MEDICALLY INCONGRUENT BACK PAIN PRESENTATION: AN INDICATION OF PHYSICAL RESTRICTION, SUFFERING, AND INEFFECTIVE COPING WITH PAIN

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Abstract

Chronic low back pain (CLBP) patients who display or report pain that is deemed incongruent and anatomically non-conforming relative to known organic impairment and expected symptomatology have been found to have a poorer outcome to medical treatment and rehabilitation, and to use health care resources excessively. The present investigation sought to contrast CLBP patients who displayed either multiple non-organic physical signs, multiple inappropriate symptoms, and/or anatomically incongruent pain drawings with a control CLBP patient sample in which these criteria were absent. A total of 80 CLBP patients, 40 with 'medically incongruent' pain and 40 'control' pain patients, completed as part of their assessment at a back pain clinic, a psychometric battery, a physical examination, a videotaped sequence of motor movements and positions, and an assessment with an experimental pressure pain induction task. Videotaped pain behavior observations and transcribed reports of cognitions during the pain induction were coded independently of pain group status. Dependent measures and other patient variables were subjected to 2 X 2 (pain group by sex) MANOVAs and appropriate univariate analyses. While there were no interaction effects in these analyses, and only minimal effects for sex, there were a number of significant effects for pain group. No differences emerged between pain groups on demographic, pain history, financial disincentives, or medication consumption, but self report and physical examination measures of physical limitation were higher in the
incongruent pain group. The incongruent pain group also received higher scores on measures of pain intensity and depression, received higher global judgment ratings of pain, displayed more ambulatory/postural pain behavior, and reported more dysfunctional cognitions during pain experiences than the control group. When physical impairment/limitation was introduced as a covariate in MANCOVAs on the dependent variables, incongruent pain patients emerged as significantly different from control pain patients on the cognitive variables, but behavioral and self-report differences failed to emerge as significant. A discriminant analysis revealed that sense of control during the experimental task was the most important discriminator between the groups. These results highlight the role of cognition in CLBP patients who present with medically incongruent pain signs and support the idea that physically based interventions may fail with these patients because dysfunctional cognitive mediation of pain may not be altered. These results also suggest that these patients may be better conceptualized as being ineffective and overwhelmed in their attempts to cope with their chronic pain condition.
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INTRODUCTION

Chronic low back pain (CLBP) has been found to be one of the leading causes of physical limitation and disability (Flor & Turk, 1984). CLBP sufferers have been found to utilize health care resources at a rate twice that of individuals without CLBP or other functional impairments (Nagi, Riley, & Newby, 1973). Yet despite the heavy demand on health care services, it has been estimated that over 60% of CLBP patients have no diagnosable medical disease or injury to account for their pain (Loeser, 1980). Therefore functional causes and psychological factors have been identified as important determinants in the maintenance of CLBP and as markers for the identification of patients unlikely to benefit from medically-based intervention efforts (Flor & Turk, 1984).

Investigations have found that when compared to patients with clearly identified organic impairment, patients without diagnostic evidence of impairment tend to be more psychologically disturbed (Sternbach & Timmermans, 1979), use different adjectives to describe their pain (Leavitt, Garron, D'Angelo, & McNeil, 1979), endorse more intense symptomatology (Hendler, 1979), and report more life stress (Leavitt, Garron, & Bieliauskas, 1980). However, a number of investigations have failed to find differences between patients with and without detectable organic impairment on measures of psychological adjustment (Heaton, 1982; Leavitt & Garron, 1979a; Leavitt & Garron, 1979b; Sternbach, 1974).
The lack of consistent findings may in part be due to simplistic assumptions about identifying a 'non-organic' pain conditions. Diagnosis has been based on the identification of such patients on the basis of exclusionary criteria (i.e., lack of organic impairment indicators). While false positives may arise where pathophysiology is present but undetected (Chapman, 1977), another more important problem is that this kind of conceptualization fails to recognize that patients with identifiable organic impairment are not a mutually exclusive category to patients whose pain problem may have been maintained or mediated by psychological or functional factors. Considerable psychological involvement may be present even when clear organic pathology exists, with reciprocal interactions between the two (Turk, Meichenbaum, & Genest, 1983). Thus, it is not surprising that low interrater reliability concerning judgements of organicity has been found (Fordyce, Brenn, Holcomb, DeLateur, & Loeser, 1978).

An alternative approach to the use of exclusionary criteria to identify 'medically incongruent' CLBP is the use of inclusionary criteria (i.e., test scores, examination findings) (Chapman, 1977; Craig, 1984a; Main & Waddell, 1982). For example, with many chronic pain patients, the behavioral expression and the verbal report of pain may suggest suffering inconsistent with physical impairment indicators (Teske, Daut, & Cleeland, 1983). Behavior or verbal report in the clinical examination situation suggesting pain that does not conform in pattern or time from an expected pathophysiological basis has been described as 'inappropriate illness behavior' (Waddell, Bircher, Finlayson, & Main, 1984). CLBP patients who present with such incongruent pain-related
behavior or report, have a greater level of health care utilization (Waddell et al., 1984), a poorer outcome to surgery and rehabilitation (Dzioba & Doxey, 1984), and a poorer response to physical pain relief modalities such as acupuncture (Lehmann, Russell, & Spratt, 1983).

Clinically, the value of identifying these patients has been crucial so as not to expose these individuals to costly, unnecessary, or potentially harmful interventions. What has not been clear however is the role cognitive, behavioral, and affective influences have on the mediation of these patients' pain experience. Further, it has not been clear as to what intervention targets are likely to lead to effective pain management. The central aim of this investigation was to compare CLBP patients who display medically incongruent pain presentation with patients who do not, to discover psychological correlates which may promote and maintain this kind of illness behavior and account for the failure to respond to physically based treatment modalities.

As suggested above, dysfunctional psychological processes and stressors may come to maintain medically incongruent pain behavior. Anger, demoralization, anxiety, and depression have been associated with chronic pain conditions (Craig, 1984a). Shared variance has been found between measures of depression and occurrence of inappropriate pain behavior and symptomatology (Main & Waddell, 1982). Alternatively, it has been proposed that reinforcing consequences provided by the environment (financial disincentives, attention) may maintain some CLBP behavior and pain report independent of originating tissue pathology (Fordyce, 1979). It has also been argued by adherents of the behavioral perspective that if there is no pain
behavior, there is no pain problem (Fordyce, 1978). This extreme perspective ignores the subjective, experiential components of pain.

More recently a cognitive model of pain has been articulated wherein thoughts, interpretations, expectations, and coping self-statements related to noxious sensory events are viewed as central to the pain experience and can come to enhance, attenuate, or maintain pain and in turn contribute to affective distress (Turk, et al., 1983). Considerable support for the role of cognition in pain has come from investigations with non-patient volunteers, as well as from pain patient populations (Weisenberg, 1984). Studies using experimentally induced pain, have demonstrated that exaggeration of the perceived intensity or consequences of noxious stimulation, reduction of perceived control, and lack of cognitions attenuating intensity or increasing control, reduce the tolerance to pain (Weisenberg, 1977). CLBP patients without detectable organic impairment were found to more readily perceive normal muscular fatigue as pain than non-patients (Schmidt, 1985). Further, perceived lack of self-efficacy in controlling pain and the presence of catastrophizing cognitions (Rosenstiel & Keefe, 1983) and distortion in the interpretation of back-pain-related events (Lefebvre, 1981) have been shown to be associated with greater affective distress and poorer adjustment in CLBP patients. Medically incongruent pain behavior and symptomatology have been found to be associated with measures that reflected excessive attention toward physical functioning (Main & Waddell, 1982).

It was proposed that dysfunctional cognitions and lack of effective cognitive coping activity during pain, characterized pain
patients that displayed incongruent pain behavior. These cognitive processes were thought to amplify and distort these patients' pain and the accompanying emotional experience and expression of distress. The underlying assumption here was that cognition is primary to pain expression and emotional experience associated with pain (cf. Beck, 1976; Turk, et al., 1983). Since chronic pain has been conceptualized as a sensory, cognitive, affective, and behavioral phenomenon (Melzack & Wall, 1983), a multidimensional assessment approach (Keefe, 1982; Keefe, Brown, Scott, & Ziesat, 1982) was expected to identify the incongruent pain patient as displaying a greater frequency of pain behavior, a lower pain tolerance, greater affective distress, and higher intensity of rated pain, in association with dysfunctional cognitive coping during pain. Further, since there are questions about the methodology of assessing cognition during pain (Genest & Turk, 1981), both retrospective self-report of cognition during pain (Rosenstiel & Keefe, 1983) and unstructured report of cognitive activity during induced pain (Genest & Turk, 1981; Turk, et al., 1983) were employed to provide some convergent validity for the cognitive variables under investigation (Merluzzi, Glass, & Genest, 1981).

The review which follows has addressed in more detail the background literature to this investigation.
LITERATURE REVIEW

Pain has been defined as "an unpleasant sensory and emotional experience associated with actual or potential tissue damage, or described in terms of such damage" (International Association for the Study of Pain, 1979). This definition acknowledges that pain experience is not always equivalent to the severity of an injury or the noxious sensory stimulation resulting from tissue damage. Observations of soldiers wounded in battle, for example, have illustrated how dramatic the lack of correspondence between the extent of tissue damage and the amount of pain experienced can be (Beecher, 1955). Further, pain can persist even after medical, surgical, or natural tissue repair has been effected (Sternbach, 1974; Fordyce, 1976). The dissociation between pain and physical substrates is poignantly illustrated in the case of phantom limb pain, where it has been estimated that over half of all amputees may experience pain that is perceptually localized in their amputated extremity (Melzack & Wall, 1983).

The 'desynchrony' between tissue pathophysiology and pain experience has prompted a broader conceptualization of pain that encompasses sensory-discriminative, motivational-affective, and cognitive-evaluative components (Melzack & Wall, 1983). While the sensory component of pain is a highly salient dimension, somatic input nonetheless is modified by cognitive, affective, and behavioral influences (Turk, et al., 1983). Presenting complaints of pain can reflect not only tissue damage but a variety of dimensions of suffering.
Recognition of the multidimensional nature of pain and the reciprocal determinism among these influences has obvious significance for the development of strategies for pain relief. Physical/somatic approaches to altering noxious sensory input can be less effective when cognitive, affective, or behavioral influences strongly maintain or modulate the pain experience.

Cognitive, affective, and behavioral influences have been observed to become especially prominent as pain persists (Bonica, 1980). The distinction between 'acute' and 'chronic' pain therefore is crucial (Sternbach, 1978). Acute pain has been described as more closely a function of injury or tissue damage and limited in duration, whereas the chronic pain condition may exist in the absence of evidence of organic pathology and with no limitation to the duration and persistence of pain (Keefe, et al., 1982). Therefore medical or disease models are better for conceptualizing acute pain problems, but less useful for understanding the chronic pain condition. Treatments for acute pain such as bedrest, withdrawal from job and personal demands, analgesic intake, have been contraindicated in chronic pain since these can, in effect, perpetuate illness and disability (Bonica, 1980).

Chronic pain has been defined as pain which persists after 6 months (Sternbach, 1978). This is an arbitrary criterion since there is no change in the chronic pain condition that is specific to this time span (Bonica, 1980). Although chronic pain has sometimes been described as a static syndrome (Crue, 1975), it is perhaps better conceptualized as a terminal stage in a developmental process occurring along multiple dimensions, which only initially may be associated with
injury or tissue damage. Pre-chronic stages, which may or may not
develop into a chronic pain condition, have been described as
characterized by a temporary decrease in activity, temporary increase
in medication intake, beliefs that the pain will be controlled, active
attempts to cope, presence of anxiety, muscle spasms, and increased
autonomic arousal (Keefe, Block, & Williams, 1980). Chronic phases, on
the other hand, have been described as characterized by a long-term
pattern of decreased activity, habitual use of medication, concerns that
the pain is uncontrollable, passive attempts to cope, depression,
preoccupation with pain and bodily complaints, constant muscle spasm,
decreased autonomic arousal, and reduced strength and endurance.
Persistent pain has been described as a 'malefic' force that leads to
progressive deterioration of the personal, interpersonal, and
occupational lives of patients (Bonica, 1974).

There is considerable variability in the progression and the
impact of chronic pain. In other words, chronic pain is not invariant
across sufferers. Patients with chronic pain have been described as
ranging from a clinical presentation characterized by severe
demoralization, depression, drug dependency, psychosocial
maladjustment, and vocational failure, to a clinical presentation showing
no impact on psychological, social or and vocational adjustment
(Sternbach, 1974). Undoubtedly more of the former have come to the
attention of health care providers. Thus, Fordyce (1976) has cautioned
against an "illusion of homogeneity" among chronic pain patients.
Personality and emotional characteristics of patients attributed to a 'pain
prone personality' (cf. Blumer & Heilbronn, 1982) may reflect changes
resulting from prolonged exposure to pain, suffering, and distress (Sternbach, 1974).

The type of underlying pathophysiology is extremely important in determining the nature of pain sensations and cannot be overlooked in attempts to understand the chronic pain experience. Turk, et al. (1983) have distinguished three basic types of chronic pain. These included: (a) chronic, acute, recurrent pain (e.g. migraine headaches, trigeminal neuralgia); (b) chronic persistent, benign pain characterized by a constant presence of varying intensity (e.g. low back pain); and (c) chronic, progressive, malignant pain (e.g. cancer). Pathophysiological processes have been proposed to reciprocally interact with subjective and interpersonal factors to contribute to the clinical presentation and the individuals' experience of pain (Dubuisson & Melzack, 1976).

To summarize, in the case of chronic pain, originating tissue damage and nociceptive stimuli may come to have a decreasing importance as pain persists in spite of attempts to cope. However, as previously suggested, there is considerable variation among pain sufferers in the extent to which complaints are congruent with pathophysiology. For a portion of patients, behavior displayed that is disproportionate or deviant given the underlying organic impairment, suggests that their complaints are more a function of intrapersonal or interpersonal variables.

The purpose of this investigation was to determine some of the factors that may account for pain complaints in chronic pain patients whose symptom picture lacks correspondence to underlying anatomy and
disease course. The first section that follows in this review has addressed some aspects of anatomically incongruent pain and approaches to identifying 'psychogenic' manifestations of chronic pain. In the second section, some of the psychosocial factors which may come to modulate pain experience independent of tissue pathophysiology have been discussed. In the third section, some approaches to the measurement of cognitive, behavioral, and affective phenomena associated with pain, have been reviewed. Finally, in the last section, some investigations of psychosocial factors in CLBP patients have been discussed.

Medically Incongruent Pain Presentation

Pain patients who come to clinical attention ordinarily display 'illness behavior' such as looking like they hurt, complaining about aches and symptoms, ceasing work, taking medication, and accepting sympathy (Bellisimo & Tunks, 1984). Illness behavior has been described as a global construct which encompasses symptom perception, symptom interpretation, sick roles, utilization of medical services, and behavior reflecting need for remedial action (Mechanic, 1976). Illness behavior is not the same as the underlying disease process, it is associated with covert and overt behaviors aimed at alleviating disease. Therefore, illness behavior may serve a vital communication function in receiving care and facilitating recovery. In order to assume the 'status' of being ill, individuals behave in way that will be recognized by others (Mechanic, 1976). Thus, illness behavior reflecting pain may be learned in a sociocultural context (Craig, 1983; Fordyce, 1976).
Illness behavior in chronic pain may be considered appropriate or inappropriate, given the underlying pathophysiology and disease course. Crue (1975), for example, makes a distinction between three types of pain related illness presentation: (a) pain expression as a signal of somatopathology, (b) pain expression as a signal of known pathology that cannot be alleviated due to inadequacies in therapeutic knowledge, and (c) pain expression associated with no demonstrable somatic problem or with a problem that is too minor or too remote in time to account for the pain problem.

For the purposes of this discussion, appropriate illness behavior reflects behavior and symptom report consistent with anatomical principles and perceptions of pain that conform to the normal disease course. Incongruent illness behavior reflects behavior inconsistent with physiology of pain, symptom report that is vague, diffuse, and poorly localized, and exaggerated perceptions and descriptions of pain. Pain-related illness behavior has been described as 'abnormal' especially when it is associated with preoccupation with symptoms, health anxiety, and persistent conviction of disease despite medical documentation and reassurance to the contrary (Pilowsky, 1984).

Pain reports and illness behaviors indicative of pain that do not reflect underlying organic impairment or that persist beyond the normal healing process may be treated diagnostically as reflecting some other origin, such as psychiatric illness, somatic expression of psychological problems, malingering, and/or 'secondary gain'. Such explanations of non-anatomical, incongruent pain have prompted a distinction to be made between 'somatogenic' and 'psychogenic' pain. Sternbach (1974, p.
21) uses the term psychogenic pain to refer to "pain which is better understood in psychological than physical language". The definition of psychogenic pain has also included pain attributed to physical sequelae of emotional factors (i.e., muscle tension) (Merskey, 1978).

While the usefulness and validity of a distinction reflecting mind/body dualism in pain has been questioned, this simple dichotomy has pervaded much research and clinical assessment practice (Sternbach, 1978). Separating pain into 'psychological' (i.e., cognitive, affective, and behavioral) and 'physical' (i.e., biochemical, structural, mechanical, and sensory) components may be somewhat artificial, as both to a large degree reflect different levels of the same phenomena which, from the sufferer's perspective, tend to be undifferentiated. It has been observed that considerable psychological involvement can be present even when clear organic etiology is also present (Turk, et al., 1983). Consistent with the concept of an interactive determinism between 'psychological' and 'physical' variables, some writers have indicated that it is even rare to find one without the other (Bellisimo & Tunks, 1984). Considerable 'abnormal' illness behavior has been found to exist even with significant organic impairment (cf. Waddell & Main, 1984). There is, therefore, no reason to assume that 'psychogenic' and 'somatogenic' pain categories are mutually exclusive. However, conceptualizing chronic pain as a function of two potentially complementary processes, 'psychological' and 'physical', can be useful for determining patient treatment and predicting outcome.
One reason for exploring the psychogenic/somatogenic distinction is that misconceptions appear to be associated with non-organic based pain (Reuler, Girard, & Nardone, 1980). Sternbach (1974) has warned that regardless of how it is assessed, the label 'psychogenic pain' should not be used to imply that the pain is any way "imaginary". This 'type' of pain, nonetheless, has pejorative connotations (Main & Waddell, 1982). Since a psychological construct must be invoked to explain pain for some patients, the attribution may be made that the pain is somehow the patient's responsibility and to some extent under the patient's control. Part of this problem may simply be a lack of understanding and appreciation of the psychological processes that contribute to chronic pain. Thus, common referral questions for psychological consultation have been observed such as "Is the pain real?", "Is this a pain prone personality?", "Is this person faking?", or "Is this an hysterical reaction?" (Greisak, 1984).

Development and advances in chronic pain patient assessment are essential, not only for creating more effective treatments, but for avoiding misconceptions and promoting accurate conceptualizations about chronic pain patients (Keefe, 1982). In order to determine what variables are associated with incongruent pain, reliable and valid criteria for identifying these patients are required. Several approaches and issues have been discussed below.

Identification of Medically Incongruent Pain Patients.

The practice of identifying chronic pain patients as having some degree of 'abnormal', 'incongruent', or 'psychogenic' pain appears to have its origins in the practical necessity of identifying patient
groupings appropriate for conventional medical or surgical interventions. One problem with the diagnosis of a psychogenic pain condition is that often, in both the research literature and clinical practice, diagnosis has been made by exclusionary criteria rather than by inclusionary criteria (Engel, 1959; Craig, 1984b). Therefore, when radiologic, laboratory, physical examination, or other indicators of objective disease are not present, despite pain report, a psychologic etiology is assumed. The fallacy of this logic is that 'false positives' may arise when organic pathology is present but undetected (Chapman, 1977).

Psychometric test efforts to differentiate groups on the basis of organicity have produced equivocal results (Sternbach, 1974) partly because of unreliability in identifying patient groups. Interrater reliabilities of ratings of organicity, based on judgement of medical examination and diagnostic test data, have been found to have only modest agreement (e.g., mean $r=.58$; Fordyce et al., 1978). When operational definitions of distinct patient behaviors were used as the basis of global judgements, the inter-judge reliability of organic indicators was found to be significantly enhanced (Waddell et al., 1982). Therefore, there is a need to objectify the assessment process with chronic pain patients rather than relying on intuitive judgement. This is especially important since failure to detect organic pathology can have serious implications for patient management (Nachemson, 1976).

The difficulty in assessing 'psychogenic' pain arises because pain is a subjective experience and is therefore dependent on self-report or other behavioral evidence. Chapman (1977) has proposed that for the
diagnosis of 'psychogenic' pain, at the very least, abnormal psychological test scores, interview findings, or evidence of an organic disease which could alter consciousness and attention should be present. Another method of making diagnostic decisions of psychological involvement has been to look for reactions disproportionate to injury or deviation from expected anatomical pain reactions (Engle, 1959). Pain patients with a significant psychological etiology have been described as more 'dramatic' in their display of pain (Brown, Barr, Nemiah, & Barry, 1954).

