ = 8.7 (Burton et al., 1995) vs mean RMDQ = 11.7 (present study)) as were depressive symptoms scores (Mean MZSRDS = 18 (Burton et al., 1995) vs mean MZSRDS = 26 (present study)). Pain Control and Responsibility (PC and PLC – B) scores were similar for both study groups.

Wand et al., (2001) examined n=94 consecutive patients with a first episode of LBP referred to an outpatient physiotherapy department. Only ALBP patients were included in this study sample although 57% were reported as having recurrent symptoms. Disability scores were similar for the Wand et al., (2001)

and the present study (Mean RMDQ = 11.3 (Wand et al., 2001) vs. RMDQ = 11.7 (present study)) and depressive symptoms were marginally lower (Mean MZSRDS = 22 (Wand et al., 2001) vs mean MZSRDS = 26 (present study)).

Parker et al., (1995) examined two consecutive cohorts of LBP patients. One cohort (Study 1, n=100) was comprised primarily of GP referrals to an orthopaedic surgery department and the other cohort (Study 2, n=100) of secondary or tertiary referrals to a pain management clinic. Compared with the present study, Study 1 had slightly lower and Study 2 had slightly higher depressive symptoms (Mean MZSRDS = 22 (Parker et al., 1995 Study 1) vs mean MZSRDS = 26 (present study) vs. mean MZSRDS = 30 (Parker et al., 1995 Study 2).

A comparison between study sample characteristics was also possible for research studies that employed the MSPQ and the MZSRDS. Main et al., (1992) combined the scores on MSPQ and the MZSRDS to produce a simple patient classification system that determined risk for poor outcome (The Distress and Risk Assessment Method (DRAM)). The classification system identified 4 patient types based on their MSPQ and MZSRDS scores: Normal (MZSRDS score < 17), At Risk (MZSRDS score 17-33, MSPQ score < 12), Distressed Depressed (MZSRDS > 33) and Distressed Somatic (MZSRDS 17-33, MSPQ >12). Main et al., (1992) developed and tested the patient classification system on a diverse range of patient groups who demonstrated a variety of severity of symptoms. They found that 13-38% of patients referred to orthopaedic services (Secondary care) were likely to be classified as Normal, 43-64% classified at Risk, 7-11% as Distressed Depressed and 2-16% as Distressed Somatic. Tertiary care patients (Pain Clinic) were more likely to be Distressed (Depressed (20-38%) and Somatic (7-15%)) than secondary care patients.

Hope and Forshaw (1999) assessed n=160 consecutive referrals to a secondary care outpatient physiotherapy department for symptoms of distress (DRAM, Main et al., 1992). Their findings were broadly in line with the orthopaedic group reported by Main et al., (1992) leading them to conclude that patients referred to secondary care present with similar levels of distress.

The results of the present study support this conclusion. Based on their MZSRDS score, 21% of the present study sample were classified as DRAM (Main et al., 1992) Normal, 56% at Risk and 22% Distressed Depressed (MSPQ scores could not be used for the classification purposes due to this variable being transformed in the present study).

These findings led to the conclusion that the present study sample had similar characteristics to those reported in other secondary care samples (Main et al., 1992; Parker et al., 1995; Hope and Forshaw 1999). The study sample had more severe symptoms than those of the Burton et al., (1995) study which was analogous to a primary care setting although they were similar to those reported in the Wand et al., (2001) primary care study.

The evidence reviewed above suggested that the present study participants were not a unique sample of patients attending hospital for secondary care and management of their LBP. The evidence suggests that they were representative of the local referrals and they shared characteristics with other UK secondary care LBP samples. It was therefore concluded that the findings of the present study could be generalised to other hospital-based populations of LBP patients.

7.3 Study 1. Investigation of a Model of LBP Disability.

The relationships between demographic, social, clinical and psychological factors and LBP disability were explored by hierarchical multiple linear regression analyses.

Data Considerations.

Study findings that cannot be generalised are of little scientific value (Crombie and Davis, 1998). Limits can be placed on generalisations from issues related to the study sample (Crombie and Davis, 1998) or overfitting of the model (Bramwell, 1996). A model may risk being "overfit" to a particular data set if it is generated from an empirical exploration of the data (i.e. exploratory factor analysis). Such models may not generalise to other samples and usually require re-testing on a new data set. An empirical test of an a priori model reduces the risk of overfitting.

The risk of overfitting the model of LBP Disability was minimised in the present study by an attempt to test a series of a priori models that were based on theory and previous research.

Psychometric Properties of Research Study Questionnaires.

The validity and reliability of the self reported questionnaires employed in the model of LBP Disability was explored by the use of Cronbach's Alpha (Cronbach 1951) (table 6.4a p121) and by an inspection of their correlation matrix (table 6.1f).

Inspection of the scores for the Total Group in table 6.4a p121 indicated that all the study questionnaires, except the Responsibility subscale of the Pain Locus of Control Questionnaire (PR) demonstrated adequate reliability ($\alpha>0.7$) (Bland and Altman, 1997). The PR subscale of the PLC (Main and Waddell, 1991) demonstrated low internal consistency score ($\alpha=0.62$) and therefore its reliability was questionable (Bland and Altman, 1997). As reliability is a necessary, but not sufficient, condition for validity (Streiner and Norman, 1995) caution was applied to the interpretation of this scale.

Examination of the correlation matrix (table 6.1f) provided evidence for the construct and discriminant validity of the study questionnaires. All relationships were in the direction posited by their theoretical constructs, except for the PC subscale of the PLC (Main and Waddell, 1991) that appeared to be largely unrelated to other study questionnaires. However the relationship of this questionnaire to the MZSRDS was in the direction posited by the theory on which from which it was derived (Main and Waddell, 1991).

It was concluded that there was adequate evidence for the validity and reliability of the research questionnaires included in the present study, although care was taken with the interpretation of the PC and PR subscales of the PLC (Main and Waddell, 1991).

Entry Order of Research Factors.

Six regression models were tested in which the order of entry of the psychological factors was rotated so that competing models of their inter-relationships and mediating roles could be fully examined. Tabachnick and Fidell (1996) suggested the order of entry of variables into a hierarchical regression model should depend upon their causal priority, where factors that according to theory or logic causally precede other research factors are entered into the model before those that causally follow them. This analytic strategy statistically controls for the variance attributed to the causally prior factors. When subsequent factors are entered into the regression model, the effect or contribution of the causally prior factors has been statistically removed or controlled for and the independent contribution to the variance of dependent variable can be determined. Cohen and Cohen (1983) pointed out that this can be conceived of as the relationship between the independent and dependent variables (or factors) for the sub set of data for which the partialled variable (or factor) does not vary (Cohen and Cohen, 1983).

For each regression model the first 3 steps comprised the fixed order entry of a demographic factor (step 1), a social factor (step 2) and a clinical factor (step 3). The entry of these factors was based on their presumptive causal ordering and on

the need for statistical control. The demographic factor (age and sex) was entered first followed by the social factor (SC) as theory suggested that these factors couldn't be caused by clinical or psychological factors. Recognising that low back pain was the primary problem and that clinical factors should be controlled for before the examination of psychological factors indicated that the clinical factor (QTF classification, Chronic LBP, co-morbidity) was entered at the third step (Waddell et al, 1993). The order of entry of the distress (MSPQ and MZSRDS), coping strategies (CAT and P&H) and pain belief (PC and PR) factors was rotated so that competing models of their independent contributions to LBP disability could be fully tested.

Demographic Influences on LBP Disability.

The present study found strong evidence that age and sex were associated with LBP disability, however their effect was weak (R^2 change = 0.03, $p<0.000$). These findings were broadly in line with the literature on the effects of demographic factors on LBP and LBP disability. Unruh (1996) reviewed the literature on gender influences on LBP and concluded that in general only small differences were reported in the majority of LBP studies. Nachemson and Vingard (2000) reached similar conclusions in a review of the literature on individual difference influences on LBP. They concluded that age and gender were associated with LBP disability, although the relationship was weak (Nachemson and Vingard, 2000).

The influence of gender and age on LBP disability was not explored further in the present study. A number of other potential relationships between the demographic factor and other research factors or disability could have been explored but these were unrelated to the purpose of the present investigation and the study hypotheses. Examination of these relationships may have inflated the risk of a type 1 error, of over fitting the model, and therefore reduced the generalisability of the study findings (Bramwell, 1996). In light of these considerations, and the limited evidence available in the literature for significant effects (Keefe et al., 1992), the moderating influences of sex and age on the relationships between research factors of interest and LBP disability were not addressed.

Although the conclusions were therefore limited to the direct effects of an age and sex factor on LBP disability, it was concluded that the present study provided strong evidence that these demographic factors were weakly associated with LBP disability.

Social Influences on LBP Disability.

After controlling for age and sex, Social Class was not significantly related to LBP disability in the present study (p=0.09). Waddell and Waddell (2000) concluded in a review of the literature on Social Class and LBP that in general any association between these two factors was at best weak. However they suggested that there was strong and consistent evidence that social classes IV and V were associated with increased LBP associated work loss, particularly for men. Although work loss due to LBP or the potential moderating influence of gender on SC was not addressed, the findings of the present study were unable to support the hypothesis that social influences contributed significantly to LBP disability.

However there are limitations to this conclusion. Social influences on LBP disability were primarily tested in the present study by examining the relationship between Social Class and LBP disability. The Social Class variable was derived from the occupational categories of each patient using the Office of Census, Population and Surveys (OCPS) Standard Classifications and Coding Methodology Vol 2 (1991). A seventh group "other" was not contained within the SC classification and was primarily comprised of housewives (n=71, 87.6%). Therefore the Social Influence factor of the present study was comprised of Social Class variables, and Housewives plus others. Waddell and Waddell (2000) pointed out that Social Class is a crude measure of social influences. Other social influence factors that have been examined in the literature include: work related factors (Gronblad et al., 1996) job satisfaction variables (Fishbain et al., 1996), workers compensation or litigation (Chapman and Brena 1990), marital status (Saarijarvi et al., 1990) and social support (Trief et al., 1995; Linton et al., 1997). Waddell and Waddell (2000) proposed that the main mechanism through which social factors influenced LBP disability was by their

effects on beliefs, implying that there was no direct relationship between social factors and LBP disability. Although the moderating roles of social factors on LBP disability were not addressed by the present study, the direct role of social influences, as measured by SC and Housewives, on LBP disability was addressed. The present study provides support for Waddell and Waddell's (2000) conclusion that there is no direct relationship between social factors and LBP disability. An investigation of more complex roles, including moderating relationships, were beyond the scope of the present investigation but could usefully be addressed in subsequent work.

In conclusion, no evidence was found in the current study to support Hypothesis 1.1a and it was therefore rejected.

Clinical Influences on LBP Disability.

The clinical factor was significantly associated with LBP disability ($p<0.001$), accounting for an additional 11% of the variance of the RMDQ. The clinical factor was entered into the regression model following the entry of the demographic and social influence factors and therefore was interpreted as the subset of data for which age, sex and social class did not vary, or from which demographic and social influences had been statistically controlled. The clinical factor for the present study comprised a functional set of variables which included: QTF classification, Chronic LBP and presence of a co-morbidity. QTF classification (Spitzer et al., 1987) described the extent of LBP referral from LBP with no radiation to LBP with neurological signs. This classification system had been shown to be a helpful clinical measure of LBP impairment (McAuley et al., 1998; Frank et al., 2000). Most of the patients in the present study were Chronic LBP patients (n=366, 85.7%). The remaining n=61 (14.3%) patients were experiencing an acute attack on a pre-existing chronic problem. Finally, n=256 (60%) patients reported the presence of a co-morbidity, 41% of whom reported more than one. The most commonly documented co-morbidity was a musculoskeletal condition, such as neck or thoracic pain. However the clinician only documented co-morbidity data if it was felt that it was likely to affect LBP management and therefore this variable was regarded as "soft". Nevertheless the proportion of patients in the current study with a co-morbidity

was similar to that reported by Nachemson and Vingard (2000) in a review of the literature on co-morbidities and LBP. The findings of the current study therefore supported Nachemson and Vingard's (2000) conclusions that the presence of at least one musculoskeletal co-morbidity was a common finding in the literature and that LBP was often not a discrete clinical condition.

The relative contribution of clinical variables.

The relative contributions of the individual variables that comprised the Clinical factor to LBP disability were not explicitly addressed in research questions or hypotheses of the current study. However an indication of their relative contributions can be determined by inspection of table C1 in the Appendix C. This table provides the regression coefficients, their 95% Confidence Intervals, and the zero-order and partial correlations for the six regression models which explored the Model of LBP Disability. The unstandardised regression coefficients (B), which provide the change in RMDQ score for a unit change in an Independent variable (IV) when all other variables are held constant, indicated that when the clinical factor was forced into the equation at step 3, the largest differences between mean RMDQ scores was between the QTF variables, particularly between QTF 1&2 and QTF 4. These variables had significantly ($p<0.01$) different mean scores from each other even when all other clinical, social and demographic variables did not vary. Although the relationship between the QTF classifications and disability was significant, an inspection of the zero-order correlation coefficients indicated that this association was moderate, accounting for approximately 10% of the variance in the RMDQ ($r=0.3$). The presence of a co-morbidity accounted for approximately 5% of the RMDQ, while Chronic or acute on chronic status was not significantly associated with disability.

These findings suggest that the referral pattern of pain may be an important contributing factor for a comprehensive model of LBP disability. Waddell (1998) argued that the QTF classification (Spitzer et al., 1987) had potential to be a practical clinical classification tool. Selim et al., (1998) examined the a modified QTF classification in a sample of n=428 male veterans with chronic LBP and found that disability scores increased and psychosocial functioning

decreased as pain was referred down the leg (Selim et al., 1998). Although McAuley et al., (1998) pointed out statistical inadequacies of Selim et al.,'s (1998) model that limited their conclusions, they found in their own work on a more heterogeneous sample of LBP patients that the QTF classification system provided a potentially simple measure of impairment associated with LBP. Frank et al., (2000) suggested that the extent of the relationship between the QTF classification and disability should be determined before any firm conclusions on its utility could be made.

The present study found strong evidence that the referral pattern of LBP was moderately associated with LBP disability, that on average patients reported increased disability as the pain was referred down the leg. However in support of McAuley et al.,'s (1998) findings, it appeared that the meaningful classification in relation to LBP disability was between patients who reported LBP between the low back and the knee (low back or thigh pain), referred beyond the knee and those with positive neurological signs.

The clinical factor in the present study accounted for 11% of the variance in the RMDQ after controlling for Social and Demographic factors. Waddell et al., (1993) reported a similar relationship when they found in their investigation that a clinical factor accounted for 14% of the variance in the RMDQ. The similarity between these findings is interesting given that in the Waddell et al., (1993) study a Severity of Pain variable (Waddell, 1987) replaced the co-morbidity variable in the clinical factor. The present study did not include a measure of pain intensity due to theoretical (Melzack Katz, 1992; Williams et al., 2000) and psychometric problems with the available measures (Jensen and McFarland 1993; Jensen et al., 1996). Nevertheless a comparison of the findings from the present study with the Waddell et al., (1993) findings suggested that clinical factors accounted for only 11-14% of the variance of the RMDQ and this was independent of the individual variables included.

The clinical characteristics (QTF and Chronic LBP) of the patients in the Waddell et al., (1993) study sample were similar to those of the present study, although the Waddell et al., (1993) sample were younger and more likely to be referred from secondary care. The relationship between clinical factors and

disability was confirmed by Linton (1985) who found that clinical factors were only weakly associated with activity level for LBP patients. Burton et al., (1995) and Rose et al., (1995) examined the predictive value of clinical factors in a sample of acute LBP patients. Both studies found that Clinical factors were largely unrelated to LBP disability at one year follow up. In an examination of the relationship between beliefs about pain and disability, Riley (1988) and Slater (1991) found that psychological factors were more strongly associated with disability than clinical factors. However Dozois et al., (1996) reported stronger relationships between clinical factors and disability in a study of n=200 patients enrolled on a work hardening rehabilitation programme. A pain factor (pain intensity, pain duration and pain site) accounted for 22% of the variance of the Oswestry (Mikail 1993), and this was primarily associated with the pain intensity variable (Dozois et al., 1996). Similar results were also reported by Waddell et al., (1993) in a pilot study of n=120 LBP patients and Millard et al., (1991) in a sample of n=179 chronic pain patients (41% LBP).

The weight of evidence contained in the literature, combined with the findings of the present study, suggest that Clinical factors play a significant but minor role in LBP disability. There is also some evidence to suggest that pain intensity may not be more important for a comprehensive Biopsychosocial model of LBP disability than other clinical variables such as the extent of LBP. In light of the reviewed evidence it appears likely that only minor increases in the relationship of the clinical factor to LBP disability could have been achieved by the addition of a measure of pain intensity. This finding supports Waddell's (1998) conclusion that pain and disability should be regarded as largely independent dimensions of the experience of LBP.

In conclusion, the present study found strong evidence to support the minor role of clinical factors in the Biopsychosocial Model of LBP Disability and therefore Hypothesis 1.1b was accepted.

Psychological influences on LBP disability.

The present study found strong evidence ($p<0.001$) that psychological factors were strongly associated with LBP disability, together accounting for some 38% of the variance of LBP disability after controlling for demographic, social and clinical factors (R^2 Change = 0.38). This finding provides evidence to support the role of psychosocial factor in LBP disability and therefore Hypothesis 1.1c was accepted.

Compared to other factors that were considered in the present study and which comprised the Biopsychosocial Model of LBP (Waddell, 1992), psychological factors had the strongest relationship with LBP disability. This replicates the findings from other research studies conducted on LBP patients in primary (Burton et al., 1995), secondary (Rose et al., 1995) and tertiary (Waddell et al., 1993) care where psychological factors have been demonstrated to be the primary factors associated with LBP disability. Although the primacy of psychological factors has not always been reported in the literature on chronic pain and disability (Millard et al., 1991), the finding in the present study that Psychological factors are the most important influences on LBP disability supports Hypothesis 1.2 and therefore this hypothesis was accepted.

Conditional Relationships with LBP Disability.

Although there is some evidence in the literature that the relationship between psychological factors and disability may be dependent upon other psychological factors (Riley and Robinson 1998) or demographic factors (Turk 1995), these conditional relationships were not examined in the present study. The relationships that were tested in the study were determined on theoretical and statistical grounds. Firstly an attempt was made to limit the number of investigationwise analyses performed on the data so that the risk of Type I error could be minimised (Cohen and Cohen 1983; Jensen et al., 1994). The maximum number of independent variables that could be included in each regression model for the present study according to the method of Altman (1991) was limited to n=20. Secondly the focus of the present investigation was to test a Model of LBP Disability by examining the mediating effects of pain beliefs and coping strategies on disability and depressive symptoms, after controlling for

Demographic, Social and Clinical factors. Differences in the proposed model between specific sub groups of LBP patients were not included in the main purpose of the research study.

Relationship of Distress, Coping Strategies and Pain Beliefs to LBP Disability.

Inspection of Table 6.3a p118 indicated that the three factors which comprised psychological influences (Distress, Pain Beliefs and Coping strategies) were significantly associated with LBP disability. After controlling for demographic, social and clinical factors Models 1 & 2 suggested that Distress accounted for 29% of the variance of the RMDQ (R^2 Change = 0.29), models 3 & 4 that Pain Beliefs for 16% of the variance of the RMDQ (R^2 Change = 0.16) and models 5 & 6 that Coping strategies accounted for 31% for the variance of the RMDQ (R^2 Change = 0.31). This evidence indicated that Hypotheses 1.3a, 1.3b and 1.3c could be accepted.

The Role of the Cognitive Factor on the relationship between LBP Disability and Distress.

Hypothesis 1.4 was addressed by exploring the relationship between pain beliefs, coping strategies and distress in 6 regression models where the order of entry of the factors was rotated to determine their mediating roles (table 6.3a p118).

These results suggested that the relationship between LBP Disability and distress was largely mediated by cognitive factors, and Coping Strategies had a stronger mediating role than Pain Beliefs.

Turk et al., (1983) proposed a Cognitive-Behavioural Model of chronic pain where cognitions develop in response to pain and disability and mediate the relationship between pain and depressive symptoms. This model proposes that following the onset of LBP, a reduction in instrumental behaviours can result in a reduction in response-contingent reinforcements, with resulting social withdrawal, further inactivity, negative cognitions, and other symptoms characteristic of depression (Cheatle et al., 1990). Rudy et al., (1988) found evidence to support this theory in a study of n=100 chronic pain patients. They

found that a perceived reduction in instrumental activities (self reported disability) and a decrease in a sense of mastery or control were necessary for the development of symptoms of depression. Their findings indicated that pain was not a sufficient condition for the development of depressive symptoms. These findings were subsequently replicated by Turk et al., (1995) in different age groups and Wells (1994) in a study of n=104 non-malignant chronic pain patients. Waddell et al., (1993) found in a sample of n=184 LBP patients that after controlling for a cognitive factor (Fear Avoidance Beliefs (Waddell et al., 1993)), depressive symptoms were significantly, but weakly, associated with LBP disability. Waddell et al., (1993) interpreted these findings as support for Rudy et al.,'s (1988) conclusions that depression associated with pain is secondary to the development of cognitive factors.

The results of the present study provide empirical support for the Hypothesis 1.4 and it was therefore retained.

The role of specific cognitive factors.

The mediational role of cognitive factors on the disability/distress relationship that was proposed by Turk et al., (1983) and empirically supported by Rudy et al., (1988) and Waddell et al., (1993), was also supported by the present study findings.

The results of the present study indicated that Coping Strategies were the primary mediators of the Disability/Distress relationship and that compared to Coping Strategies, Pain Beliefs played a minor role.

These findings are surprising given that Rudy et al., (1988) found that certain Pain Beliefs, particularly those associated with a lack of control or helplessness, were the primary mediators of depressive symptoms. They also appear to contradict Main and Waddell's (1991) suggestion that Pain Beliefs underlie Coping Strategies. Crisson and Keefe (1988) also suggested that these two factors were associated although they acknowledged that the correlational nature of their study precluded definitive statements on the causal ordering of Coping Strategies and Pain Beliefs. However they suggested that their findings provided

supportive evidence for the theory that Coping Strategies were determined by Pain Beliefs that in turn determined depressive symptoms (Crisson and Keefe 1988). The limitations on inferences of causality posed by correlational designs were described by Harkapaa et al., (1991) in a study of the relationship between Pain Control beliefs and Coping Strategies in a sample of n=415 LBP patients. They pointed out that significant correlational relationships between Pain Control Beliefs and Coping Strategies could mean that either Control Beliefs had influenced the style of Coping Strategy, or alternatively that positive experiences resulting from the use of coping strategies had strengthened the belief in personal control. The present study design was cross-sectional and therefore causality cannot be demonstrated (Tabachnick and Fidell, 1996). However although these limitations on the present study are acknowledged, it was also noted that cross-sectional designs, particularly those employing hierarchical regression techniques, can provide evidence for testing an a priori theoretical model (Tabachnick and Fidell, 1996) and for inferring causality (Main and Waddell, 1991).

The Role of Control Beliefs.

Control beliefs were developed from "Locus of Control" theories proposed by Rotter (1966, 1975) and adapted by Levenson (1974). The assessment of Control Beliefs is common in many questionnaires that measure Pain Beliefs (Jensen et al., 1987; Vlaeyen et al., 1990; Schwartz et al., 1985; Tait and Chibnall 1997; Williams and Thorn 1989; Flor et al., 1988). According to social learning theory (Bandura 1977) control beliefs are reinforced by experience and can be modified through social, environmental and individual contingencies. They are also proposed to be transient attributions rather than stable personality traits (Bandura 1986). Harkapaa (1991) argued that these attributes make control beliefs potentially modifiable by the pain experience, and primary candidates for determining the style of coping strategy. Pain Beliefs were assessed in the present study by Pain Locus of Control (PLC) (Main and Waddell, 1991) which included sub-scales which measured Pain Control (PC) and the Pain Responsibility (PR). PC assesses patient's beliefs about how well they can control their pain and PR beliefs about the extent to which they believe that they are responsible for the management of their pain. The PLC questionnaire was

derived from Rotter's (1966) "Locus of Control" and Wallston and Wallston's (1976) "Health Locus of Control" concepts (Main and Waddell, 1991). In a study which directly compared the PLC (Main and Waddell, 1991) with the Multidimensional Health Locus of Control (MHLC) (Wallston and Wallston 1987) and the Pain Related Self Statements (PRSS) and Pain Related Control Statements (PRCS) (Flor et al., 1988), Main and Waddell (1991) concluded that the PLC was the most appropriate measure of Locus of Control beliefs due to its comparatively more robust psychometric properties and positive predictive relationship to outcome.

Table C1 in Appendix C (page xvii-xxiv) was inspected to determine the relative strengths of the sub scales of the PLC. It was noted that whenever the Pain Beliefs factor was forced into a regression model, the PR subscale appeared to account for most of the additional variance. The PC subscale appeared to be largely unrelated to RMDQ. This suggests that beliefs about who was responsible for the management of the condition/pain were the main active component of the Pain Beliefs factor. Main and Waddell (1991) reported that the PC subscale of the PLC was related to disability, predicting 3.5% of the variance of the RMDQ. Symonds et al., (1996) also found that in an industrial setting the PLC predicted an additional 10% of the variance of work absence, even after controlling for other cognitive factors such as Fear-Avoidance beliefs (Waddell et al., 1993). The current study findings therefore suggest that Beliefs about who is responsible for the management of pain/the condition are important for a comprehensive model of LBP disability. These findings also support a model of LBP disability that suggests that increasing levels of disability coupled with increasing beliefs that the responsibility for LBP management is not the patient's are associated with more frequent symptoms of depression. They also suggest that the relationship between LBP disability and Beliefs about who is responsible for the management of the LBP is largely accounted for by using Praying and Hoping or Catastrophising as a Coping Strategy.

The Role of Coping Strategies. Coping Strategies were developed from theories of Coping proposed by Lazarus (1966) and Lazarus and Folkman, (1984) and were measured in the present by two sub scales (Praying and Hoping

(P&H) and Catastrophising (CAT)) of the Coping Strategies Questionnaire (CSQ) (Rosenstiel and Keefe 1983). Patients who scored highly on the P&H subscale endorsed frequent use of Praying or Hoping to manage the stress associated with LBP, whereas patients who scored highly on the CAT subscale indicated that they used catastrophic thoughts to manage their LBP. However studies on patients with chronic pain have suggested that there may be empirical problems with P&H (Robinson et al., 1997) and conceptual difficulties with CAT (Jensen and Karoly 1991).

Praying and Hoping.

In a study of n=956 chronic pain patients Robinson et al., (1997) found evidence that the CSQ P&H scale comprised two subscales: "Praying" and "Hoping", and that the "Hoping" subscale was unstable. These findings were subsequently confirmed in a sample of n=472 chronic pain patients (Riley and Robinson, 1997). Robinson et al., (1997) suggested that the "Praying" subscale may be largely responsible for the previously reported relationships between P&H and adjustment (Burton et al., 1995; Dozois et al., 1996). The present study did not explicitly examine the factor structure of the P&H subscale although evidence was found that it had relatively low internal consistency (table 9). This finding, coupled with the work of Robinson et al., (1996) and Riley and Robinson (1997) suggests that further work may be indicated on the construct and content validity of this CSQ sub scale.

Catastrophising.

The CAT subscale of the CSQ has been consistently demonstrated to be psychometrically stable (Main and Waddell, 1991; Robinson et al., 1997; Tuttle et al., 1991; Swartzman et al., 1993) and associated with measures of adjustment to LBP (Burton et al., 1995; Dozois et al., 1996) and chronic pain (Jensen et al., 1992; Jensen and Romano 1994), particularly with depressive symptoms (Main and Waddell 1991). The present study also found evidence to suggest that this subscale had good internal consistency (table 6.4a p121). However Jensen et al., (1991) argued that Catastrophising was less associated with managing the stress associated with LBP (Coping Strategy) than with worry and negativistic thoughts in response to pain (cognitive appraisal). Main and Waddell (1991) also

suggested that cognitive distortion may be an integral part of depressive reactions to pain and may develop simultaneously with lower mood. The relationship between Catastrophising and Depression was investigated by Sullivan and D'Eon (1990). They reported that clinical psychologists had been unable to distinguish between cognitive symptoms of depression and items contained within the CSQ CAT subscale. Once these items were removed from the CSQ they found that Coping Strategies, were not associated with Depression for chronic pain patients (n=125, 82% LBP) in a hierarchical regression analysis.

The individual contributions of CAT and P&H to LBP disability and their associations with Pain Beliefs and Distress were examined (Appendix C table C1). The partial correlation coefficients were interpreted as the relationship between the Coping strategy variable and the RMDQ, after controlling for all other factors and variables in the equation, including the other Coping Strategy variable (Cohen and Cohen, 1983). Inspection of the correlation coefficients in Model 5 indicated that when the coping strategies factor was forced into the regression model equation at step 4, CAT was the most strongly related factor to disability (partial r=0.49). Although P&H was significantly associated with RMDQ, this relationship was weaker (partial correlation coefficient = 0.20). When the Coping Strategies factor was entered after the Pain Belief factor (Model 3, step 5), the evidence against a relationship between the P&H subscale and the RMDQ was sufficiently strong (p=0.04) to indicate that this variable no longer meaningfully contributed to the RMDQ. CAT was still moderately associated with LBP Disability (partial r=0.49) after the entry of the Pain Beliefs factor. This finding suggests that although CAT and P&H have similar relationships with Pain Beliefs they have different relationships with LBP Disability and distress.

Other researchers have also reported complex relationships between Coping Strategies, Distress and Pain Beliefs. In a study of n=118 chronic pain patients (46% LBP) Jensen and Karoly (1991) found that Pain Control Beliefs were only strongly associated with activity level (disability) for patients who reported low pain intensity scores. They also reported that coping strategies mediated the relationship between activity level and Pain Control Beliefs. Weickgenant et al.,

(1993) examined 3 groups of LBP patients: depressed, non-depressed and healthy controls. They found that only LBP patients who were distressed exhibited passive-avoidant coping strategies.

The present study found more evidence to suggest that Coping Strategies mediated the relationship between LBP Disability and Pain Beliefs than Pain Beliefs mediated the relationship between LBP Disability and Coping Strategies. However this may be in part dependent upon the types of Pain Beliefs and Coping Strategies that were assessed. Evidence was presented that P&H was only weakly associated with LBP Disability and CAT was the primary mediator of the relationship between LBP Disability and Beliefs about the management of LBP.

Hypothesis 1.4 was therefore rejected.

Summary.

The present study findings support a model of LBP Disability in which clinical and psychological factors play important and distinct roles. No evidence was found for the role of social influences, although this may be in part associated with the choice of social variables included in the model. These findings are broadly in line with previous research that propose the primacy of psychological factors in a model of LBP Disability.

7.4 Study 2. An Investigation of the Cross Cultural psychometric properties of self reported LBP measures.

The cross cultural psychometric properties of self reported LBP measures were investigated by examining aspects of the validity and reliability of the RMDQ, MSPQ, MZSRDS, CSQ (P&H and CAT) and the PLC (PC and PR).

As reliability is a necessary but not sufficient condition *for validity* (Streiner and Norman, 1995), the reliability of the instruments was examined in the first instance followed by an examination of validity characteristics.

Reliability. The three main types of reliability assessment include temporal stability (test-retest), inter-rater reliability or form equivalence and internal consistency (AERA et al., 1999). Temporal stability required a repeated administration of the test/questionnaire on two occasions separated by a time interval sufficiently short for it to be assumed that the variable being measured had not changed (Wiesinger et al., 1999). An assessment of test retest reliability was therefore inappropriate for the present cross-sectional study. As all questionnaires were self completed, inter-rater reliability was also inappropriate. Two of the most common tests proposed to investigate the internal consistency of a questionnaire are: Cronbach's Alpha (1951) and split half (Streiner and Norman, 1995). However the coefficient produced by Split half may be problematic as it can depend on the method used to group the sample. Cronbach's Alpha provides a superior measure of internal consistency than Split half as it is based on the average inter-item correlation and not just on the correlation between two halves of the sample.

Cronbach's Alpha requires that all observations are independent, errors should be uncorrelated between items, each pair of items should have a bivariate normal distribution and scales should be additive so that each item is linearly related to the total score. Cronbach's Alpha coefficient provides an overall index of the internal consistency of the scale and a measure of the extent to which the items are related to each other. The test is robust to nominal, ordinal, interval and ratio data (Stevens, 1951).

Table 6.4a p121 presents the Cronbach's alpha coefficients (α) for the cross cultural investigation of the self reported disability and psychological questionnaires. Three cultural factors were investigated: Ethnicity, Region of Birth and Religion.

The study provided evidence that all questionnaires, other than the P&H and the PR, appeared to have adequate cross cultural internal consistency (α>0.7, Bland and Altman, 1997). The internal consistency of the RMDQ, the MSPQ and the MZSRDS also appeared to be cross culturally robust, where the range of Cronbach's Alpha scores was α=0.03 for the RMDQ and α=0.06 for the MSPQ and the MZSRDS. The range of Cronbach alpha scores for CAT (range of α=0.10) and PC (range of α=0.12) suggested that although there was evidence that these questionnaires had adequate internal consistency across the different cultural groups, the degree of internal consistency varied by cultural group.

The α scores of the CAT and the PC were inspected to explore potential patterns. Differences between the α scores for the CAT subscale, appeared to be largely between the South Asian, South Asia, Hindu and Muslim cultural groups and patients classified into the "Other" Ethnic, Region of Birth and Religious groups, where the internal consistency of the CAT subscale was higher for the "Other" groups than those of the South Asian, South Asia, Hindu and Muslim groups. This suggested that compared to South Asian, South Asian, Hindu and Muslim groups statistical analyses with this questionnaire are likely produce more consistent results for the patients in the "Other" cultural groups.

No consistent pattern was suggested for the α scores for the PC subscale.

These findings suggested that although there was evidence that the internal consistency of the CAT and the PC was adequate, the findings also indicated that this psychometric property varied by cultural group.

Inspection of the α scores for the P&H subscale of the CSQ indicated that according to Bland and Altman (1997), the British, British Isles, Christian and "Other" cultural groups had adequate internal consistency scores (α>0.70). The

α scores for South Asian, South Asia, Africa, Hindu and Muslim cultural groups suggested that P&H had inadequate internal consistency properties for these groups ($\alpha<0.7$). This finding provided evidence that the P&H subscale of the CSQ did not have robust cross cultural psychometric properties. Consistent findings from this questionnaire were likely to be obtained when the questionnaire was employed with LBP patients who identified as British, Christian or "Other" cultural groups, or who were born in the British Isles.

The α scores for PR indicated that this subscale had adequate internal consistency for Muslim and Hindu religious groups and for LBP patients from Africa or "Other" regions of birth. The internal consistency scores for all other cultural groups were inadequate for this questionnaire. This finding suggested that the PR subscale of the PLC (Main and Waddell, 1991) was less likely to produce consistent results for patients who *identified* as British, South Asian or Christian or who reported Africa or an "other" region of birth compared to patients who identified as Muslim or Hindu or who were born in Africa. It was also noted that high α scores for both subscales of the PLC suggested that compared to other cultural groups the assessment of pain control beliefs of Muslim LBP patients may provide particularly consistent results.

The results of investigations into the P&H subscale of the CSQ and the PR subscale of the PLC provided evidence to suggest that these questionnaires did not have robust cross cultural internal consistencies.

It appeared from the present investigation that the RMDQ, the MSPQ and the MZSRDS had reliable and robust cross-cultural internal consistency properties. This suggests that the inter-item correlations was high for these questionnaires and that they are likely to provide consistent results for the cultural groups assessed in the present study. The construct that was being measured by these tools was therefore being measured consistently for the total group and for the cultural sub groups. The findings also suggest that the internal consistency of questionnaires which have been used to assess the beliefs of LBP patients, particularly coping strategies and beliefs about pain, were likely be dependent upon the cultural group which was being assessed.

The study research questionnaires were examined to explore potential causes for the finding that the internal consistency of a questionnaire varied by cultural group. As not all study questionnaires demonstrated inadequate psychometric properties, problems understanding the written English questions was not considered a serious threat to the reliability of the measures. Questionnaires that assessed disability (RMDQ) or distress (MSPQ or MZSRDS) had cross culturally reliable internal consistencies, whereas questionnaires that addressed cognitive factors (P&H, CAT, PC and PR) did not. This finding appeared to suggest that questionnaires that assessed cognitive factors were more likely to have unreliable cross cultural psychometric properties than questionnaires that assessed distress. However McAuley et al., (1999) and Estlander et al., (1995) examined the factor structure of the MZSRDS and found evidence that it also contained a cognitive factor. Although the validity of this factor was questioned (McAuley et al., 1999), applied to the current study these findings suggest that the cross cultural variability of the study questionnaires α's was not related to whether or not cognitions were being assessed.

The relative low α coefficients for the belief based questionnaires compared to the disability or distress questionnaires may, at least in part, be related to the calculation of the α statistic (Cronbach, 1951). The general principle is that, all other things being equal, increases in numbers of items used for the calculation of α will generally result in a higher coefficient α (Tabachnick and Fidell, 1987). The higher number of items of the RMDQ (n=24), MSPQ (n=13) and MZSRDS (n=23) compared to the P&H (n=6), CAT (n=6), PC n=10) and PR (n=5) suggests that this may be a factor in the demonstrably lower α coefficient scores for these questionnaires.

The cross cultural differences however remain unexplained. Although not always consistent there appeared to be a pattern in the data where compared to other cultural groups, the CSQ subscales (P&H and CAT) had inferior and the PLC PR subscale had superior internal consistency for Hindu and Muslim LBP patients. It is probable that these differences represent real cultural differences in

the meanings attached to the assessed beliefs that are created within the context of shared social meanings. Further work on this issue may be required.

Validity.

The differential validity of the self reported psychological questionnaires was examined according to the method outlined by Cohen and Cohen (1983). The RMDQ was defined as the criterion and relationships between this measure and an interaction term made up of a factor containing cultural (ethnicity, religion or region of birth) and psychological questionnaire (MSPQ, MZSRDS, P&H, CAT, PC, PR) interactions were examined by hierarchical multiple regression. A significant interaction term indicated that the relationship between the psychological questionnaire and the RMDQ was dependent upon the cultural group, which Cohen and Cohen (1983) argued provided evidence against the validity of the questionnaire. A measure that was not valid therefore had a different relationship with the RMDQ for the relevant cultural group.

Inspection of table 6.4b p122 indicated that none of cultural group by psychological questionnaire interaction terms was significant ($p>0.05$). This finding suggested that the psychological questionnaires employed in the present study functioned in similar ways across the cultural groups and therefore had reliable cross-cultural validity.

Cross cultural psychometric properties.

The current investigation addressed the cross cultural psychometric properties of self reported disability and psychological measures of LBP by assessing their internal consistency (Cronbach, 1951) and differential validity (Cohen and Cohen, 1983) across cultural groups. Whilst the study found evidence for some cross cultural differences in the reliability of the measures and no evidence for cross cultural validity differences it is acknowledged that only one aspect of reliability and one aspect of validity was examined in the current investigation. No evidence was presented for test stability nor for form equivalence (AERA et al., 1999) as an assessment of these properties was precluded by the study design. The findings of the present study suggest that further research could usefully examine these qualities of measures used to assess LBP patients from diverse

cultural backgrounds. This may be particularly salient for the RMDQ, the MSPQ and the MZSRDS as although demonstrated in the current investigation to be of good cross cultural internal consistency, this provides evidence for one aspect of their reliability. This may be insufficient to recommend their use without a prior examination of the questionnaire's test re-test stability. The findings from the present study suggest that more work may be required on the CSQ and the PLC, particularly with reference to their use in different cultural samples (CAT, P&H, PC and PR) and with more general samples of LBP patients (P&H, PR).

Although the present study also found evidence for the cross cultural validity of the study self reported questionnaires, similar caution is indicated when interpreting these findings. As the reliability of an assessment tool is necessary but not sufficient for the tool validity, the validity of a study questionnaire was only appropriate for those questionnaires that had been demonstrated to have adequate reliability (RMDQ, MZSRDS, MSPQ, CAT and PC). Differential validity is suited to examining the validity of an assessment tool in different groups (Cohen and Cohen, 1983). Other forms of validity such as criterion, concurrent, divergent, predictive (Streiner and Norman, 1995) were not addressed by the present study. Streiner and Norman (1995) argued that the validity of an assessment tool cannot be either demonstrated or rejected by the findings of a single investigation. They argued that research study findings can provide evidence for and against the validity of an assessment tool and that the determination of validity is an ongoing process of evidence gathering (Streiner and Norman, 1995). In light of Streiner and Norman's (1995) argument, the study findings provide further evidence for the validity of the RMDQ, MZSRDS, MSPQ, CAT and PC.

One further consideration to aid interpretation of the study findings is related to the particular cultural groups under investigation. Cohen and Cohen (1983) pointed out that in an analysis which employed dummy variables (i.e. cultural groups) the generalisability of study findings is limited to the sampled groups. In the context of the present study, evidence for cross cultural psychometric properties of the study questionnaires therefore extends only to those cultural groups included in the investigation. Generalisability of the study findings to

other cultural groups requires examination of the psychometric properties of the study questionnaires in samples of the new cultural groups.

Conclusion.

The present investigation found evidence to support Hypotheses 2.1a, 2.1b, 2.1c and 2.1f (page 57). Evidence was also found to support Hypotheses 2.2a, 2.2b, 2.2c, 2.2d, 2.2e, and 2.2f (page 58). Hypotheses 2.1d, 2.1e and 2.1g (page 57) were rejected.

7.5 Study 3. Investigation of Cultural Influences on LBP.

Operationalisation of Research Factors.

Cultural influences on LBP were explored by examining the contributions that ethnicity, country of birth and religious factors made to LBP, and by exploring the differences between cultural groups and measures of the experience of LBP.

For the current investigation LBP was conceptualised as comprising disability, psychological distress, coping strategies and beliefs about LBP. These factors have been demonstrated to be important for a comprehensive model of LBP (Klapow et al., 1993; Strong et al., 1994) and chronic pain (Mikail et al., 1993; De Gagne et al., 1995). The findings from Study 1 of the present investigation demonstrated that psychological distress, coping strategies and beliefs about LBP were the most important factors in a model of LBP disability.

Disability, Psychological distress, coping strategies and pain beliefs were operationalised as comprising self reported disability (disability), symptoms of depression and somatic anxiety (psychological distress), praying & hoping and catastrophising (coping strategies) and beliefs about pain control and the management of LBP (pain beliefs). To assess these constructs, the study employed measures which had previously been used to assess LBP patients (Main et al., 1991, 1992, 1993; Burton et al., (1995), Rose et al., 1995) and whose cross cultural psychometric properties had been examined in Study 2 of the present investigation.

Statistical models.

The effect of ethnic, region of birth or religious group on LBP was explored by testing a series of hierarchical multiple regression models with dependent variables comprising variables which had been demonstrated to comprise a model of LBP in Study 1. The fixed order entry of the research factors was determined by theory and the need for statistical control (Waddell and Main., 1993). Steps 1, 2 & 3 included a demographic factor (age and sex), a social factor (social class) and a clinical factor (QTF classification, chronic LBP and co-morbidity). At step 4, a cultural factor was forced into the regression model.

This method produced a regression yield which provided the partialled contribution to the dependent variable (R^2 change), after controlling for demographic, social and clinical factors, and for an assessment of it's statistical significance (Cohen and Cohen, 1983). Any potential confounding effect of demographic, social or clinical factors on the relationship between cultural factors and the experience of LBP was removed by this method. Regression coefficients (B) were examined to determine partial mean values of the dummy cultural variables. These values were tested for significance according to Protected T method outlined by Cohen and Cohen (1983).

Ethnic influences on LBP.

Hypothesis 3.1 There are significant ethnic group differences in the experience of LBP.

When the ethnicity research factor was forced into the regression model at step 4, significant additional variance was accounted for in several dimensions of the experience of LBP. This finding suggested that patients from different self-defined ethnic groups had significantly different experiences of LBP.

The results also suggested that ethnic differences in the experience of LBP were primarily represented in the dimensions of distress, coping strategies and pain control beliefs.

When the pairwise comparisons were inspected the results indicated that on average the main differences between the ethnic groups were between South Asian and British patients. Inspection of group means suggested that patients who reported a self defined ethnicity as South Asian appeared to experience LBP significantly worse than British patients. On average, South Asian patients reported significantly higher levels of psychological distress (MSPQ) more frequent use of passive coping strategies (P&H and CAT), a weaker belief in the personal responsibility for management of LBP (PR) and personal control of pain (PC) than their British LBP counterparts.

However the change statistics presented in table 6.5a p124 suggested that the overall effect of ethnicity was weak for the MSPQ, CAT, PC and PR (R^2 change

< 0.04). This suggested that after controlling for demographic, social and clinical factors, ethnicity was only weakly associated with these measures of LBP. Ethnicity was more strongly associated with P&H (R^2 change = 0.15) that indicated that there were moderate ethnic influences on this variable.

The current study findings provide support for Hypothesis 3.1 in that they provide evidence for ethnic influences on the experience of LBP. Hypothesis 3.1 was therefore accepted.

Country of Birth

Hypothesis 3.2. There are significant country of birth group differences in the experience of LBP.

After controlling for demographic, social and clinical factors, the Region of Birth cultural factor was significantly associated with several dimensions of the experience of LBP. This finding suggested that experience of LBP was dependent upon the region that a patient reported that he or she was born in.

The dimensions of LBP that were dependent upon region of birth included self reported disability, distress, coping strategies and pain beliefs.