Attempts have been made to operationalize chronic pain patient 'types' that reflect differences in the 'appropriateness' or 'inappropriateness' of the presenting pain complaints to organic pathology. Brena, Chapman, and Decker (1981), have described four categories of pain patients: chronic sufferers who display high 'pain behavior' and high tissue pathology; pain reducers who display low 'pain behavior' and high tissue pathology; pain amplifiers who display high 'pain behavior' and low tissue pathology; and pain verbalizers who display low 'pain behavior' and low tissue pathology. So called 'pain behavior' was actually determined by a rating based on patient self-report measures (MMPI, McGill Pain Questionnaire, activity, and medication levels). Tissue pathology was based on a physician's judgement of examination, neurologic, and radiologic findings. High 'pain behavior' was associated with the presence of financial compensation and with greater reported disability. (Brena, Chapman, Stegal, & Chyatte, 1979). However, the association between high 'pain behavior' and compensation status is irrelevant to the question of
whether 'appropriateness' is well operationalized. Recent investigations have challenged the simplistic association between compensation and problematic chronic pain on both methodological and empirical grounds (Dworkin, Handlin, Richlin, Brand, & Vannucci, 1985; Kremer, et al., 1983; Melzack et al., 1985). Thus, the empirical validity of this model has not yet been adequately established.

Hendler (1981) has proposed a similar four category conceptualization reflecting incongruent and appropriate pain: objective pain patients (have an identifiable organic basis), unspecified pain patients (have a non-exaggerated report of pain but no identifiable organic basis), exaggerated pain patients (reports of pain are disproportionate to organic impairment), and affective or associative pain patients (exaggerated report of pain maintained by an affective disturbance). Psychological involvement was determined on the basis of the presence of psychiatric symptoms and psychometric indicators. This approach is problematic since the criteria for "organically defineable lesions with positive objective signs" and the criteria for determining exaggerated pain were not specified. Both the exaggerated and associative patients were found to have, on retrospective examinations, a poorer prognosis for surgery (Hendler, 1981).

In CLBP populations, Waddell et al. (1980) have operationalized incongruent pain on the basis of objective clinical indicators. These include behaviors elicited during an orthopedic examination procedure which deviate from anatomical principles (Waddell, et al., 1980) and endorsement of symptoms which are exaggerated and do not conform to anatomy or disease course (Main & Waddell, 1984a). Another indicator
of incongruent pain presentation that has been proposed is exaggerated and non-anatomical drawings patients produce to illustrate their pain (Ransford, Carins, & Mooney, 1976). All of these criteria have the demonstrated advantage of being reliable and easily assessed during routine examination.

Slight sex differences in pain presentation have been found with women tending to display more signs and symptoms than men (Main & Waddell, 1984b). The presence of the behavioral signs has been shown to be moderately correlated with self-report measures of tendency to report somatic complaints and depression (Main & Waddell, 1982), weakly correlated with the MMPI (Waddell, et al., 1980), and appeared to be independent of medical diagnosis (Waddell, et al., 1980).

CLBP patients identified as displaying a large amount of medically incongruent pain (i.e., non-organic signs, non-anatomical representation in pain drawings, and inappropriate symptom endorsement) had been found to have received more specific treatments (i.e., analgesics, lumbar injections, orthodic supports, physiotherapy, spinal manipulation, and bedrest) upon admission to a back pain clinic than patients with moderate or little display of incongruent pain (Waddell, Bircher, Finlayson, & Main, 1984). Further, success rates in response to treatment have been found to be poorer for patients who display multiple incongruent pain signs than those who display no incongruent pain signs. Successful treatment outcome to various physical interventions (chemonucleolysis, lumbar surgery, graded exercise, and medication) was found to range from 4-48% for patients with multiple incongruent pain signs, and from 54-94% for patients
without incongruent pain signs (Dzioba & Doxey, 1984). Similarly, patients displaying medically incongruent pain have been found to obtain less pain relief from acupuncture and transcutaneous nerve stimulation (TNS) (Lehmann, Russell, & Spratt, 1983).

To summarize, there have been criteria proposed that allow for an operationalization of medically incongruent pain. Vague, physically incongruous, exaggerated pain as reflected in non-organic signs, pain drawings, and incongruent symptom report described by Waddell, Ransford and their colleagues may be preferred to the methods described by Hendler or Brena and his colleagues in determining incongruent pain because of better demonstrated reliability and validity. The following section has addressed some of the potential psychosocial mediators of incongruent pain expression.

Psychosocial Modulation of Pain

A number of psychological factors may come to determine or maintain incongruent illness behavior described above and serve to prolong suffering and distress associated with chronic pain. While there have been few attempts to empirically investigate psychological processes in individuals who present with incongruent pain there has been considerable research examining the interactions between cognitive, affective, and behavioral factors and their influence on the sensory aspects of pain. Central to this investigation is the idea that maladaptive cognitive coping, which increases affective distress and heightens expressions of pain, is characteristic of chronic pain patients who manifest incongruent pain. Elaboration of this hypothesis follows.
discussion below of some experimental and correlational investigations of cognitive, affective, and behavioral mediators in pain.

**Cognition and Pain.**

Cognitive perspectives emphasize the role of sensory information search, selection, and interpretation in determining the experience of pain. The role of covert processes in pain has been established in experimental investigations of induced pain (radiant heat, pressure, muscle ischemia, or electric shock) with non-clinical populations. Some general dispositional variations in cognitive processes have been found to be related to experimental pain tolerance. Greater pain tolerance has been associated with the tendency to intellectualize and actively cope with threatening external stimulation (Davidson & Bobey, 1970), and the tendency to be independent from external stimulus characteristics in making perceptual judgments (Alder, Gervasi, & Holzer, 1973). Manipulation of environmental parameters, of which cognitive interpretations or appraisals of pain are a function, have also been found to affect experimental pain tolerance. For example, presence of a tolerant model decreases pain report from induced pain while the presence of an intolerant model produces the opposite effect (Craig, 1978). In studies where subjects perceived that they could control either the intensity or timing of an aversive, painful stimulus, they were able to tolerate higher intensity shock (Bowers, 1968; Staub, Tursky, & Schwartz, 1971) and longer cold pressure exposure (Kanfer & Seidner, 1973) than those without the perceived control. Analgesic suggestions and instructions in cognitive coping strategies have increased tolerance to electric shock (Blitz & Dinnerstein, 1971).
Further, with experimentally induced pain, the manipulation of expectancies (Hall & Stride, 1954) and attention (Ahles, Blanchard, & Leventhal, 1983) have also resulted in increased pain tolerance. The manipulation of cognitive expectancies has produced both analgesic and hyperalgesic affects after administration of the same doses of nitrous oxide in response to tooth pulp stimulation (Dworkin, Chen, LeResche, & Clark, 1983).

Cognitive factors have long been recognized as playing a role in the maintenance or exacerbation of the chronic pain condition. Engle (1959) observed that the more complex the ideational activity and imagery involved in the description of pain, the more complex the 'psychic' processes in the pain experience. Szasz (1968) described 'l'homme douloureux' as having a career characterized by 'excessive' or 'too intense' attending to his pain. More recently, Craig (1984b) has outlined how attentional processes, memory, belief systems, and distorted cognitive appraisals can operate to maintain the pain experience and pain behavior. Indicators of conviction of disease and/or somatic focusing and preoccupation have been shown to be correlated with depression in chronic pain populations (Pilowsky, et al., 1977), and incongruent pain display (Main & Waddell, 1982), suggesting that cognitive processes are associated with affective disturbance and pain behavior in pain patients. The meaning attributed to chronic pain also has affective and behavioral consequences. Pain may be viewed as a threat to the individual, with associated meanings that he or she is now disabled, has lost independence, and has lost financial and physical security (Bellisimo & Tunks, 1984).
Considerable research has been directed toward understanding the cognitive processes and structures which guide peoples' understanding and interpretation of physical symptoms (Leventhal, Meyer, & Nerenz, 1980; Mechanic, 1976; Pennebacker, 1982). There would seem to be a relationship between the kind of mental 'schema' people have for interpreting, monitoring, and emotionally reacting to physical symptoms and the consequent actions they take in attempt to alleviate symptoms. It has been proposed that some chronic pain patients fail "to develop a cognitive system that allows for coping processes that more reasonably limit suffering" (Pinsky, 1979, p.314).

Weisenberg (1984) has argued that the amount of perceived control may be a crucial element in coping with chronic pain. How a person copes with a stressor, such as pain, is dependent on the persons' appraisal of threat, perceived consequences of the threat, and resources available to cope (Roskies & Lazarus, 1980). Belief systems influence cognitive appraisals and the emotional consequences that arise from the perceived threat (Beck, 1976). Therefore, beliefs about pain and the perception of control over pain may determine coping processes (Girodo & Wood, 1977).

In their attempts to cope, most people suffering from chronic pain have reported using some sort of cognitive strategy in addition to behavioral pain management strategies (Copp, 1974). Therefore, not surprisingly, covert processes have been described as targets for modification in individuals suffering pain (Turk et al., 1983). Cognitive strategies (reinterpretation of symptoms, distraction, dissociation, self-hypnosis) have become increasingly popular in the treatment and
management of both acute and chronic pain (Tan, 1982; Turk, et al., 1983; Turner & Chapman, 1982). However, as Weisenberg (1984) has pointed out, coping strategies are not sufficient for successful coping. Patients must believe: they have the skills to cope; that they are capable of using coping skills or strategies; and that their attempts to cope will have some effect on pain. In other words, self-efficacy (cf. Bandura, 1977) determines whether the person attempts to cope with or avoid exacerbations of their pain.

Individual differences in coping, adjustment, and pain behavior in chronic pain patients may reflect the operation of covert processes. A number of studies have found differences among CLBP patients on self-report measures of cognitive variables. Lefebvre (1981) has demonstrated that depressed CLBP patients make more cognitive 'errors' (catastrophizing, overgeneralization, personalization, and selective abstraction) than do non-depressed CLBP patients. Although depressed non-pain patients also make more cognitive errors, only the depressed LBP patients made specific errors concerning CLBP experiences. As with non-pain populations, this research was consistent in demonstrating that distortions in cognitive processes are associated with dysphoric mood (Beck, 1976).

A couple of recent investigations have illustrated the relationship between cognition and the musculature of CLBP patients. Mental stress tasks have been shown to increase EMG level in paravertebral muscles in CLBP and non-pain patients (Flor, Turk, & Birbaumer, 1985). However, in comparison to non-pain controls, CLBP patients show impaired return to baseline EMG levels after the end of the task. In
another investigation, CLBP patients without major pathological findings were compared to matched non-pain patients on controlled levels of physical exertion (Schmidt, 1985). CLBP patients were more likely to rate the physical exertion as distressing and indicative of tissue damage than matched non-pain controls.

Despite the recent development of cognitive-behavioral interventions in pain (Turk et al., 1983) and despite advances in cognitive assessment (described below) there have been few attempts to study the covert processes spontaneously employed by chronic pain sufferers. Two goals of cognitive approaches to pain management are to foster (a) reconceptualization and reappraisal of pain and (b) the development of self-control over dysfunctional thoughts, feelings, behavior, and physiological responses related to pain (Turk, et al., 1983). However, in order to test hypotheses implied by the cognitive model, that maladaptive cognitive processes mediate incongruent pain, the cognitive targets need to be identified and measured.

**Affect and Pain.**

Affective processes can accentuate or attenuate pain (Craig, 1984a). In investigations with experimentally induced pain, the manipulation of positive emotive imagery (Horan & Dellinger, 1974) has resulted in increased pain tolerance while manipulations designed to increase apprehension and anxiety have been shown to reduce tolerance (Nisbett & Schachter, 1966). Chronic pain has been reported to be closely associated with depression and to a lesser extent, anxiety, fear, and anger (Craig, 1984a; Sternbach, 1974). Such affective states may represent failure of physical, behavioral, and cognitive pain-coping
mechanisms resulting in greater helplessness, frustration, dependency, hostility, and interpersonal manipulation (Craig, 1984a; Fordyce, 1976; Rachman & Phillips, 1980).

While affective processes, like cognitive and expressive aspects of pain, are intimately involved with the experience of pain, they are not usually conceptualized as causal antecedents to pain. The affective dimension has been characterized as a loosely coupled, partially independent system that interacts with cognitive, behavioral, and physiological processes (Rachman & Hodgson, 1974). It is important to recognize the independent and interactive functioning of these processes in the pain experience since they may or may not covary when chronic pain conditions are assessed (Lethem, Slade, Tröup, & Bentley, 1983; Leventhal & Everhart, 1979; Melzack & Wall, 1983). Emotional distress has been described as associated with heightened anticipation, vigilance, rumination, and monitoring of pain (Craig, 1984a). Thus, affective states have been proposed to modulate the chronic pain condition independently of organic impairment or pathology (Blumer & Heilbronn, 1982).

While depression has been the most common affective state associated with chronic pain, research on the relationship between depression and chronic pain has been inconclusive. Pilowsky, Chapman, and Bonica (1977) found that only a small subset, approximately 10%, of chronic pain patients were depressed whereas others have reported estimates as high as 85% (Lindsey & Wykoff, 1981). Romano and Turner (1985) reviewed over 35 investigations exploring depression and chronic pain and found that because of a lack of adequately controlled studies
it was not possible to determine whether depression was actually more prevalent in chronic pain patients than in other chronic medical patients or healthy controls. These authors suggested that depression manifested itself in two different ways: concurrently with the onset of pain or after the onset of pain. Relatively few patients developed pain after the onset of depression.

As mentioned above, dysphoric mood has been associated with dysfunctional cognitive appraisal and maladaptive cognitive coping processes (Lefebvre, 1981). Depression has been found to be associated with incongruent pain behavior and symptom report (Main & Waddell, 1982). It was hypothesized here that pain-related cognitive activity mediates both dysphoric mood and incongruent pain.

Overt Behavior and Pain.

Studies with experimentally induced pain have demonstrated that the intensity of pain is closely related to non-verbal indices. Intensity of electric shock has been shown to be discriminable on the basis of facial expression and facial muscle movement (Lanzetta & Kleck, 1970; Patrick, Craig, & Prkachin, in press). Environmental manipulations designed to alter pain tolerance have also been found to produce changes in facial expression. Kleck et al. (1976) found less judged discomfort among subjects who were observed while shocked than those shocked while alone. Subjects who were shocked in the presence of a tolerant model were distinguishable from subjects shocked in the presence of an intolerant model by the relative infrequency of discrete facial movements (Prkachin, Currie, & Craig, 1983).
Environmental contingencies have been proposed as factors that maintain behavior associated with chronic pain independent of organic impairment or pathology. Fordyce (1978) has argued that 'pain' and 'pain behavior' are the same since, as a subjective experience, pain must be inferred from behavior. Pain behaviors were conceptualized as being either respondent or operant. Respondent pain behaviors were initially unconditioned responses to painful stimuli that, through association with previously neutral cues (such as posture or movement), became conditioned responses. Operant pain behaviors were instrumental and reinforced by their consequences. Pain behavior starts as a reflexive response to tissue damage then comes to be maintained by contingent events according to Fordyce (1976). Pain behavior in turn was proposed to result in avoidance and restriction of physical activities.

Pain behavior has consequences for other people since behaviors used to avoid and express pain are also a means of communicating distress (Craig, 1978; Engle, 1959) and may increase distress in the observer (von Baeyer, Johnson, & McMillan, 1984). Pain behavior as an instrumental means to elicit care-taking and sympathetic responses and to facilitate avoidance of responsibilities has also been demonstrated (Fordyce, 1976; Wooley, Blackwell, & Winget, 1978) and has been shown to be under contingencies such as staff attention (Redd, 1980) or attention from significant others (Block, Kremer, & Gaylor, 1980).

Financial incentives, such as disability payments, litigation awards, sometimes referred to as 'secondary gain', have been hypothesized to similarly reinforce pain 'behavior' (Brena & Chapman,
1981) although the interpretation of compensation status in pain is problematic since other variables may be spuriously associated with compensation status (Kremer et al., 1983). Nonetheless, because of the potential for reinforcing environmental contingencies, it is hypothesized that chronic pain behavior can be maintained independently of originating tissue damage and nociception (Fordyce, 1983). The nature of such reinforcing contingencies in a patients' environment may partially account for the considerable variation in pain behavior that has been observed across individuals, which ranges from very exaggerated displays of pain to absence of overt pain behavior (Steger, Fox, & Feinberg, 1980).

Incongruent pain may be manifest in individuals whose physical, pharmacological, behavioral, and cognitive coping resources have failed. Consistent with their greater levels of perceived distress, patients who fail to cope with chronic pain may exaggerate help-eliciting illness behavior (Wooley et al., 1978). In this way, increasingly salient behavior may become selectively reinforced as less 'dramatic' displays of pain fail to elicit desired responses from health-care providers. Pain behavior may also become more exaggerated in attempts to convince others of the 'reality' of the pain (Leavitt, 1985).

Conclusions.

It was proposed in this investigation, that there were differences between patients with pain deemed incongruent and those with pain deemed congruent or appropriate given the degree and nature of pathophysiology. Differences were expected to be manifested in the cognitive, behavioral, and affective processes, described above, that
modulate pain. Specifically, it was expected that differences between these patient groups would manifest themselves primarily in cognitive coping activity during the pain experience. Experimental work with induced pain has suggested that: (a) no one cognitive coping strategy is consistently better in increasing pain tolerance than the strategies subjects spontaneously generate; and (b) the presence of cognitions that serve to magnify noxious sensory input or accentuate lack of control are associated with reduced pain tolerance (Turk et al., 1983). The presence of cognitions that worsen the pain experience and the lack of spontaneously generated cognitive coping strategies were hypothesized as characteristic of the cognitive coping activity associated with exaggerated, anatomically incongruent pain presentation. Maladaptive cognitive coping was proposed to be associated with intolerance of pain, greater displays of pain behavior, and more affective disturbance.

A test of these hypotheses was dependent on accurate identification of incongruent pain patients as discussed previously, and on reliable and accurate assessment of the psychological mediators of the pain experience. Recent advances have been made in the assessment and measurement of the cognitive, affective, and behavioral influences on pain (Melzack, 1983b; Turk et al., 1983). The following section has addressed some of the issues and approaches to assessment of cognition, affect, and behavior in pain.
Multidimensional Assessment of Pain

The lack of correspondence between factors that modulate pain indicates the necessity of a multifaceted approach to assessment. Multidimensional models of chronic pain assessment have attempted to address cognitive, affective, and behavioral, components as well as pathophysiological components (Chapman, 1977; Keefe, 1982; Keefe et al., 1982). Chapman (1977), for example, included the following dimensions along which chronic pain should be assessed: noxious sensory, motivational-emotional, conceptual-judgemental, and social-cultural. Operationally, assessment targets have included overt motor behaviors, self-report, and physiological responses (Keefe, 1982).

Various writers have pointed to the need to refine assessment methods and demonstrate sensitivity to subgroup differences (Keefe, et al., 1982; Turk, et al., 1983). Multidimensional assessment has been the preferred approach for operationalizing and understanding differences among chronic pain subgroups and the complex associations between the different factors that contribute to the pain experience.

Psychometric indices of personality or pathological tendencies (i.e., traditional assessment approaches) may be too limited a methodology for understanding experiential and expressive aspects of chronic pain. It has been argued, for example, that traditional assessment approaches are trait oriented, have little face validity for patients, and are not designed specifically to be sensitive to processes that underlie individual pain experience (Keefe et al., 1982). Further, it has been observed that such assessment may provoke hostility and resentment by implying a psychological etiology to the pain (Leavitt, 1985).
Diagnostic assignment based on test scores provides limited information relevant to an individual's pain. For example, a measure of 'hypochondriasis' has multiple connotations and meanings and has been viewed as being vague as an explanation of what is influencing a patient's pain (Main & Waddell, 1982). On the other hand, proponents of psychometric assessment for chronic pain patients point out that such devices are empirically derived and have demonstrated adequate reliability and validity in most instances (Viernstien, 1982), and may be especially useful in detecting psychopathology. While traditional assessment tools have provided descriptive information about different pain patient subgroups (Sternbach, 1974), they have not been useful in providing information relevant to planning treatment strategies designed to facilitate coping with pain.

Part of the problem lies in the difficulty associated with measuring pain intensity and quality, the cognitive and affective processes that modify (and are modified by) the sensory experience, and the overt behavioral aspects of pain. Self-report measures have been used commonly in the assessment of chronic pain because of the assumption that only the individual has access to these private experiences. There is reason to believe, however, that self-report of actual ongoing overt or covert behavior is difficult to distinguish from post-hoc rationalizations (Genest & Turk, 1981; Nisbett & Wilson, 1977). Further, it has been argued that a number of factors, such as mood, medication intake, and environmental contingencies, can distort self-report and are particular to chronic pain populations (Kremer et al., 1983).
On the other hand, nonverbal and behavioral indices may be equally or more sensitive to some aspects of the pain experience and less subject to distortion (cf. Craig & Prkachin, 1983). Another promising assessment approach described below involves the 'in vivo' sampling of cognitive activity during induced pain. This may also be a more sensitive indicator of the clinical pain experience than retrospective accounts under different pain levels (Turk, et al., 1983) and perhaps less subject to distortion than other self-report indices.

Cognitive Assessment in Pain.

Experimental manipulations of environmental events and cognitive activity suggest that covert activity can increase or decrease tolerance to pain. Thus, Turk, et al., (1983) have proposed two broad classes of pain-related cognitive acitivity: (a) attempts to cope with the pain experience, and (b) cognitions that worsen the pain experience.

However, as mentioned above, describing pain sufferers in terms of covert processes has been hampered by the problem of measuring non-observable events. The experience of pain and the covert processes that accompany pain are subjective and usually private, therefore assessment has tended to be dependent on verbal report.

Self-report measures of coping activity during pain have been used to assess cognitions related to CLBP. Rosensteil and Keefe (1983) found that factors derived from items endorsed on their Coping Strategy Questionnaire predicted behavior, emotional adjustment, and pain ratings beyond patient history and other psychometric variables. Their findings support the notion that the tendency to catastrophize was related to anxiety and depression. Unexpectedly, this study also
found that higher endorsement of items on the 'cognitive coping' and 'suppression' factors were related to greater self-reported functional impairment. Perhaps this reflected distortion inherent in retrospective accounts of cognitive processes (Nisbett & Ross, 1980) or the possibility that coping skills per se are not as important as the belief and expectancies that they will be effective (Turk, et al., 1983).

One problem in measuring cognitive events is that self-report is dependent on a number of processes which cannot be assessed through introspection, hence reports of cognitive events as causal explanations or descriptions of thought patterns may be inaccurate for reasons that are voluntary or involuntary (Nisbett & Wilson, 1977). From an attribution theory perspective, Nisbett and Wilson (1977) demonstrated that an 'actor' may overlook or mistake actual cause and can be no more accurate than an 'observer' who does not have direct access to the actor's cognitions. Demand characteristics, social desirability influences, and availability heuristics all influence reports of covert processes (Genest & Turk, 1981; Nisbett & Ross, 1980). According to Kahneman and Tversky (1972; 1973), the process of making observations of causal connections depends on the availability and representativeness of information relevant to the event. To the extent that the heuristics used to explain the event are not representative, the verbal report will lack verity. Therefore, it is not always possible to distinguish post hoc rationalizations from accounts of 'actual' covert events. Even the process of verbalizing thoughts can change the 'actual' thought process (Mahoney, 1974).
Genest and Turk (1981), however, have argued that, under certain conditions, reactance to environmental influence and distortion and bias in self-report can be minimized. They have argued that there are differences between treating verbal reports of thinking as causal explanations of behavior and treating verbal reports of thinking and feelings as behavioral events of importance that can be dealt with as data. While there are limitations to the direct assessment of covert processes, Genest and Turk suggested that the biases in self-report can be limited by the use of open-ended questions, minimizing reflection through cueing, random sampling of self-report, and by asking for non-quantitative as opposed to quantitative judgements. Validity of cognitive assessment may also be enhanced by using multiple convergent assessment methods (Merrluzzi, Glass, & Genest, 1981).

Behavior reflecting cognitive activities (such as self-statements, coping strategies, beliefs, cognitive errors) have been suggested as important assessment targets which may be predictive of response to pain, ability to cope with chronic distress, and valuable in planning treatment strategies (Rollman, 1983). One way to elicit such targets is through a cognitive affective-functional analysis of the covert events that occur during the experience of pain (Genest & Turk, 1981; Turk, et al., 1983). The idea here is to delineate cognitive and affective antecedents, mediators, and consequent events that serve to maintain or exacerbate pain or pain related behaviors (cf. Hollon & Kendall, 1981). This has been accomplished in vivo by means of a 'behavioral trial' (Turk, et al., 1983) where cognitive behavior is assessed either in an open-ended fashion or through structured inventories in response to experimentally controlled noxious stimuli.
The goal of the cognitive affective-functional analysis in the assessment of pain sufferers stands in contrast to the psychiatric and traditional psychometric assessment models. In the former, the aim is to identify controlling variables, particular to the individual, to be modified. In the diagnostic model, the aim is classification to a diagnostic category or static personality structure (e.g., hypochondriasis, psychogenic pain, conversion reaction) (Goldfried & D'Zurillia, 1969). The functional analysis approach has the advantage of identifying individual treatment targets and of elucidating the individual's idiosyncratic experience (Hollon & Kendall, 1981).

The importance of this assessment approach has been illustrated in various investigations (Barber & Cooper, 1972; Kanfer & Goldfoot, 1966; Scott, 1978; Scott & Barber, 1977), which have found that individuals spontaneously use their own coping strategies when exposed to noxious stimulation regardless of the experimental manipulations. Turk, et al. (1983) found in their review of experimental investigations of cognitive strategies with pain, that in under half the studies, spontaneous strategies were as good as those provided by the experimenter. When coping strategies have not been experimentally manipulated, relationships between cognitive/affective activity and pain tolerance have been found. Alder and Lomazzi (1972) used an open ended interview and asked subjects what they did to cope with the induced pain. Ratings of subjects' use of coping strategies were significantly correlated with pain tolerance. Genest & Mann (1978) found that self-report reconstructions of the pain experience during pressor task were related to tolerance on this task. High tolerance
subjects indicated more power to persevere and were more convinced they could control their pain, while low tolerance subjects were more likely to catastrophize and express doubts that they could control their pain. Spanos, Radtke-Bodorik, Ferguson, and Jones (1979) categorized reports to open-ended questions after repeated cold water immersions. 'Catastrophizers' showed no evidence of incremental pain tolerance from the first to the second immersion, while 'non-catastrophizers' did show increased pain tolerance. Further, the magnitude of this increase was related to the number of coping cognitions employed such as imagery, distraction, and relaxing self-statements.

In an example of an 'in vivo' cognitive assessment approach with clinical populations, Arberger, Denney, and Hutchings (1983) exposed dysmenorrheic and non-dysmenorrheic women to a muscle-ischemic pain and analysed cognitions reported while under the induced pain. Although there was no difference between the groups on pain threshold or tolerance measures, the groups did differ in their report of what they were doing while experiencing the ischemic pain. The dysmenorrheic groups tended to 'exacerbate the pain', 'compare the pain' to other painful stimuli, and also 'cognitively redirect their attention' away from the pain more than the non-dysmenorrheic women. Assessment with cognitive behavioral trials can be used to distinguish accurate self-report data from potentially 'misleading' or erroneous self-report. In the Spanos et al. (1979) study roughly half of the sample were rated as including some sort of coping strategy. Interestingly, when coping subjects were asked if they had done anything to cope with the pain, only half reported that they had.
Therefore a number of subjects made misleading conclusions concerning their own cognitions. Subjects have also been found to be inaccurate in predicting how different cognitive activities affected pain. Johnson (1973) induced ischemic pain with a blood pressure cuff after subjects were given instructions in distraction and dissociation strategies (involving attention to sensations) and asked to predict which would be more effective. Most subjects chose the distraction strategy as the one most effective, yet ratings with the blood pressure cuff indicated that the dissociative strategy was the most effective.

Thus, cognitive 'sampling' during the experience of pain appears to be a more accurate data source than subjects own conclusions about their cognitive activity. Further, cognitive/behavioral trials also have the advantage of simultaneously providing important behavioral data on pain tolerance as has been described below.

Experimental Pain Induction with Pain Patients.

A considerable number of variables have been found to be related to pain tolerance and pain threshold in non-clinical populations (Weisenberg, 1977). Covert phenomena relevant to chronic pain have been investigated using induced pain methodology. For example, cognitive processes may be an important mediator of a 'hypervigilance' to pain (cf. Chapman, 1978). Hypervigilant individuals may actively and selectively search for sensations indicative of pain. Malow, Grimm, and Olson (1980), found that myofascial pain dysfunction sufferers reported lower pain thresholds than non-pain controls with pressure induced pain. They also found that the lower the threshold the less likely they were to improve in treatment.
However, in contrast to this model, an 'adaptation' model predicts that chronic pain sufferers should have higher thresholds than non-pain controls (Rollman, 1977). When externally induced experimental pain is 'compared' to internal discomfort it is perceived as less severe. Some research employing experimentally induced pain in LBP populations has supported this model. Naliboff, Cohen, Schandler, and Heinrich (1981) found higher radiant heat thresholds in low back pain patients than in non-pain patients and normal controls. Rollman (1983) has suggested findings in support of the 'hypervigilance' notion may be a function of greater affective involvement in those patient samples studied. These investigations have demonstrated the utility of using experimental pain induction methods to test hypotheses concerning covert processes.

Because variability in performance on induced pain tasks has been shown to be a function of cognitive variables, it is not surprising that behavioral pain tolerance trials have been shown to be related to treatment effects, treatment outcome, and various patient characteristics. Malow and Olsen (1981) found decreased sensitivity to pain threshold in successfully treated chronic pain patients, but not in unsuccessfully treated patients. Sternbach (1974) has used a muscle ischemic technique to derive a pain ratio, based on a comparison between the patients' back pain, the muscle ischemic pain and the patients' pain tolerance. The derived ratio has been shown to decrease after treatment. Pope et al. (1980) found that a group of back pain patients who were intolerant of pain, as assessed by the muscle ischemic procedure, demonstrated reduced spinal mobility, straight leg raising, and altered flexor-extensor muscle balance compared to a pain
tolerant group. Similarly, the role of affect states in pain has been explored with experimentally induced pain. Timmermans and Sternbach (1976) found that the reported intensity of pain as measured by a muscle-ischemic pain ratio was greater in depressed pain patients. Research on non-pain depressed subjects, however, has demonstrated both increased tolerance (Davis, Buschbaum, & Bunney, 1979) and decreased tolerance (Ganchrow, Steiner, & Kleiner, 1978) on a cold pressor task when compared to non-pain non-depressed subjects.

Each pain induction procedure has advantages and limitations for assessment applications. For example, one limitation of muscle ischemic procedures has been the prolonged exposure required to achieve tolerance. Having a ceiling on exposure time, in order to prevent tissue damage, may reduce the sensitivity to group differences (Sternbach, Deems, Timmermans, & Huey, 1977). Further, subtle variations in the ischemic muscle task have been shown to alter tolerance substantially (Moore, Duncan, Scott, Gregg, & Ghia, 1979) and there have been demonstrations of a lack of a linear relationship between pain estimate and elapsed time (Fox, Steger, & Jennisen, 1979). On the other hand, both individual variability in tolerance and the overall mean time taken to reach tolerance is less for cold-pressor procedures. However, tolerance on the cold pressor can be affected by thickness of subcutaneous fat and standardization of temperature makes the administration more difficult. Therefore, induced pressure pain was chosen in this investigation because of the ease of administration, standardization, and production of sensations more akin to skeletal nociception than ischemic or temperature pain. The pressure pain procedure has been outlined in the methods section below.
Overt, Nonverbal, Behavioral Aspects of Pain.

Pain behavior and expressive displays serve a communicative function (Craig, 1978; Fordyce, 1978). Pain and distress behavior engages health care providers and significant others to help relieve discomfort and distress. These, therefore, have been identified as important assessment targets since these behaviors serve to maintain maladaptive chronic pain responses (Johnson, 1977; Wooley et al., 1978).

The subjective experience of pain can be inferred from verbal and non-verbal behavioral indicators of discomfort and distress or avoidance of stimuli which produce those signs (Fordyce, 1978). Fordyce (1976) has argued that verbal reports are subjective, therefore not verifiable, and subject to distortion along the lines previously discussed. Overt behavior, however, is observable and publicly verifiable and therefore constitutes a less distorted index.

Non-verbal behaviors such as paralinguistic vocalizations, autonomic reflexes, facial expressions, gesticulations, and postural adjustments have been used routinely in the clinical assessment of pain (Craig & Prkachin, 1983). Because of distrust of self-report among clinicians and the general public, non-verbal indicators are more likely to be relied upon in judging the severity of pain. A preference for non-verbal indicators was indicated in a study by Johnson (1977) who found that nurses reported physiological signs, body movements, and facial expression to be easier indexes to use in pain assessment than verbal communication. Others have pointed to the necessity of assessing verbal and non-verbal behaviors simultaneously (Bookwater,
Johnson, & Volkert, 1978). The discrepancy between verbal report and non-verbal behaviors has been observed to be greater in chronic pain patients than in acute pain conditions (Teske, Daut & Cleeland, 1983). It has been demonstrated, for example, that chronic pain patients will report higher levels of pain to a neurosurgeon than to a psychologist or to a psychiatrist within the same hour (Ignelzi, Atkinson, & Kremer, 1980).

Even though overt behaviors are objective and verifiable, inferences drawn regarding these behaviors remain problematic. Contextual or individual difference variables may affect exaggeration or attenuation of expressions or behaviors conveying pain (Craig & Prkachin, 1983). Even though non-verbal behaviors are observable, they are also subject to distortion (Craig & Prkachin, 1983; Turk, et al., 1983). Also, observers can make erroneous judgements based on pain expression (Jacox, 1980; Prkachin, Currie, & Craig, 1983). Clinicians may use 'acute' pain signs of discomfort and distress when these may not be sufficient, or applicable to 'chronic' pain (Johnson, 1977) or actually covary with the pain experience. This is why there is a need for "standardized samples of patient behavior" (Fordyce, 1983) and a need for coding systems to assess pain and the empirical validation of these systems (Craig & Prkachin, 1983; Prkachin, Currie, & Craig, 1983).

Some attempts have been made at using standardized behavioral assessment systems with CLBP patients. Keefe and Block (1982) developed a reliable observation system to assess the occurrence of pain behaviors (i.e., guarded movement, bracing, rubbing, grimacing, &
sighing) in a standard 10 minute assessment session. The frequency of discrete pain behaviors was shown to be correlated with patient and independent observer ratings of pain intensity. Further, the frequency of these behaviors has been shown to decrease with treatment and is correlated with change in pain ratings. Seres and Newman (1976) used standard range of motion and body position measures as a criterion of CLBP behavior. These behavioral indicators were also found to improve with treatment. Hyde (1986) examined facial expression using the Facial Action Coding System (FACS) in CLBP patients undergoing painful physical range of motion exercises. While no effect was found for instructions to exaggerate or attenuate expressions, there was a tendency for women to receive higher ratings of global facial expressiveness than men. Global expressiveness was also found to correlate with the use of affective pain descriptors, duration of the pain complaint, and severity of disability.

Assessment with Verbal Descriptors.

Adjective descriptors of the pain experience have been used to assess the subjective experience of pain (Melzack, 1975; 1983a). There appears to be support for distinct groupings of verbal pain descriptors roughly corresponding to sensory, affective, and evaluative components of the subjective pain experience (Melzack, 1975). Further, the pattern of verbal pain description has been shown to differentiate, to some extent, different pain syndromes (Dubuisson & Melzack, 1976). Experimental pain induction research has shown that individuals can reliably discriminate and rate differentially the sensory and affective components of their pain experience (Johnson, 1973). Further, it has
been shown that analgesics can differentially affect sensory and affective verbal rating descriptor scales (Gracely, McGrath, & Dubner, 1978; 1979).

As affective distress increases, verbal pain description becomes more 'diffuse', reflecting a number of dimensions related to suffering, and less to the specific sensory qualities of pain (Kremer & Atkinson, 1983). Affectively laden verbal pain descriptors may reflect more emotional or personality disturbance (McCreary, 1983). Investigations have found that psychological disturbance in CLBP patients, as indicated by the MMPI, was associated with endorsement of pain descriptors emphasizing affective and evaluative dimensions rather than sensory dimensions (McCreary & Turner, 1983; Kremer & Atkinson, 1983).

Conclusions.

Measurement of pain relevant thoughts, feelings, and behaviors is a minimum requirement for adequate assessment of the 'multidimensional' chronic pain experience. It was proposed that measures of cognitive/affective processes during pain, experimental pain tolerance, overt pain behavior, and verbal descriptors would constitute an assessment battery that was comprehensive and adequately sensitive to variables hypothesized to mediate and maintain incongruent chronic pain.

In contrast to the assessment approaches outlined above, some research on CLBP with traditional psychometric instruments has been addressed below. Also, as CLBP patients were the focus of this investigation, some general research and background information about this chronic pain condition has been reviewed in the following section.
Chronic Low Back Pain

Background to the Problem.

PREVALENCE. Chronic low back pain is the leading cause of physical limitations and disability in persons under 45 years of age (Flor & Turk, 1984). Nagi, Riley, & Newby (1973) surveyed 1100 adults in the U.S. and found 18% reported persistent backache. Of these, 44% reported that backache resulted in significant impairment of their ability to work. Backache sufferers also indicated a level of health care utilization which was twice that of individuals with other functional impairments and of individuals without backache.

It has been estimated that 60-80% of people will suffer from significant back pain at some point in their life (Flor & Turk, 1984; Kelsey & White, 1980), although most will experience relief without health care intervention (Nachemson, 1976; Waddell, 1982). Yet, of patients whose pain persists for more than 6 months, only 50% have been found to return to work (Calliet, 1981). In addition, it has been estimated that of 1.25 million in the United States who suffered a back injury in one calendar year, 65,000 were permanently disabled (Beals & Hickman, 1972).

The economic impact of CLBP has been substantial. In a study of over 10,000 compensable injuries in Washington state in 1977, 25% were found to be back related (Loeser, 1980). However, these same injuries accounted for 36% of the compensation payments made in that year. The cost of chronic back disorder including work lost and health care costs has been estimated at $17.6 billion annually in the U.S. (Bonica, 1980) and 1 billion pounds annually in the U.K. (Waddell, 1982).
ETIOLOGY. As with other chronic pain conditions, CLBP appears to have multiple etiologies. The physical etiology of CLBP has often been elusive for a significant proportion of sufferers. The primary physical cause of CLBP has been proposed to result from abnormal activity in nerve root fibers due to slight changes in the surrounding vertebrae and tissues (Melzack & Wall, 1983). According to Flor and Turk (1984), this physical pathogenesis has been assumed to result from (a) degenerative processes (primarily of the intervertebral discs), (b) structural abnormalities, (c) muscular and ligamentous dysfunction, (d) traumatic injury and occupational factors, and (e) inflammatory conditions.

It has been estimated, however, that as many as 60-78% of patients who suffer CLBP have no apparent pathophysiological basis for their pain (Loeser, 1980; Melzack & Wall, 1983). Some CLBP, for which objective evidence of an organic condition is lacking, has been attributed to undiagnosed abnormalities of the spine (Gunn & Milbrandt, 1978) or hyperreactivity of the musculature of the back (Dolce & Raczynski, 1985; Flor et al., 1985). Still, epidemiological surveys of backache in general medical practice have found the condition to be more closely associated with episodes of anxiety and depression and more emotionally stressful life events than other physical impairments (Frymoyer et al., 1980). Thus, various psychological models of pain have been proposed to explain chronic back pain (Turk & Flor, 1984): (a) psychodynamic models (cf. Engle, 1959), (b) family and systems models (cf. Waring, 1977), (c) respondent conditioning models (cf. Gentry & Bernal, 1977), (d) operant learning models (cf. Fordyce,
1979), (e) social and observational learning models (cf. Craig, 1983), and (f) cognitive-behavioral models (cf. Turk et al., 1983). These psychological perspectives are by no means mutually exclusive as considerable overlap between the models exists. To date, research does not suggest overwhelmingly any one particular model of physical or psychological pathogenesis of CLBP (Murray, 1982).

TREATMENT. Somatic treatment for the alleviation of CLBP has had mixed success. Long term success rates for surgical intervention averages between 30-40% (Flor & Turk, 1984) while success with medication occurs in roughly 60% of cases (Melzack & Wall, 1983) but may be as low as 10% after 5 years (Gottlieb, et al., 1977). Studies with other somatic-based treatments, such as steroid injections, chemonucleolysis, nerve blocks, and physical therapy, have reported success rates in excess of 50% (Flor & Turk, 1984).

The outcome of psychologically-based therapies for CLBP is promising but inconclusive. While impressive results have been reported, with up to 75% of chronic patients successfully treated with operant approaches (Anderson, Cole, Gullickson, Hudgens, & Roberts, 1977; Cairns, Thomas, Mooney, & Pace, 1976), no controlled studies have been undertaken. Uncontrolled studies of EMG biofeedback and relaxation have demonstrated success rates of up to 60%, but there have also been equivocal results in controlled outcome studies (Turk & Flor, 1984). Promising cognitive-behavioral approaches have produced effects lasting for 2 years and have been found to be superior to relaxation and no treatment controls (Turner, 1982).
Comprehensive treatment packages including both somatic and psychologically based treatments have produced the most favorable results but there clearly are problems in specifying the source of the changes. Success rates of up to 79% demonstrating unimpaired physical functioning at discharge and 82% demonstrating return to work or training have been reported at a 6 month follow-up (Gottlieb, et al., 1977).

Interpretation of any treatment outcome results must be undertaken cautiously since methodological problems abound. There has been considerable variation in the length of follow up, type of outcome measures used, type and amount of treatment, as well as flaws such as subject self-selection to treatment; inadequate controls, and unvalidated dependent measures (Dolce, 1984). Flor and Turk (1984) have also noted that just about any form of intervention works for acute back pain. The necessity of adequate controls in demonstrating treatment effects is obvious since it has been shown that with conservative management alone (usually consisting of bedrest), as many as 50% have reported relief from pain (Gottlieb, et al., 1977). Further, it has been estimated that 30% of all procedures and treatments for backache provide a "placebo" response that can last up to 3 months (Waddell, 1982).

Regardless of outcome research design problems, etiology still cannot be inferred on the basis of treatment outcome. For example, some somatically based treatments may work because they provide psychological support or are interpreted by patients as "fixing" the problem. Conversely, some psychologically based treatments may work
because they remove resistance and enhance cooperation and compliance to medical treatment regimens which alter the back pain condition.