The Region of Birth factor was investigated to determine which constituent groups accounted for differences in the experience of LBP. The results of a series of pairwise comparisons suggested that African born patients appeared to experience LBP significantly and consistently worse than British born LBP patients. Although the mean scores of African and Asian patients were often not significantly different, a trend was also suggested where patients born in Africa had the highest RMDQ, MSPQ, P&H, CAT and PR mean scores and lowest PR means scores than all other region of birth groups. This finding provided possible evidence to suggest that on average LBP patients who were born in Africa were more likely to experience LBP worse than patients born in any other region.

A measure of the size of the effect was obtained from the R^2 change statistics presented in Table 6.5c p128. These findings suggested that the overall effect of

Region of Birth was weak for the RMDQ, MSPQ, PC and PR (R^2 change = 0.02). The relationship between Region of Birth and CAT was stronger (R^2 change = 0.06), although still weak. The strongest effect size was for the P&H regressed on to the Region of Birth factor (R^2 change = 0.17). These findings suggested that after controlling for demographic, social and clinical factors, Region of Birth was significantly but weakly associated with disability, distress, catastrophising and pain control beliefs. Region of Birth's stronger association with P&H indicated that this variable was moderately influenced by Region of Birth, and inspection of the mean values suggested that this effect was primarily carried by differences between South Asia and African born patients and British born LBP patients.

The current study findings provide support for Hypothesis 3.2 in that they provide evidence for Region of Birth influences on the experience of LBP. Hypothesis 3.2 was therefore accepted.

Religion.

Hypothesis 3.3 There are significant reported religious group differences in the experience of LBP.

The finding that after controlling for demographic, social and clinical factors, the Religion cultural factor was significantly associated with the experience of LBP, indicated that experience of LBP was dependent upon the religion of the patient.

All dimensions of LBP that comprised a comprehensive model of LBP (Dozois et al., 1995) were dependent upon the religion of the patient, suggesting that religion influenced the experience of LBP.

The Religion factor was investigated by a series of pairwise comparisons to determine which constituent groups accounted for differences in the experience of LBP. The results suggested that Muslim patients appeared to experience LBP significantly and consistently worse than Christian LBP patients. Although the mean scores of Hindu and Muslim patients were not significantly different, a trend was also suggested where Muslim patients demonstrated the highest mean RMDQ, MSPQ, P&H, CAT and PR scores and lowest mean PR scores than any

other Religious group. However other than for disability and symptoms of depression, the Hindu and Muslim groups did not appear to have significantly different experiences of LBP. These finding suggested that Muslim and Hindu patients presented at clinic with a quantitatively and qualitatively worse experience of LBP than either Christian or other religion patients.

The effect size for Religion on LBP was obtained from the R^2 change statistics presented in Table 6.5e p133. These findings suggested that the overall effect of Religion was weak for distress (MSPQ, MZSRDS) and Pain beliefs (PC and PR) (R^2 change < 0.03). The relationship between Religion and CAT (R^2 change = 0.05), RMDQ (R^2 change = 0.04) was stronger although still weak. As for the Ethnicity and Region of Birth factors, the strongest effect size was for the P&H regressed on to Religion (R^2 change = 0.14).

These findings suggested that after controlling for demographic, social and clinical factors, Religion was significantly associated with disability, distress, coping strategies and pain control beliefs.

The current study findings provide support for Hypothesis 3.3 in that they provide evidence for Religious influences on the experience of LBP. Hypothesis 3.3 was therefore accepted.

Cultural Influences on LBP.

The purpose of the present investigation was to determine to what extent different ethnic, region of birth and religious groups demonstrated "shared beliefs and behaviours" (Waddell and Waddell, 2000) and the influence of these factors on the experience of LBP. However as definitions of culture imply that cross cultural differences in beliefs and behaviours are necessarily true (for the definition of culture to hold), the identification of these differences was to some extent pseudoempirical (Smedslund 1994). The hypotheses of the present study therefore tested whether the experience of LBP was mediated by cultural influences encompassed within ethnic, region of birth and religious groups (McAuley et al., 1996). It was predicted that negative findings would lead to the conclusion of a culturally homogenous experience of LBP, whereas positive

findings would indicate that the experience of LBP was influenced by cultural factors.

The study findings were generally positive; therefore the current study provided evidence for cultural influences on the experience of LBP. Although the overall influences of cultural factors was weak, it was suggested that LBP patients who identified with a particular ethnic group, who were born in similar regions or who shared a religion, had similar experiences of LBP to members of the same cultural group. These experiences were quantitatively different from members of other cultural groups. For example, evidence was found to suggest that in general South Asian patients presented to secondary care with a qualitatively and quantitatively worse experience of LBP than British LBP patients. Cultural differences also evident for Muslim patients who consistently reported the worst experience of LBP, compared to all other Religious groups. Muslim LBP patients were also clinically significantly more disabled than either Christian or other LBP patients (Roland and Morris, 1983). The statistical control of clinical variables in the regression models, including "chronic LBP", led to the conclusion that these groups of patients had a more "chronic" experience of LBP.

Cultural influences on Coping Strategies

The findings of Study 1 of the present investigation supported previous research findings for a cognitive-behavioural mediational model of LBP related distress (Rudy, Kerns and Turk, 1988). In this model cognitive factors, including cognitive coping strategies, mediated the relationship between disability and distress (Waddell et al., 1993).

Evidence from the present study indicated that in general South Asian, South Asia or Africa -born, and Hindu or Muslim patients reported significantly higher uses of passive coping strategies (Jensen et al., 1991), especially P&H, than other LBP patients. Praying and Hoping has been demonstrated to be associated with poor outcome for LBP at one year (Burton et al., 1995) and related to disability for chronic LBP (Dozois et al., 1996) and chronic pain patients (Geisser et al., 1994). The results of Study 1 suggested that patients who reported high P&H scores were likely to report high frequency of symptoms of distress. However in

the current study, the relationship between elevated P&H scores and increased symptoms of distress was only apparent for the MSPQ, and not for the MZSRDS. These findings could be interpreted to suggest that for South Asian, South Asia-born or Africa-born, and Hindu or Muslim patients, cognitive factors mediated the relationship between disability and somatic anxiety but not depressive symptoms.

However there are limitations to these conclusions. Study 2 of the present investigation examined the cross cultural psychometric properties of the disability and psychological questionnaires employed in the present study. Evidence was found to support the cross cultural reliability of the RMDQ, MSPQ and MZSRDS, however the internal consistency of the P&H subscale was low for South Asian, African born, Muslim and Hindu LBP patients. This evidence suggests that although the strongest cultural influences on LBP were found for the P&H subscale of the CSQ, these findings may not be reliable for South Asian, African-born, Hindu and Muslim patients. Firm conclusions on the use of Praying and Hoping as a coping strategy for these patients were therefore limited.

The current study finding also provided evidence for the validity of the CAT subscale of the CSQ. Geisser et al., (1994, p79) described this scale as a measure of "judgements of an inability to persist in coping efforts, excessive worry about the future and a tendency to view pain and the individual's life situation as overwhelming". In a study of rheumatoid arthritis pain, Keefe et al., (1989) found evidence to suggest that catastrophising was a maladaptive coping strategy. However Affleck et al., (1992) and Sullivan and D'Eon (1990) have criticised these conclusions and suggested that catastrophising was a symptom of depression rather than a related and separate construct. Jensen et al., (1992) also questioned the validity of this coping strategy and suggested that catastrophising was more appropriately defined as an appraisal rather than a coping strategy. However other than for religion, the present investigation found cultural differences in the mean scores of the CAT subscale but not for the mean scores of the MZSRDS. The different pattern of cultural influences for the CAT and MZSRDS suggested that these two variables are independent. The present study

findings therefore support Geisser et al.,'s (1994) conclusions from a sample of chronic pain patients that catastrophising is a separate construct from depression.

The differential influence of cultural factor on LBP.

Evidence was also found to suggest that the effect of the cultural factors on LBP was not constant. Religion appeared to influence all dimensions of the LBP measured in the study, whereas Region of Birth did not influence depressive symptoms and Ethnicity did not influence disability or depressive symptoms. This finding suggested that Religion appeared to influence the experience of LBP to a larger extent than either Region of Birth or Ethnicity. It was concluded therefore that Religion may be more important measure of cultural influences on LBP than either Ethnic or Region of Birth group.

This finding provides evidence for the differential effect of cultural factors on LBP and therefore supports Hypothesis 3.2. Hypothesis 3.2 was therefore accepted.

Controlling for Social and Clinical Factors.

The study results indicated that the demographic factor was weakly associated with the experience of LBP (R^2 change<0.04, p<0.02) and the social factor was weakly associated with coping strategies (R^2 change<0.04, p<0.02). The clinical factor accounted for the largest share of the variance in each regression model compared to the demographic, social and ethnic factors in except for P&H, PC and PR models

The finding that culture influenced the experience of LBP in the present study was independent of the potential confounding effects of Social Class (Croft and Rigby, 1994) and clinical factors (Main and Waddell, 1991).

Conclusion.

It was concluded from the results of the present study that, although the effect was weak, culture influenced the experience of LBP. It was also concluded that compared to other cultural factors, Religion had the strongest and greatest influence on LBP.

7.6 Speculative Reasons for Study Findings.

The data from Study 1 of the present investigation appear to generally support a Cognitive Behavioural model of chronic pain (Rudy and Turk, 1988). This model predicts that differences in disability may be the associated with differences in coping strategies and pain beliefs. Study 1 found that reported disability was indeed associated with negative coping strategies (and to a lesser extent Pain Beliefs) where patients who relied on a more "passive" coping strategy i.e. Praying and Hoping (Rosensteil and Keefe 1983) were more likely to demonstrate increased features of disability. Previous research has demonstrated the relationship between external locus of control and increased symptoms disability and the relationship between "negative" coping strategies and disability (e.g Dozois et al., 1995). Haythornthwaite (1998) also demonstrated that relationship between coping strategies and perceived control over pain where coping strategies predicted perceived control.

The current investigation has added to existing scientific knowledge by providing evidence that certain cultural groups are more likely to have a more chronic experience of LBP than patients than other cultural groups. In general patients who identified their religious affiliation as Muslim were particularly at risk for developing more severe symptoms of disability than other religious groups. Interpreted within the Cognitive Behavioural Model (Rudy and Turk 1988) these findings suggest that increased symptoms of reported disability are likely to be due, at least in part, to increased use of "passive" coping strategies such as Praying and Hoping. This coping strategy appeared in the present study to be the strongest discriminator between the cultural groups with South Asian, Muslim, and African-born patients reporting the increased use compared to their other respective cultural groups. However in Study 2 of the current investigation, the questionnaire used to measure the Praying and Hoping construct, the Praying and Hoping subscale of the Coping Strategies Questionnaire (CSQ) (Rosensteil and Keefe 1983), demonstrated reduced reliability compared to the other cultural groups which suggests that there is a risk of producing inconsistent findings when using this questionnaire with South Asian, African-born or Muslim groups. Riley et al., (1997) and Robinson (1997) suggested that the Praying and Hoping subscale of the CSQ (Rosensteil and Keefe 1983) was psychometrically unstable

and may comprise two distinct subscales "Praying" and "Hoping" and that most of the variance accounted for in disability was associated with the "Praying" items. Praying is a fundamental aspect of daily Muslim life and is one of the five pillars of Islam with formal worship or prayer (Salat) outlined in Islamic Law (Sharia). Although the present study does not offer any data to confirm this, it may be that increased features of disability reported by patients identifying as Muslim may be related to an over-reliance on "external" or "passive" sources of coping. Further work on the meaning of Praying as a coping strategy and on its relationship with LBP disability for non-Christian groups would appear warranted.

Chapter 8. Study Conclusions.

The current research investigated cultural influences on LBP. Three independent but linked research studies addressed the research question by testing a model of LBP disability, examining the cross cultural psychometric properties of self reported measures of LBP and exploring cultural influences on the experience of LBP.

Summary of Study Findings.

Study 1 found evidence to support a model of LBP disability in which psychological factors were the most prominent features. Study 2 suggested that self reported psychological questionnaires, particularly those that assessed cognitive coping strategies and beliefs about LBP, may not have robust cross cultural psychometric properties. Study 3 found evidence to support the role of cultural factors on the experience of LBP, although some of the conclusions were limited by the cross cultural psychometric properties of the assessment tools. Standardisation of the questionnaires within the cultural groups may improve understanding and the strength of the relationships.

Conclusions of Study Findings.

The finding that LBP disability was predominantly a psychological experience has potential theoretical and management implications for clinical practice. A definition of LBP usually includes the identification of clinical factors (e.g. Frank 1993) and therefore it is accepted that clinical factors are the primary problem in LBP. However the findings of the present investigation suggest that once a diagnosis of LBP has been made on the basis of clinical factors, psychological factors are dominant and account for the strongest relationships with LBP disability. The inter-relationship between clinical and psychological factors was not addressed in the present investigation, and therefore no firm conclusions can be made on the basis of the present findings about the causal priority of these factors. However previous research identified the role of psychological factors in the development of new episodes of LBP (Papageorgiou et al., 1996). Linton (2000) also concluded from a review of the literature on psychological predictors of LBP that psychological factors were associated with

the development of chronic LBP. The evidence from the current investigation and previous research appears to suggest that psychological factors are important at each step during the course of LBP. Applied to clinical practice, these findings suggest that psychological factors should be a primary target in the management of LBP, and that this may be particularly salient for patients attending secondary care.

The present study also identified specific psychological factors that may be appropriate targets for psychological management of LBP. Primary amongst these were catastrophising coping strategies and beliefs about the management of the condition. The study findings suggested that patients who reported high levels of disability were also more likely to hold strong beliefs that they were not responsible for the management for their condition, were more likely to view their condition as overwhelming and worry about the future, and were more likely to report high levels of symptoms of psychological distress. Investigations of the relationships between these factors suggested that coping strategies and beliefs about pain mediated the strong relationship between disability and distress. It is therefore suggested that interventions, incorporated in a framework of psychologically orientated pain management, that are targeted towards modifying these beliefs may reduce the distress associated with LBP. However caution is always indicated when interpreting psychological research findings due to the limitations of psychological questionnaires.

Research in recent years has confirmed the importance of cognitive factors to LBP disability (Strong et al., 1992; Slater et al., 1991; Waddell et al., 1993). Strong beliefs that pain is associated with disability or restriction of activity, or that pain is best avoided, have been consistently demonstrated to be related to LBP disability (Slater et al., 1987; Waddell et al., 1993; Strong et al., 1992; Asmundson et al., 1997; Vlaeyen et al., 1995) and chronic pain (Riley et al., 1988; Jensen et al., 1997; Tait and Chibnall 1997; McCracken et al., 1996). However although these cognitive factors were derived from more recent developments and refinements of psychological theory to LBP and disability, the strength of their relationships with disability was remarkably similar (R^2=0.25 to R^2=0.30) to that of the present study cognitive factors and LBP disability

(Waddell et al., 1993; Strong et al., 1992; Slater et al., 1991; Tait and Chibnall 1997).

The findings of the present investigation, and those from previous research, suggest that further work is required on the precise nature of the cognitive factor that accounts for the relationship between Beliefs and LBP disability and on the relationships between individual cognitive coping strategies, beliefs and appraisals. It appears that despite recent developments in the application of psychological theories to LBP, research findings have indicated that these newer developments do not appear to have contributed significantly to further understanding LBP and disability.

The study also found evidence that cultural factors influenced the predominantly psychological experience of LBP. The findings suggested that in general LBP patients who reported a South Asian ethnicity, who were born in a South Asian or African country, or who were Hindu or Muslim appeared to experience LBP significantly worse than British, British-born or Christian LBP patients. These findings were still significant after the potential confounding influences of Social factors (Nazroo 1998; Njobvu et al., 1999) had been statistically removed from the model.

Previous research suggested that there may be important cultural influences on the experience of chronic pain (Zborowski, 1952; Bates and others 1993, 1994, 1995; Strassberg 1992; Nelson et al., 1996) and LBP (Tait et al., 1982; Carron et al., 1985; Strong et al., 195; Brena et al., 1990; Sanders et al., 1992; Honeyman and Jacobs 1996), although much of this work was criticised by Waddell and Waddell, (2000) for being methodologically weak. The cultural groups investigated by much of this research were diverse, and few consistent conclusions, other than broad generalisations, can be made. Some qualitative work suggested that "Indian" and "United States" patients with chronic pain (Kodiath and Kodiath, 1992) or cancer pain (Kodiath and Kodiath, 1995) had different experiences of their pain. Intra-cultural differences were also reported in research conducted on chronic pain patients in India, where evidence of weak sociodemographic influences in rates and experiences of heterogeneous chronic

pain conditions were found amongst "Indians" (Chaturvedi et al., 1984; Varma et al., 1986).

The present study found evidence to suggest that cultural influences varied by the cultural factor that was addressed. The strongest cultural influence on LBP in the present investigation appeared to be Religion. Muslim patients particularly demonstrated a more chronic experience of LBP compared to other groups. Other than the work of Zborowski (1952) who investigated the beliefs and behaviours of Jewish chronic pain patients, this area of research appeared to have been largely neglected in the literature on LBP. In relation to wider health issues Cruickshank and Beevers (1989 p5) commented, "Religion has little to do with health or disease". However there are suggestions from research on other chronic illnesses that Religious identification may moderate adjustment to illness. Sissons Joshi (1995) found in a study of diabetes mellitus that Hindu and British patients differed in the beliefs that mediated their adjustment to their illness.

The finding that Muslim patients were at increased risk for chronicity appeared to be a novel finding of the current research, in that previous work on LBP had not identified this apparent risk group.

There are important clinical implications associated with the identification of these cultural differences. The findings suggest that particular aspects of the experience of LBP may require extra attention for South Asian, South Asia and Africa born, and Hindu or Muslim patients. Although in general culture was found to influence multiple aspects of LBP, evidence was found that the main influence of cultural factors on LBP appeared to be through their effect on cognitive coping strategies, particularly Praying and Hoping. However the questionnaire which was used to assess this coping strategy (CSQ P&H) was identified in Study 2 as having low cross cultural reliability scores. Further work is therefore required on the internal structure of this questionnaire and its relationships to cultural factors. The effect of using "Praying", as distinct from "Hoping" (Robinson et al., 1997) as a LBP coping strategy may also be worth further investigation, particularly in relation to religious differences. The

importance of Catastrophising as a coping strategy to LBP disability and distress was identified the Study 1. However the findings from Study 2 suggested that the questionnaire used to assess this construct (CSQ CAT) may not provide results that are cross culturally consistent. Study 3 however found evidence to support the validity of catastrophising as an independent construct from depression. Although evidence was found for cultural differences in beliefs about Pain Control, this factor was largely unrelated to LBP disability or distress. Further work may be required on beliefs about pain control and their relationship to LBP.

Clinical Implications.

There are important clinical implications to be taken from the present investigation. Management strategies for LBP should take into consideration the dominance of psychological factors, which need to be addressed directly. The importance of these psychological factors also appears to vary by cultural group, particularly by religious group. Muslim LBP patients appear to present a specific risk group for chronicity of symptoms, and culturally appropriate psychological interventions, particularly in relation to coping strategies, may need to be designed and implemented for these patients. A cautious approach should also be taken when using self report questionnaires to assess psychological constructs associated with LBP and disability. Certain questionnaires such as those that measure patient cognitions or beliefs may pose particular problems for clinicians and researchers. Finally, recognising that the effect of cultural influences on LBP was generally found to be weak, care should be taken when attempting to apply the findings and conclusions of the present study to individual patients with LBP. Indeed the evidence for weak cultural influences on LBP implies that the differences between members of the same cultural group are likely to be more evident than differences between members of different cultural groups.

Limitations of Study findings.

Limitations on the study findings are primarily concerned with limitations on generalisation. Generalisation of the study finding is largely dependent on the characteristics of the study sample and the extent to there is evidence that suggests that it is representative of the population from which it was drawn. The

strongest evidence for a representative sample is obtained from sample of individuals that have been randomly drawn from the parent population. The study sample in the present investigation was not a truly random sample of the population LBP patients. However investigation of the sample characteristics suggested that the study sample shared these characteristics with other research studies (Main and Waddell, 1991, Waddell et al., 1993). This finding provided evidence for the comparative validity of the study sample. Furthermore the study sample was a consecutive cohort of patients referred for secondary care at to a specialist NHS LBP clinic. As patients were excluded from the study if they did not have simple LBP (Frank, 1993), this indicated that the sample was not highly selected. The clinical characteristics of the sample have been described in detail elsewhere and it was concluded that the sample was representative of patients referred for secondary care in the UK (Frank et al., 2000).

Although the evidence suggests that the study did not sample a unique population of LBP patients there are limitations on the generalisation of the findings due to patients refusal to participate. On average those patients who refused to participate were older than those who consented to participate in the study. This suggests that generalisation of the study findings may be limited to younger patients. The methodology presented by the present investigation was clearly inappropriate for older patients referred to the clinic. Further research is indicated on this patient group.

Cultural Groups.

Generalisation of the findings is also limited to the cultural groups assessed in the study. This implies that the finding that LBP is influenced by cultural factors is only generalisable to the cultural groups that were represented in the study sample. This also applies to the size effect and inter-relationships of the cultural factors on the experience of LBP. Generalisation of the study findings to other cultural groups is only appropriate if the models described in the present research are re-tested in the different ethnic groups.

Suggestions for Future Research.

The literature on cultural influences on chronic pain has been criticised for being too descriptive and not examining the possible causes for observed cultural differences (Encandela 1993). To some extent the present investigation does not escape this criticism. Although strong evidence was found that members of different cultural groups have different experiences of LBP, no empirical evidence was provided for the possible causes of these differences.

Johnston (1996) proposed that Ajzen's (1985) "Theory of Planned Behaviour" could be applied to disability. This model proposed that that the best predictor of a behaviour was the formation of an "intention". Intention was predicted by the attitude towards the behaviour, subjective norms or social pressure to perform the behaviour and perceived behavioural control or self efficacy (Terry and O'Leary 1995). In pilot work McAuley et al., (1998) tested this model on a sample of LBP patients and found evidence to suggest that the performance of future disability associated behaviours was predicted by elements of the Ajzen (1985) model.

McAuley et al., (1998) concluded that this model may have potential for understanding why LBP patients engage or refrain from engaging in particular disability-associated behaviours. Furthermore this model has potential to provide a synthesis of research findings on LBP into a coherent social cognition model. Attitudes have been found to predict disability (Jensen et al., 1987) for chronic pain and LBP (Tait and Chibnall, 1997) patients. Furthermore the current study findings and those from previous research (e.g. Main and Waddell, 1991) suggest that control beliefs are also associated with LBP disability. Self efficacy has also been found to be an important variable that predicts behaviour of LBP and chronic pain patients (e.g. Dolce et al., 1987, Dolce 1986; Council et al., 1988; Jensen et al., 1991; Nicholas 1992). Finally social influences have been found to predict pain response (Lambert et al., 1960, Prkachin et al., 1986) and behaviour of LBP patients (Sandstrom 1986: Romano et al., 1995; Lousberg et al., 1992).

The Theory of Planned Behaviour (Ajzen 1991) also provides a mechanism with potential for illuminating the role of cultural factors on LBP disability.

Triandis (1993) proposed the classification of cultures according to the strength of their identification with individualist or collectivist attributes might be a useful mechanism for understanding behaviour. In this scheme more individualistic themes are found in Western cultures where the centrality of the autonomous individual is emphasised and more collectivist themes are found in Eastern or traditional cultures where the centrality of the collective is emphasised (Triandis 1993).

In light of the Triandis (1993) model, it might be predicted that individuals from collectivist cultures are more likely to respond to social pressure (social norms) than patients from individualistic cultures that may be more likely to behave in response to their attitude towards the behaviour (Ajzen 1985). Indeed much of the work on the Theory of Planned Behaviour that has been conducted on samples of individuals from Individualistic cultures has suggested that Social Norms are not as strongly associated with Intention as Attitudes (Valois et al., 1988; Terry and O'Leary 1995; Ajzen and Madden, 1986; Ajzen and Driver 1992; McAuley and Courneya 1993; Ajzen and Timko 1986).

Future research arising from the present study finding could address some of the issues arising from a cultural investigation of the Theory of Planned Behaviour (Ajzen 1986). This research may help to address some of the issues that arose from the findings and conclusions of the present investigation and provide a theoretical framework for the influence of cultural factors on LBP.

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Appendices

Appendix A

Missing Data

Missing data is a pervasive problem in research and occurs when values on particular variables of interest are not available for analysis (Little and Rubin 1987). Missing data may have varied causes including illegible, incoherent or out of range responses, participant non-compliance or attrition and equipment failure or administration difficulties.

Missing Data Patterns and their Implications.

Little and Rubin (1987) argued that the main factor that determined the choice of a strategy for handling missing data was the pattern that it formed in the data matrix and the process that caused the data to be missing. They argued that the amount of missing data played a minor role in the choice between strategies and that missing data that was distributed at random though the data set was less problematic than non random missing data (Little and Rubin 1987). Tabachnick and Fidell (1996) argued that most methods for handling small amounts of randomly distributed missing data were likely to yield similar results. Non randomly missing data was argued to have more serious implications for the generalisability of the results.

Little and Rubin (1987) suggested that missing data can be classified with respect to their random distribution in the data matrix: Missing Completely at Random (MCAR), Missing at Random (MAR) and Non-Ignorable missing data (Little and Rubin, 1987). MCAR was defined as missing data whose cause was unrelated to either its own value or to any other observation. MAR was defined as missing data that was found to be related to another observed variable (or assumed to be related to an unmeasured variable) but not related to the dependant variable. Little and Rubin (1987) argued that MAR was a milder assumption than MCAR in that the likelihood is that missing data are associated with an observed or unobserved variable. Non-ignorable missing data was defined as missing data for which the likelihood of being missing was dependent upon the values of the dependant variable. Dunn, Everitt and Pickles, (1993) argued that

in general, and for practical reasons, missing data are assumed to be either MCAR or MAR.

Review of Missing Data Strategies.

Tabachnick and Fidell (1996) pointed out that all strategies for dealing with missing data produced a data set that was inferior to a complete data set and that the choice between the methods for handling missing data was a choice between bad alternatives.

Tabachnick and Fidell (1996) described 3 general approaches to handling missing data; complete case analysis, available case analysis and missing data imputation methods.

Complete Case Analysis.

A complete case analysis was based on the assumption that if the sample size was large and the missing data was small and random (MCAR), it was unlikely to produce a data set that differed markedly from the complete data set (Cohen and Cohen 1983; Tabachnick and Fidell, 1996). However there is no consensus in the literature for how much missing data can be tolerated for any given sample size. Cohen and Cohen (1983) suggested a rule of thumb, where dropping 10-15 cases of missing data from a total database of several hundred was regarded as unlikely to have any practical effect. Graham and Hofer (1996) suggested that a data set was robust to losing 5% or fewer cases due to missing data. In general, the results obtained from an analysis of a complete data set were unlikely to be markedly different from a data set in which a few cases with missing data have been deleted (Cohen and Cohen, 1983, Tabachnick and Fidell, 1996, Graham and Hofer 1996). However the distribution of the missing data and the loss of statistical power become increasingly important considerations when the proportion of missing data is increased. Generally, deletion of cases with missing data is only appropriate for data sets in which the missing data is MAR.

Missing Data Correlation Matrix (available case analysis).

This method analyses all available pairs of cases for which there were complete data and the coefficients are used to calculate the multiple correlation (R).

However depending on the pattern of missing values, this method can result in different numbers of cases employed to calculate the correlations used to derive R which can produce correlations with different stabilities within the same correlation matrix. Furthermore the calculation of standard error of R also becomes problematic as the total number of cases included in the analysis is unknown. Other problems include potential out of range correlation estimates (with r>1 or r<-1) and negative eigenvalues (Tabachnick and Fidell 1996) i.e. the correlation matrix may not be positive-definite. Although large samples and only a few cases with missing data can mitigate some of these problems (Tabachnick and Fidell 1996), Graham and Hofer (1996) concluded that this method should not be used for handling missing data, not even for "quick and dirty" analyses.

Data Imputation Methods.

Tabachnick and Fidell (1996) described 2 methods of data imputation (mean substitution and regression), Little and Rubin (1987) described imputation with the Expectation Maximisation (EM) algorithm and recently Hofer et al., (1996) proposed multiple imputation (MI).

Prior knowledge and mean substitution.

This method refers to replacing the missing value with a either a well educated guess of what the missing value could have been (a "guestimate"), or inserting the total grand or group mean value for the variable with missing values.

Both these methods are problematic. The reliability of the prior knowledge method is dependent upon the kind of prior knowledge is used for the imputation. If only knowledge of the particular variable with missing data is used then it is likely that the imputed score will be closer to the mean value than the unknown missing value that can result in reducing the variance of the variable and therefore deflating correlations. Correlations can be inflated if the prior knowledge used is based on the values of other complete variables.

Mean substitution may result in reducing the amount of variance available and deflating correlations as the imputed score is closer to the mean value (exactly the mean) than the unknown missing value. Both of these methods are only

appropriate for data analyses for which the amount of missing data is small and the sample size large (Tabachnick and Fidell, 1987).

Hot Deck.

An extension of prior knowledge and the group mean imputation. The data set is examined for a complete data case that is the same or similar to the case with the missing data. The missing value on the complete case is then imputed to the incomplete case. The main problem with this method is determining 'similarity' between the donor case and the case with missing values. This method is presently used by the US Census (Lessler and Kalsbeck 1992).

Regression.

In a multivariate data set other complete variables can be used to write a regression equation for the complete cases of the variable for which there are missing data. This equation can predict the missing values (Tabachnick and Fidell 1996). This method may include replacing the missing values with the values obtained from a first round of regression and then developing a second regression equation using all the cases. A third equation is then developed from the round two predicted values for the variable with the missing data. The method proceeds in an iterative fashion until the predicted values from one step are similar to the predicted values from the next with the values from this final step used to replace missing values (Tabachnick and Fidell 1996). Improvements to this method can be achieved by adding uncertainty to the imputed values to protect against imputing the mean at each step.

Although regression imputation not as insensitive as mean insertion (Tabachnick and Fidell, 1996), the solution of an analysis is at increased risk of being over fit. Tabachnick and Fidell (1996) pointed out that not only is it an impractical method as it is dependent upon good predictors of the variable with missing data, but that it can lead to estimates of values which are out of range (Tabachnick and Fidell, 1996).

Expectation Maximization (EM) (Little & Rubin, 1987).

The EM approach to handling missing data is an iterative procedure that proceeds in two steps. During the first step (Expectation) an expected value is computed from the available data, based on a specified model, and is equivalent to the 'best guess' by the EM algorithm of the likely parameters. During the maximisation step, the expected values are substituted for the missing data and the maximum likelihood approach derives new parameter estimates (usually the means and co-variances). The new parameter estimates are substituted back into the Estimation step and a new Maximisation step is performed. The procedure continues iteratively through these two steps until convergence when the change of the parameter estimates from iteration to iteration becomes negligible (Little and Rubin 1987).

The statistical properties of this approach are well known (Schafer et al., 1997). It assumes incomplete cases have data missing at random (MAR) rather than missing completely at random (MCAR) and therefore outperforms other ad hoc methods of incomplete data handling such as the complete case analysis, pairwise data deletion and mean substitution methods. The primary disadvantage of the EM approach is does not include an uncertainty component to the estimated data which can result in unreliable standard errors.

Raw maximum likelihood methods and Multiple Imputation.

These methods impute missing data based on extensions of the maximum likelihood estimating procedure (Full Information Maximum Likelihood). The multiple imputation method generates typically five to ten databases that are then analysed with usual statistical procedures, the results from which are combined into a single summary finding.

Comparison of Missing data handling strategies.

Roth (1994), Little & Rubin (1987) and Wothke (1998) reviewed the above methods for handling missing data and tended to agree that complete case analysis, pairwise, and mean substitution missing data handling methods were inferior to the maximum likelihood based methods such as the raw maximum likelihood or multiple imputation methods. Imputation by regression was found

to be somewhat better than analyses with complete cases, pairwise or mean substitution methods, but not as good as the maximum likelihood based approaches. Although the EM method was also superior to a complete case analysis, pairwise, and mean substitution approaches, Wothke (1998) argued that it lacked the uncertainty component contained in the raw maximum likelihood and multiple imputation methods. Tabachnick and Fidell (1996) suggested that the results obtained from a data imputation method should be compared with those from a complete case analysis and an available case analysis. They argued that this might be particularly important if the amount of missing data is large and non-random (Tabachnick and Fidell, 1996).

Appendix B

Results of Data Screening

Accuracy of Data File

Inspection of the hospital notes and the self completed questionnaires confirmed the identification of patients who failed to meet the study inclusion criteria (n=119), patients who refused to consent in the study (n=40) and those patients for whom self reported data collection was suspended (n=71).

Inspection of the frequency tables and charts from the data file obtained following exclusions (n=427) indicated that no out of range or implausible values on any of the potential study variables were detected.

A proof read confirmed the accuracy of the data input for a randomly selected 25 raw data cases (5%).

Missing Data.

A missing data analysis was performed on the data set derived from those patients included in the study (n=427). Examination of table B1 indicated that there were missing data on the following variables: Duration of LBP, RMDQ, MSPQ, MZSRDS, CSQ – P&H, CSQ – CAT, PLC – A, PLC – B and Years in the UK.

Table B1. Missing Data

	N	*Mean*	*SD*	*Missing*	
				Count	Percent
DURATION	419	2.70	5.46	8	1.87
RMDQ	408	11.87	6.45	19	4.45
MSPQ	360	7.91	6.29	67	15.69
ZSRDS	362	25.68	11.25	65	15.22
P&H	383	20.67	9.20	44	10.30
CAT	385	13.05	9.41	42	9.84
PC	373	11.49	4.89	54	12.65
PR	370	6.44	2.74	57	13.35
PROP IN UK	419	0.69	0.31	8	1.87

Key: RMDQ = Roland and Morris Disability Questionnaire; MZSRDS = Modified Zung Self Rating Depression Scale, MSPQ = Modified Somatic Perception Questionnaire; CAT = Catastrophising subscale of the Coping Strategies Questionnaire; P&H = Praying and Hoping subscale of the Coping Strategies Questionnaire; PC = Pain Control subscale of the Pain Locus of Control; PR = Pain Responsibility subscale of the Pain Locus of Control; Duration = Duration of LBP; Prop in UK = Proportion of Life spent in the UK

The results of investigations into patterns of missing data are presented in Table B2.

Table B2. Missing Data Patterns

Number of Cases	*RMDQ*	*CAT*	*P&H*	*PC*	*PR*	*MZSRDS*	*MSPQ*	*a.*
302								302
12							X	314
10						X		312
13						X	X	339
9	X							311
6					X			308
5				X	X			313
14		X	X	X	X	X	X	348
5		X	X	X	X			313
4		X	X	X	X	X		325

a. Number of complete cases if variables missing in that pattern (marked with X) are not used.

Key: RMDQ = Roland and Morris Disability Questionnaire; MZSRDS = Modified Zung Self Rating Depression Scale, MSPQ = Modified Somatic Perception Questionnaire; CAT = Catastrophising subscale of the Coping Strategies Questionnaire; P&H = Praying and Hoping subscale of the Coping Strategies Questionnaire; PC = Pain Control subscale of the Pain Locus of Control; PR = Pain Responsibility subscale of the Pain Locus of Control; Duration = Duration of LBP

Ten patterns of missing data were identified. An analysis including complete cases only included n=302 cases (70.7% of the study sample).

Inspection of Table B2 suggested a complex interaction of missing data across multiple variables accounted for a maximum of 14 cases. For example if the variables MSPQ and the MZSRDS were excluded an additional n=13 cases would be made available for an analysis. A missing data strategy that deleted a single or combination of variables would not substantially increase the number of cases available for analysis. Missing data patterns that accounted for less than 1% of the data were not displayed in the table.

Table B3 provided the results of t tests of missing vs. non-missing for each of the continuous variables included in the study.

Table B3. Separate Variance T-tests

		AGE	*DURAT*	*RMDQ*	*MSPQ*	*ZSRDS*	*P&H*	*CAT*	*PC*	*PR*	*Prop*
MSPQ	t	-1.86	1.30	0.71.		-1.74	-0.78	-0.88	-1.25	-0.09	-1.76
	df	90.37	160.64	83.78.		24.93	54.82	51.86	39.45	41.62	89.60
	P(2-tail)	0.07	0.19	0.48.		0.09	0.44	0.38	0.22	0.93	0.08
	# Present	360	352	347	360	338	340	343	337	333	356
	# Missing	67	67	61	0	24	43	42	36	37	63
	Mean(Present)	47.00	2.80	11.97	7.91	25.33	20.55	12.90	11.36	6.44	0.68
	Mean(Missing)	50.78	2.15	11.34.		30.54	21.65	14.24	12.69	6.49	0.75
ZSRDS	t	-2.03	0.49	0.36	0.18.		-1.64	-0.39	-1.95	0.18	-0.08
	df	93.60	115.85	82.52	22.93.		43.17	44.18	34.28	38.49	82.24
	P(2-tail)	**0.05**	0.62	0.72	0.86.		0.11	0.70	0.06	0.86	0.94
	# Present	362	354	348	338	362	346	348	341	335	357
	# Missing	65	65	60	22	0	37	37	32	35	62
	Mean(Present)	47.01	2.74	11.92	7.93	25.68	20.41	12.99	11.29	6.45	0.69
	Mean(Missing)	50.83	2.46	11.60	7.64.		23.14	13.62	13.53	6.34	0.69
P&H	t	-2.23	-0.53	-0.22	-1.09	-3.20.		-1.83	1.25	0.07	0.25
	df	50.54	55.39	46.62	20.24	16.56.		5.19	8.44	8.13	51.43
	P(2-tail)	**0.03**	0.60	0.83	0.29	**0.01**.		0.12	0.25	0.95	0.81
	# Present	383	375	368	340	346	383	379	364	361	376
	# Missing	44	44	40	20	16	0	6	9	9	43
	Mean(Present)	46.98	2.65	11.85	7.80	25.29	20.67	12.94	11.53	6.44	0.69
	Mean(Missing)	52.93	3.09	12.10	9.85	34.00.		19.50	9.56	6.33	0.68
CAT	t	-1.89	-0.60	0.87	-0.90	-2.24	0.41.		-1.62	-0.49	0.36
	df	47.43	51.82	44.83	16.74	14.13	3.03.		6.13	6.06	45.47
	P(2-tail)	0.06	0.55	0.39	0.38	**0.04**	0.71.		0.16	0.64	0.72
	# Present	385	377	370	343	348	379	385	366	363	380
	# Missing	42	42	38	17	14	4	0	7	7	39
	Mean(Present)	47.07	2.65	11.96	7.82	25.42	20.70	13.05	11.41	6.42	0.69
	Mean(Missing)	52.36	3.16	11.00	9.82	32.07	18.00.		15.43	7.43	0.67
PC	t	-1.90	-0.21	-0.44	-0.66	-1.35	-1.44	-0.47.		0.68	1.67
	df	68.88	75.61	60.65	23.69	21.83	20.76	19.62.		7.43	69.18
	P(2-tail)	0.06	0.84	0.66	0.51	0.19	0.16	0.65.		0.52	0.10
	# Present	373	365	360	337	341	364	366	373	362	366
	# Missing	54	54	48	23	21	19	19	0	8	53
	Mean(Present)	47.06	2.68	11.82	7.84	25.45	20.54	12.99	11.49	6.45	0.70
	Mean(Missing)	51.22	2.83	12.25	9.00	29.38	23.21	14.11.		5.88	0.63
PR	t	-1.89	0.09	-0.17	-0.96	-2.35	0.39	0.22	-0.70.		0.61
	df	73.27	82.30	65.32	28.76	30.55	23.51	23.79	10.48.		72.30
	P(2-tail)	0.06	0.93	0.86	0.35	**0.03**	0.70	0.83	0.50.		0.54
	# Present	370	363	357	333	335	361	363	362	370	364
	# Missing	57	56	51	27	27	22	22	11	0	55
	Mean(Present)	47.04	2.71	11.85	7.80	25.29	20.72	13.07	11.45	6.44	0.69
	Mean(Missing)	51.14	2.64	12.02	9.26	30.44	19.91	12.64	12.64.		0.67

For each quantitative variable, pairs of groups are formed by Indicator variables (present, missing). a. Indicator variables with less than 5% missing are not displayed

Key: RMDQ = Roland and Morris Disability Questionnaire; MZSRDS = Modified Zung Self Rating Depression Scale. MSPQ = Modified Somatic Perception Questionnaire; CAT = Catastrophising subscale of the Coping Strategies Questionnaire; P&H = Praying and Hoping subscale of the Coping Strategies Questionnaire; PC = Pain Control subscale of the Pain Locus of Control; PR = Pain Responsibility subscale of the Pain Locus of Control

The results of t tests of missing vs. non-missing on quantitative variables suggested that the assumption of MCAR (Little and Rubin 1987) could not be supported in the current data set. For example, those patients who provided complete MZSRDS or P&H scores were significantly younger than those who did not, indicating that the missing data were dependant upon at least one measured independent variable. Although not meeting the threshold for significance ($p=<0.05$), the strength of evidence against accepting the null hypothesis was strong for several other self-completed variables that showed similar patterns with age.

There is currently no method available for testing for Non-Ignorable missing data, therefore the milder assumption that the missing data was Missing At Random (Little and Rubin 1987) was made.

Complete case analysis and available case analysis methods for handling missing data are dependent upon the assumption that data is MCAR. Complete case analysis and available case analysis were rejected for the current data set.

Table B4 provides the means and standard deviations obtained from a complete case, an available case analysis and the EM analysis.

Table B4. Summary of Estimated Means (Means) and Standard Deviations (sd)

	Complete Case		Available Case		EM	
	mean	*sd*	*mean*	*sd*	*mean*	*sd*
AGE	46.65	14.84	47.59	14.94	47.59	14.94
DURATION	2.99	6.15	2.70	5.46	2.69	5.45
RMDQ	11.96	6.34	11.87	6.45	11.79	6.48
MSPQ	8.13	6.17	7.91	6.29	7.95	6.31
ZSRDS	25.59	10.81	25.68	11.25	25.60	11.24
P&H	20.95	8.89	20.67	9.20	20.74	9.23
CAT	13.24	9.46	13.05	9.41	13.02	9.49
PC	11.37	4.69	11.49	4.89	11.52	4.90
PR	6.38	2.68	6.44	2.74	6.41	2.74
PROP IN UK	0.69	0.31	0.69	0.31	0.69	0.31

Key: RMDQ = Roland and Morris Disability Questionnaire; MZSRDS = Modified Zung Self Rating Depression Scale, MSPQ = Modified Somatic Perception Questionnaire; CAT = Catastrophising subscale of the Coping Strategies Questionnaire; P&H = Praying and Hoping subscale of the Coping Strategies Questionnaire; PC = Pain Control subscale of the Pain Locus of Control; PR = Pain Responsibility subscale of the Pain Locus of Control; Duration = Duration of LBP; Prop in UK = Proportion of Life spent in the UK

Table B5 provides the correlation matrix for the available case analysis and table B6 for the EM analysis.

Table B5. Complete Case Correlation Matrix

	AGE	DURATION	RMDQ	MSPQ	ZSRDS	P&H	CAT	PC	PR	YRS IN UK
AGE	1.00									
DURATION	0.09	1.00								
RMDQ	0.17	0.08	1.00							
MSPQ	0.02	0.13	0.45	1.00						
ZSRDS	0.00	0.10	0.55	0.49	1.00					
P&H	0.17	0.11	0.44	0.21	0.29	1.00				
CAT	0.00	0.11	0.59	0.48	0.63	0.46	1.00			
PC	0.10	-0.03	-0.07	-0.11	-0.15	0.09	-0.08	1.00		
PR	-0.21	-0.11	-0.44	-0.26	-0.40	-0.38	-0.40	-0.02	1.00	
Prop in UK	-0.06	-0.11	-0.14	-0.12	-0.10	-0.50	-0.21	-0.16	0.13	1.00

Key: RMDQ = Roland and Morris Disability Questionnaire; MZSRDS = Modified Zung Self Rating Depression Scale, MSPQ = Modified Somatic Perception Questionnaire; CAT = Catastrophising subscale of the Coping Strategies Questionnaire; P&H = Praying and Hoping subscale of the Coping Strategies Questionnaire; PC = Pain Control subscale of the Pain Locus of Control; PR = Pain Responsibility subscale of the Pain Locus of Control; Duration = Duration of LBP; Prop in UK = Proportion of Life spent in the UK

Table B6. Estimation Maximisation (EM) Correlation Matrix

	AGE	DURATION	RMDQ	MSPQ	ZSRDS	P&H	CAT	PC	PR	YRS IN UK
AGE	1.00									
DURATION	0.06	1.00								
RMDQ	0.16	0.09	1.00							
MSPQ	0.01	0.14	0.47	1.00						
ZSRDS	0.02	0.11	0.57	0.54	1.00					
P&H	0.17	0.10	0.46	0.24	0.30	1.00				
CAT	-0.02	0.11	0.59	0.52	0.64	0.48	1.00			
PC	0.13	0.00	-0.07	-0.10	-0.14	0.09	-0.09	1.00		
PR	-0.20	-0.10	-0.46	-0.28	-0.39	-0.40	-0.41	-0.04	1.00	
Prop in UK	-0.05	-0.07	-0.15	-0.11	-0.10	-0.47	-0.21	-0.15	0.15	1.00

Key: RMDQ = Roland and Morris Disability Questionnaire; MZSRDS = Modified Zung Self Rating Depression Scale, MSPQ = Modified Somatic Perception Questionnaire; CAT = Catastrophising subscale of the Coping Strategies Questionnaire; P&H = Praying and Hoping subscale of the Coping Strategies Questionnaire; PC = Pain Control subscale of the Pain Locus of Control; PR = Pain Responsibility subscale of the Pain Locus of Control; Duration = Duration of LBP; Prop in UK = Proportion of Life spent in the UK

The results for each missing data method were inspected and compared (Tabachnick and Fidell, 1996).