Another problem with treatment outcome studies, and which is most relevant to this investigation, has been the tendency to emphasize 'similarities' among patients with CLBP as opposed to 'differences'. One issue that has received little attention is the adherence to a 'uniformity myth' with respect to pain patients in general (Turk, et al., 1983) and CLBP patients in particular (Block, 1982; Flor & Turk, 1984; Fordyce, 1976; Turk & Flor, 1984). Most importantly, there are clear differences in the pathophysiological mechanisms underlying different CLBP groups (Block, 1982; Flor & Turk, 1984). Some of the psychological literature, however, has fostered homogeneous conceptions of these patients such as the "low-back loser" (Sternbach, Wolf, Murphy, & Akeson, 1973) or the 5"Ds" (i.e., Drug misuse, Dysfunction, Disuse, Depression, & Disability) (Brena & Chapman, 1981). Back pain is multiply determined and varies in manifestation from one individual to the next (cf. Sternbach, 1974). This observation points to the value of psychological assessment research addressing psychological mechanisms and subgroup differences such as the CLBP patients who present with incongruent pain since identification of this patient subgroup has important implications for treatment and patient management (Waddell et al., 1984).

Subgroups of CLBP Patients.

Psychological factors in the maintenance of chronic pain disabilities would appear to be important because they may serve to undermine surgical and rehabilitation efforts in CLBP. For instance, a
number of studies have shown psychometric test scores to be predictive of response to surgical intervention for backache (Hanvik, 1951; Kuperman, Golden, & Blumer, 1979; Oostdam, Duivenvoorden, & Pondaag, 1981; Pheasant, Gilbert, Goldfarb, & Herron, 1979; Wilfling, Klonoff, & Kokan, 1973; Wiltse & Rocchio, 1975). However, the 'hit rate' or accuracy of these predictions may be too low to warrant reliance on test score indicators in individual cases (Murray, 1982). Some studies have demonstrated better predictive power with the inclusion of medical history and demographic variables (Oostdam & Duivenvoorden, 1983). Research examining the use of the psychometric tests to predict response to conservative medical interventions (i.e., bedrest, analgesic medication) however has not yielded consistent results (McCreary, Turner, & Dawson, 1979).

Psychometric test scores have been used to identify subgroups of patients that cluster together. Using the MMPI, clinically elevated and unelevated clusters for male and for female CLBP patients have been found (Bradley, 1983). The group exhibiting more psychopathology demonstrated more contact with health care professionals and rated their pain as more intense in both the male and female groups. Further, males in the elevated groups had higher rates of medication consumption and utilized more treatment resources. Other investigations have found similar clusters, with restricted physical and social activity (Armentrout, Moore, Parker, Hewitt, & Feltz, 1982), increased duration and hospitalization (McGill, Lawlis, Selby, Mooney, & McCoy, 1982), and poor response to treatment (McCreary, 1985) associated with the clinically elevated MMPI scale clusters. McCreary (1985) has
characterized the back pain patients identified by the elevated scale clusters as having a "more intense pain portrayal".

Some of the earliest work with self-report assessment of CLBP examined differences between back pain patients with orthopedic, radiologic, and/or neurologic signs indicative of organic pathology and those without such signs. Hanvik (1951) devised a scale from the MMPI to differentiate these groups although subsequent work has not found the scale to be a useful discriminator (Freeman, Caslyn, & Loucks, 1976). Subsequent investigations have found that CLBP patients with organic signs endorse different adjectives to describe their pain and to describe their pain as less intense (Leavitt, Garron, D'Angelo, & McNeill, 1979) and to have lower scores on scales of recent life stress (Leavitt, et al., 1980) in comparison to patients without demonstrable organic disease.

Rosen, Frymoyer, and Clements (1980) compared two CLBP dimensions: presence vs absence of organic signs and incongruent vs appropriate levels of functional disability. While no MMPI scales were significantly associated with organicity status, there were significant correlations between the presence of functional disability and scale scores, suggesting that the MMPI scale scores are independent of organicity status, but associated with degree of disability. In a mixed pain patient group, including CLBP, Swanson and Maruta (1980) utilized observational measures in addition to self-report. They found high ratings of extreme pain, with little variability over time, were not related to orthopedic or neurological diagnosis and were not related to type of pain problem. Extreme constant pain was related to the
chronicity of the disability, longer duration of pain, higher number of pain related operations, and higher ratings of facial and body pain behaviour.

Conclusions. While demonstrations of CLBP subgroup differences along psychological dimensions are interesting, there are limitations in the interpretations that can be drawn from this research. More often than not, objective and replicable indicators of organic disease/impairment and criteria for the determination of 'functional' disability have not been specified. For the most part, organicity has been determined by subjective estimates which, in other investigations (Fordyce et al., 1978), have been found to lack interrater reliability. Further, many of these studies rely solely on self-report measures. Still, research on treatment outcome, profile clusters, and patients who lack evidence of organic disease, support the idea that dysfunctional psychological processes are associated with greater distress, exaggerated pain display, and difficult patient management.

Hypotheses and Design

Medically incongruent pain presentation criteria (non-organic signs, inappropriate symptoms, and exaggerated pain drawings) provide a replicable means of identifying CLBP patients whose subjective pain experience may be relatively independent of pathophysiology. Identification of patients based on inclusionary criteria was a departure from previous research paradigms in which the 'psychologically' involved CLBP patients were determined according to the absence of organic signs to account for back pain. Thus, it was assumed here that the
presence of replicable incongruent pain signs would be a better indicator of the operation of dysfunctional psychological processes than a lack of positive organic signs. A number of hypotheses were proposed to differentiate the control pain from the incongruent pain groups:

1. It was hypothesized that CLBP patients who display incongruent pain signs were more likely to engage in dysfunctional cognitive processes related to the search, selection, and interpretation of sensory information concerning pain. When compared to patients who did not display these signs, patients who displayed incongruent pain signs were hypothesized to engage in more catastrophizing (pain amplifying or worsening cognitions) and less coping or pain ameliorating cognitions. Measures of cognitive activity concerning pain were expected to be the primary discriminators between incongruent pain and control CLBP patient groups. Further, since different methods of assessing cognitive activity may be subject to different sources of measurement error (Genest & Turk, 1981), both retrospective accounts of cognitive activity and accounts elicited in the induced pain cognitive assessment trials were used to assess cognitive activity.

2. If dysfunctional cognitive processes concerning pain sensations mediate the incongruent pain presentations, then it was expected that different verbal descriptions of pain would be apparent in the patients who display these signs. It was expected that subjective estimates of pain intensity would be higher, and that
the patients with incongruent pain signs would use more affectively-laden pain descriptors because they were expected to engage in more catastrophizing concerning their pain. Subjective report of suffering was also expected to be reflected in greater levels of depression.

3. Because non-verbal behavior has been described as an indicator of pain experience that is sensitive and less subject to distortion than self-report (Craig & Prkachin, 1983), it was expected that a greater frequency of discrete pain behaviors would be displayed in CLBP patients who present with incongruent pain in comparison to control pain patients, corresponding to the amplification of pain sensation and exaggeration of distress in the former group.

4. Since the use of coping strategies and the presence of catastrophizing cognitions has been shown to affect pain tolerance with induced pain (Turk, et al., 1983), patients who display incongruent pain were also expected to tolerate noxious sensory stimulation for a shorter interval than patients who did not display incongruent pain.

5. Finally, since there has been evidence of sex differences in the manifestation of these clinical signs (Main & Waddell, 1984b), sex differences in the tolerance of pain (Weisenberg, 1977), and sex differences in expressiveness of pain in CLBP patients (Hyde, 1986), these differences were expected to be accentuated in women who present with incongruent pain criteria.
The dependent variables were analyzed in a 2 X 2, pain presentation by sex, design. Groups were determined according to presence or absence of multiple non-organic physical signs (Waddell, et al., 1980), incongruent symptom report (Main & Waddell, 1984a), or exaggerated pain drawing scores (Ransford et al., 1976). This design was, in actuality, a quasi-experimental design, since, obviously, the pain presentation status and sex could not be manipulated. While 'correlational' results do not imply causality, a causal assumption does imply a correlation (Campbell & Stanley, 1963). The causal assumption here was that cognitive processes were 'prior' determinants of incongruent pain presentation. Since any number of variables could account for a spurious relationship, an attempt was made to rule out potential confounding variables that correlated with incongruent pain criteria such as chronicity, compensation, socio-economic status, degree of physical impairment/disability, and other pain history and demographic characteristics.

Following the assumption of the cognitive/affective functional assessment model, it was assumed that the typical covert behavior of a CLBP sufferer would be reflected in his or her response to a standard noxious sensory stimulus. Patients were exposed to a standard noxious stimulus, and pain tolerance and cognitive reports assessed including: (a) 'catastrophizing' cognitions (i.e., those that amplify or focus on the pain), (b) cognitions reflecting a lack of control, helplessness, or inability to persevere, and (c) the cognitive coping strategies used (Genest, 1978). A self-report measure of coping strategies patients use for their CLBP was also included (Rosenstiel & Keefe, 1983). An
observational assessment of pain behavior under standardized conditions was also undertaken (Keefe & Block, 1982), to assess whether pain behaviors were associated with the presence of incongruent pain signs. Patients also completed self-report measures of depression (Beck, Ward, Mendelson, Mock, & Erbaugh, 1961) and verbal pain descriptors (Melzack, 1975) to assess these hypothesized differences.
METHOD

Subjects

CLBP patients were recruited from the Back Pain Clinic (BPC) at Shaughnessy Hospital in Vancouver, British Columbia. The BPC is a comprehensive assessment centre that receives referrals from general practitioners, medical specialists, Workers’ Compensation Board, and insurance companies in order to: determine potential for surgical, rehabilitation, or other interventions; determine the nature and degree of impairment; and provide plans for patient management. Consecutive admissions between January and July of 1985, who satisfied the following criteria: (a) were between 20-60 years of age, (b) had a primary physical complaint of persistent pain in the lumbosacral region of the back, (c) demonstrated sufficient command of English to complete the questionnaires, and (d) provided consent to participate, formed the subject pool for this study. The first 20 patients meeting these criteria were chosen for each of the four patient groups described below. A total of 80 patients, 40 men and 40 women, were included in the final data analysis. Thus, 20 patients of each sex displayed criteria for incongruent pain presentation while 20 patients of each sex did not display the criteria for incongruent pain presentation as described below. Two patients in the continuous clinical series of those approached who satisfied the criteria refused participation in the study.

The mean age of the patient sample was 39.8 years (SD=10.5; range 21-59 years). Mean self-reported duration of the pain problem, or
chronicity, was 8.8 years (SD=7.6; range 1-30 years). Over 61% (n=49) of the sample had no previous surgery. Twenty-one percent (n=17) had one previous back-related surgery, and 17% (n=14) had two or more previous back-related surgeries.

Of the total, 28% (n=22) were receiving compensation or disability payments while 25% (n=20) were pursuing either Workers' Compensation adjudication or litigation related to their injury. Since some patients were receiving both disability payments and were pursuing adjudication or litigation, when combined 41% (n=33) of the sample had some financial disincentive for recovery at the time of the assessment.

Socioeconomic status was determined on the basis of Blishen's index of Canadian occupations (Blishen & McRoberts, 1976). The overall mean on this index was 38.9 (SD=13.5). On the basis of class intervals proposed by Blishen and McRoberts (1976), percentages of occupational categories were as follows: 33% (n=26) were unskilled, 26% (n=21) were semiskilled, 19% (n=15) were skilled trades level, 14% (n=11) were semi-professional, and 9% (n=7) were classified as professional. Only 9% (n=7) were unemployed at the time of the assessment. Of the rest, 73% (n=58) had full or part-time employment, 15% (n=12) were homemakers not seeking competitive employment, and 4% (n=3) were enrolled in training or educational programs. This suggested that the sample represented a relatively high level of occupational functioning given the average chronicity of the back pain.

With respect to ethnic composition, 77% (n=62) were caucasian anglophones. For 18%, English was their second language, but they were able to demonstrate a command of the language by completing a
valid MMPI unaided, a test which requires a minimum grade 8 education. In total, 57% (n=46) were in a marital or common-law relationship while the remaining 43% (n=34) were single, separated, divorced, or widowed.

Physical impairment, expressed as the percentage of functional loss was calculated for all patients based on physical examination criteria outlined below (Waddell & Main, 1984). Mean percentages for the sample were 18.5% (SD=8.2) for men and 14.2% (SD=6.1) for women. This was roughly equivalent to means reported for a sample of problem back pain referral patients by Waddell and Main (1984). Medication reported being consumed on a regular basis was coded as to the pharmacological action of the drug as determined by the Canadian Compendium of Pharmaceutical Specialties (1985). Since some medications had more than one type of pharmacological action, they were coded in more than one category. In the patient sample, the breakdown for medication consumption was as follows: 70% (n=56) non-narcotic analgesics; 43% analgesics with narcotic content; 18% (n=14) anti-inflammatory analgesics; 11% (n=9) antidepressants; 23% (n=18) sedatives; 14% (n=11) muscle relaxants; 16% (n=13) anxiolytics. Almost 19% (n=15) reported taking no medication.

Table 1 shows the breakdown by primary diagnostic category and secondary diagnoses and/or contributing factors as reported in the medical assessment. Of interest to note is that almost 24% of the primary diagnostic assignments were anatomically non-specific (i.e., behavioral/psychological). Iatrogenic CLBP was diagnosed in 12.8% of all patients and in 32.3% of patients with previous surgery. Of the total sample, 45% (n=36) were judged to have some contributing factor
Table 1: Percentage Breakdown of Diagnoses in the Patient Sample

<table>
<thead>
<tr>
<th>Primary Diagnostic Assignments</th>
<th>Secondary Diagnostic Assignments &amp;/or Contributing Factors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mechanical LBP</td>
<td>Depression</td>
</tr>
<tr>
<td>15.0</td>
<td>23.8</td>
</tr>
<tr>
<td>Facet Joint Related</td>
<td>Physical Deconditioning/Inactivity</td>
</tr>
<tr>
<td>13.8</td>
<td>16.3</td>
</tr>
<tr>
<td>LBP Unknown or No Clear Findings</td>
<td>Facet Joint Related</td>
</tr>
<tr>
<td>13.8</td>
<td>10.0</td>
</tr>
<tr>
<td>Soft Tissue Sprain/Injury</td>
<td>Psychological Overlay</td>
</tr>
<tr>
<td>11.3</td>
<td>8.8</td>
</tr>
<tr>
<td>Chronic Pain Syndrome</td>
<td>Drug Abuse/Dependancy</td>
</tr>
<tr>
<td>6.3</td>
<td>8.8</td>
</tr>
<tr>
<td>Discogenic LBP</td>
<td>Pain in the Setting of</td>
</tr>
<tr>
<td>6.3</td>
<td>7.5</td>
</tr>
<tr>
<td>Degenerative Disc</td>
<td>Previous Surgery</td>
</tr>
<tr>
<td>5.0</td>
<td>3.8</td>
</tr>
<tr>
<td>Pain in the Setting of</td>
<td>Obesity</td>
</tr>
<tr>
<td>Previous Surgery</td>
<td>5.0</td>
</tr>
<tr>
<td>3.8</td>
<td></td>
</tr>
<tr>
<td>Fibrocytis</td>
<td>Soft Tissue Strain/Injury</td>
</tr>
<tr>
<td>3.8</td>
<td>3.8</td>
</tr>
<tr>
<td>Disc Protrusion</td>
<td>Spondylolithesis</td>
</tr>
<tr>
<td>3.8</td>
<td>3.8</td>
</tr>
<tr>
<td>Spinal Stenosis</td>
<td>Scoliosis</td>
</tr>
<tr>
<td>2.5</td>
<td>2.5</td>
</tr>
<tr>
<td>Spondylolithesis</td>
<td>Chronic Pain Syndrome</td>
</tr>
<tr>
<td>2.5</td>
<td>2.5</td>
</tr>
<tr>
<td>Other</td>
<td>Leg Length Discrepancy</td>
</tr>
<tr>
<td>7.5</td>
<td>2.5</td>
</tr>
<tr>
<td></td>
<td>Other</td>
</tr>
<tr>
<td></td>
<td>7.5</td>
</tr>
</tbody>
</table>

Note: n=77 (3 missing diagnoses)

that was anatomically non-specific in nature. Thirty-nine percent of the sample had a specific identifiable-anatomical CLBP condition without associated or contributing behavioral/psychological factors.

Equipment

Pain behavior was video-taped with an RCA Colorvision Camera Model No. CC077, with a built-in microphone, and a Panasonic Omnivision II VHS video cassette recorder. Audio dubbing, for the preparation of cueing standard time sampled intervals, was done with a Panasonic AG6300 VCR which was capable of 2-channel audio recording. Verbal reports elicited during the structured interview were audiotaped
with a Sanyo cassette tape recorder, Model No. M1001. Timing was done with a Chronus 3-S digital display stopwatch. The apparatus used to apply pressure pain to the second phalanx of the index finger of the dominant hand was constructed from acrylic plastic similar to specifications reported by Forgione and Barber (1972). Lead weights were added to the lowered arm to produce a pressure of 1500 gms at the point where the wedge contacted the finger.

Procedure

The standard assessment procedure at the BPC involved a comprehensive assessment by one of 3 'teams' which included a general practice physician, orthopedic specialist, psychologist, and physiotherapist. Demographic and pain history data were obtained from the BPC team psychologist's intake regarding the patient's age, occupation, number of previous surgeries, current medication intake, duration of CLBP problem, location of pain, disability allowance, and pending litigation. The psychologists followed an interview schedule in conducting their assessment.

The entire team assessment was scheduled over a 2-3 day period. Inbetween assessments, patients were asked if they would be willing to participate in an additional assessment procedure for research purposes. Patients were given an information and consent form (Appendix A) describing the research and describing what the 20 minutes of additional assessment procedures involved. The research was described as requiring (a) a brief questionnaire asking them about how they cope with their pain, (b) an assessment of the sensations and
feelings they would experience in a standardized pain experience (i.e., placing a weighted wedge on their index finger for as long as they could); and (c) video-taped assessment of their ability to move in different positions. The information and consent form given to patients indicated: (a) that the experimental assessment results were to be used for research purposes and kept confidential by the researchers; (b) that participation in the experimental pain assessment procedures was voluntary and that they could decline to participate at any time; and (c) that they could contact the researchers for additional information. Permission to access additional medical examination information, for research purposes, was also obtained.

The experimental assessment followed the same sequence across subjects: (a) video observation, (b) cognitive/behavioral trial, and (c) interview for inappropriate symptoms. The author assessed 56 patients while a female graduate student research assistant assessed 24 patients. Total number assessed by each experimenter was equal across the four groups described below. Experimental assessments were conducted blind to pain presentation status since diagnostic information, examination data, and psychometric scores were obtained from patients' files after completion of the teams' assessments.

Three undergraduate students served as coders. Coders were given a manual and completed training sessions to criterion reliability in each of the three scoring systems described below (i.e., Pain Drawing Scoring Procedure; Scoring Key for the Structured Interview Schedule for Pain; and the Observational Scoring System for Pain Behavior). Details of the data processing and the measures used have been described below.
Self-report Measures. Patients completed a self-report battery which included the following:

1. Oswestry Low Back Pain Disability Questionnaire
2. McGill Pain Questionnaire
3. Beck Depression Inventory
4. Coping Strategy Questionnaire
5. Pain Drawing
6. Inappropriate Symptom Scale
7. Descriptor Differential Scales for Pain

These self-report instruments have been described below:

OSWESTRY LOW BACK PAIN DISABILITY QUESTIONNAIRE. The Oswestry Low Back Pain Disability Questionnaire (Fairbank, Couper, Davies, & Brien, 1980) consists of 10 scales each containing 6 ordered behavioral examples reflecting various degrees of disability. Each scale focuses on the problem areas that have been found to be most relevant to people suffering backache (Waddell & Main, 1984; Wing, Wilfling, & Kokan, 1976). These areas of disability include: analgesic medication consumption, personal care (i.e., washing & dressing), lifting, walking, sitting, standing, sleeping, sexual activity, social activity, and travelling. Scores for the scales were summed to provide a percentage disability score. Disability, as measured by the questionnaire, has been shown to decrease with recovery from an acute back problem. Adequate retest reliability (r=.99) and internal consistency have been demonstrated (Fairbank, et al 1980).

MCGILL PAIN QUESTIONNAIRE. The McGill Pain Questionnaire (Melzack, 1975; 1983) consists of 20 groups of adjectives used to
specify 3 major classes of subjective pain experience: sensory, affective, and evaluative. Quantitative indices derived from the adjectives endorsed on the McGill Pain Questionnaire include 3 pain rating indexes which have been broken down into sensory, affective, and evaluative scores. Factor analysis of the McGill Pain Questionnaire has lent some support for the validity of the classes of word descriptors in back pain populations (Crockett, Prkachin, & Craig, 1978; Leavitt, Garon, Whisler, & Sheinkop, 1978; McCreary, Turner, & Dawson, 1981; Prieto & Geisinger, 1980).

BECK DEPRESSION INVENTORY. The Beck Depression Inventory (Beck, Ward, Mendelson, Mock & Erbaugh, 1961) consists of 21 items pertaining to depressive symptoms. The items sample self-reported dysphoric feelings and self-evaluations as well as symptoms of depression, such as disturbances of sleep, appetite, and energy level. Level of depression as measured by the Beck Depression Inventory has been shown to be related to greater cognitive distortion of back pain related events in CLBP patients (Lefebvre, 1981).