Inspection revealed only marginal differences between the estimates obtained by the 3 missing data methods. Estimated means and standard deviations of the EM and the available cases analysis approached equality. In light of the statistical efficiency of the EM method (Little and Rubin 1987), i.e. this method uses more

of the information contained within the data than the other two methods whilst producing unbiased estimates, the imputed EM data file (n=427) was employed in subsequent analyses.

Normality

Skew and Kurtosis for each quantitative variable are presented in table B7. Variables with z-scores greater than z=3.29 were significant at the p=<0.001 level (Tabachnick and Fidell, 1996). Two variables, Duration of LBP and MSPQ demonstrated significant positive skew.

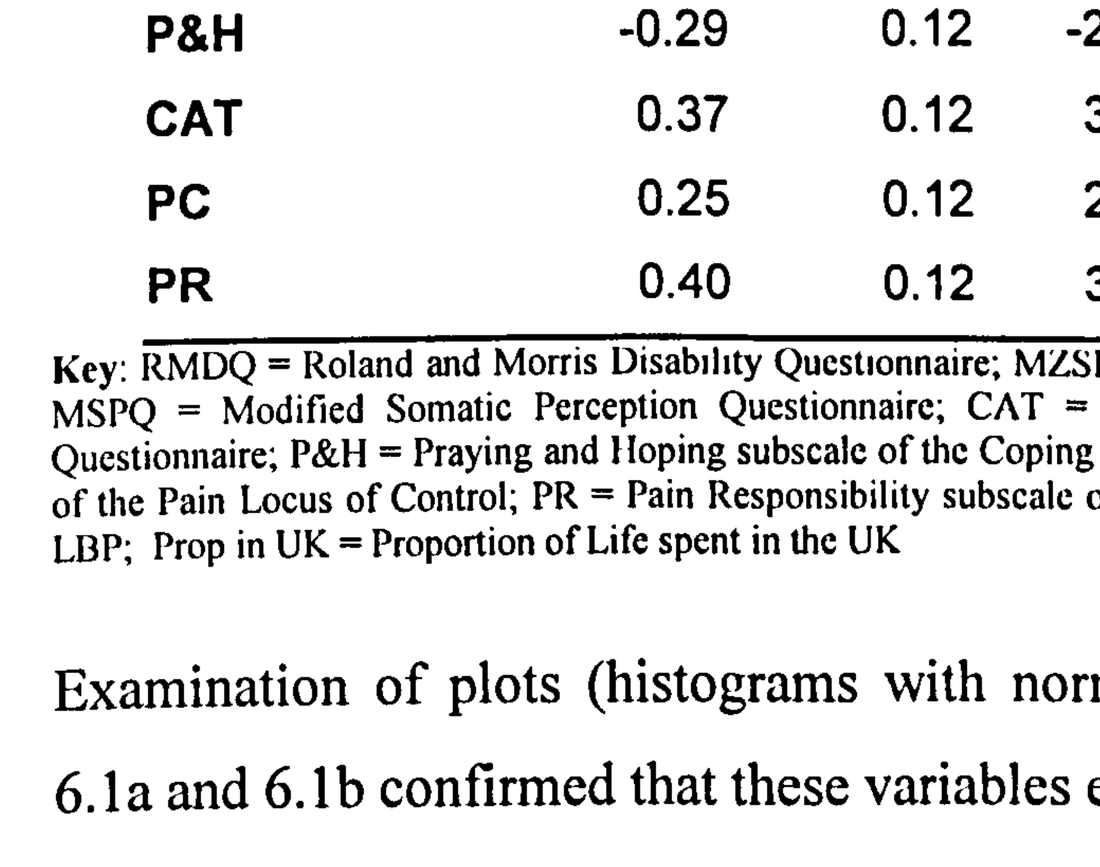
Table B7 Skew and Kurtosis

	Skew	*SE*	*z-score*	*Kurtosis*	*SE*	*z-score*
AGE	0.21	0.12	1.75	-0.70	0.24	-1.71
PROP IN UK	-0.34	0.12	-0.22	-1.30	0.24	-1.03
DURATION	4.43	0.12	36.90	23.16	0.24	9.82
RMDQ	0.02	0.12	0.17	-1.03	0.24	-2.07
MSPQ	0.95	0.12	7.90	0.82	0.24	1.85
MZSRDS	0.26	0.12	2.17	-0.10	0.24	-0.65
P&H	-0.29	0.12	-2.42	-0.75	0.24	-1.77
CAT	0.37	0.12	3.08	-0.53	0.24	-1.49
PC	0.25	0.12	2.08	2.07	0.24	2.95
PR	0.40	0.12	3.25	1.52	0.24	0.80

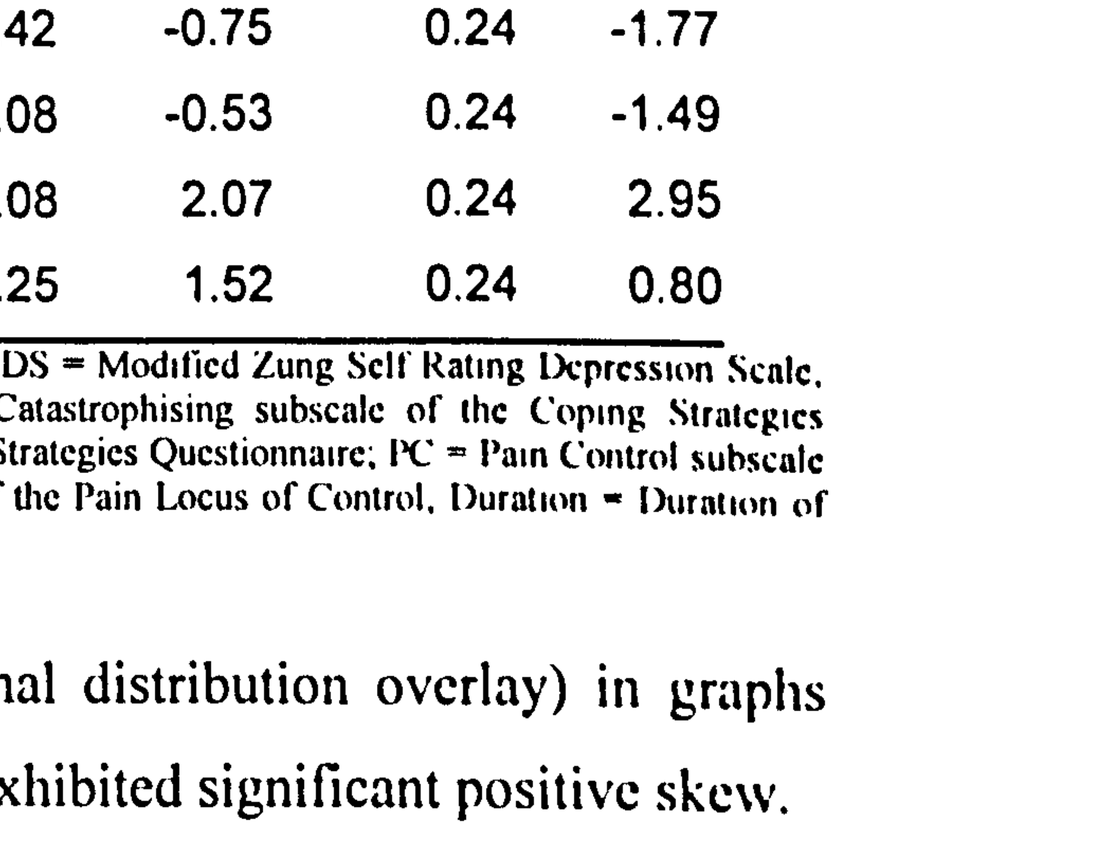
Key: RMDQ = Roland and Morris Disability Questionnaire; MZSRDS = Modified Zung Self Rating Depression Scale, MSPQ = Modified Somatic Perception Questionnaire; CAT = Catastrophising subscale of the Coping Strategies Questionnaire; P&H = Praying and Hoping subscale of the Coping Strategies Questionnaire; PC = Pain Control subscale of the Pain Locus of Control; PR = Pain Responsibility subscale of the Pain Locus of Control, Duration = Duration of LBP; Prop in UK = Proportion of Life spent in the UK

Examination of plots (histograms with normal distribution overlay) in graphs 6.1a and 6.1b confirmed that these variables exhibited significant positive skew.

Graph B1. Histogram of Duration of LBP



Graph B2. Histogram of MSPQ



Duration of LBP was a meaningfully scored variable in that each value represents the absolute length of time in years that the patient reportedly had symptoms of LBP. A transformation was likely to hinder interpretation (Tabachnick and Fidell 1996). Furthermore duration of LBP was not considered a substantive variable for the present research. A transformation of this variable was not performed.

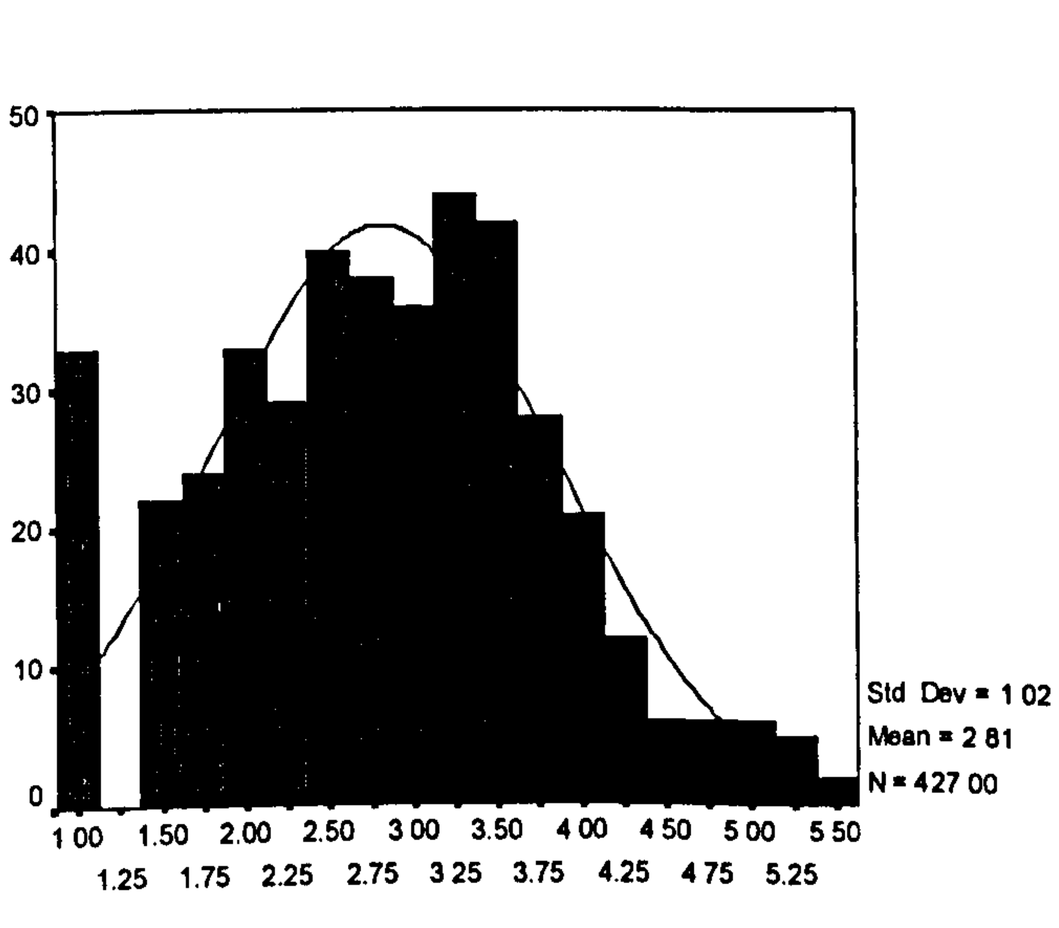
The MSPQ is arbitrarily scored it was therefore a possible candidate for transformation. Inspection of the histogram with normal curve overlaid (graph B2), and skew statistics (table B7) suggested that a square root transformation may be appropriate (Tabachnick and Fidell, 1996).

As total scores on the MSPQ ranged from 0 to 23, a constant (1) was added to each score to bring the smallest value to at least 1 thereby avoiding taking the square root of 0 (Tabachnick and Fidell 1996).

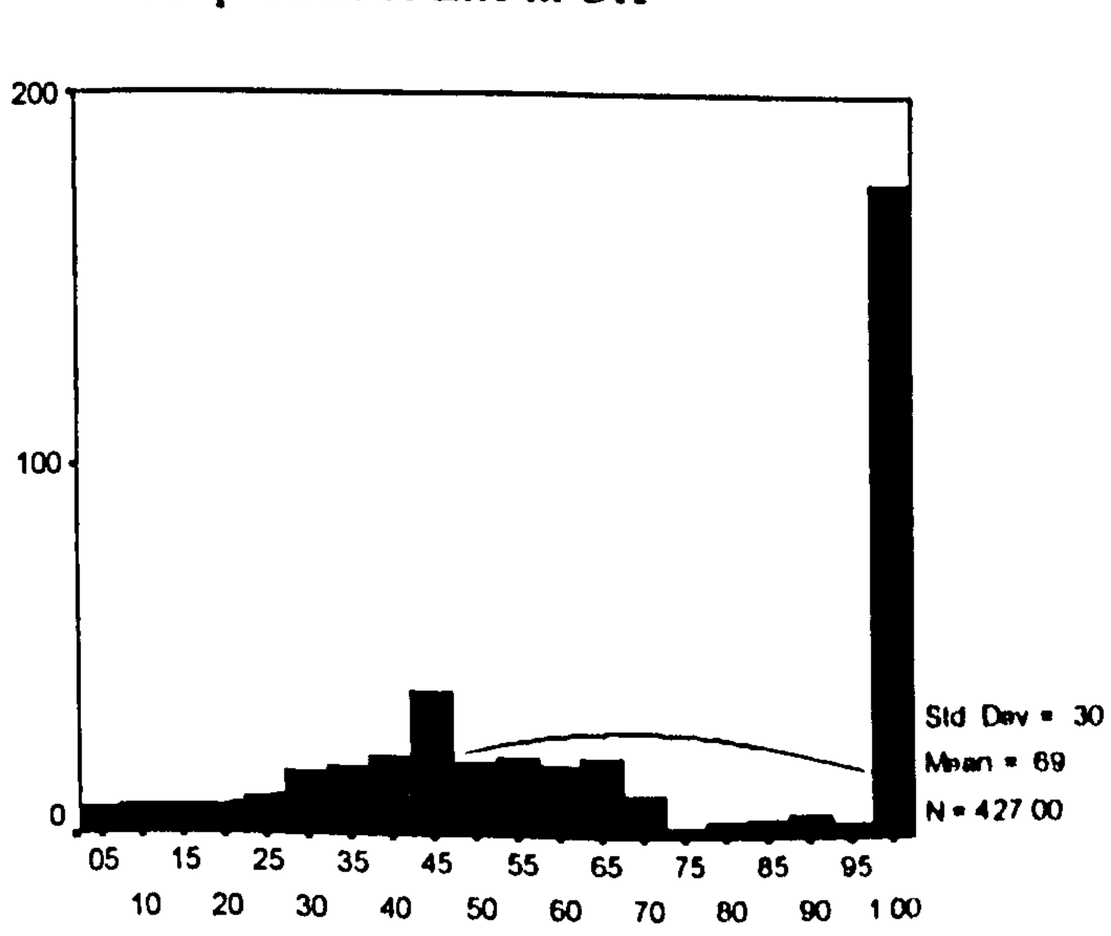
The square root of each value was found and skew statistics were examined to determine the adequacy of the transformation.

Inspection of the histogram (graph B3) indicated that the transformed variable appeared to be normally distributed and the skew (skew = 0.11, se = 0.12, z-score = 0.91) and kurtosis (kurtosis = -0.43, se = 0.24, z-score = -1.33) statistics indicated that the distribution was not significantly different from normal ($p>0.001$).

Graph B3. Histogram of Transformed MSPQ



Graph B4. Histogram of Proportion of Life in UK



The transformed MSPQ was employed in all subsequent analyses involving the MSPQ.

Prior knowledge of the data set suggested that the variable YEARS IN UK was likely to demonstrate a bi-modal distribution with certain groups such as "British", "Christian" or "British Isles" likely to approach unity, and other groups demonstrating alternative distributions. Examination of the histogram *confirmed* that this variable was not normally distributed (graph 6.1d). The inspection of the histogram also suggested *that* a transformation was unlikely to normalise the distribution therefore non parametric statistics analyses were performed on this variable.

Outliers

Univariate Dichotomous Outlier Variables.

Univariate dichotomous outliers were found for Ethnicity, Country of Birth, Religion and Social Economic Status variables.

Ethnic Groups.

Inspection the data indicated that all ethnic groups, other than South Asian and British, accounted for less than 10% of the cases. These groups were therefore were collapsed into a single heterogeneous ethnic group – "Other" (Tabachnick and Fidell 1996). The final ethnic groups were: South Asian (n=146, 34.2%), British (n=181, 42.4%) and "Other" ethnicity (n=100, 23.4%).

Region of Birth Groups.

Inspection of the data indicated that South Asia, British Isles and Africa each accounted for more than 10% of the patients. Other countries of birth accounted for less than 10% of patients and were therefore collapsed onto a single group – "other" (Tabachnick and Fidell, 1996). The final Region of Birth Groups were: British Isles (n=210, 49.2%), South Asia (n=90, 21.1%), Africa (n=69, 16.2%) and "Other" Region of Birth (n=58, 13.6%).

Religious Groups.

Inspection the data indicated that reported religious affiliations could be grouped into Christian and Hindu, each of which accounted for more than 10% of patients. The religious group "Muslim" accounted for n=42 (9.8%) cases and was therefore was on the threshold for definition as a univariate outlier (Tabachnick and Fidell, 1996). "Muslim" was retained as an ethnic group. All other religions accounted for less than 10% of the cases and were therefore collapsed into the "other" religion group (Tabachnick and Fidell, 1996). The final Religious Groups were: Christian (n=230, 53.9%), Hindu (n=102, 23.9%), Muslim (n=42, 9.8%) and "Other" religion (n=53, 12.4%)

Social Class (SC) Groups

Social Class groups 1 and 5 met the criteria for univariate dichotomous outliers (Tabachnick and Fidell 1996) and therefore were collapsed into SC groups 2 and 4 respectively. The four additional groups were collapsed into a single category "other" which was primarily comprised of Housewives. The final SC groups were: SC 1&2 (n=104, 24.4%), SC 3M (n=76, 17.8%), SC 3NM (n=92, 12.6%), SC 4&5 (n=74, 17.3%) and "Other" SC (n=81, 19.0%).

Univariate Continuous Variable Outliers

Scores on continuous variables age, duration, number of co-morbidities, RMDQ, MZSRDS, MSPQ, CSQ-P&H, CSQ-CAT, PLC-A, PLC-B were standardised and inspected for values greater than 3.29 (Tabachnick and Fidell 1987).

Standardised scores greater than z=3.29 were found for the MZSRDS (n=1), PLC-A (n=4), PLC-B (n=3) and duration (n=9).

Tabachnick and Fidell (1996) pointed out that some cases with standardised scores greater than z=3.29 are expected in a data set of several hundred therefore these cases were retained.

Multivariate Outliers.

6 cases with Mahalanobis distance values greater than 52.62 (the critical value for chi-square with 25 df and $p<0.001$) were found in the data set. Cooks Distance statistics were examined to determine the impact on the solution of the dummy regression run of excluding any of the multivariate or univariate outliers from the analysis. Cook's D statistics indicated only marginal influences on the solution for the identified multivariate outliers therefore all cases were retained (Maximum Cook's D value for significant Mahalanobis Distance value = 0.01462).

Conclusion of Data Screening

Following successful screening of the data, the cleaned data set (n=427) was employed for in all subsequent statistical analyses.

Appendix C.

Table C1
Regression Models for LBP Disability

			RMDQ	Coefficients					95% CI for B		Correlations	
Model	Step	IV	Mean	B	SE	Beta	t	Sig.	Lower	Upper	Zero-order	Partial
1	1	(Constant)		7.82	1.09		7.15	0.00	5.67	9.97		
		age		0.07	0.02	0.17	3.48	0.00	0.03	0.11	0.17	0.17
		sex	8.77	0.88	0.64	0.07	1.38	0.17	-0.37	2.13	0.07	0.07
	2	(Constant)		9.04	1.48		6.13	0.00	6.14	11.94		
		age		0.07	0.02	0.15	3.17	0.00	0.02	0.11	0.17	0.15
		sex	10.02	0.97	0.71	0.07	1.37	0.17	-0.42	2.37	0.07	0.07
		SC 1&2	7.10	-1.95	0.97	-0.13	-2.00	0.05	-3.86	-0.03	-0.10	-0.10
		SC 3M	9.04	-0.01	1.13	-0.00	-0.00	1.00	-2.23	2.21	0.04	-0.00
		SC 3NM	7.14	-1.90	0.98	-0.12	-1.95	0.05	-3.82	0.02	-0.07	-0.09
		SC 4&5	8.27	-0.77	1.05	-0.05	-0.74	0.46	-2.83	1.29	0.02	-0.04
	3	(Constant)		13.41	1.66		8.06	0.00	10.14	16.67		
		age		0.05	0.02	0.11	2.26	0.02	0.01	0.09	0.17	0.11
		sex	14.03	0.62	0.68	0.05	0.91	0.36	-0.72	1.96	0.07	0.04
		SC 1&2	11.99	-1.42	0.93	-0.10	-1.52	0.13	-3.25	0.42	-0.10	-0.07
		SC 3M	13.45	0.05	1.07	0.00	0.05	0.96	-2.06	2.16	0.04	0.00
		SC 3NM	11.75	-1.66	0.93	-0.11	-1.78	0.08	-3.49	0.18	-0.07	-0.09
		SC 4&5	12.67	-0.74	1.00	-0.04	-0.74	0.46	-2.70	1.22	0.02	-0.04
		QTF1	7.95	-5.46	0.88	-0.37	-6.22	0.00	-7.18	-3.73	-0.21	-0.29
		QTF2	8.28	-5.12	0.87	-0.36	-5.89	0.00	-6.84	-3.41	-0.16	-0.28
		QTF3	11.14	-2.26	0.86	-0.16	-2.62	0.01	-3.96	-0.57	0.13	-0.13
		co-morbidity	14.60	1.19	0.61	0.09	1.96	0.05	-0.00	2.39	0.10	0.10
		Chronic LBP	12.62	-0.78	0.84	-0.04	-0.93	0.35	-2.42	0.86	-0.01	-0.05
	4	(Constant)		2.07	1.56		1.33	0.19	-1.00	5.15		
		age	2.13	0.06	0.02	0.14	3.64	0.00	0.03	0.09	0.17	0.18
		sex	1.71	-0.36	0.56	-0.03	-0.64	0.52	-1.46	0.74	0.07	-0.03
		SC 1&2	1.70	-0.38	0.76	-0.03	-0.50	0.62	-1.87	1.12	-0.10	-0.02
		SC 3M	1.92	-0.16	0.87	-0.01	-0.18	0.86	-1.87	1.56	0.04	-0.01
		SC 3NM	0.67	-1.41	0.75	-0.09	-1.87	0.06	-2.89	0.07	-0.07	-0.09
		SC 4&5	1.39	-0.68	0.81	-0.04	-0.85	0.40	-2.27	0.90	0.02	-0.04
		QTF1	-0.46	-2.53	0.74	-0.17	-3.41	0.00	-3.99	-1.08	-0.21	-0.17
		QTF2	-0.75	-2.82	0.72	-0.20	-3.90	0.00	-4.24	-1.40	-0.16	-0.19
		QTF3	1.47	-0.60	0.71	-0.04	-0.85	0.39	-1.99	0.79	0.13	-0.04
		co-morbidity	1.89	-0.18	0.50	-0.01	-0.36	0.72	-1.17	0.81	0.10	-0.02
		Chronic LBP	0.91	-1.16	0.68	-0.06	-1.71	0.09	-2.49	0.17	-0.01	-0.08
		MSPQ		1.22	0.29	0.19	4.21	0.00	0.65	1.79	0.49	0.20
		MZSRDS		0.27	0.03	0.45	10.11	0.00	0.22	0.32	0.59	0.45
	5	(Constant)		0.08	1.50		0.05	0.96	-2.86	3.02		
		age		0.05	0.02	0.13	3.48	0.00	0.02	0.08	0.17	0.17
		sex		-0.33	0.52	-0.02	-0.64	0.52	-1.35	0.68	0.07	-0.03
		SC 1&2		0.55	0.71	0.04	0.77	0.44	-0.85	1.95	-0.10	0.04
		SC 3M		0.72	0.81	0.04	0.88	0.38	-0.88	2.32	0.04	0.04
		SC 3NM		-0.28	0.71	-0.02	-0.39	0.70	-1.67	1.12	-0.07	-0.02
		SC 4&5		-0.24	0.75	-0.01	-0.32	0.75	-1.71	1.23	0.02	-0.02
		QTF1		-2.12	0.69	-0.14	-3.07	0.00	-3.47	-0.76	-0.21	-0.15
		QTF2		-2.41	0.67	-0.17	-3.59	0.00	-3.73	-1.09	-0.16	-0.17
		QTF3		-0.73	0.66	-0.05	-1.11	0.27	-2.02	0.56	0.13	-0.05
		co-morbidity		0.21	0.47	0.02	0.45	0.65	-0.71	1.13	0.10	0.02
		Chronic LBP		-0.99	0.63	-0.05	-1.58	0.12	-2.22	0.24	-0.01	-0.08
		MSPQ		0.75	0.28	0.12	2.74	0.01	0.21	1.30	0.49	0.13
		MZSRDS		0.16	0.03	0.27	5.59	0.00	0.11	0.22	0.59	0.27
		CSQ P&H		0.13	0.03	0.18	4.57	0.00	0.08	0.19	0.47	0.22
		CSQ CAT		0.18	0.04	0.25	4.87	0.00	0.11	0.25	0.61	0.23
	6	(Constant)		4.28	1.94		2.21	0.03	0.47	8.08		
		age		0.05	0.02	0.11	2.94	0.00	0.02	0.08	0.17	0.14
		sex		-0.26	0.51	-0.02	-0.51	0.61	-1.27	0.74	0.07	-0.03
		SC 1&2		0.51	0.70	0.03	0.73	0.47	-0.87	1.90	-0.10	0.04
		SC 3M		0.62	0.80	0.04	0.77	0.44	-0.97	2.20	0.04	0.04
		SC 3NM		-0.22	0.70	-0.01	-0.31	0.75	-1.60	1.16	-0.07	-0.02
		SC 4&5		-0.34	0.74	-0.02	-0.45	0.65	-1.79	1.12	0.02	-0.02
		QTF1		-2.02	0.68	-0.14	-2.96	0.00	-3.36	-0.68	-0.21	-0.14
		QTF2		-2.32	0.66	-0.16	-3.49	0.00	-3.62	-1.01	-0.16	-0.17
		QTF3		-0.67	0.65	-0.05	-1.03	0.30	-1.94	0.61	0.13	-0.05
		co-morbidity		0.17	0.46	0.01	0.38	0.71	-0.74	1.08	0.10	0.02
		Chronic LBP		-0.98	0.62	-0.05	-1.59	0.11	-2.20	0.23	-0.01	-0.08
		MSPQ		0.71	0.27	0.11	2.59	0.01	0.17	1.24	0.49	0.13
		MZSRDS		0.14	0.03	0.24	4.83	0.00	0.08	0.20	0.59	0.23
		CSQ P&H		0.11	0.03	0.16	3.83	0.00	0.06	0.17	0.47	0.19

Table C1cont.,

			RMDQ	Coefficients					95% CI for B		Correlations	
Model	*Step*	*IV*	*Mean*	*B*	*SE*	*Beta*	*t*	*Sig.*	*Lower*	*Upper*	*Zero-order*	*Partial*
		CSQ CAT		0.16	0.04	0.23	4.50	0.00	0.09	0.23	0.61	0.22
		PLC - A		-0.05	0.05	-0.03	-0.99	0.32	-0.14	0.05	-0.07	-0.05
		PLC - B		-0.33	0.10	-0.13	-3.32	0.00	-0.52	-0.13	-0.48	-0.16

			RMDQ	Coefficients					95% CI for B		Correlations	
Model	Step	IV	Mean	B	SE	Beta	t	Sig.	Lower	Upper	Zero-order	Partial
2	4	(Constant)		2.07	1.56		1.33	0.19	-1.00	5.15		
		age		0.06	0.02	0.14	3.64	0.00	0.03	0.09	0.17	0.18
		sex		-0.36	0.56	-0.03	-0.64	0.52	-1.46	0.74	0.07	-0.03
		SC 1&2		-0.38	0.76	-0.03	-0.50	0.62	-1.87	1.12	-0.10	-0.02
		SC 3M		-0.16	0.87	-0.01	-0.18	0.86	-1.87	1.56	0.04	-0.01
		SC 3NM		-1.41	0.75	-0.09	-1.87	0.06	-2.89	0.07	-0.07	-0.09
		SC 4&5		-0.68	0.81	-0.04	-0.85	0.40	-2.27	0.90	0.02	-0.04
		QTF1		-2.53	0.74	-0.17	-3.41	0.00	-3.99	-1.08	-0.21	-0.17
		QTF2		-2.82	0.72	-0.20	-3.90	0.00	-4.24	-1.40	-0.16	-0.19
		QTF3		-0.60	0.71	-0.04	-0.85	0.39	-1.99	0.79	0.13	-0.04
		co-morbidity		-0.18	0.50	-0.01	-0.36	0.72	-1.17	0.81	0.10	-0.02
		Chronic LBP		-1.16	0.68	-0.06	-1.71	0.09	-2.49	0.17	-0.01	-0.08
		MSPQ		1.22	0.29	0.19	4.21	0.00	0.65	1.79	0.49	0.20
		MZSRDS		0.27	0.03	0.45	10.11	0.00	0.22	0.32	0.59	0.45
	5	(Constant)		7.87	1.95		4.04	0.00	4.04	11.70		
		age		0.04	0.02	0.10	2.61	0.01	0.01	0.07	0.17	0.13
		sex		-0.23	0.54	-0.02	-0.42	0.67	-1.29	0.84	0.07	-0.02
		SC 1&2		-0.29	0.74	-0.02	-0.39	0.69	-1.74	1.16	-0.10	-0.02
		SC 3M		-0.15	0.85	-0.01	-0.18	0.85	-1.82	1.51	0.04	-0.01
		SC 3NM		-1.12	0.73	-0.07	-1.53	0.13	-2.56	0.32	-0.07	-0.08
		SC 4&5		-0.75	0.78	-0.04	-0.96	0.34	-2.29	0.79	0.02	-0.05
		QTF1		-2.33	0.72	-0.16	-3.23	0.00	-3.75	-0.91	-0.21	-0.16
		QTF2		-2.58	0.70	-0.18	-3.67	0.00	-3.96	-1.20	-0.16	-0.18
		QTF3		-0.55	0.69	-0.04	-0.81	0.42	-1.90	0.79	0.13	-0.04
		co-morbidity		-0.13	0.49	-0.01	-0.28	0.78	-1.10	0.83	0.10	-0.01
		Chronic LBP		-1.12	0.66	-0.06	-1.70	0.09	-2.41	0.18	-0.01	-0.08
		MSPQ		1.07	0.28	0.17	3.79	0.00	0.51	1.62	0.49	0.18
		MZSRDS		0.22	0.03	0.37	8.11	0.00	0.17	0.28	0.59	0.37
		PLC - A		-0.03	0.05	-0.02	-0.51	0.61	-0.13	0.07	-0.07	-0.03
		PLC - B		-0.53	0.10	-0.22	-5.31	0.00	-0.73	-0.34	-0.48	-0.25
	6	(Constant)		4.28	1.94		2.21	0.03	0.47	8.08		
		age		0.05	0.02	0.11	2.94	0.00	0.02	0.08	0.17	0.14
		sex		-0.26	0.51	-0.02	-0.51	0.61	-1.27	0.74	0.07	-0.03
		SC 1&2		0.51	0.70	0.03	0.73	0.47	-0.87	1.90	-0.10	0.04
		SC 3M		0.62	0.80	0.04	0.77	0.44	-0.97	2.20	0.04	0.04
		SC 3NM		-0.22	0.70	-0.01	-0.31	0.75	-1.60	1.16	-0.07	-0.02
		SC 4&5		-0.34	0.74	-0.02	-0.45	0.65	-1.79	1.12	0.02	-0.02
		QTF1		-2.02	0.68	-0.14	-2.96	0.00	-3.36	-0.68	-0.21	-0.14
		QTF2		-2.32	0.66	-0.16	-3.49	0.00	-3.62	-1.01	-0.16	-0.17
		QTF3		-0.67	0.65	-0.05	-1.03	0.30	-1.94	0.61	0.13	-0.05
		co-morbidity		0.17	0.46	0.01	0.38	0.71	-0.74	1.08	0.10	0.02
		Chronic LBP		-0.98	0.62	-0.05	-1.59	0.11	-2.20	0.23	-0.01	-0.08
		MSPQ		0.71	0.27	0.11	2.59	0.01	0.17	1.24	0.49	0.13
		MZSRDS		0.14	0.03	0.24	4.83	0.00	0.08	0.20	0.59	0.23
		PLC - A		-0.05	0.05	-0.03	-0.99	0.32	-0.14	0.05	-0.07	-0.05
		PLC - B		-0.33	0.10	-0.13	-3.32	0.00	-0.52	-0.13	-0.48	-0.16
		CSQ P&H		0.11	0.03	0.16	3.83	0.00	0.06	0.17	0.47	0.19
		CSQ CAT		0.16	0.04	0.23	4.50	0.00	0.09	0.23	0.61	0.22

Table C1cont.,

			RMDQ	Coefficients					95% CI for B		Correlations	
Model	*Step*	*IV*	*Mean*	*B*	*SE*	*Beta*	*t*	*Sig.*	*Lower*	*Upper*	*Zero-order*	*Partial*
3	4	(Constant)		21.67	1.77		12.26	0.00	18.20	25.15		
		age		0.02	0.02	0.05	1.10	0.27	-0.02	0.06	0.17	0.05
		sex		0.56	0.62	0.04	0.91	0.36	-0.65	1.77	0.07	0.04
		SC 1&2		-0.89	0.84	-0.06	-1.05	0.29	-2.55	0.77	-0.10	-0.05
		SC 3M		-0.01	0.97	-0.00	-0.01	0.99	-1.91	1.89	0.04	-0.00
		SC 3NM		-1.02	0.84	-0.07	-1.22	0.22	-2.68	0.63	-0.07	-0.06
		SC 4&5		-0.85	0.90	-0.05	-0.95	0.34	-2.62	0.91	0.02	-0.05
		QTF1		-4.13	0.80	-0.28	-5.14	0.00	-5.71	-2.55	-0.21	-0.25
		QTF2		-3.97	0.79	-0.28	-5.00	0.00	-5.53	-2.41	-0.16	-0.24
		QTF3		-1.62	0.78	-0.11	-2.08	0.04	-3.16	-0.09	0.13	-0.10
		co-morbidity		0.82	0.55	0.06	1.48	0.14	-0.27	1.90	0.10	0.07
		Chronic LBP		-0.80	0.75	-0.04	-1.07	0.29	-2.28	0.68	-0.01	-0.05
		PLC - A		-0.11	0.06	-0.08	-1.95	0.05	-0.23	0.00	-0.07	-0.10
		PLC - B		-1.02	0.10	-0.41	-9.75	0.00	-1.23	-0.82	-0.48	-0.43
	5	(Constant)		9.25	1.84		5.02	0.00	5.63	12.87		
		age		0.04	0.02	0.10	2.73	0.01	0.01	0.08	0.17	0.13
		sex		0.05	0.53	0.00	0.10	0.92	-0.99	1.09	0.07	0.00
		SC 1&2		0.60	0.74	0.04	0.82	0.41	-0.84	2.05	-0.10	0.04
		SC 3M		1.07	0.84	0.06	1.28	0.20	-0.57	2.71	0.04	0.06
		SC 3NM		0.24	0.73	0.02	0.32	0.75	-1.20	1.67	-0.07	0.02
		SC 4&5		-0.25	0.77	-0.01	-0.33	0.74	-1.77	1.27	0.02	-0.02
		QTF1		-2.64	0.70	-0.18	-3.78	0.00	-4.02	-1.27	-0.21	-0.18
		QTF2		-2.81	0.69	-0.20	-4.09	0.00	-4.16	-1.46	-0.16	-0.20
		QTF3		-1.08	0.67	-0.08	-1.61	0.11	-2.41	0.24	0.13	-0.08
		co-morbidity		0.69	0.47	0.05	1.45	0.15	-0.24	1.62	0.10	0.07
		Chronic LBP		-0.83	0.65	-0.05	-1.29	0.20	-2.10	0.44	-0.01	-0.06
		PLC - A		-0.08	0.05	-0.06	-1.61	0.11	-0.18	0.02	-0.07	-0.08
		PLC - B		-0.46	0.10	-0.19	-4.57	0.00	-0.66	-0.26	-0.48	-0.22
		CSQ P&H		0.10	0.03	0.14	3.35	0.00	0.04	0.16	0.47	0.16
		CSQ CAT		0.29	0.03	0.42	9.63	0.00	0.23	0.36	0.61	0.43
	6	(Constant)		4.28	1.94		2.21	0.03	0.47	8.08		
		age		0.05	0.02	0.11	2.94	0.00	0.02	0.08	0.17	0.14
		sex		-0.26	0.51	-0.02	-0.51	0.61	-1.27	0.74	0.07	-0.03
		SC 1&2		0.51	0.70	0.03	0.73	0.47	-0.87	1.90	-0.10	0.04
		SC 3M		0.62	0.80	0.04	0.77	0.44	-0.97	2.20	0.04	0.04
		SC 3NM		-0.22	0.70	-0.01	-0.31	0.75	-1.60	1.16	-0.07	-0.02
		SC 4&5		-0.34	0.74	-0.02	-0.45	0.65	-1.79	1.12	0.02	-0.02
		QTF1		-2.02	0.68	-0.14	-2.96	0.00	-3.36	-0.68	-0.21	-0.14
		QTF2		-2.32	0.66	-0.16	-3.49	0.00	-3.62	-1.01	-0.16	-0.17
		QTF3		-0.67	0.65	-0.05	-1.03	0.30	-1.94	0.61	0.13	-0.05
		co-morbidity		0.17	0.46	0.01	0.38	0.71	-0.74	1.08	0.10	0.02
		Chronic LBP		-0.98	0.62	-0.05	-1.59	0.11	-2.20	0.23	-0.01	-0.08
		PLC - A		-0.05	0.05	-0.03	-0.99	0.32	-0.14	0.05	-0.07	-0.05
		PLC - B		-0.33	0.10	-0.13	-3.32	0.00	-0.52	-0.13	-0.48	-0.16
		CSQ P&H		0.11	0.03	0.16	3.83	0.00	0.06	0.17	0.47	0.19
		CSQ CAT		0.16	0.04	0.23	4.50	0.00	0.09	0.23	0.61	0.22
		MSPQ		0.71	0.27	0.11	2.59	0.01	0.17	1.24	0.49	0.13
		MZSRDS		0.14	0.03	0.24	4.83	0.00	0.08	0.20	0.59	0.23

Table C1cont.,

			RMDQ	Coefficients					95% CI for B		Correlations	
Model	*Step*	*IV*	*Mean*	*B*	*SE*	*Beta*	*t*	*Sig.*	*Lower*	*Upper*	*Zero-order*	*Partial*
4	4	(Constant)		21.67	1.77		12.26	0.00	18.20	25.15		
		age		0.02	0.02	0.05	1.10	0.27	-0.02	0.06	0.17	0.05
		sex		0.56	0.62	0.04	0.91	0.36	-0.65	1.77	0.07	0.04
		SC 1&2		-0.89	0.84	-0.06	-1.05	0.29	-2.55	0.77	-0.10	-0.05
		SC 3M		-0.01	0.97	-0.00	-0.01	0.99	-1.91	1.89	0.04	-0.00
		SC 3NM		-1.02	0.84	-0.07	-1.22	0.22	-2.68	0.63	-0.07	-0 06
		SC 4&5		-0.85	0.90	-0.05	-0.95	0.34	-2.62	0.91	0.02	-0.05
		QTF1		-4.13	0.80	-0.28	-5.14	0.00	-5.71	-2.55	-0.21	-0.25
		QTF2		-3.97	0.79	-0.28	-5.00	0.00	-5.53	-2.41	-0.16	-0.24
		QTF3		-1.62	0.78	-0.11	-2.08	0.04	-3.16	-0.09	0.13	-0.10
		co-morbidity		0.82	0.55	0.06	1.48	0.14	-0.27	1.90	0.10	0.07
		Chronic LBP		-0.80	0.75	-0.04	-1.07	0.29	-2.28	0.68	-0.01	-0.05
		PLC - A		-0.11	0.06	-0.08	-1.95	0.05	-0.23	0.00	-0.07	-0.10
		PLC - B		-1.02	0.10	-0.41	-9.75	0.00	-1.23	-0.82	-0.48	-0.43
5		(Constant)		7.87	1.95		4.04	0.00	4.04	11.70		
		age		0.04	0.02	0.10	2.61	0.01	0.01	0.07	0.17	0.13
		sex		-0.23	0.54	-0.02	-0.42	0.67	-1.29	0.84	0.07	-0.02
		SC 1&2		-0.29	0.74	-0.02	-0.39	0.69	-1.74	1.16	-0.10	-0.02
		SC 3M		-0.15	0.85	-0.01	-0.18	0.85	-1.82	1.51	0.04	-0.01
		SC 3NM		-1.12	0.73	-0.07	-1.53	0.13	-2.56	0.32	-0.07	-0.08
		SC 4&5		-0.75	0.78	-0.04	-0.96	0.34	-2.29	0.79	0.02	-0.05
		QTF1		-2.33	0.72	-0.16	-3.23	0.00	-3.75	-0.91	-0.21	-0.16
		QTF2		-2.58	0.70	-0.18	-3.67	0.00	-3.96	-1.20	-0.16	-0.18
		QTF3		-0.55	0.69	-0.04	-0.81	0.42	-1.90	0.79	0.13	-0.04
		co-morbidity		-0.13	0.49	-0.01	-0.28	0.78	-1.10	0.83	0.10	-0.01
		Chronic LBP		-1.12	0.66	-0.06	-1.70	0.09	-2.41	0.18	-0.01	-0.08
		PLC - A		-0.03	0.05	-0.02	-0.51	0.61	-0.13	0.07	-0.07	-0.03
		PLC - B		-0.53	0.10	-0.22	-5.31	0.00	-0.73	-0.34	-0.48	-0.25
		MSPQ		1.07	0.28	0.17	3.79	0.00	0.51	1.62	0.49	0.18
		MZSRDS		0.22	0.03	0.37	8.11	0.00	0.17	0.28	0.59	0.37
6		(Constant)		4.28	1.94		2.21	0.03	0.47	8.08		
		age		0.05	0.02	0.11	2.94	0.00	0.02	0.08	0.17	0.14
		sex		-0.26	0.51	-0.02	-0.51	0.61	-1.27	0.74	0.07	-0.03
		SC 1&2		0.51	0.70	0.03	0.73	0.47	-0.87	1.90	-0.10	0.04
		SC 3M		0.62	0.80	0.04	0.77	0.44	-0.97	2.20	0.04	0.04
		SC 3NM		-0.22	0.70	-0.01	-0.31	0.75	-1.60	1.16	-0.07	-0.02
		SC 4&5		-0.34	0.74	-0.02	-0.45	0.65	-1.79	1.12	0.02	-0.02
		QTF1		-2.02	0.68	-0.14	-2.96	0.00	-3.36	-0.68	-0.21	-0.14
		QTF2		-2.32	0.66	-0.16	-3.49	0.00	-3.62	-1.01	-0.16	-0.17
		QTF3		-0.67	0.65	-0.05	-1.03	0.30	-1.94	0.61	0.13	-0.05
		co-morbidity		0.17	0.46	0.01	0.38	0.71	-0.74	1.08	0.10	0.02
		Chronic LBP		-0.98	0.62	-0.05	-1.59	0.11	-2.20	0.23	-0.01	-0.08
		PLC - A		-0.05	0.05	-0.03	-0.99	0.32	-0.14	0.05	-0.07	-0.05
		PLC - B		-0.33	0.10	-0.13	-3.32	0.00	-0.52	-0.13	-0.48	-0.16
		MSPQ		0.71	0.27	0.11	2.59	0.01	0.17	1.24	0.49	0.13
		MZSRDS		0.14	0.03	0.24	4.83	0.00	0.08	0.20	0.59	0.23
		CSQ P&H		0.11	0.03	0.16	3.83	0.00	0.06	0.17	0.47	0.19
		CSQ CAT		0.16	0.04	0.23	4.50	0.00	0.09	0.23	0.61	0.22