COPING STRATEGY QUESTIONNAIRE. The Coping Strategy Questionnaire is a questionnaire developed by Rosentiel and Keefe (1983) consisting of 41 items reflecting 6 scales of cognitive coping (i.e., diverting attention, reinterpreting pain sensations, coping self-statements, ignoring pain sensations, praying or hoping, & catastrophizing) and one scale of behavioral coping (i.e., increasing activity level) (Appendix B). In addition there are two pain control effectiveness ratings (i.e., control over pain, & ability to decrease pain). Scores on the cognitive coping have been shown to be
responsive to cognitive-behavioral interventions (Kee & Middaugh, 1984). Principal component analyses of the scale have found 3 factors accounting for approximately 70% of the variance (Harrell & Rosenberg, 1984; Rosentiel & Keefe, 1983). These components have been shown to be related to different patterns of adjustment to CLBP. For example, a component reflecting catastrophizing and lack of control over pain has been shown to be correlated with self-report measures of anxiety and depression (Rosenstiel & Keefe, 1983).

PAIN DRAWING. Ransford, Cairns, and Mooney (1976) developed a scoring system for quantifying non-anatomical or exaggerated graphic depiction of the quality and location of the pain (Appendix C). Using their scoring system, 80% (n=60) of the pain drawings in this sample were independently rated by a second blind rater, resulting in an inter-rater reliability correlation of .89. The reliability of the pain drawing scoring criteria found here was comparable with reliability reported elsewhere (von Baeyer, Bergstrom, Brodwin, & Brodwin, 1983).

INAPPROPRIATE SYMPTOM SCALE. Waddell, Main, Morris, DiPaola, and Gray (1984) identified a pool of 22 specific symptoms which were judged to be vague, ill-localized, and lacked normal patterns of progression, change over time, and appropriate anatomy in a sample of 182 back pain patients. Those with low reliability, low base rate, high frequency in normal subjects, and ambiguous interpretation were eliminated. A final set of 7 symptoms was used by Waddell et al. (1984) in the inappropriate symptom scale (Appendix D). Since these were designed to be assessed in routine history intake, a brief structured
interview covering the scale items was conducted following the experimental assessment described below.

**DESCRIPTOR DIFFERENTIAL SCALES.** The Descriptor Differential Scales for pain (Gracely, 1983) consisted of two verbal descriptor ratio scales, sensory intensity (15 items), and affective intensity (15 items). These were used to rate pain throughout the induced pain procedure, and ratings of current clinical pain intensity (Appendix E). These scales were developed using cross-modality matching procedures and ratio scaling techniques (Gracely, 1983). Adequate reliability has been demonstrated ($r=.96$ for sensory intensity, and $r=.89$ for affective intensity), as has differential sensitivity to placebo, narcotic, and tranquillizing medication (Gracely, McGrath, & Dubner, 1978; 1979). Because of the psychophysical scaling properties built into these scales, they have been preferred over other types of rating scales for current pain intensity (Chapman, et al., 1985).

**Physical Examination.**

**NON-ORGANIC PHYSICAL SIGNS.** Waddell, McCulloch, Kummel, and Venner (1980) identified examination signs based on pain report that deviated from standard anatomical principles. These were found to have a zero incidence in people without back pain, high percentage agreement between observers, and high reliability across assessments. In a series of back pain patient samples, involving over 500 patients, the investigators found both interrater and retest reliability to range from 78 to 86%. Incidence of patients with multiple signs ranged from 0% in a sample asymptomatic of back pain, 12% in a new back-pain referral sample, 40 to 47% in multiple operation and 2nd referral
samples, to 100% in problem admission samples (Waddell, et al., 1980). There appeared to be slight sex differences with women tending to display more signs than men (Lehmann, et al., 1985; Main & Waddell, 1984a). The presence of these signs was correlated with some self-report measures of tendency to report somatic complaints and depression (Main & Waddell, 1982) but only weakly with the MMPI (Waddell, et al., 1980). The presence of these non-organic signs was also found to be independent of medical diagnosis (Waddell, et al., 1980).

These signs were assessed on a checklist that was completed during the physiotherapist or medical staff's assessment (Appendix F). These included: (a) superficial non-anatomically based tenderness, (b) deep non-anatomically based tenderness, (c) report of pain under simulation of axial loading, (d) report of pain under simulated spinal rotation, (e) increase in straight leg raising greater than 30% under distraction, (f) regional weakness or regional nonanatomic sensory disturbance (i.e., stocking anesthesia disturbance on leg), (g) overreaction including disproportionate verbalization, facial expression, muscle tension and tremor, collapsing or sweating. Operational definitions and examples have been detailed by Waddell, et al. (1980) and Main and Waddell (1984b) (Appendix G).

ORGANIC SIGNS. A standard set of reliable indices of organic impairment and physical limitation was assessed in the course of the physical exam. While routine medical assessment can sometimes be imprecise and unreliable (Brand & Lehmann, 1983), various indicators of organicity have been shown to be highly reliable (Waddell et al., 1982). In a total sample of 475 patients with backache and 335 'normal'
subjects, Waddell et al. (1982) identified examination signs that showed a low (less than 8%) or zero incidence in 'normals', acceptable inter-rater agreement (above 70%), and provided clinically meaningful information. The final set of signs identified included: (a) presence of operative scars, (b) sciatic list (or lateral shift) (>1 cm), (c) limited lumbar flexion (<5 cm), (d) abnormal rhythm on recovery from flexion, (e) tenderness (lumbar and buttocks), (f) restricted straight leg raising (<75 degrees) and neurologic deficits such as (g) dural irritation, and (h) root compression signs. Operational definitions of these signs were discussed in detail in Waddell et al. (1982) and have been listed on the Examination Checklist (Appendix F).

PHYSICAL IMPAIRMENT INDEX. Waddell and Main (1984) have developed a Physical Impairment Index based on pain pattern, time pattern, type of fracture, previous surgery, root compression signs, lumbar flexion, and straight leg raising (Appendix H). These were used to calculate an overall physical impairment index. This index of percentage impairment corresponds to American Medical Association (AMA, 1971) guidelines for the determination of physical impairment.

RELIABILITY OF PHYSICAL EXAMINATION FINDINGS. The presence/absence of organic and non-organic physical findings was assessed by the staff separately and independently. Reliability by means of percentage agreement (Hartmann, 1977) and correlations between the independent observations were calculated. BPC staff was consulted on the protocol and the development of the checklist to ensure uniformity in the assessment. The checklist was completed by either the orthopedic consultant, general practitioner, or
physiotherapist as part of the patient examination. The examination checklist was completed by a second BPC staff member during a separate examination for 26.2% (n=21) of all patients and interrater reliability calculated.

<table>
<thead>
<tr>
<th>Examination Sign</th>
<th>r</th>
<th>% Agreement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-Organic Signs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Superficial Tenderness</td>
<td>.82</td>
<td>94</td>
</tr>
<tr>
<td>Deep Tenderness</td>
<td>.50</td>
<td>76</td>
</tr>
<tr>
<td>Axial Loading</td>
<td>1.00</td>
<td>100</td>
</tr>
<tr>
<td>Simulated Rotation</td>
<td>.68</td>
<td>94</td>
</tr>
<tr>
<td>Straight-leg Raising</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Under Distraction</td>
<td>1.00</td>
<td>100</td>
</tr>
<tr>
<td>Over-reaction to exam</td>
<td>.57</td>
<td>82</td>
</tr>
<tr>
<td>Regional Disturbances</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sensory</td>
<td>.66</td>
<td>76</td>
</tr>
<tr>
<td>Regional Disturbances</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Motor</td>
<td>1.00</td>
<td>100</td>
</tr>
<tr>
<td>Organic Signs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sciatic list</td>
<td>.45</td>
<td>82</td>
</tr>
<tr>
<td>Abnormal rhythm from recovery (&quot;catch&quot;)</td>
<td>.55</td>
<td>82</td>
</tr>
<tr>
<td>Lumbar Flexion</td>
<td>.35</td>
<td>65</td>
</tr>
<tr>
<td>Leg Raising</td>
<td>.79</td>
<td>88</td>
</tr>
<tr>
<td>Root irritation signs</td>
<td>.86</td>
<td>94</td>
</tr>
<tr>
<td>Root compression signs</td>
<td>.54</td>
<td>76</td>
</tr>
<tr>
<td>Tenderness lumbar</td>
<td>.23</td>
<td>76</td>
</tr>
<tr>
<td>Tenderness Buttock</td>
<td>.31</td>
<td>82</td>
</tr>
<tr>
<td>Operative scars</td>
<td>1.00</td>
<td>100</td>
</tr>
</tbody>
</table>

Note: (n=21)
Table 2 shows the reliability calculations for the examination signs. While there was some variability in the reliability of individual signs, the overall Pearson correlation between the number of organic signs identified was $r = .70$. Total number of non-organic signs identified was highly correlated with $r = .85$. Variables recorded as continuous variables such as lumbar flexion (cms), right straight leg raising (degrees), left straight leg raising (degrees) demonstrated higher interrater reliabilities of .83, .88, and .93, respectively. The total Physical Impairment Index reliability was $r = .94$.

While some individual organic and non-organic examination signs did not demonstrate high reliability, the reliability for total scores was found to be acceptable especially considering the number of different raters, patient variability in examination behavior, the dichotomous nature of these variables, and the relatively small number of subjects on whom reliability was calculated. Patient variability was apparent in pilot observations where patients were followed across examiners and were observed giving different responses to the same tests. It has been reported elsewhere that different types and intensities of pain report are reported to different staff (Ignelzi, et al., 1980). Given that these assessments were undertaken under clinical conditions present in most health care settings, this reliability was suitably high.

Staff also rated the extent to which the back pain problem was organically or non-organically based on a 7-point scale. Interrater agreement was $r = .57$, almost identical to interrater agreement of organicity reported elsewhere (Fordyce, et al., 1978). The data here indicate that specific criteria, not surprisingly, enhance the reliability of judgements concerning the patients' pain problem.
Experimental Assessment Procedure.

OBSERVATIONAL ASSESSMENT OF PAIN BEHAVIORS. Following Keefe and Block (1982), subjects were videotaped while sitting, standing, reclining, and walking (Appendix I). Each 10-min standardized taping consisted of the following: (a) both a 1-and 2-min sitting period, (b) both a 1-and 2-min standing period, (c) two 1-min reclining periods, and (d) two 1-min walking periods. The order of the positions was randomized across patients while the amount of time in each position remained constant. During the videotaping, interaction with the patient was kept to a minimum, consisting mainly of requests for position changes. Patients provided Differential Descriptor Scale ratings of their pain prior to and after the videotaping (see below).

Following Keefe and Block (1982), tapes were coded for the occurrence of the following pain behaviors: (a) guarded movement, (b) bracing, (c) rubbing, (d) grimacing, and (e) sighing (Appendix J). The operational definition of 'sighing' was modified slightly to include other para-linguistic indicators of pain such as moans and groans. A total of 20 observational intervals were coded for each patient using a time-sampling procedure consisting of continuous cycles of 20 seconds observation and 10 seconds of recording over 10 minutes (Appendix K).

RELIABILITY OF BEHAVIORAL MEASURES. Thirty five percent (n=28) of patients' video assessments were coded independently using the observational coding system for LBP behavior (Keefe & Block,
1982). Reliability for each of the pain behaviors has been shown in Table 3. Mean values observed were comparable to those reported by Keefe and Block (1982) and Keefe, Wilkins, and Cook (1984). Total number of behaviors observed was also reliable ($r = .82$).

<table>
<thead>
<tr>
<th>Pain Behavior</th>
<th>M</th>
<th>SD</th>
<th>% agreement</th>
<th>% effective agreement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Guarded Movement</td>
<td>.84</td>
<td>1.86</td>
<td>97.1</td>
<td>90.2</td>
</tr>
<tr>
<td>Bracing</td>
<td>2.55</td>
<td>2.81</td>
<td>92.7</td>
<td>84.5</td>
</tr>
<tr>
<td>Rubbing</td>
<td>2.20</td>
<td>2.91</td>
<td>87.7</td>
<td>82.0</td>
</tr>
<tr>
<td>Grimacing</td>
<td>.90</td>
<td>1.68</td>
<td>90.2</td>
<td>85.1</td>
</tr>
<tr>
<td>Sighing</td>
<td>1.77</td>
<td>2.22</td>
<td>86.0</td>
<td>81.1</td>
</tr>
</tbody>
</table>

PAIN INDUCTION PROCEDURE. A pressure pain procedure was used, as adapted from Forgione and Barber (1972), wherein a plastic wedge of 1500 gm. weight was applied to the first phalanx of the index finger of the non-dominant hand (Appendix L). Patients were asked to try to keep the weight on their finger for as long as they could. They were also told that they could remove the weight at any time. Prior to placing the weight on their finger, patients were told what sensations they could expect to experience. In order to prevent damage to the finger, a 4 minute ceiling was imposed. Thus, trials in which the patient tolerated the pressure for the full four minutes were terminated by the experimenter. Spontaneous verbal comments or behaviors, along with ratings were noted or recorded.
The Differential Descriptor Scale ratings were used throughout the pain induction procedure. Patients were asked to indicate the item on each scale that best corresponded to the degree of pain they experienced whenever the experimenter asked "what is your pain--now?". Ratings were requested by the experimenter at 30 second intervals until tolerance was achieved or the trial terminated by the experimenter.

COGNITIVE ASSESSMENT. Immediately after the pain induction, patients were assessed in a structured interview adapted from Genest's (1978) Structured Interview Schedule for Pain and Turk, et al. (1983) (Appendix M). They were asked first to describe in detail feelings and thoughts they remembered thinking or saying to themselves while the wedge was pressing on their finger. After this, they were asked to describe what they were thinking, feeling, and experiencing at specific times: (a) before the weight was placed down; (b) after the weight was placed on their finger; (c) after they felt and reported pain; (d) while they gave ratings from time to time, (e) just before the weight was removed; and (f) when they made specific spontaneous comments or behaviors during the task.

Genest (1978) used a videotaped record of the pain induction to prompt subject reports. Pilot testing indicated that recalling the sequence of events (a to f above) was sufficient to elicit descriptions of cognitive activity. This procedure also ensured that the cues were self-generated so as to minimize demand characteristics (Genest & Turk, 1981; Meichenbaum and Butler, 1979). Patients' reports were tape-recorded and transcribed verbatim.
Transcribed reports from the cognitive assessment were coded on a 5-point anchored scale (Appendix N) following scoring criteria of the Structured Interview Schedule for Pain, for the presence of verbal report indicating any of the following: (a) dissociates pain from self; (b) relaxation, (c) imagery; (d) non-imagery distraction; (e) expression of sense of control; (f) catastrophizing (Appendix N). All coding was undertaken by two undergraduate coders blind to the nature of the study so as to derive an intercoder reliability estimate. All 80 patients were independently coded.

RELIABILITY OF THE COGNITIVE MEASURES. Transcripts were coded independently for all subjects. Pearson correlations and percentage agreement were calculated for each of the categories as defined by Genest (1978) and are shown in Table 4. Examination of frequency data for the total sample revealed that fewer than 7 individuals had a coded occurrence of Relaxation, Imagery, or Non-Imagery distraction.

Because of the low incidence, of relaxation, imagery, and distraction, any of these predefined strategies was coded along with dissociation as one variable, which was called 'Coping Strategy'. Therefore, any of the criteria for relaxation, non-imagery distraction, distraction, and dissociation were coded as Coping Strategy. Reliability of the new variable was $r=.86$ with percentage agreement=88.3 and percentage effective agreement=81.8. Correlations between Coping Activity, Sense of Control, and Catastrophizing revealed a negative association between use of a strategy and catastrophizing ($r=-.57$, $p<.001$), and between sense of control and catastrophizing ($r=-.39$, $p<.001$).
Table 4: Reliabilities and Frequencies of the Cognitive Categories

<table>
<thead>
<tr>
<th>Cognitive Activity</th>
<th>Frequency</th>
<th>r</th>
<th>% Agreement</th>
<th>% Effective Agreement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dissociation</td>
<td>36</td>
<td>.86</td>
<td>89.5</td>
<td>84.3</td>
</tr>
<tr>
<td>Relaxation</td>
<td>7</td>
<td>.85</td>
<td>96.5</td>
<td>66.0</td>
</tr>
<tr>
<td>Imagery</td>
<td>5</td>
<td>.77</td>
<td>95.3</td>
<td>60.2</td>
</tr>
<tr>
<td>Non-Imagery Distraction</td>
<td>6</td>
<td>.60</td>
<td>96.3</td>
<td>60.0</td>
</tr>
<tr>
<td>Sense of Control</td>
<td>30</td>
<td>.83</td>
<td>86.0</td>
<td>81.7</td>
</tr>
<tr>
<td>Catastrophizing</td>
<td>53</td>
<td>.81</td>
<td>88.3</td>
<td>83.6</td>
</tr>
</tbody>
</table>

n=80

p<.001). There was no significant correlation between the use of strategy and sense of control.

Determination of Medically Incongruent Pain Group.

It had originally been proposed that group assignment could be determined on the basis of the presence or absence of multiple nonorganic physical findings. Initial assessment revealed that relatively few patients would be identified as inappropriate with this as the sole criterion (23.8% of this sample), which was considerably less than BPC staff original estimates of 40-60%. Using multiple non-organic signs as the sole criterion also presented difficulties because it would have included patients in the appropriate pain group whose expression of pain via symptom report and/or visual representation was exaggerated or non-anatomical. Therefore, for the purposes of this research,
incongruent pain presentation was operationalized as patients who met any one of the following criteria: the presence of 2 or more non-organic physical signs, the presence of 3 or more inappropriate symptoms, or a score of 5 or greater on the pain drawing. Control pain patients were operationalized by the absence of these criteria. Table 5 shows the group percentages for patients satisfying each of these criteria.

<table>
<thead>
<tr>
<th>Table 5: Occurrence of Criteria Within Each Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Criteria</td>
</tr>
<tr>
<td>Group</td>
</tr>
<tr>
<td>Sex</td>
</tr>
<tr>
<td>Non-organic Signs (&gt;1)</td>
</tr>
<tr>
<td>Inappropriate Symptoms (&gt;2)</td>
</tr>
<tr>
<td>Pain Drawing Score (&gt;4)</td>
</tr>
<tr>
<td>Control Patients</td>
</tr>
<tr>
<td>Female</td>
</tr>
<tr>
<td>0</td>
</tr>
<tr>
<td>Male</td>
</tr>
<tr>
<td>0</td>
</tr>
<tr>
<td>Incongruent Pain Patients</td>
</tr>
<tr>
<td>Female</td>
</tr>
<tr>
<td>65</td>
</tr>
<tr>
<td>-</td>
</tr>
<tr>
<td>80</td>
</tr>
<tr>
<td>80</td>
</tr>
<tr>
<td>Male</td>
</tr>
<tr>
<td>30</td>
</tr>
<tr>
<td>55</td>
</tr>
<tr>
<td>60</td>
</tr>
<tr>
<td>(n=80)</td>
</tr>
<tr>
<td>Note. Percentages calculated as a proportion of 20 per group.</td>
</tr>
</tbody>
</table>

Table 6 shows the percentages within the female and male incongruent pain groups of the patients who satisfied different numbers of the criteria. As Table 6 indicates, female incongruent pain presentation was more extreme in that females were more likely to display 2 or more of the criteria, whereas men were more likely to be identified on the basis of one criterion.
Table 6: Incongruent Pain Patients by Number of Criteria

<table>
<thead>
<tr>
<th>Sex</th>
<th>Three</th>
<th>Two</th>
<th>One</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female</td>
<td>40%</td>
<td>50%</td>
<td>10%</td>
</tr>
<tr>
<td>Male</td>
<td>15%</td>
<td>15%</td>
<td>70%</td>
</tr>
</tbody>
</table>

n=20 per sex.

Correlations were calculated between the criteria scores and the organicity rating. These appear in Table 7. All the criteria were moderately intercorrelated with each other and with the organicity rating.

Table 7: Relationships Among Incongruent Pain Indicators

<table>
<thead>
<tr>
<th>Variable</th>
<th>Non-organic Signs</th>
<th>Inappropriate Symptoms</th>
<th>Pain Drawing Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-organic signs</td>
<td>----</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inappropriate Symptoms</td>
<td>.42**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pain Drawing Score</td>
<td>.53**</td>
<td>.30*</td>
<td></td>
</tr>
<tr>
<td>Organicity Rating</td>
<td>.60**</td>
<td>.33*</td>
<td>.33*</td>
</tr>
</tbody>
</table>

n=80.
* p<.01; ** p<.001.
Statistical Analyses.

Categorical data (e.g., employment status, marital status, compensation status) were first analysed using non-parametric statistics to determine if the groups differed on basic descriptive and demographic variables. Interval patient data (e.g., age, chronicity, percentage of physical impairment) were analysed in a 2 X 2 (pain group X sex) MANOVA to determine if that combination of variables could account for differences between the four patient groups. Univariate analyses were then examined to identify covariates to be used in subsequent analyses described below. The purpose of these analyses was to identify and rule out variables potentially confounding the interpretation of differences between groups on the dependent variables.

Dependent variables were divided into 3 a priori conceptual groups: cognitive variables, behavioral variables, and subjective self-report variables. To reduce redundancy among the Coping Strategy Questionnaire scales and among the coded pain behaviors, both the scales and behaviors were subjected to principal component analyses and the resulting factor scores used instead of individual scales and specific pain behaviors.

Each set of variables was analysed first with a 2 X 2 MANOVA. Univariate analyses were conducted on each of the three variable sets with a Bonferroni stepped down alpha level (i.e. alpha level divided by the number of variables) to provide control over Type I error. Then, those variables identified as potential confounding variables were included as covariates in 2 X 2 MANCOVAs for each of the three sets of
variables. Univariate analyses of covariance were examined again with
the Bonferroni correction applied to alpha level. Comparison of the
analyses first with and then without the introduction of the covariates
was used to clarify interpretation of the results.

Following the hypotheses, it was expected that: (a) the coded in-vivo cognitions and factors derived from the Coping Strategy
Questionnaire would reflect greater catastrophizing, less use of
cognitive coping strategies, and less sense of control over pain in the
incongruent pain groups; (b) pain behavior factor scores and
observers’ rating of pain would reflect greater pain, while pain
tolerance would be less in the incongruent pain groups; (c) self-report
measures of pain and depression would reflect greater intensity and
severity in the incongruent pain groups; (d) pain group differences
would interact with sex with the above hypothesized effect more
pronounced in female patients. It was expected that these differences
would emerge as significant even with the introduction of the
covariates.

Finally, in order to assess the relative contribution of these
variables in discriminating incongruent (male and female combined) from
appropriate (male and female combined) pain patients, all the dependent
variables, along with variables used as covariates, were entered into a
step-wise discriminant function analysis. The purpose of this analysis
was to determine the variables that significantly discriminate
incongruent from control pain patients. Following the hypotheses, it was
expected that the cognitive variables, especially those assessed in-vivo,
would emerge as the most significant in discriminating the groups.
RESULTS

Group Differences: Patient Characteristics

Much of the descriptive patient data were non-continuous and categorical in nature; hence, analysed in a 2 X 4 (presence or absence of descriptive variable by each group) contingency table using Chi square statistics. No significant differences emerged between the four groups on marital status, previous surgeries, presence of financial disincentive, employment status, ethnic membership, and English as a second language, as shown in Table 8.

Medication intake was also similarly analysed with Chi square analyses and has been outlined in Table 8. Two types of medication emerged in significantly different proportions in the groups: sedatives and muscle relaxants. A total of 10 women compared with only 1 male were regularly taking medication with muscle relaxant properties. Similarly, a total of 16 women compared with 2 males were regularly taking medication with sedative properties. No difference between pain groups (with sexes combined) was apparent [$\chi^2(1)=.07$, $p=.79$, for sedatives; $\chi^2(1)=.11$, $p=.74$, for muscle relaxants] but significant differences emerged between men and women (with pain group combined) [$\chi^2(1)=12.11$, $p=.0005$, for sedatives; $\chi^2(1)=8.53$, $p=.0035$, for muscle relaxants]. Inspection of the data revealed the the effect was largely due to the fact that women in this sample were more likely to have been prescribed diazepam (Valium) which has muscle relaxant and sedative properties.
<table>
<thead>
<tr>
<th>Variable</th>
<th>Control Male</th>
<th>Control Female</th>
<th>Incongruent Male</th>
<th>Incongruent Female</th>
<th>$\chi^2(3)$</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Financial Disincentive</td>
<td>30</td>
<td>50</td>
<td>30</td>
<td>50</td>
<td>2.63</td>
<td>.45</td>
</tr>
<tr>
<td>Had Previous Surgery</td>
<td>40</td>
<td>35</td>
<td>25</td>
<td>55</td>
<td>3.95</td>
<td>.27</td>
</tr>
<tr>
<td>Multiple Surgeries</td>
<td>15</td>
<td>15</td>
<td>15</td>
<td>25</td>
<td>1.04</td>
<td>.79</td>
</tr>
<tr>
<td>Unemployed</td>
<td>0</td>
<td>5</td>
<td>15</td>
<td>15</td>
<td>4.23</td>
<td>.24</td>
</tr>
<tr>
<td>Non-Caucasian</td>
<td>10</td>
<td>15</td>
<td>35</td>
<td>30</td>
<td>4.87</td>
<td>.18</td>
</tr>
<tr>
<td>English Second Language</td>
<td>5</td>
<td>15</td>
<td>30</td>
<td>20</td>
<td>4.50</td>
<td>.21</td>
</tr>
<tr>
<td>Not Married or Not Commonlaw</td>
<td>45</td>
<td>30</td>
<td>60</td>
<td>35</td>
<td>4.77</td>
<td>.23</td>
</tr>
<tr>
<td>Analgesics</td>
<td>70</td>
<td>80</td>
<td>55</td>
<td>75</td>
<td>3.33</td>
<td>.34</td>
</tr>
<tr>
<td>Narcotic Analgesics</td>
<td>35</td>
<td>55</td>
<td>30</td>
<td>50</td>
<td>3.48</td>
<td>.32</td>
</tr>
<tr>
<td>Anti-Inflammatory Analgesics</td>
<td>5</td>
<td>25</td>
<td>20</td>
<td>20</td>
<td>3.12</td>
<td>.37</td>
</tr>
<tr>
<td>Anti-Depressants</td>
<td>5</td>
<td>10</td>
<td>10</td>
<td>20</td>
<td>2.38</td>
<td>.50</td>
</tr>
<tr>
<td>Sedatives</td>
<td>10</td>
<td>30</td>
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<td>Anxiolytic</td>
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<td>15</td>
<td>5</td>
<td>25</td>
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</tbody>
</table>

n=20 per group.
Interval data such as age, socioeconomic index, strength of analgesic medication consumed, number of previous surgeries, duration of CLBP problem, the Physical Impairment Index, and the Oswestry Low Back Pain Disability Questionnaire, were entered into a MANOVA. Table 9 contains the result of the MANOVA and the univariate analyses of these variables have been listed in Table 10.

<table>
<thead>
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<th>Source</th>
<th>Wilks Lambda</th>
<th>F(7,70)</th>
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</thead>
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<td>Sex</td>
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<tr>
<td>Group X Sex</td>
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<td>.81</td>
<td>.584</td>
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</table>

No significant interaction effects emerged; however, significant main effects were found for both group and sex. Inspection of the univariate F's with alpha stepped down to .0071, revealed significant effects on both the Physical Impairment Index and the Oswestry Low Back Pain Disability Questionnaire. Table 10 breaks down the mean values of these variables by group. Patients in the incongruent pain group had a greater percentage of physical impairment and limited mobility and a greater percentage of functional impairment in activities of daily living.

Waddell et al. (1984) have described physical impairment and restricted activity reports as indicators of the 'severity' of the back
<table>
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<tr>
<th>Variable</th>
<th>Pain Group</th>
<th>Source</th>
<th>Sex</th>
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<td>Age (years)</td>
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<td>.59</td>
<td>.44</td>
<td>.13 .72</td>
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<td>SES^a</td>
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<td>.01</td>
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<td>17.51 .000</td>
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<td>Female</td>
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<td>32.4</td>
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<tr>
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<td>10.0</td>
<td></td>
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</tbody>
</table>

n=20 per group.
(a) Higher scores reflect higher SES.
(b) Higher scores reflect greater narcotic potency
pain condition. In a regression analysis, those investigators also found 'severity' of the back condition to be associated with magnified illness behavior indicators. Since this association could account for group variation and pose interpretive problems, it was decided to include the Physical Impairment Index and Disability Questionnaire measures as covariates in subsequent analyses. A correlational analysis between the Physical Impairment Index, the Disability Questionnaire, and the inappropriate pain indicators revealed moderate inter-correlations with the exception of Physical Impairment Index and the number of non-organic signs, as shown in Table 11. Waddell et al. (1980) have suggested that the nonorganic physical signs may be independent of physical findings, which was suggested here by the lack of association with physical impairment. However, inappropriate symptom report and the pain drawing were associated with physical impairment. All the Inappropriate Pain criteria were associated with pain related activity restriction.
Table 11: Relationships Between Physical Severity and Incongruent Pain

<table>
<thead>
<tr>
<th>Incongruent Pain Criteria</th>
<th>Physical Severity Indicators</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Physical Impairment</td>
</tr>
<tr>
<td>Nonorganic Signs</td>
<td>.16</td>
</tr>
<tr>
<td>Inappropriate Symptoms</td>
<td>.33*</td>
</tr>
<tr>
<td>Pain Drawing Score</td>
<td>.37**</td>
</tr>
</tbody>
</table>

n=80
* p<.01; ** p<.001.

Principal Component Analyses: Cognitive and Behavioral Measures

Coping Strategy Questionnaire Scales.

Prior to analyses of group differences, the nine Coping Strategy Questionnaire scales were subjected to a principal component analysis and rotated orthogonally with varimax rotation. Three factors emerged with eigenvalues greater than 1. These accounted for 69.5% of the variance as shown in Table 12. Factor scores were computed based on the factor loadings and used in subsequent data analyses. The resulting factor structure was somewhat different from factor analyses reported elsewhere (Rosensteil & Keefe, 1983). One reason for the discrepancy may be that the subject to variable ratio was 9:1 in this sample, while the ratio for the factor structure reported by Rosensteil and Keefe (1983) was 6:1. Therefore the factor solution reported here may have been somewhat more stable.
### Table 12: Principal Component Analyses of the Coping Strategy Questionnaire

<table>
<thead>
<tr>
<th>Scale</th>
<th>Factor 1</th>
<th>Factor 2</th>
<th>Factor 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ignoring</td>
<td>.85</td>
<td>.10</td>
<td>-.13</td>
</tr>
<tr>
<td>Coping Self Statements</td>
<td>.82</td>
<td>.12</td>
<td>.07</td>
</tr>
<tr>
<td>Reinterpreting Sensations</td>
<td>.77</td>
<td>-.11</td>
<td>-.07</td>
</tr>
<tr>
<td>Diverting Attention</td>
<td>.74</td>
<td>.08</td>
<td>.35</td>
</tr>
<tr>
<td>Increasing Behaviors</td>
<td>.71</td>
<td>.28</td>
<td>.11</td>
</tr>
<tr>
<td>Ability To Decrease</td>
<td>.02</td>
<td>.85</td>
<td>.12</td>
</tr>
<tr>
<td>Control Over Pain</td>
<td>.22</td>
<td>.79</td>
<td>-.16</td>
</tr>
<tr>
<td>Catastrophizing</td>
<td>-.16</td>
<td>-.20</td>
<td>.84</td>
</tr>
<tr>
<td>Praying/Hoping</td>
<td>.29</td>
<td>-.20</td>
<td>.78</td>
</tr>
</tbody>
</table>

n=80

The principal component pattern suggested the following factor interpretations. Factor 1 reflected the active use of coping strategy to deal with pain. Factor 2 reflected a pain-related sense of self-efficacy. Factor 3 reflected catastrophizing and perhaps a perceived need for miraculous intervention. This resulting factor structure was very similar conceptually to the three main cognitive strategies coded in the in vivo cognitive assessment task. Specific pain ameliorating strategies loaded on the Coping Strategy Questionnaire Factor 1 and were also reflected in the Coping Strategy designation in the Structured Interview Schedule for Pain. Effectiveness ratings, which loaded on Factor 2, closely resembled thoughts reflected in the coding criteria for Sense of Control in the Structured Interview Schedule for Pain. Catastrophizing
and perceived need for miraculous escape from pain reflected in Factor 3 also resembled the coded criteria for Catastrophizing on the Structured Interview Schedule for Pain. As the correlations in Table 13 show, however, the correlations among these cognitive variables were nonsignificant with the exception of catastrophizing.

<table>
<thead>
<tr>
<th>Table 13: Relationships Between Coping Strategy Questionnaire (CSQ) Factors and In Vivo Categories</th>
</tr>
</thead>
<tbody>
<tr>
<td>CSQ Factors</td>
</tr>
<tr>
<td>In-Vivo Category                     Factor 1</td>
</tr>
<tr>
<td>Active Coping</td>
</tr>
<tr>
<td>Strategy</td>
</tr>
<tr>
<td>Coping Strategy                      -.13</td>
</tr>
<tr>
<td>Sense of Control                     -.08</td>
</tr>
<tr>
<td>Catastrophizing                      .05</td>
</tr>
</tbody>
</table>

_n=80; ** p<.001_

Pain Behaviors.

Prior to analyses of group differences, the five pain behaviors were subject to a principal component analysis and rotated orthogonally using varimax rotation. Two factors emerged with eigenvalues greater than 1. These accounted for 65.0% of the variance. Factor scores were computed based on the factor loadings and used in subsequent data analyses. The resulting factor structure was very similar to a distinction reported by Turk, Wack, and Kerns (1985). They found two dimensions to overt pain behavior: ambulation/postural and
facial/audible. Table 14 reports the loadings on the two factors. Factors were selected if they had an eigenvalue greater than 1 for both sets of variables.

<table>
<thead>
<tr>
<th>Behavior</th>
<th>Factor 1</th>
<th>Factor 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rubbing</td>
<td>.80</td>
<td>.18</td>
</tr>
<tr>
<td>Bracing</td>
<td>.74</td>
<td>.02</td>
</tr>
<tr>
<td>Guarded Movement</td>
<td>.66</td>
<td>.18</td>
</tr>
<tr>
<td>Grimacing</td>
<td>.01</td>
<td>.92</td>
</tr>
<tr>
<td>Sighing</td>
<td>.32</td>
<td>.79</td>
</tr>
</tbody>
</table>

Table 14: Principal Component Analyses of the Pain Behaviors

Group Differences: Cognitive Measures

A total of six cognitive measures (the three Coping Strategy Questionnaire factors and the three main coded categories from the transcribed reports) were analysed in a two-way, pain presentation by sex, MANOVA. Since an association between severity of the back problem and pain presentation group was found, variables were analyzed first without the severity indicators and then with Physical Impairment and Disability indices included as covariates. As Table 15 shows, there was a significant multivariate main effect for pain presentation both with and without physical severity of the pain problem taken into consideration.
Table 15: MANOVA and MANCOVA Summary Table for Cognitive Measures

<table>
<thead>
<tr>
<th>Analysis Source</th>
<th>Wilks Lambda (s=1,m=2,n=34 1/2)</th>
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<th>P</th>
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<td>Group</td>
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<td>.213</td>
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<td>.322</td>
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<td>MANCOVA</td>
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<td></td>
</tr>
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<td>.531</td>
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<tr>
<td>Group X Sex</td>
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<td>.92</td>
<td>.483</td>
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</tbody>
</table>

Note. Physical Impairment and Disability scores used as covariates. df=(6,71) & (6,69) for MANOVA & MANCOVA respectively.

Univariate F's for the individual variables were examined to determine which variables, with alpha stepped down to .0083 were significantly different between groups when the severity of the back problem was controlled. Means and univariate results have been presented in Table 16. Relative to patients without any incongruent pain signs, patients with incongruent pain presentation reported on the retrospective measure that catastrophizing, praying, and hoping were characteristic of their thinking when they feel pain.
<table>
<thead>
<tr>
<th>Variable</th>
<th>Male Mean (SD)</th>
<th>Female Mean (SD)</th>
<th>Without F(1,76)</th>
<th>With F(1,74)</th>
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<tbody>
<tr>
<td>Structured Interview Schedule for Pain (a)</td>
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<tr>
<td>Coping Strategies</td>
<td>2.5 (1.2)</td>
<td>2.0 (1.0)</td>
<td>0.03</td>
<td>0.85</td>
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<tr>
<td>M</td>
<td>2.4 (1.2)</td>
<td>2.0 (1.1)</td>
<td>0.00</td>
<td>0.99</td>
</tr>
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<td>1.2 (1.1)</td>
<td>1.0 (1.1)</td>
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<tr>
<td>Sense of Control</td>
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<td>2.0 (1.3)</td>
<td>5.86</td>
<td>0.018</td>
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<tr>
<td>M</td>
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<td>1.5 (0.9)</td>
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<tr>
<td>Catastrophizing</td>
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<td>2.6 (1.4)</td>
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<tr>
<td>M</td>
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<td>.07 (1.1)</td>
<td>0.03</td>
<td>0.86</td>
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<tr>
<td>Pain Self-Efficacy</td>
<td>.10 (1.1)</td>
<td>.20 (0.9)</td>
<td>1.62</td>
<td>0.21</td>
</tr>
<tr>
<td>M</td>
<td>-.31 (0.8)</td>
<td>.03 (1.1)</td>
<td>0.80</td>
<td>0.37</td>
</tr>
<tr>
<td>SD</td>
<td>1.1 (0.7)</td>
<td>0.9 (1.1)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Catastrophizing</td>
<td>-.33 (0.8)</td>
<td>-.49 (0.7)</td>
<td>17.21</td>
<td>0.000</td>
</tr>
<tr>
<td>M</td>
<td>.00 (1.0)</td>
<td>.82 (1.0)</td>
<td>7.01</td>
<td>0.010</td>
</tr>
<tr>
<td>SD</td>
<td>1.0 (1.0)</td>
<td>1.0 (1.0)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

n=20 per group.
(a) Higher values reflect greater activity.
(b) Factor scores transformed on a z-distribution.
Group Differences: Behavioral Measures

A total of four behavioral measures (the two pain behavior factors, the global pain rating, and pain tolerance duration) were analysed in a two-way pain presentation by sex MANOVA. The variables were analyzed first without the physical severity indicators and then in a MANCOVA with Physical Impairment and Disability scores as covariates. As Table 17 shows, there was a significant multivariate main effect for pain presentation. However, when the physical severity of the pain problem was taken into account, no significant multivariate effects appeared.

<table>
<thead>
<tr>
<th>Source</th>
<th>MANOVA</th>
<th>MANCOVA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group</td>
<td>.83</td>
<td>.95</td>
</tr>
<tr>
<td>Sex</td>
<td>.93</td>
<td>.93</td>
</tr>
<tr>
<td>Group X Sex</td>
<td>.97</td>
<td>.97</td>
</tr>
<tr>
<td>Wilks Lambda</td>
<td>F</td>
<td>p</td>
</tr>
<tr>
<td>(s=1,m=2,n=34 1/2)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MANOVA</td>
<td>3.79</td>
<td>.484</td>
</tr>
<tr>
<td>MANCOVA</td>
<td>1.45</td>
<td>1.30</td>
</tr>
<tr>
<td></td>
<td>.55</td>
<td>.58</td>
</tr>
<tr>
<td></td>
<td>.007</td>
<td>.484</td>
</tr>
<tr>
<td></td>
<td>.226</td>
<td>.277</td>
</tr>
<tr>
<td></td>
<td>.700</td>
<td>.678</td>
</tr>
</tbody>
</table>

Note. Physical Impairment and Disability scores used as covariates. df=(4,73) & (4,71) for MANOVA & MANCOVA respectively.

Inspection of the univariate analyses in Table 18 revealed that the sources of significant difference were on the ambulation/posture factor and on the global pain rating. It was not surprising that when
the physical severity of the back problem was controlled these failed to reach significance since as reported above and elsewhere (Keefe, et al., 1984) organic impairment was found to be correlated with physical impairment and total pain ratings. Correlations on the total sample indicated however, that behaviors were less correlated with the Physical Impairment Index, but moderately correlated with the Disability score as shown in Table 19.
Table 18: Means and Univariate Analyses: Behavioral Variables

<table>
<thead>
<tr>
<th>Variable</th>
<th>Male</th>
<th>Female</th>
<th>Male</th>
<th>Female</th>
<th>F(1,76)</th>
<th>p</th>
<th>F(1,74)</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pain Tolerance (sec)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>M</td>
<td></td>
<td>M</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>202</td>
<td>145</td>
<td>153</td>
<td>139</td>
<td>2.07</td>
<td>.15</td>
<td>.76</td>
<td>.39</td>
</tr>
<tr>
<td></td>
<td>SD</td>
<td></td>
<td>SD</td>
<td></td>
<td>.69</td>
<td>.85</td>
<td>.85</td>
<td>.97</td>
</tr>
<tr>
<td>Observer Rating (a)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>M</td>
<td></td>
<td>M</td>
<td></td>
<td>1.4</td>
<td>.4</td>
<td>2.4</td>
<td>3.1</td>
</tr>
<tr>
<td></td>
<td>SD</td>
<td></td>
<td>SD</td>
<td></td>
<td>1.8</td>
<td>.5</td>
<td>2.6</td>
<td>2.5</td>
</tr>
<tr>
<td>Pain Behavior Factors (b):</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ambulation/Posture</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>M</td>
<td></td>
<td>M</td>
<td></td>
<td>-.46</td>
<td>-.2</td>
<td>.11</td>
<td>.55</td>
</tr>
<tr>
<td></td>
<td>SD</td>
<td></td>
<td>SD</td>
<td></td>
<td>.61</td>
<td>.83</td>
<td>1.1</td>
<td>1.1</td>
</tr>
<tr>
<td>Facial/Audible</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>M</td>
<td></td>
<td>M</td>
<td></td>
<td>-.23</td>
<td>-.13</td>
<td>.16</td>
<td>.16</td>
</tr>
<tr>
<td></td>
<td>SD</td>
<td></td>
<td>SD</td>
<td></td>
<td>.61</td>
<td>.7</td>
<td>1.2</td>
<td>1.3</td>
</tr>
</tbody>
</table>

n=20 per group.