Table C1cont.,

Model	Step	IV	RMDQ Mean	Coefficients B	SE	Beta	t	Sig.	95% CI for B Lower	Upper	Correlations Zero-order	Partial
5	4	(Constant)		3.75	1.47		2.55	0.01	0.86	6.65		
		age		0.06	0.02	0.13	3.38	0.00	0.02	0.09	0.17	0.16
		sex		0.00	0.54	0.00	0.00	1.00	-1.07	1.07	0.07	0.00
		SC 1&2		0.66	0.75	0.04	0.88	0.38	-0.82	2.14	-0.10	0.04
		SC 3M		1.29	0.85	0.08	1.51	0.13	-0.39	2.97	0.04	0.07
		SC 3NM		0.23	0.75	0.01	0.30	0.76	-1.24	1.70	-0.07	0.01
		SC 4&5		-0.10	0.79	-0.01	-0.12	0.90	-1.65	1.46	0.02	-0.01
		QTF1		-2.90	0.72	-0.20	-4.05	0.00	-4.30	-1.49	-0.21	-0.20
		QTF2		-3.03	0.70	-0.21	-4.31	0.00	-4.41	-1.65	-0.16	-0.21
		QTF3		-1.25	0.69	-0.09	-1.82	0.07	-2.61	0.10	0.13	-0.09
		co-morbidity		0.84	0.48	0.06	1.73	0.08	-0.11	1.79	0.10	0.08
		Chronic LBP		-0.82	0.66	-0.04	-1.24	0.22	-2.12	0.48	-0.01	-0.06
		CSQ P&H		0.13	0.03	0.18	4.18	0.00	0.07	0.19	0.47	0.20
		CSQ CAT		0.34	0.03	0.49	11.47	0.00	0.28	0.40	0.61	0.49
5		(Constant)		0.08	1.50		0.05	0.96	-2.86	3.02		
		age		0.05	0.02	0.13	3.48	0.00	0.02	0.08	0.17	0.17
		sex		-0.33	0.52	-0.02	-0.64	0.52	-1.35	0.68	0.07	-0.03
		SC 1&2		0.55	0.71	0.04	0.77	0.44	-0.85	1.95	-0.10	0.04
		SC 3M		0.72	0.81	0.04	0.88	0.38	-0.88	2.32	0.04	0.04
		SC 3NM		-0.28	0.71	-0.02	-0.39	0.70	-1.67	1.12	-0.07	-0.02
		SC 4&5		-0.24	0.75	-0.01	-0.32	0.75	-1.71	1.23	0.02	-0.02
		QTF1		-2.12	0.69	-0.14	-3.07	0.00	-3.47	-0.76	-0.21	-0.15
		QTF2		-2.41	0.67	-0.17	-3.59	0.00	-3.73	-1.09	-0.16	-0.17
		QTF3		-0.73	0.66	-0.05	-1.11	0.27	-2.02	0.56	0.13	-0.05
		co-morbidity		0.21	0.47	0.02	0.45	0.65	-0.71	1.13	0.10	0.02
		Chronic LBP		-0.99	0.63	-0.05	-1.58	0.12	-2.22	0.24	-0.01	-0.08
		CSQ P&H		0.13	0.03	0.18	4.57	0.00	0.08	0.19	0.47	0.22
		CSQ CAT		0.18	0.04	0.25	4.87	0.00	0.11	0.25	0.61	0.23
		MSPQ		0.75	0.28	0.12	2.74	0.01	0.21	1.30	0.49	0.13
		MZSRDS		0.16	0.03	0.27	5.59	0.00	0.11	0.22	0.59	0.27
6		(Constant)		4.28	1.94		2.21	0.03	0.47	8.08		
		age		0.05	0.02	0.11	2.94	0.00	0.02	0.08	0.17	0.14
		sex		-0.26	0.51	-0.02	-0.51	0.61	-1.27	0.74	0.07	-0.03
		SC 1&2		0.51	0.70	0.03	0.73	0.47	-0.87	1.90	-0.10	0.04
		SC 3M		0.62	0.80	0.04	0.77	0.44	-0.97	2.20	0.04	0.04
		SC 3NM		-0.22	0.70	-0.01	-0.31	0.75	-1.60	1.16	-0.07	-0.02
		SC 4&5		-0.34	0.74	-0.02	-0.45	0.65	-1.79	1.12	0.02	-0.02
		QTF1		-2.02	0.68	-0.14	-2.96	0.00	-3.36	-0.68	-0.21	-0.14
		QTF2		-2.32	0.66	-0.16	-3.49	0.00	-3.62	-1.01	-0.16	-0.17
		QTF3		-0.67	0.65	-0.05	-1.03	0.30	-1.94	0.61	0.13	-0.05
		co-morbidity		0.17	0.46	0.01	0.38	0.71	-0.74	1.08	0.10	0.02
		Chronic LBP		-0.98	0.62	-0.05	-1.59	0.11	-2.20	0.23	-0.01	-0.08
		CSQ P&H		0.11	0.03	0.16	3.83	0.00	0.06	0.17	0.47	0.19
		CSQ CAT		0.16	0.04	0.23	4.50	0.00	0.09	0.23	0.61	0.22
		MSPQ		0.71	0.27	0.11	2.59	0.01	0.17	1.24	0.49	0.13
		MZSRDS		0.14	0.03	0.24	4.83	0.00	0.08	0.20	0.59	0.23
		PLC - A		-0.05	0.05	-0.03	-0.99	0.32	-0.14	0.05	-0.07	-0.05
		PLC - B		-0.33	0.10	-0.13	-3.32	0.00	-0.52	-0.13	-0.48	-0.16

Table C1cont.,

			RMDQ	Coefficients					95% CI for B		Correlations	
Model	*Step*	*IV*	*Mean*	*B*	*SE*	*Beta*	*t*	*Sig.*	*Lower*	*Upper*	*Zero-order*	*Partial*
6	4	(Constant)		3.75	1.47		2.55	0.01	0.86	6.65		
		age		0.06	0.02	0.13	3.38	0.00	0.02	0.09	0.17	0.16
		sex		0.00	0.54	0.00	0.00	1.00	-1.07	1.07	0.07	0.00
		SC 1&2		0.66	0.75	0.04	0.88	0.38	-0.82	2.14	-0.10	0.04
		SC 3M		1.29	0.85	0.08	1.51	0.13	-0.39	2.97	0.04	0.07
		SC 3NM		0.23	0.75	0.01	0.30	0.76	-1.24	1.70	-0.07	0.01
		SC 4&5		-0.10	0.79	-0.01	-0.12	0.90	-1.65	1.46	0.02	-0.01
		QTF1		-2.90	0.72	-0.20	-4.05	0.00	-4.30	-1.49	-0.21	-0.20
		QTF2		-3.03	0.70	-0.21	-4.31	0.00	-4.41	-1.65	-0.16	-0.21
		QTF3		-1.25	0.69	-0.09	-1.82	0.07	-2.61	0.10	0.13	-0.09
		co-morbidity		0.84	0.48	0.06	1.73	0.08	-0.11	1.79	0.10	0.08
		Chronic LBP		-0.82	0.66	-0.04	-1.24	0.22	-2.12	0.48	-0.01	-0.06
		CSQ P&H		0.13	0.03	0.18	4.18	0.00	0.07	0.19	0.47	0.20
		CSQ CAT		0.34	0.03	0.49	11.47	0.00	0.28	0.40	0.61	0.49
5		(Constant)		9.25	1.84		5.02	0.00	5.63	12.87		
		age		0.04	0.02	0.10	2.73	0.01	0.01	0.08	0.17	0.13
		sex		0.05	0.53	0.00	0.10	0.92	-0.99	1.09	0.07	0.00
		SC 1&2		0.60	0.74	0.04	0.82	0.41	-0.84	2.05	-0.10	0.04
		SC 3M		1.07	0.84	0.06	1.28	0.20	-0.57	2.71	0.04	0.06
		SC 3NM		0.24	0.73	0.02	0.32	0.75	-1.20	1.67	-0.07	0.02
		SC 4&5		-0.25	0.77	-0.01	-0.33	0.74	-1.77	1.27	0.02	-0.02
		QTF1		-2.64	0.70	-0.18	-3.78	0.00	-4.02	-1.27	-0.21	-0.18
		QTF2		-2.81	0.69	-0.20	-4.09	0.00	-4.16	-1.46	-0.16	-0.20
		QTF3		-1.08	0.67	-0.08	-1.61	0.11	-2.41	0.24	0.13	-0.08
		co-morbidity		0.69	0.47	0.05	1.45	0.15	-0.24	1.62	0.10	0.07
		Chronic LBP		-0.83	0.65	-0.05	-1.29	0.20	-2.10	0.44	-0.01	-0.06
		CSQ P&H		0.10	0.03	0.14	3.35	0.00	0.04	0.16	0.47	0.16
		CSQ CAT		0.29	0.03	0.42	9.63	0.00	0.23	0.36	0.61	0.43
		PLC - A		-0.08	0.05	-0.06	-1.61	0.11	-0.18	0.02	-0.07	-0.08
		PLC - B		-0.46	0.10	-0.19	-4.57	0.00	-0.66	-0.26	-0.48	-0.22
6		(Constant)		4.28	1.94		2.21	0.03	0.47	8.08		
		age		0.05	0.02	0.11	2.94	0.00	0.02	0.08	0.17	0.14
		sex		-0.26	0.51	-0.02	-0.51	0.61	-1.27	0.74	0.07	-0.03
		SC 1&2		0.51	0.70	0.03	0.73	0.47	-0.87	1.90	-0.10	0.04
		SC 3M		0.62	0.80	0.04	0.77	0.44	-0.97	2.20	0.04	0.04
		SC 3NM		-0.22	0.70	-0.01	-0.31	0.75	-1.60	1.16	-0.07	-0.02
		SC 4&5		-0.34	0.74	-0.02	-0.45	0.65	-1.79	1.12	0.02	-0.02
		QTF1		-2.02	0.68	-0.14	-2.96	0.00	-3.36	-0.68	-0.21	-0.14
		QTF2		-2.32	0.66	-0.16	-3.49	0.00	-3.62	-1.01	-0.16	-0.17
		QTF3		-0.67	0.65	-0.05	-1.03	0.30	-1.94	0.61	0.13	-0.05
		co-morbidity		0.17	0.46	0.01	0.38	0.71	-0.74	1.08	0.10	0.02
		Chronic LBP		-0.98	0.62	-0.05	-1.59	0.11	-2.20	0.23	-0.01	-0.08
		CSQ P&H		0.11	0.03	0.16	3.83	0.00	0.06	0.17	0.47	0.19
		CSQ CAT		0.16	0.04	0.23	4.50	0.00	0.09	0.23	0.61	0.22
		PLC - A		-0.05	0.05	-0.03	-0.99	0.32	-0.14	0.05	-0.07	-0.05
		PLC - B		-0.33	0.10	-0.13	-3.32	0.00	-0.52	-0.13	-0.48	-0.16
		MSPQ		0.71	0.27	0.11	2.59	0.01	0.17	1.24	0.49	0.13
		MZSRDS		0.14	0.03	0.24	4.83	0.00	0.08	0.20	0.59	0.23

Appendix C. Table C2.
Regression coefficients for Ethnicity

DV			*Coefficients*		*t*	*Sig.*	*95% CI for B*		*Correlations*	
	IV	*Mean*	*B*	*SE*			*Lower*	*Upper*	*Zero-order*	*Partial*
RMDQ										
	(Constant)	13.32	13.32	1.79	7.43	0.00	9.79	16.84		
	sex	13.99	0.68	0.68	0.99	0.32	-0.66	2.02	0.07	0.05
	age		0.05	0.02	2.35	0.02	0.01	0.09	0.17	0.12
	SES 1 & 2	12.04	-1.28	0.94	-1.36	0.18	-3.13	0.57	-0.10	-0.07
	SES 3 Manual	13.59	0.27	1.08	0.25	0.80	-1.85	2.39	0.04	0.01
	SES 3 non manual	11.79	-1.53	0.93	-1.64	0.10	-3.36	0.30	-0.07	-0.08
	SES 4 & 5	12.86	-0.45	1.01	-0.45	0.65	-2.43	1.53	0.02	-0.02
	QTF1	8.01	-5.31	0.88	-6.03	0.00	-7.04	-3.58	-0.21	-0.28
	QTF2	8.37	-4.95	0.87	-5.66	0.00	-6.66	-3.23	-0.16	-0.27
	QTF3	11.09	-2.23	0.86	-2.58	0.01	-3.92	-0.53	0.13	-0.13
	Chronic LBP	12.62	-0.70	0.84	-0.83	0.40	-2.34	0.95	-0.01	-0.04
	co-morbidity	14.49	1.18	0.61	1.94	0.05	-0.01	2.37	0.10	0.10
	South Asian	13.55	0.24	0.79	0.30	0.76	-1.31	1.78	0.09	0.01
	British	12.30	-1.01	0.75	-1.34	0.18	-2.49	0.47	-0.13	-0.07
MSPQ transformed										
	(Constant)	2.77	2.77	0.28	9.76	0.00	2.22	3.33		
	sex	3.10	0.32	0.11	2.98	0.00	0.11	0.53	0.16	0.15
	age		-0.00	0.00	-0.97	0.33	-0.01	0.00	0.02	-0.05
	SES 1 & 2	2.69	-0.08	0.15	-0.56	0.57	-0.38	0.21	-0.11	-0.03
	SES 3 Manual	3.06	0.28	0.17	1.66	0.10	-0.05	0.62	0.05	0.08
	SES 3 non manual	2.78	0.00	0.15	0.01	0.99	-0.29	0.29	-0.01	0.00
	SES 4 & 5	2.87	0.10	0.16	0.62	0.53	-0.21	0.41	0.01	0.03
	QTF1	1.98	-0.79	0.14	-5.69	0.00	-1.07	-0.52	-0.23	-0.27
	QTF2	2.23	-0.54	0.14	-3.92	0.00	-0.82	-0.27	-0.04	-0.19
	QTF3	2.42	-0.36	0.14	-2.62	0.01	-0.63	-0.09	0.09	-0.13
	Chronic LBP	2.98	0.21	0.13	1.56	0.12	-0.05	0.47	0.07	0.08
	co-morbidity	3.16	0.39	0.10	4.02	0.00	0.20	0.58	0.19	0.19
	South Asian	2.93	0.15	0.12	1.22	0.23	-0.09	0.40	0.14	0.06
	British	2.59	-0.18	0.12	-1.53	0.13	-0.42	0.05	-0.15	-0.08
MZSRDS										
	(Constant)	28.28	28.28	3.11	9.09	0.00	22.16	34.39		
	sex	30.58	2.30	1.18	1.95	0.05	-0.02	4.63	0.13	0.10
	age		-0.03	0.03	-0.89	0.37	-0.10	0.04	0.02	-0.04
	SES 1 & 2	25.25	-3.03	1.64	-1.85	0.06	-6.24	0.19	-0.14	-0.09
	SES 3 Manual	28.25	-0.02	1.87	-0.01	0.99	-3.70	3.66	0.00	-0.00
	SES non manual	27.66	-0.62	1.62	-0.38	0.70	-3.80	2.57	0.02	-0.02
	SES 4 & 5	28.30	0.03	1.75	0.01	0.99	-3.41	3.46	0.03	0.00
	QTF1	21.28	-7.00	1.53	-4.58	0.00	-10.00	-3.99	-0.16	-0.22
	QTF2	22.56	-5.71	1.52	-3.77	0.00	-8.70	-2.73	-0.05	-0.18
	QTF3	23.88	-4.40	1.50	-2.94	0.00	-7.34	-1.45	0.03	-0.14
	Chronic LBP	28.99	0.72	1.45	0.49	0.62	-2.14	3.57	0.01	0.02
	co-morbidity	31.56	3.29	1.05	3.12	0.00	1.22	5.36	0.16	0.15
	South Asian	29.24	0.97	1.36	0.71	0.48	-1.71	3.65	0.08	0.03
	British	27.95	-0.33	1.30	-0.25	0.80	-2.89	2.23	-0.06	-0.01

Table C2. cont.,

DV		Coefficients		t	Sig.	95% CI for B		Correlations	
IV	*Mean*	*B*	*SE*			*Lower*	*Upper*	*Zero-order*	*Partial*
CSQ Praying & Hoping									
(Constant)	20.18	20.18	2.37	8.50	0.00	15.52	24.85		
sex	21.07	0.88	0.90	0.98	0.33	-0.89	2.66	0.07	0.05
age		0.09	0.03	3.52	0.00	0.04	0.15	0.17	0.17
SES 1 & 2	17.20	-2.98	1.25	-2.39	0.02	-5.43	-0.53	-0.12	-0.12
SES 3 Manual	19.27	-0.91	1.43	-0.64	0.52	-3.72	1.90	-0.01	-0.03
SES 3 non manual	17.16	-3.02	1.24	-2.44	0.01	-5.45	-0.59	-0.08	-0.12
SES 4 & 5	20.02	-0.16	1.33	-0.12	0.90	-2.79	2.46	0.04	-0.01
QTF1	17.41	-2.78	1.17	-2.38	0.02	-5.07	-0.48	-0.15	-0.12
QTF2	17.75	-2.44	1.16	-2.10	0.04	-4.71	-0.16	-0.11	-0.10
QTF3	20.42	0.24	1.14	0.21	0.83	-2.01	2.49	0.15	0.01
Chronic LBP	20.10	-0.08	1.11	-0.07	0.94	-2.26	2.10	-0.00	-0.00
co-morbidity	19.48	-0.70	0.80	-0.87	0.38	-2.29	0.88	0.01	-0.04
South Asian	23.07	2.89	1.04	2.77	0.01	0.84	4.93	0.33	0.14
British	15.15	-5.03	1.00	-5.05	0.00	-6.99	-3.07	-0.39	-0.24
CSQ Catastrophising									
(Constant)	18.67	18.67	2.61	7.16	0.00	13.54	23.79		
sex	20.47	1.80	0.99	1.82	0.07	-0.15	3.75	0.13	0.09
age		-0.05	0.03	-1.72	0.09	-0.11	0.01	-0.02	-0.08
SES 1 & 2	14.68	-3.98	1.37	-2.91	0.00	-6.68	-1.29	-0.13	-0.14
SES 3 Manual	16.61	-2.06	1.57	-1.31	0.19	-5.14	1.03	-0.03	-0.06
SES 3 non manual	15.03	-3.64	1.36	-2.68	0.01	-6.30	-0.97	-0.07	-0.13
SES 4& 5	18.52	-0.15	1.47	-0.10	0.92	-3.03	2.74	0.08	-0.00
QTF1	12.92	-5.75	1.28	-4.49	0.00	-8.26	-3.23	-0.19	-0.22
QTF2	14.41	-4.25	1.27	-3.35	0.00	-6.75	-1.76	-0.05	-0.16
QTF3	15.91	-2.76	1.25	-2.20	0.03	-5.22	-0.29	0.08	-0.11
Chronic LBP	19.38	0.71	1.22	0.59	0.56	-1.68	3.10	0.01	0.03
co-morbidity	19.85	1.18	0.88	1.33	0.18	-0.56	2.92	0.08	0.07
South Asian	20.68	2.01	1.14	1.76	0.08	-0.24	4.26	0.19	0.09
British	16.60	-2.07	1.09	-1.89	0.06	-4.22	0.08	-0.20	-0.09
PLC - Control									
(Constant)	8.92	8.92	1.37	6.51	0.00	6.23	11.62		
sex	8.62	-0.30	0.52	-0.58	0.56	-1.33	0.72	-0.05	-0.03
age		0.05	0.02	3.29	0.00	0.02	0.08	0.13	0.16
SES 1 & 2	9.66	0.74	0.72	1.03	0.30	-0.68	2.16	0.05	0.05
SES 3 Manual	8.82	-0.10	0.82	-0.12	0.90	-1.72	1.52	-0.04	-0.01
SES 3 non manual	9.25	0.33	0.71	0.46	0.64	-1.07	1.73	0.00	0.02
SES 4 & 5	9.20	0.28	0.77	0.36	0.72	-1.24	1.79	-0.01	0.02
QTF1	10.02	1.10	0.67	1.63	0.10	-0.23	2.42	0.07	0.08
QTF2	9.20	0.27	0.67	0.41	0.69	-1.04	1.58	-0.07	0.02
QTF3	9.58	0.65	0.66	0.99	0.32	-0.64	1.95	0.02	0.05
Chronic LBP	8.98	0.05	0.64	0.08	0.93	-1.20	1.31	0.01	0.00
co-morbidity	8.04	-0.88	0.46	-1.90	0.06	-1.79	0.03	-0.08	-0.09
South Asian	9.79	0.87	0.60	1.44	0.15	-0.31	2.05	0.11	0.07
British	8.32	-0.61	0.57	-1.05	0.29	-1.73	0.52	-0.11	-0.05
PLC - Responsibility									
(Constant)	7.34	7.34	0.75	9.74	0.00	5.86	8.82		
sex	7.29	-0.05	0.29	-0.19	0.85	-0.62	0.51	-0.01	-0.01
age		-0.03	0.01	-3.71	0.00	-0.05	-0.01	-0.21	-0.18
SES 1 & 2	7.68	0.34	0.40	0.86	0.39	-0.44	1.12	0.09	0.04
SES 3 Manual	7.18	-0.16	0.45	-0.35	0.73	-1.05	0.73	-0.03	-0.02
SES 3 non manual	7.85	0.51	0.39	1.31	0.19	-0.26	1.28	0.08	0.06
SES 4 & 5	7.05	-0.29	0.42	-0.69	0.49	-1.13	0.54	-0.07	-0.03
QTF1	8.46	1.12	0.37	3.02	0.00	0.39	1.84	0.12	0.15
QTF2	8.36	1.02	0.37	2.77	0.01	0.30	1.74	0.09	0.14
QTF3	7.86	0.52	0.36	1.44	0.15	-0.19	1.24	-0.07	0.07
Chronic LBP	7.26	-0.08	0.35	-0.23	0.82	-0.77	0.61	-0.03	-0.01
co-morbidity	7.08	-0.26	0.26	-1.01	0.31	-0.76	0.24	-0.08	-0.05
South Asian	6.91	-0.42	0.33	-1.29	0.20	-1.07	0.22	-0.11	-0.06
British	7.70	0.36	0.32	1.14	0.26	-0.26	0.98	0.12	0.06