(a) 10 cm. line with "no pain" to "pain as bad as it can be"
(b) Factor scores transformed to a z-distribution
Table 19: Relationship Between Severity and Pain Behaviors

<table>
<thead>
<tr>
<th>Severity</th>
<th>Physical Impairment</th>
<th>Disability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pain Behaviors</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pain Behavior Factors:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ambulation/Posture</td>
<td>0.17</td>
<td>0.45**</td>
</tr>
<tr>
<td>Facial/Audible</td>
<td>0.03</td>
<td>0.32*</td>
</tr>
<tr>
<td>Total Pain Behavior</td>
<td>0.14</td>
<td>0.54**</td>
</tr>
<tr>
<td>Observer's Rating</td>
<td>0.28*</td>
<td>0.46**</td>
</tr>
</tbody>
</table>

n=80
* p<.01; ** p<.001.

Group Differences: Self-Report Measures of Pain and Depression

A total of six self-report measures (three McGill Pain Questionnaire scales, the two Differential Descriptor Scale ratings of present pain intensity, and the Beck Depression Inventory) were analyzed in a two-way pain presentation by sex MANOVA. The six self-report variables were analyzed first without the physical severity indicators and then with Physical Impairment and Disability as covariates. As shown in Table 20, there was again a significant multivariate main effect for pain presentation. When the physical severity of the pain problem was taken into account, this multivariate main effect became nonsignificant.

Univariate F's for the individual variables prior to the introduction of the covariates, all reached significance, with the
Table 20: MANOVA and MANCOVA Summary Table for Self-Report Measures

<table>
<thead>
<tr>
<th>Analysis</th>
<th>Source (s=1,m=2,n=34 1/2)</th>
<th>Wilks Lambda</th>
<th>F</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>MANOVA</td>
<td>Group</td>
<td>.69</td>
<td>5.22</td>
<td>&lt;.001</td>
</tr>
<tr>
<td></td>
<td>Sex</td>
<td>.91</td>
<td>1.18</td>
<td>.327</td>
</tr>
<tr>
<td></td>
<td>Group X Sex</td>
<td>.93</td>
<td>.86</td>
<td>.525</td>
</tr>
<tr>
<td>MANCOVA</td>
<td>Group</td>
<td>.84</td>
<td>2.15</td>
<td>.059</td>
</tr>
<tr>
<td></td>
<td>Sex</td>
<td>.92</td>
<td>.93</td>
<td>.476</td>
</tr>
<tr>
<td></td>
<td>Group X Sex</td>
<td>.94</td>
<td>.70</td>
<td>.652</td>
</tr>
</tbody>
</table>

Note. Physical Impairment and Disability scores used as covariates df=(6,71) & (6,69) for MANOVA & MANCOVA respectively.

exception of the Unpleasantness Differential Descriptor Scale and the Sensory intensity scale from the McGill Pain Questionnaire with alpha stepped down to .0083. After controlling for the physical severity, only the Affective scale of the McGill Pain Questionnaire achieved significance. Therefore, when physical severity was taken into account, sensory pain and level of depression were not significantly different between groups. Table 21 presents these means and F ratios.

Therefore relative to patients without any incongruent pain signs, patients with incongruent pain presentation used affective descriptors to a greater extent in describing their pain. These results must be treated somewhat cautiously as the overall MANCOVA main effect was nonsignificant.
Table 21: Means and Univariate Analyses: Self-Report Measures

<table>
<thead>
<tr>
<th>Variable</th>
<th>Pain Group</th>
<th>Analyses: Group Effect</th>
<th>Without Covariates</th>
<th>With Covariates</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>F(1,76) p</td>
<td>F(1,74) p</td>
<td></td>
</tr>
<tr>
<td>Beck Depression Inventory</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M</td>
<td>8.7 7.5</td>
<td>11.4 13.8</td>
<td>8.44 .005 2.57 .113</td>
<td></td>
</tr>
<tr>
<td>SD</td>
<td>5.2 4.5</td>
<td>9.0 7.8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>McGill Pain Questionnaire</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sensory</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M</td>
<td>12.9 14.4</td>
<td>15.6 18.2</td>
<td>5.14 .026 1.42 .24</td>
<td></td>
</tr>
<tr>
<td>SD</td>
<td>5.3 6.5</td>
<td>6.7 6.9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Affective</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M</td>
<td>1.3 1.7</td>
<td>2.7 4.5</td>
<td>18.43 .000 8.24 .005</td>
<td></td>
</tr>
<tr>
<td>SD</td>
<td>1.9 1.5</td>
<td>2.3 2.8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Evaluative</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M</td>
<td>2.2 2.3</td>
<td>2.7 3.9</td>
<td>12.67 .001 4.10 .047</td>
<td></td>
</tr>
<tr>
<td>SD</td>
<td>1.2 1.4</td>
<td>1.3 1.1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Differential Descriptor Scales for Pain</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sensation</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M</td>
<td>7.3 7.4</td>
<td>9.5 10.8</td>
<td>15.19 .000 3.17 .08</td>
<td></td>
</tr>
<tr>
<td>SD</td>
<td>3.4 3.0</td>
<td>3.7 2.7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unpleasantness</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M</td>
<td>5.1 4.9</td>
<td>5.8 6.7</td>
<td>2.28 .14  .01 .94</td>
<td></td>
</tr>
<tr>
<td>SD</td>
<td>3.5 3.2</td>
<td>3.8 4.0</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

n=20 per group.
Discriminant Function Analyses of Pain Presentation

Since there were no interaction effects with sex as a variable, and since the numbers of men and women were equal, the cognitive, behavioral, and subjective measures were included in a discriminant function analysis to determine what dependent variables optimally discriminated the two types of pain presentations. The 16 dependent variables were entered along with the Physical Impairment and Disability scores. In the first analysis, all the variables were entered simultaneously resulting in a significant discriminant function \( \chi^2(18) = 46.784, p = .0002 \) in which 85% of patients were correctly classified as to pain presentation as shown in Table 22.

Following this analysis, a stepwise discriminant function analysis was conducted to determine what set of variables optimally discriminated the pain groups. Since the use of stepwise entry order as a criterion for determining the relative importance of variables has been questioned (Huberty, 1984), standardized weight of the first discriminant function and the F-to-remove index were used in determining the relative importance of variables. These values have been presented in Table 23. As was shown in this table, 3 cognitive measures, affective pain rating, and physical impairment emerged as optimally discriminating the pain groups. The discriminant function based on these variables correctly classified 81.25% of patients. Five control pain patients were misclassified as incongruent while 10 incongruent pain patients were classified as control pain patients.
Table 22: Classification of Pain Group Membership with the Discriminant Function

<table>
<thead>
<tr>
<th>Actual Group</th>
<th>Control Pain</th>
<th>Incongruent Pain</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control Pain</td>
<td>36</td>
<td>4</td>
</tr>
<tr>
<td>Incongruent Pain</td>
<td>8</td>
<td>32</td>
</tr>
</tbody>
</table>

Table 23: Relative Ordering of Discriminating Variables

<table>
<thead>
<tr>
<th>Variable</th>
<th>Standardized Discriminant Function Coefficient</th>
<th>F to Remove</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sense of Control (in vivo)</td>
<td>0.61</td>
<td>10.03</td>
</tr>
<tr>
<td>Catastrophizing (CSQ)</td>
<td>0.58</td>
<td>7.69</td>
</tr>
<tr>
<td>Physical Impairment</td>
<td>0.55</td>
<td>10.50</td>
</tr>
<tr>
<td>Affective Pain Rating (MPQ)</td>
<td>0.49</td>
<td>6.02</td>
</tr>
<tr>
<td>Catastrophizing (in vivo)</td>
<td>0.45</td>
<td>4.40</td>
</tr>
</tbody>
</table>
DISCUSSION

Cognition and Medically Incongruent Pain

Chronic pain patients whose illness behavior and symptom report were anatomically inconsistent, vague, poorly localized, and exaggerated or disproportionate to their back pain condition, appeared to engage in less efficacious coping with pain than patients whose behavior and symptom report were deemed appropriate. As hypothesized, in comparison to CLBP patients who did not display incongruent pain criteria, CLBP patients with one or more of the incongruent pain criteria differed in the kind of cognitive events that occurred during their experience of pain. Relative to other variables, the presence of thoughts indicative of personal control or efficacy during exposure to a standardized, noxious pain stimulus was one of the most important discriminators between incongruent pain and control groups.

Incongruent chronic pain patients also appeared to engage in more maladaptive or dysfunctional cognitions concerning their pain. In retrospective self-report, as reflected in Coping Strategy Questionnaire factor scores, incongruent pain patients relative to control patients endorsed more items reflecting catastrophizing thoughts or wishes of miraculous escape from their back pain.

Also in comparison to control patients, there was a significant tendency for patients with Incongruent Pain to receive higher scores on the affective and evaluative scales of the McGill Pain Questionnaire. The subjective pain experience tended to be perceived and judged to be
more disturbing, distressing, and debilitating by incongruent Pain patients in comparison to control patients. These results were consistent with the notion that dysfunctional cognitive activity may also underlie incongruent pain.

While the emphasis here was on psychological correlates which may maintain incongruent pain, the role of physical impairment, limited activity, and limited mobility was also important. Restricted physical functioning and impairment was found to be greater in the incongruent pain group. Sternbach (1974) has pointed out that more extreme psychological disturbance is associated with greater pain-related physical disability. However, differences between the control and incongruent pain groups emerged on cognitive variables, even when the degree of physical mobility and the extent of activity restriction due to the CLBP condition was taken into consideration. Other hypothesized differences, such as the frequency of ambulatory/postural pain behaviors, observer's global pain ratings, depression scores, and sensory intensity ratings of pain, did emerge as greater in the incongruent pain patients, but failed to reach significance when the degree of limitation in physical mobility and activity due to the back condition was introduced as a covariate. On the one hand, these results support the idea that incongruent pain patients were more affectively distressed and had more overt pain display than the control pain patients. However, on the other hand, these results also suggested that the degree of subjective and expressed pain may be more a function of the level to which mobility and behavior are compromised because of the pain.
Patients with an incongruent pain presentation demonstrated maladaptive coping in that they anticipated more distress, amplified the sensation associated with pain, and appeared to have less conviction in their ability to control pain. Genest and Turk (1981) have argued that cognitive 'events', as reflected in the Coping Strategy Questionnaire and In-vivo 'samples', are the basic datum from which inferences can be drawn concerning cognitive processes and schemata related to pain and the processing of noxious sensory information (cf. Leventhal et al., 1980; Pennebaker, 1982). It may be inferred from these results that Incongruent Pain behavior and symptom report may identify those chronic pain patients who fail to develop a 'cognitive system' that facilitates coping and limits distress (Pinsky, 1979).

Cognitive processes and cognitive schemas may operate in a number of ways to maintain incongruent pain and increase avoidance of, and restriction in, physical mobility and activity. First, pain has been recognized as a signal of actual or potential tissue damage (Melzack & Wall, 1983). Cognitive processes that accentuate the distress associated with pain may predispose some chronic pain patients to readily evaluate their pain as a signal of tissue damage. Those CLBP patients with cognitive processes that accentuate the distress may be more likely to avoid physical activity, therapeutic exercise, housework and chores, and seek more bedrest than those with cognitive responses associated with greater pain endurance. Negative, maladaptive expectancies are more resistant to modification if experiences of failure or difficulties in those activities have been attributed to stable factors (Weiner, 1974) such as a physical disability. Negative expectancies about walking,
lifting, prolonged sitting, and exercise may lead to avoidance of those activities (Schmidt, 1985). Schema and cognitive processes that bias selectively the evaluation of noxious sensory information and pain causing activity (cf. Schmidt, 1985) may reinforce catastrophizing activity which in turn may reinforce avoidance of physical activity. A cycle of negative reinforcement and heightened fear of pain, may be enhanced by such dysfunctional thought processes, may also lead to avoidance of activity (Lethem, Slade, Troup, & Bentley, 1983; Slade, Troup, Lethem, & Bentley, 1983) and physical deconditioning. This may be one reason why impaired physical mobility and activity was greater in the incongruent pain group.

Second, there may be cognitively mediated processes that directly affect physiology. Research supports the concept that some CLBP patients are likely to overreact to mental stressors with heightened muscle tension (Flor, Turk, & Birbaumer, 1985) and engage in maladaptive evaluations of the impact of muscle activity on their back (Schmidt, 1985). Individual differences in the "pain-muscle spasm-pain cycle" (Dolce & Raczynski, 1985) may underlie variation in protective muscle tension which may also contribute to avoidance of physical activity and eventually results in physical deconditioning. These patients may be perceived as having a 'psychogenic' pain problem since this idiographic CLBP results from musculature reactivity and/or protective avoidance behavior and not identifiable disease processes (Dolce & Raczynski, 1985).

Third, as this investigation seems to indicate, an important cognitive variable associated with incongruent pain was the lack of a
sense of control during a painful experience. Lack of control is an essential feature of learned helplessness in response to a stressor such as pain (Weisenberg, 1984). Learned helplessness in chronic pain, which has also been associated with reduced activity levels (Skevington, 1983), may reflect a perceived loss of effective management of and control over pain.

It was hypothesized that ineffective pain coping skills would be reflected in a lower frequency of specific spontaneously generated cognitive coping strategies in the incongruent pain group. However, no differences in the use of cognitive strategies between groups on either of the cognitive measures emerged. It did not appear to be the case that group differences could be a function of an inadequate repertoire of coping strategies per se. Incongruent pain patients may lack the conviction that the strategies that they have at their disposal will be efficacious in facilitating coping or attenuating painful sensations (cf. Bandura, 1977). The lack of perceived control may contribute to a sense of helplessness and the attribution that pain is a permanent, unchangeable threat. Alternatively, these patients may have a history of being ineffective in using coping strategies. Incongruent pain patients may have used their coping skills too inconsistently, too rigidly, or may have 'catastrophized while attempting to implement coping.

These results along with investigations reviewed previously, add support to the emerging cognitive models of pain (Turk, et al., 1983). It is suggested here that lack of effective control over acute pain episodes and a tendency to assume the worse and accentuate the
ongoing pain experience may serve to maintain pain, facilitate avoidance of activity, indirectly increase back pain severity, and result in incongruent manifestations of CLBP. Still, as discussed below, these speculations have been based on correlational data. Thus the causal direction and hypothesized operation of cognitive variables has yet to be determined. Future research directed at manipulating and altering maladaptive cognitive coping in incongruent pain patients may elucidate these hypothesized links.

**Interpretive Issues**

One limitation in this research is the correlational nature of the data. By not having control over the presenting pain status, the results could be accounted for by other factors, thus confounding interpretation. However, consistent with other investigations (Waddell et al., 1980), display of incongruent pain criteria was independent of potential confounding variables as socio-economic status, age, chronicity, number of previous surgeries, type of medication consumed, strength of analgesic medication consumed, presence of compensation or litigation, employment status, ethnic membership, and marital status. It thus appears that these 'gross' patient characteristics are independent of pain-related cognitive activity or coping skill. Lehmann, et al. (1983) reported evidence that 'invalid' pain presentation was associated with pending litigation and compensation, but their small sample size (10 patients) made it difficult to draw firm conclusions. The present sample was substantially larger and did not find evidence that pain presentation was related to compensation or litigation. This was
consistent with concern expressed elsewhere (Dworkin et al., 1985) that chronic pain patients have been inappropriately described as under the control of financial incentives. In general, demographic, pain history characteristics, or financial disincentives did not appear to be spuriously associated with these clinical pain criteria.

The only demographic variable previously found to be associated with the criteria was sex (Waddell et al., 1984). Sex differences between groups in the present study appeared to be minimal, and were associated with less impairment of physical mobility and greater Valium consumption in women patients. It should be noted however that women displayed more of each of the incongruent pain signs and were more likely than the men to display more than one of the criteria. This is consistent with previous observations on the expression of some of the incongruent pain criteria which have found the manifestation more extreme in women (Main & Waddell, 1984). Certainly, sociocultural factors may influence expression of pain-related behaviors encompassed by the incongruent pain criteria (cf. Craig, 1978). In this study, the method by which groups were determined may have attenuated effects for sex on some dependent variables. Extreme manifestations of incongruent pain in women were treated as equivalent to the less extreme manifestations in male patients. Therefore, it is difficult to draw conclusions about sex differences in the expression of the incongruent pain criteria.

Global indices of non-organic incongruent pain behavior and degree of organic impairment in mobility appeared to be reliable in this investigation. Even with a relatively small reliability sample, patient
variability, the use of multiple examiners, and the dichotomous nature of these signs, coefficients of reliability suggested that the determination of multiple non-organic signs and overall physical impairment was accomplished consistently. The variability in reliability observed across individual signs may reflect not only inadequate standardization or measurement error but also the idiosyncratic nature of incongruent pain expression. It should be noted that consistent with previous research, general global judgements of organicity that are not keyed to specific behavior are less reliable (Fordyce, et al., 1978). Also in this investigation, measurement of pain behavior and scoring of pain drawings were consistent with reliability reported elsewhere (Keefe & Block, 1982; von Baeyer, et al., 1983).

This investigation points to the necessity of including measures of the physical severity of the CLBP in future research on psychological processes in back pain. Some of the variance attributable to cognitive, affective, and behavioral variables also could be accounted for by differences in the physical limitations imposed by pathophysiological processes associated with the CLBP condition. This suggested that pain behaviors, depression, and sensory pain intensity were more a function of the severity of the back pain problem than a function of the appropriateness or incongruence of the way the CLBP patient presents in a clinical situation. The relationship between the severity of the back condition and the frequency of discrete pain behaviors supports the validity of these observations as reflecting more mechanical and neurological impairment (Keefe, et al., 1984). Also, the lack of a main effect for the groups on the sensory pain ratings after the
introduction of the covariate supports the validity of the sensory
ratings as specific to the severity of physical pain stimuli.

Some caution is warranted in interpreting the impairment and
disability indicators. As Fordyce (1983) has pointed out, there is a
difference between overt, publicly verifiable behavior and self-report
about that behavior. Most aspects of the determination of activity
restriction and mobility were based on the patient's report about his or
her pain-related behavior. Even the measures of spinal flexibility had a
perceptual component in that the patient indicated that the maneuver
was painful or not painful. Therefore, it was not surprising that these
measures were correlated with pain tolerance (Pope et al., 1980).

Implications for Patient Management

The limitations inherent in correlational designs imply cautious
treatment concerning the causal influence of the variables measured.
However, these results do suggest potential theoretical mechanisms that
may explain why incongruent pain indicators are predictive of poor
medical/rehabilitation outcome (Dzioba & Doxey, 1984; Lehmann et al.,
1985) or increased health care utilization (Waddell et al., 1984). One
explanation of the findings would be that these patients had more
severe physical impairment and disability, and therefore, were less
likely to respond to treatment and require more care. However, since
cognitive factors distinguished between pain groups even when the
severity of the back pain condition was taken into account, the degree
of restricted physical mobility and activity due to back pain was not
sufficient to explain group differences. Another explanation suggested
by these results would be that conventional medical/rehabilitation approaches failed to alter dysfunctional cognitive coping styles as reflected in catastrophizing and a perceived lack of efficacy over the pain sensations. The interpretation and perception of pain as more distressing and disturbing may result in greater health care utilization by incongruent pain patients because they may interpret their pain as a greater threat to their well-being (Leventhal et al., 1981; Mechanic, 1976) than control pain patients.

Some implications for treatment components in pain management programs are suggested by these results. Cognitive-behavioral based treatment programs, for patients identified by incongruent pain criteria, may be less effective to the extent that the emphasis is on teaching cognitive strategies for pain control. In comparison to control pain patients, incongruent pain patients were no different in their use of specific strategies in the experimental situation or on the Coping Strategy Questionnaire. Thus, cognitively-based therapy for these patients may be more effective to the extent that the treatment emphasis is on reducing catastrophizing cognitions (Turk et al., 1983), heightening confidence in control over pain exacerbations, and counteracting feelings of helplessness (Gottlieb, et al., 1977). Alternatively, special emphasis may need to be placed in carefully assessing exactly 'how' incongruent pain patients implement coping strategies. In cognitive/behavioral treatment of pain careful attention to the process of skill implementation has been considered crucial (Meichenbaum, 1985). Future research could determine if achieving cognitive/behavioral treatment goals would serve to enhance the quality
of life or enhance responsiveness to rehabilitation regimens for incongruent pain patients.

Incongruent pain patients no doubt, have a greater likelihood of being referred for psychological consultation where services are available. These patients are at risk of being false positives for clinicians to conclude inappropriately that there is no organic basis for pain and that psychological factors are primary. This position on the part of health care providers may prompt more exaggerated pain and distress on the part of the patient in order to convince the clinician of the 'reality' of the pain problem (Leavitt, 1985). In actuality, incongruent pain patients, in this investigation, appeared to have had a more severe organic pain problem. The 'reality' of these patients' pain may not be acknowledged especially when reports of suffering are associated with more dramatic, intense, and anatomically inconsistent displays of pain. It is suggested here that an adequate assessment of pain patient referrals requires the determination of what patient behavior prompted the referral. It is important to note in this regard that incongruent indicators may not necessarily be associated with psychopathology (von Baeyer, et al., 1983; Waddell, et al., 1980) or efforts to receive financial compensation. These results suggest that coping style and skills may be the most important assessment target in pain referral for psychological consultation if the referral has been prompted by incongruent pain display.
Cognitive/Behavioral Trials in the Assessment of Chronic Pain

This was the first investigation to report the use of cognitive-behavioral trials (Turk, et al., 1983) in the assessment of CLBP patients. Reports of cognitions in an actual standardized pain experience were the most important discriminators between types of clinical pain presentation. Further, immediate recall of cognitions during induced pain can be reliably and relatively easily coded and provide meaningful data. This investigation supports the potential clinical utility of using cognitive-behavioral trials (Turk, et al., 1983) to both sample cognitive coping style and discriminate subgroups of CLBP patients.