Appendix C. Table C3
Regression coefficients for Region of Birth

TA			*Coefficients*		*t*	*Sig.*	*95% CI for B*		*Correlations*	
	IV	*Mean*	*B*	*SE*			*Lower*	*Upper*	*Zero-order*	*Partial*
RMDQ										
	(Constant)	13.62	13.62	1.88	7.26	0.00	9.94	17.31		
	sex	14.36	0.73	0.68	1.08	0.28	-0.60	2.06	0.07	0.05
	age		0.05	0.02	2.26	0.02	0.01	0.09	0.17	0.11
	SES 1 and 2	12.37	-1.25	0.93	-1.34	0.18	-3.09	0.58	-0.10	-0.07
	SES 3 Manual	14.08	0.46	1.07	0.43	0.67	-1.65	2.56	0.04	0.02
	SES 3 non manual	12.33	-1.29	0.93	-1.39	0.17	-3.12	0.54	-0.07	-0.07
	SES 4 and 5	13.42	-0.20	1.00	-0.20	0.84	-2.17	1.77	0.02	-0.01
	QTF1	8.25	-5.38	0.87	-6.15	0.00	-7.09	-3.66	-0.21	-0.29
	QTF2	8.66	-4.97	0.87	-5.69	0.00	-6.68	-3.25	-0.16	-0.27
	QTF3	11.35	-2.27	0.86	-2.65	0.01	-3.96	-0.59	0.13	-0.13
	Chronic LBP	12.96	-0.67	0.83	-0.81	0.42	-2.30	0.96	-0.01	-0.04
	co-morbidity	14.73	1.10	0.60	1.82	0.07	-0.09	2.29	0.10	0.09
	South Asia	13.27	-0.36	1.01	-0.35	0.73	-2.35	1.64	0.06	-0.02
	British Isles	12.06	-1.56	0.90	-1.73	0.08	-3.33	0.21	-0.17	-0.09
	Africa	14.61	0.99	1.08	0.91	0.36	-1.13	3.10	0.11	0.04
MSPQ transformed										
	(Constant)	2.87	2.87	0.30	9.58	0.00	2.28	3.46		
	sex	3.19	0.33	0.11	3.01	0.00	0.11	0.54	0.16	0.15
	age		-0.00	0.00	-1.09	0.27	-0.01	0.00	0.02	-0.05
	SES 1 and 2	2.77	-0.10	0.15	-0.66	0.51	-0.39	0.19	-0.11	-0.03
	SES 3 Manual	3.16	0.29	0.17	1.71	0.09	-0.04	0.63	0.05	0.08
	SES 3 non manual	2.89	0.03	0.15	0.18	0.86	-0.27	0.32	-0.01	0.01
	SES 4 and 5	0.14	0.11	0.16	0.69	0.49	-0.20	0.42	0.01	0.03
	QTF1	2.05	-0.82	0.14	-5.86	0.00	-1.09	-0.54	-0.23	-0.28
	QTF2	2.30	-0.56	0.14	-4.04	0.00	-0.84	-0.29	-0.04	-0.20
	QTF3	2.49	-0.38	0.14	-2.74	0.01	-0.64	-0.11	0.09	-0.13
	Chronic LBP	3.07	0.20	0.13	1.50	0.13	-0.06	0.46	0.07	0.07
	co-morbidity	3.24	0.38	0.10	3.91	0.00	0.19	0.57	0.19	0.19
	South Asia	-0.01	-0.01	0.16	-0.08	0.94	-0.33	0.31	0.05	-0.00
	British Isles	2.65	-0.22	0.14	-1.53	0.13	-0.50	0.06	-0.15	-0.08
	Africa	3.08	0.21	0.17	1.23	0.22	-0.13	0.55	0.13	0.06
MZSRDS										
	(Constant)	30.08	30.08	3.28	9.16	0.00	23.63	36.53		
	sex	32.39	2.31	1.18	1.95	0.05	-0.02	4.64	0.13	0.10
	age		-0.04	0.04	-1.09	0.28	-0.11	0.03	0.02	-0.05
	SES 1 and 2	26.81	-3.27	1.63	-2.00	0.05	-6.49	-0.06	-0.14	-0.10
	SES 3 Manual	30.07	-0.01	1.87	-0.01	1.00	-3.69	3.67	0.00	-0.00
	SES 3 non manual	29.44	-0.64	1.63	-0.39	0.69	-3.84	2.56	0.02	-0.02
	SES 4 and 5	30.09	0.01	1.75	0.01	1.00	-3.43	3.45	0.03	0.00
	QTF1	23.15	-6.93	1.53	-4.54	0.00	-9.94	-3.93	-0.16	-0.22
	QTF2	24.44	-5.64	1.53	-3.69	0.00	-8.64	-2.64	-0.05	-0.18
	QTF3	25.72	-4.36	1.50	-2.91	0.00	-7.32	-1.41	0.03	-0.14
	Chronic LBP	30.77	0.69	1.45	0.48	0.63	-2.16	3.54	0.01	0.02
	co-morbidity	33.39	3.31	1.06	3.13	0.00	1.23	5.38	0.16	0.15
	South Asia	29.46	-0.62	1.78	-0.35	0.73	-4.11	2.87	0.05	-0.02
	British Isles	28.14	-1.94	1.57	-1.23	0.22	-5.04	1.15	-0.08	-0.06
	Africa	29.21	-0.87	1.89	-0.46	0.65	-4.57	2.84	0.02	-0.02

Table C3 cont.,

TA		Coefficients		t	Sig.	95% CI for B		Correlations	
IV	Mean	B	SE			Lower	Upper	Zero-order	Partial
CSQ Praying and Hoping									
(Constant)	20.36	20.36	2.47	8.24	0.00	15.50	25.22		
sex	21.29	0.93	0.89	1.04	0.30	-0.83	2.68	0.07	0.05
age		0.09	0.03	3.21	0.00	0.03	0.14	0.17	0.16
SES 1 and 2	17.27	-3.10	1.23	-2.52	0.01	-5.52	-0.68	-0.12	-0.12
SES 3 Manual	19.62	-0.74	1.41	-0.53	0.60	-3.52	2.03	-0.01	-0.03
SES 3 non manual	17.62	-2.74	1.23	-2.23	0.03	-5.15	-0.33	-0.08	-0.11
SES 4 and 5	20.47	0.10	1.32	0.08	0.94	-2.49	2.70	0.04	0.00
QTF1	17.28	-3.09	1.15	-2.68	0.01	-5.35	-0.83	-0.15	-0.13
QTF2	17.94	-2.42	1.15	-2.11	0.04	-4.69	-0.16	-0.11	-0.10
QTF3	20.58	0.22	1.13	0.19	0.85	-2.01	2.44	0.15	0.01
Chronic LBP	20.22	-0.14	1.09	-0.13	0.90	-2.29	2.00	-0.00	-0.01
co-morbidity	19.54	-0.82	0.80	-1.03	0.30	-2.39	0.74	0.01	-0.05
South Asia	23.58	3.22	1.34	2.41	0.02	0.59	5.85	0.24	0.12
British Isles	15.92	-4.44	1.19	-3.74	0.00	-6.77	-2.11	-0.41	-0.18
Africa	24.52	4.16	1.42	2.93	0.00	1.37	6.95	0.24	0.14
CSQ Catastrophising									
(Constant)	19.41	19.41	2.72	7.14	0.00	14.06	24.75		
sex	21.28	1.88	0.98	1.91	0.06	-0.05	3.81	0.13	0.09
age		-0.05	0.03	-1.83	0.07	-0.11	0.00	-0.02	-0.09
SES 1 and 2	15.35	-4.05	1.35	-2.99	0.00	-6.72	-1.39	-0.13	-0.15
SES 3 Manual	17.59	-1.82	1.55	-1.17	0.24	-4.87	1.24	-0.03	-0.06
SES 3 non manual	16.20	-3.20	1.35	-2.37	0.02	-5.86	-0.55	-0.07	-0.12
SES 4 and 5	19.57	0.16	1.45	0.11	0.91	-2.69	3.02	0.08	0.01
QTF1	13.40	-6.00	1.27	-4.74	0.00	-8.49	-3.51	-0.19	-0.23
QTF2	14.94	-4.46	1.26	-3.53	0.00	-6.95	-1.97	-0.05	-0.17
QTF3	16.41	-2.99	1.24	-2.40	0.02	-5.44	-0.54	0.08	-0.12
Chronic LBP	20.04	0.64	1.20	0.53	0.60	-1.72	3.00	0.01	0.03
co-morbidity	20.43	1.03	0.87	1.17	0.24	-0.69	2.75	0.08	0.06
South Asia	19.75	0.34	1.47	0.23	0.82	-2.55	3.24	0.07	0.01
British Isles	16.79	-2.62	1.30	-2.00	0.05	-5.18	-0.05	-0.22	-0.10
Africa	22.92	3.52	1.56	2.25	0.02	0.45	6.59	0.21	0.11
PLC - Control									
(Constant)	9.14	9.14	1.45	6.32	0.00	6.30	11.98		
sex	8.83	-0.31	0.52	-0.59	0.56	-1.33	0.72	-0.05	-0.03
age		0.05	0.02	3.13	0.00	0.02	0.08	0.13	0.15
SES 1 and 2	9.82	0.68	0.72	0.94	0.35	-0.74	2.09	0.05	0.05
SES 3 Manual	9.04	-0.10	0.83	-0.12	0.90	-1.73	1.52	-0.04	-0.01
SES 3 non manual	9.47	0.33	0.72	0.46	0.65	-1.08	1.74	0.00	0.02
SES 4 and 5	9.41	0.27	0.77	0.35	0.73	-1.25	1.79	-0.01	0.02
QTF1	10.21	1.07	0.67	1.58	0.11	-0.26	2.39	0.07	0.08
QTF2	9.43	0.29	0.67	0.43	0.67	-1.03	1.61	-0.07	0.02
QTF3	9.79	0.65	0.66	0.98	0.33	-0.65	1.95	0.02	0.05
Chronic LBP	9.16	0.02	0.64	0.03	0.97	-1.24	1.28	0.01	0.00
co-morbidity	8.26	-0.88	0.47	-1.90	0.06	-1.80	0.03	-0.08	-0.09
South Asia	9.96	0.82	0.78	1.05	0.29	-0.71	2.36	0.09	0.05
British Isles	8.50	-0.64	0.69	-0.91	0.36	-2.00	0.73	-0.14	-0.05
Africa	9.83	0.69	0.83	0.83	0.41	-0.95	2.32	0.05	0.04

Table C3 cont.,

TA		*Coefficients*		*t*	*Sig.*	*95% CI for B*		*Correlations*	
IV	*Mean*	*B*	*SE*			*Lower*	*Upper*	*Zero-order*	*Partial*
PLC - Responsibility									
(Constant)		7.46	0.79	9.40	0.00	5.90	9.02		
sex	7.41	-0.06	0.29	-0.20	0.84	-0.62	0.51	-0.01	-0.01
age	7.43	-0.03	0.01	-3.68	0.00	-0.05	-0.01	-0.21	-0.18
SES 1 and 2	7.80	0.34	0.40	0.85	0.39	-0.44	1.11	0.09	0.04
SES 3 Manual	7.29	-0.18	0.45	-0.39	0.70	-1.07	0.71	-0.03	-0.02
SES 3 non manual	7.94	0.48	0.39	1.21	0.23	-0.30	1.25	0.08	0.06
SES 4 and 5	7.15	-0.32	0.42	-0.75	0.45	-1.15	0.51	-0.07	-0.04
QTF1	8.62	1.16	0.37	3.13	0.00	0.43	1.88	0.12	0.15
QTF2	8.50	1.03	0.37	2.80	0.01	0.31	1.76	0.09	0.14
QTF3	8.01	0.55	0.36	1.51	0.13	-0.17	1.26	-0.07	0.07
Chronic LBP	7.40	-0.06	0.35	-0.18	0.85	-0.75	0.62	-0.03	-0.01
co-morbidity	7.22	-0.24	0.26	-0.95	0.34	-0.75	0.26	-0.08	-0.05
South Asia	6.94	-0.53	0.43	-1.22	0.22	-1.37	0.32	-0.08	-0.06
British Isles	7.64	0.18	0.38	0.46	0.64	-0.57	0.92	0.14	0.02
Africa	6.72	-0.74	0.46	-1.62	0.11	-1.64	0.16	-0.09	-0.08

Appendix C. Table C4
Regression coefficients for Religion

DV		*Coefficients*		*t*	*Sig.*	*95% CI for B*		*Correlations*	
	IV	*Mean*	*B*	*SE*		*Lower*	*Upper*	*Zero-order*	*Partial*
RMDQ									
	(Constant)	11.58	11.58	1.85	6.27	0.00	7.95	15.21	
	sex	12.34	0.76	0.67	1.13	0.26	-0.56	2.08	0.07	0.06
	age	11.64	0.05	0.02	2.72	0.01	0.02	0.09	0.17	0.13
	SES 1 and 2	10.90	-0.69	0.93	-0.73	0.46	-2.52	1.15	-0.10	-0.04
	SES 3 Manual	12.40	0.81	1.07	0.76	0.45	-1.29	2.92	0.04	0.04
	SES 3 non manual	10.61	-0.98	0.93	-1.05	0.29	-2.80	0.85	-0.07	-0.05
	SES 4 and 5	11.79	0.21	1.00	0.21	0.84	-1.76	2.18	0.02	0.01
	QTF1	6.18	-5.41	0.86	-6.27	0.00	-7.10	-3.71	-0.21	-0.29
	QTF2	6.61	-4.97	0.86	-5.80	0.00	-6.66	-3.29	-0.16	-0.27
	QTF3	9.21	-2.37	0.85	-2.80	0.01	-4.04	-0.70	0.13	-0.14
	Chronic LBP	10.72	-0.86	0.82	-1.05	0.29	-2.48	0.75	-0.01	-0.05
	co-morbidity	12.65	1.06	0.60	1.78	0.08	-0.11	2.24	0.10	0.09
	HINDU	13.10	1.52	1.00	1.52	0.13	-0.45	3.49	0.08	0.07
	MUSLIM	15.81	4.23	1.23	3.44	0.00	1.81	6.64	0.18	0.17
	CHRISTIAN	11.68	0.09	0.90	0.10	0.92	-1.68	1.86	-0.14	0.01
MSPQ transformed									
	(Constant)	2.81	2.81	0.30	9.44	0.00	2.22	3.39		
	sex	3.13	0.33	0.11	3.04	0.00	0.12	0.54	0.16	0.15
	age		-0.00	0.00	-0.85	0.40	-0.01	0.00	0.02	-0.04
	SES 1 and 2	2.74	-0.07	0.15	-0.43	0.66	-0.36	0.23	-0.11	-0.02
	SES 3 Manual	3.13	0.32	0.17	1.86	0.06	-0.02	0.66	0.05	0.09
	SES 3 non manual	2.85	0.04	0.15	0.30	0.77	-0.25	0.34	-0.01	0.01
	SES 4 and 5	2.94	0.14	0.16	0.85	0.40	-0.18	0.45	0.01	0.04
	QTF1	1.99	-0.82	0.14	-5.87	0.00	-1.09	-0.54	-0.23	-0.28
	QTF2	2.25	-0.56	0.14	-4.03	0.00	-0.83	-0.29	-0.04	-0.19
	QTF3	2.43	-0.37	0.14	-2.74	0.01	-0.64	-0.11	0.09	-0.13
	Chronic LBP	2.99	0.18	0.13	1.40	0.16	-0.08	0.44	0.07	0.07
	co-morbidity	3.17	0.36	0.10	3.78	0.00	0.18	0.55	0.19	0.18
	HINDU	2.92	0.12	0.16	0.73	0.46	-0.20	0.44	0.11	0.04
	MUSLIM	3.03	0.22	0.20	1.11	0.27	-0.17	0.61	0.10	0.05
	CHRISTIAN	2.60	-0.20	0.14	-1.41	0.16	-0.49	0.08	-0.16	-0.07
MZSRDS									
	(Constant)	25.38	25.38	3.23	7.87	0.00	19.04	31.73		
	sex	27.77	2.38	1.17	2.03	0.04	0.08	4.69	0.13	0.10
	age		-0.02	0.03	-0.72	0.47	-0.09	0.04	0.02	-0.04
	SES 1 and 2	23.16	-2.23	1.63	-1.36	0.17	-5.44	0.99	-0.14	-0.07
	SES 3 Manual	26.00	0.62	1.87	0.33	0.74	-3.06	4.29	0.00	0.02
	SES 3 non manual	25.37	-0.02	1.62	-0.01	0.99	-3.20	3.17	0.02	-0.00
	SES 4 and 5	26.13	0.75	1.75	0.43	0.67	-2.69	4.19	0.03	0.02
	QTF1	18.34	-7.05	1.51	-4.67	0.00	-10.01	-4.08	-0.16	-0.22
	QTF2	19.62	-5.76	1.50	-3.84	0.00	-8.71	-2.81	-0.05	-0.19
	QTF3	20.74	-4.64	1.48	-3.13	0.00	-7.55	-1.73	0.03	-0.15
	Chronic LBP	25.83	0.45	1.44	0.31	0.76	-2.38	3.27	0.01	0.02
	co-morbidity	28.65	3.27	1.05	3.12	0.00	1.21	5.33	0.16	0.15
	HINDU	28.40	3.01	1.75	1.72	0.09	-0.43	6.46	0.05	0.08
	MUSLIM	32.27	6.89	2.15	3.21	0.00	2.67	11.11	0.14	0.16
	CHRISTIAN	27.44	2.06	1.57	1.31	0.19	-1.03	5.15	-0.06	0.06

Table C4 cont.,

DV		Coefficients		t	Sig.	95% CI for B		Correlations	
IV	Mean	B	SE			Lower	Upper	Zero-order	Partial
CSQ Praying and Hoping									
(Constant)	15.22	15.22	2.51	6.07	0.00	10.29	20.15		
sex	16.17	0.95	0.91	1.04	0.30	-0.84	2.74	0.07	0.05
age		0.10	0.03	3.71	0.00	0.05	0.15	0.17	0.18
SES 1 and 2	13.15	-2.07	1.27	-1.63	0.10	-4.57	0.42	-0.12	-0.08
SES 3 Manual	14.90	-0.32	1.45	-0.22	0.82	-3.18	2.53	-0.01	-0.01
SES 3 non manual	12.74	-2.47	1.26	-1.96	0.05	-4.95	0.00	-0.08	-0.10
SES 4 and 5	15.49	0.28	1.36	0.20	0.84	-2.40	2.95	0.04	0.01
QTF1	12.00	-3.22	1.17	-2.75	0.01	-5.52	-0.92	-0.15	-0.13
QTF2	12.40	-2.82	1.17	-2.42	0.02	-5.11	-0.53	-0.11	-0.12
QTF3	15.15	-0.07	1.15	-0.06	0.95	-2.33	2.20	0.15	-0.00
Chronic LBP	14.67	-0.55	1.12	-0.49	0.62	-2.74	1.65	-0.00	-0.02
co-morbidity	14.28	-0.94	0.81	-1.15	0.25	-2.54	0.66	0.01	-0.06
HINDU	23.42	8.20	1.36	6.02	0.00	5.52	10.87	0.28	0.28
MUSLIM	24.54	9.32	1.67	5.58	0.00	6.04	12.61	0.21	0.27
CHRISTIAN	16.98	1.76	1.22	1.44	0.15	-0.64	4.16	-0.25	0.07
CSQ Catastrophising									
(Constant)	17.50	17.50	2.71	6.46	0.00	12.17	22.82		
sex	19.40	1.91	0.98	1.94	0.05	-0.03	3.84	0.13	0.10
age		-0.04	0.03	-1.54	0.12	-0.10	0.01	-0.02	-0.08
SES 1 and 2	14.00	-3.50	1.37	-2.55	0.01	-6.20	-0.80	-0.13	-0.12
SES 3 Manual	16.03	-1.46	1.57	-0.93	0.35	-4.55	1.62	-0.03	-0.05
SES 3 non manual	14.43	-3.07	1.36	-2.25	0.02	-5.75	-0.39	-0.07	-0.11
SES 4 and 5	17.94	0.45	1.47	0.30	0.76	-2.44	3.34	0.08	0.01
QTF1	11.57	-5.93	1.27	-4.68	0.00	-8.42	-3.44	-0.19	-0.22
QTF2	13.13	-4.36	1.26	-3.47	0.00	-6.84	-1.89	-0.05	-0.17
QTF3	14.54	-2.96	1.24	-2.38	0.02	-5.40	-0.51	0.08	-0.12
Chronic LBP	17.94	0.44	1.21	0.37	0.71	-1.93	2.81	0.01	0.02
co-morbidity	18.43	0.94	0.88	1.06	0.29	-0.79	2.66	0.08	0.05
HINDU	20.83	3.33	1.47	2.26	0.02	0.44	6.22	0.18	0.11
MUSLIM	22.00	4.51	1.80	2.50	0.01	0.96	8.05	0.16	0.12
CHRISTIAN	16.50	-0.99	1.32	-0.75	0.45	-3.59	1.60	-0.21	-0.04
PLC - Control									
(Constant)	8.16	8.16	1.44	5.68	0.00	5.34	10.99		
sex	7.88	-0.29	0.52	-0.55	0.58	-1.31	0.74	-0.05	-0.03
age		0.05	0.02	3.32	0.00	0.02	0.08	0.13	0.16
SES 1 and 2	9.04	0.88	0.73	1.21	0.23	-0.55	2.31	0.05	0.06
SES 3 Manual	8.18	0.01	0.83	0.02	0.99	-1.62	1.65	-0.04	0.00
SES 3 non manual	8.57	0.41	0.72	0.57	0.57	-1.01	1.83	0.00	0.03
SES 4 and 5	8.51	0.34	0.78	0.44	0.66	-1.19	1.88	-0.01	0.02
QTF1	9.22	1.05	0.67	1.57	0.12	-0.27	2.37	0.07	0.08
QTF2	8.38	0.22	0.67	0.33	0.74	-1.09	1.53	-0.07	0.02
QTF3	8.75	0.59	0.66	0.89	0.37	-0.71	1.89	0.02	0.04
Chronic LBP	8.13	-0.04	0.64	-0.06	0.95	-1.29	1.22	0.01	-0.00
co-morbidity	7.25	-0.92	0.47	-1.97	0.05	-1.83	-0.00	-0.08	-0.10
HINDU	9.91	1.75	0.78	2.24	0.03	0.21	3.28	0.10	0.11
MUSLIM	9.89	1.73	0.96	1.81	0.07	-0.15	3.61	0.05	0.09
CHRISTIAN	8.61	0.44	0.70	0.63	0.53	-0.94	1.82	-0.08	0.03

Table C4 cont.,

DV		Coefficients		t	Sig.	95% CI for B		Correlations	
IV	Mean	B	SE			Lower	Upper	Zero-order	Partial
PLC - Responsibility									
(Constant)	8.09	8.09	0.78	10.33	0.00	6.55	9.63		
sex	8.02	-0.07	0.28	-0.25	0.80	-0.63	0.49	-0.01	-0.01
age	8.06	-0.03	0.01	-3.89	0.00	-0.05	-0.02	-0.21	-0.19
SES 1 and 2	8.25	0.16	0.40	0.40	0.69	-0.62	0.94	0.09	0.02
SES 3 Manual	7.79	-0.30	0.45	-0.66	0.51	-1.19	0.59	-0.03	-0.03
SES 3 non manual	8.48	0.38	0.39	0.97	0.33	-0.39	1.16	0.08	0.05
SES 4 and 5	7.66	-0.43	0.43	-1.02	0.31	-1.27	0.40	-0.07	-0.05
QTF1	9.24	1.15	0.37	3.14	0.00	0.43	1.87	0.12	0.15
QTF2	9.14	1.05	0.36	2.89	0.00	0.33	1.77	0.09	0.14
QTF3	8.68	0.58	0.36	1.63	0.10	-0.12	1.29	-0.07	0.08
Chronic LBP	8.09	-0.00	0.35	-0.01	0.99	-0.69	0.68	-0.03	-0.00
co-morbidity	7.85	-0.24	0.25	-0.94	0.35	-0.74	0.26	-0.08	-0.05
HINDU	7.02	-1.08	0.43	-2.53	0.01	-1.91	-0.24	-0.09	-0.12
MUSLIM	6.36	-1.73	0.52	-3.31	0.00	-2.75	-0.70	-0.13	-0.16
CHRISTIAN	7.65	-0.44	0.38	-1.16	0.25	-1.19	0.31	0.09	-0.06