As previously suggested (Merluzzi et al., 1981), different types of cognitive assessment methods may produce different results. In this study, an unstructured immediately cued recall of cognitive events in an acute experimental pain session revealed different kinds of cognitive activity than did a structured, self-report, retrospective measure reflecting cognitive activity over a longer time frame. Conceptually similar kinds of pain-related cognitions were not correlated between these measures, with the exception of catastrophizing which was only moderately correlated. An assumption made here was that pain related cognitive activity could be roughly divided into two types: those that accentuate, exacerbate, or amplify pain sensations and those that attenuate and lessen pain. Principal component analyses of the Coping Strategy Questionnaire, as well as the Structured Interview Schedule for Pain categories, appeared to suggest three main categorizations: specific coping strategies, self-efficacy operations, and catastrophizing.
While finer theoretical discriminations are possible, more specific
categorizations may not be empirically demonstrable.

The lack of correspondence in the measures may reflect
differences between acute induced pain and chronic pain (cf.
Sternbach, 1984). It has been argued that experimental acute pain is
not at all similar to the clinical manifestation of such pain. This does
not mean however, that cognitions in the experimental pain situations
have no relationship to the chronic situation. As these results
demonstrate, the different back pain groups reported different kinds of
cognitions during the acute pain situation even though there was no
difference in pain tolerance between the groups. It would be
interesting to see if cognitions sampled during acute exacerbations of
back pain more closely correspond to cognitions sampled during the pain
induction task or to those reported on the Coping Strategy
Questionnaire. Perhaps what is more important in chronic pain is how
people behave during acute exacerbations, which are closer to
experimental pain, than the tonic, on-going, or usual pain intensity. It
has been shown for example, that patients exaggerate recall of previous
pain levels when current pain intensity levels are elevated (Eich et al.,
1985). Since it is difficult to trust peoples' report of their own
cognitive activity the cognitive/behavioral trial may provide a more
veridical evaluation.

It was also hypothesized that the different CLBP groups would
differ in pain tolerance, with the incongruent pain patients
demonstrating less perseverance. The lack of a significant difference
here may be due to the ceiling effect of the four minute time limit
imposed on exposure to the pressure pain apparatus, since over 50% (n=42) tolerated the full four minutes. Even with the limit there was a difference in the expected direction. Rather than actual pain tolerance, it may have been the perception of tolerance, as reflected in ratings of sense of control, that may have been more important. In this regard it was noted that two patients, both of whom tolerated less than 1 minute on the pressure pain task, spontaneously expressed how their performance showed that they had a high pain tolerance! Perhaps pain tolerance/endurance is an orthogonal dimension (cf. Wolff, 1984) to pain presentation. Alternatively, behavioral performance on this task is so situationally specific as to preclude association with pain presentation.

Conclusions

CLBP patients who displayed incongruent illness behavior and symptom report appeared to be less efficacious in their ability to cope with pain and appeared to engage in dysfunctional catastrophizing when experiencing pain. A tendency to evaluate pain as more distressing and as having more affective involvement was also observed in the patients identified by the incongruent pain criteria. While incongruent pain patients relative to control pain patients evidenced more depression and displayed greater pain behavior, these variables appeared to be more a function of physical limitations in activity and mobility. Defective pain coping ability may possibly contribute to avoidance of physical acuity and a worsening of the back pain condition. Physically-based treatment modalities (surgical interventions, TNS, physiotherapy) may
fail for incongruent pain patients as these interventions do not alter pain related cognitive activity. Rather than conceptualize these patients as having a 'psychological disturbance' perhaps the patient identified by the incongruent pain criteria should be conceptualized as having deficits in the effective use of coping strategies and ability to interpret and monitor pain in a way to attenuate the associated distress. Further research should address whether cognitive/behavioral interventions can facilitate the development of effective pain management skills in these patients and foster a greater level of physical and psychological well-being.
REFERENCES


- 112 -


transcutaneous electrical nerve stimulation and electroacupuncture.

*Spine, 8*, 625-634.


Appendix A

INFORMATION AND CONSENT FORM

We are interested in studying different back disorders and what kinds of pain are associated with them. We are also interested in what effects back pain has on physical movement and on thoughts and mood. Finally we want to study how people react to pain and what things they do to cope with pain. For this study, we are requesting 25 minutes of your time to do the following:

1. Complete a short questionnaire that asks about how you cope with your back pain;
2. Move from walking to standing to sitting to laying down positions while we videotape your movements;
3. Undertake a standard pain task where you will place a weight on your index finger and describe the physical sensations, thoughts, and feelings that occur.

Afterwards, we will be glad to discuss any questions you have about the research.

Since we want to find out how pain is related to different back disorders, we also ask for your permission to obtain diagnostic, laboratory, and medical examination data related to your back problem from the Back Pain Unit.
All of the information you provide will be kept confidential and used for research only. To ensure anonymity, all information will be identified by a number. Participation in the Back Pain Study is strictly voluntary. We would appreciate your help and cooperation but you are free to refuse or stop your participation at any time. Since this study is independent of the Back Pain Unit, whether you choose to participate or not will in no way affect your treatment at the clinic.

Thank-you for your time. If you have any further questions about this study, do not hesitate to call us.

I agree to participate in this study and give permission to the Back Pain Unit to release medical information solely for the purposes of this investigation and subject to the condition that this information is kept in strict confidence. I also acknowledge that I have received a copy of this form.

Signature:..........................Date:..........................
Appendix B
COPING STRATEGY QUESTIONNAIRE

The CSQ described by Rosenstiel and Keefe (1983) consisted of seven scales, 6 concerning cognitive activity and 1 concerning behavioral activity during the experience of pain. Each scale consisted of 6 items. Patients rated each item on a 7-point scale where: the '0' anchor indicated that the cognitive or behavioral activity was "never" characteristic of their experience during pain; the '3' anchor indicated that the cognitive or behavioral activity was "sometimes" characteristic of their experience during pain; the '6' anchor indicated that the cognitive or behavioral activity was "always" characteristic of their experience during pain; The seven scales have been listed below along with representative items:

1. Diverting attention:
   I count numbers in my head or run a song through my mind.
   I think of people I enjoy doing things with.

2. Reinterpreting the pain sensations:
   I don't think of it as pain but rather as a dull or warm feeling.
   I just think of it as some other sensation, such as numbness.
3. **Catastrophizing:**
   
   I worry all the time about whether it will end.
   
   I feel like I can't go on.

4. **Ignoring sensations:**
   
   I don't pay any attention to it.
   
   I just go on as if nothing happened.

5. **Praying or hoping:**
   
   I pray to God it won't last long.
   
   I have faith in doctors that someday there will be a cure for my pain.

6. **Coping self-statements:**
   
   I tell myself that I can overcome the pain.
   
   No matter how bad it gets, I know I can handle it.

7. **Increased behavioral activities:**
   
   I try to be around other people.
   
   I do something I enjoy, such as watching TV or listening to music.

In addition to these seven scales, the CSQ also contained two items concerning the effectiveness of patients' efforts to cope. Patients were also asked to rate, on 7-point scales, the amount of control they had over their pain and the extent to which they were able to decrease their pain.
Appendix C
PAIN DRAWINGS

Following Ransford et al. (1976), patients were given an outline of a human form depicting both the front and back perspectives. Included at the top of the page were 5 sets of symbols representing 5 different types of pain: numbness, pins and needles, burning, stabbing, and aching pain. Patients were instructed to illustrate on the outline the location, distribution, and type of pain using the different symbols. Scoring was based on following criteria:

1. Non-anatomical pain localization as reflected in drawings that depict:
   a. total leg pain
   b. lateral whole leg pain (trochanter area and lateral thigh was considered anatomically correct)
   c. circumferential thigh pain
   d. bilateral anterior tibial area pain (unilateral was considered appropriate)
   e. circumferential foot pain
   f. bilateral foot pain
   g. use of all four modalities suggested in instructions
2. Amplification or expansion, of pain as reflected in drawings that depict:
   a. back pain radiating to iliac crest, groin, or anterior perineum (coccygeal pain was not considered exaggerated)
   b. anterior knee pain
   c. anterior ankle pain
   d. pain drawing outside the outline

3. Excessive emphasis or focussing on a specific location as reflected in drawings that contain:
   a. explanatory notes and written descriptions
   b. circles around painful areas
   c. lines demarcating painful areas
   d. arrows highlighting painful areas
   e. excessive detail in the use of the symbols to illustrate the painful areas.

4. Tendency to depict global bodily pain where additional painful areas in the trunk, head, neck, or upper extremities are included on the drawing.

Details, examples, and the weighted scores for these criteria have been described in Ransford et al. (1976).
Appendix D

INAPPROPRIATE SYMPTOMS

Following Main and Waddell (1984), patients were assessed in a brief structured interview for the presence of inappropriate symptoms. The seven symptom criteria that comprise scale have been listed below:

1. Pain at the tip of the tailbone
2. Whole leg pain
3. Whole leg numbness
4. Whole leg muscle weakness
5. Lack of any relatively pain-free periods over previous year
6. Reaction to or intolerance of treatment for back pain
7. Emergency admission to hospital for back pain

Scoring was determined by adding the number of symptoms the patient endorsed.
### Appendix E

**DESCRIPTOR DIFFERENTIAL SCALES**

<table>
<thead>
<tr>
<th>PAIN SENSATIONS</th>
<th>PAIN UNPLEASANTNESS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Extremely Intense</td>
<td>Excruciating</td>
</tr>
<tr>
<td>Very Intense</td>
<td>Unbearable</td>
</tr>
<tr>
<td>Intense</td>
<td>Intolerable</td>
</tr>
<tr>
<td>Strong</td>
<td>Agonizing</td>
</tr>
<tr>
<td>Slightly Intense</td>
<td>Horrible</td>
</tr>
<tr>
<td>Clear Cut</td>
<td>Dreadful</td>
</tr>
<tr>
<td>Barely Strong</td>
<td>Frightful</td>
</tr>
<tr>
<td>Moderate</td>
<td>Miserable</td>
</tr>
<tr>
<td>Slightly Moderate</td>
<td>Distressing</td>
</tr>
<tr>
<td>Mild</td>
<td>Upsetting</td>
</tr>
<tr>
<td>Very Mild</td>
<td>Irritating</td>
</tr>
<tr>
<td>Weak</td>
<td>Unpleasant</td>
</tr>
<tr>
<td>Very Weak</td>
<td>Uncomfortable</td>
</tr>
<tr>
<td>Faint</td>
<td>Annoying</td>
</tr>
<tr>
<td>Extremely Weak</td>
<td>Distracting</td>
</tr>
</tbody>
</table>
Appendix F

EXAMINATION CHECKLIST

Please check the appropriate column for each sign and complete information at each blank (____) where required.

POSTURE & MOVEMENT:  POSITIVE  NEGATIVE.

<table>
<thead>
<tr>
<th>Sign</th>
<th>POSITIVE</th>
<th>NEGATIVE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sciatic list (lateral shift)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Abnormal rhythm on recovery</td>
<td></td>
<td></td>
</tr>
<tr>
<td>from flexion</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lumbar flexion: (____)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

DURAL IRRITATION:

<table>
<thead>
<tr>
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<th>NEGATIVE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bowstring</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tripod</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Femoral stretch</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Straight-leg raising with crossover</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Straight-leg raising to pain:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Right: (____) degrees</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Left: (____) degrees</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

ROOT COMPRESSION:  NORMAL  ABNORMAL  ANATOMICAL

<table>
<thead>
<tr>
<th>Sign</th>
<th>NORMAL</th>
<th>ABNORMAL</th>
<th>ANATOMICAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Motor</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sensory</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reflex</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>--------</td>
<td>-------</td>
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<td>-------</td>
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<tr>
<td>Root: (___)</td>
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</table>

**PALPATION:**

<table>
<thead>
<tr>
<th></th>
<th>NEGATIVE</th>
<th>POSITIVE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Localised tenderness to palpation over L1 to S1 and/or paravertebral muscles</td>
<td>____</td>
<td>____</td>
</tr>
<tr>
<td>Localised tenderness to palpation over sciatic notch</td>
<td>____</td>
<td>____</td>
</tr>
<tr>
<td>Operative scars</td>
<td>____</td>
<td>____</td>
</tr>
</tbody>
</table>

**NON-ORGANIC SIGNS:**

<table>
<thead>
<tr>
<th></th>
<th>NEGATIVE</th>
<th>POSITIVE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Superficial tenderness not localised anatomically</td>
<td>____</td>
<td>____</td>
</tr>
<tr>
<td>Non-anatomical deep tenderness not localised to underlying structures</td>
<td>____</td>
<td>____</td>
</tr>
<tr>
<td>Simulated axial loading</td>
<td>____</td>
<td>____</td>
</tr>
<tr>
<td>Simulated rotation</td>
<td>____</td>
<td>____</td>
</tr>
<tr>
<td>Marked improvement in straight-leg raising under distraction</td>
<td>____</td>
<td>____</td>
</tr>
<tr>
<td>Over-reaction to examination (disproportionate verbalization, facial expression, tension, tremors, collapsing, or sweating)</td>
<td>____</td>
<td>____</td>
</tr>
</tbody>
</table>

Please rate the extent to which this back pain problem is organically based:

1  2  3  4  5  6  7
Entirely organic  Mixed  Entirely non-organic
Appendix G

NON-ORGANIC SIGNS

Detailed descriptions of the non-organic signs are given elsewhere (Main & Waddell, 1984; Waddell et al., 1980). Following the work of these investigators, these signs have been described briefly below:

1. TENDERNESS: Inappropriate tenderness was considered to be one of two types:
   a. SUPERFICIAL: Tenderness reported in response to a light pinch to the skin over a wide area in the lumbar region. A localised band of tenderness conforming to a posterior ramus distribution may have been caused by nerve irritation and was not considered inappropriate.
   b. NON-ANATOMICAL: Deep tenderness to palpation that was felt over a wide area, was not localised to an identifiable anatomical structure, or extended to the thoracic spine, sacrum, pelvis and soft tissues.

2. SIMULATION TESTS: These were essentially 'bogus' tests that gave the patient the impression that a particular examination was being performed when in fact it was not. These tests were based on formal examination movements that elicit pain. The difference with these tests was that the movements were 'simulated' without actually being performed. The tests were conducted under conditions where suggestions of pain were minimized.
a. **AXIAL LOADING**: Report of low back pain in response to 'loading' on the patient's spine. The examiner pressed down on the patient's skull to produce a weighted 'load'. Report of neck pain was not considered anatomically deviant.

b. **ROTATION**: Report of back pain when the shoulders and pelvis were passively rotated in the same plane while the patient stood relaxed with feet together. Leg pain was not considered anatomically inappropriate when root irritation was present.

3. **DISTRACTION TESTS**: The basic idea behind the distraction test was to assess a physical finding in a routine manner and then to assess the finding again while the patient's attention was distracted. Distraction in this test was non-painful, non-emotional and non-surprising. Primarily, this consisted of simply observing an aspect of physical mobility throughout the examination period, while the patient was unaware that this particular physical aspect of their condition was being assessed. Thus, a finding that was consistently present was likely to be 'physically' based. A finding that was present only on formal examination and disappeared at other times was considered to have a non-anatomical component.

a. **STRAIGHT LEG RAISING**: Marked improvement in straight leg raising on distraction, as compared with formal testing when the patient's attention was focussed on the procedure, suggested a considerable psychological
element limiting SLR. Distraction was accomplished by ostensibly testing different movements by varying the position of the patient during the SLR test.

4. REGIONAL DISTURBANCES: Report of altered sensory and motor function involving a widespread region of neighbouring body parts. The essential feature was divergence from accepted neuroanatomy.
   a. SENSORY: Report of altered sensation over a wide area in comparison with the normal, unaffected side. This typically would involve the entire leg or the leg from the knee down as in a stocking pattern.
   b. WEAKNESS: Abnormal motor weakness was demonstrated on normal testing by a 'giving way' of any muscle groups that could not be explained on a localised neurological basis.

5. OVER-REACTION TO EXAMINATION: Over-reaction during examination that manifested as disproportionate verbalisation, facial expression, muscle tension, tremor, collapsing, and/or sweating.
Appendix H

PHYSICAL IMPAIRMENT INDEX.

Following Waddell and Main (1984), a Physical Impairment Index was calculated based on their clinically weighted chart. The breakdown of variables used to calculate impairment have been listed below:

1. Pain pattern:
   a. Low back pain
   b. Back and referred leg pain
   c. Root pain

2. Time pattern:
   a. Recurring
   b. Chronic

3. Previous fracture:
   a. Transverse process
   b. Wedge compression
   c. Fracture dislocation

4. Previous back surgery:
   a. None
   b. One
   c. More than one

5. Root compression:
   a. None
b. Doubtful
c. Definite

6. Range of motion measures:
   a. Lumbar flexion
   b. Straight leg raising left (checked with distraction)
   c. Straight leg raising right (checked with distraction)

Actual weights for the different manifestations within these variables classes and for the range of motion measures have been reported in Waddell and Main (1984). These weights also incorporate correction factors to allow for the interactions between various characteristics in particular diagnostic categories.
Appendix I

VIDEO OBSERVATION INSTRUCTIONS

1. Set up camera within 5 meters of patient. It is usually best to position the camera at the doorway to the room.

2. Make sure VCR is on, camera is on, power amp is on, and that the cable from the amp is connected to the Video in and Audio in connectors. The camera should be set for indoor lighting.

3. Make sure shades and curtains are closed and that the lights in the room are on.

4. Arrange cue cards in random order.

5. Show the patient where you want them to sit, stand, recline, and walk. Sitting should be on the bed. Reclining should be on the bed. Walking should be done at the farthest end of the room from the camera. Patients should be told to walk to the wall and back and keep repeating this sequence until told to do the next activity. Standing should be done next to the bed.

6. Take a pre-video rating of current pain intensity using the DDS scales.

7. Start VCR and instruct patient to do first activity. Unless patient is moving from one position to another there is no need to look through the camera eyepiece. Simply let camera roll, turn away from patient and watch your stopwatch. Do not talk,
smile, joke, or interact with patient. If patient makes eye contact, break eye contact. When patient is involved in movement you will need to observe patient through viewfinder (eyepiece) to ensure that a good picture is taken. Other than requesting position changes there is no interaction with patient.

8. Record activity order on the experimental assessment record and on the videotape record as these are performed.

9. Take a post-video rating of current pain intensity using the DDS scales.

10. After session is over, stop tape, replace lens cap, and record verbally the date then stop the tape.
Appendix J

PAIN BEHAVIORS

Following Keefe and Block (1982), the behaviors described below were coded from the videotapes.

Ambulatory/Postural Behaviors

1. Guarding: Abnormally stiff, interrupted or rigid movement while changing from one position to another (i.e., when recording during a shift) or during pacing. It includes patients using canes or walkers, and cannot occur during a stationary position (i.e., sitting, standing, or reclining). The movement must be hesitant or interrupted, not merely slow.

2. Bracing: Position in which an almost fully extended limb supports and maintains an abnormal distribution of weight. It cannot occur during movement (i.e., pacing, shifting), and must be held for at least three seconds. It most frequently is the gripping of the edge of a bed while sitting, but can also be against a table, etc., or cane or walker while standing. What appears to be bracing during movement is termed guarding. It can occur with a leg if patient leans against wall using no other support, but is not simply the shifting of weight when standing.
3. Rubbing: Touching, rubbing, or holding the affected area which includes low back, hips, and legs (for a minimum of three seconds). It includes patients' hands in pockets or behind the back, but not the hands folded in lap. It can occur during any interval of movement or non-movement. Patients' palm(s) must be touching the affected area to be considered rubbing during a "sit". If a clear view is not available, a rub is recorded if touching can be reasonably inferred from the patient's position.

Facial Expressions

1. Grimacing: Obvious facial expression of pain which may include: Furrowed brow, narrowed eyes, tightened lips, corners of mouth pulled back, clinched teeth. It often resembles wincing. Observer must be alert to catch this. It often occurs during a shift.

2. Sighing: Obvious exaggerated exhale of air, usually accompanied by shoulders first rising and then falling. Cheeks may be expanded. Includes moans or groans and other paralinguistic vocalizations.
Appendix K

VIDEO SCORING PREPARATION

1. Dub over the first 10 minutes of the tape. This is done by using the VCR with microphone connected to audio dub. Let tape run for at least 10 seconds then say "OBSERVE", time out 20 seconds, then say "RECORD-1", time out 10 seconds then say "OBSERVE", time out 20 seconds then say "RECORD-2", time out for 10, etc until you reach "RECORD-20". Note: Do not always start the observation at the exact point that you told the patient to do the first activity. If you do, most of the position changes will occur during Record intervals and you will not be able to observe shifting from one position to another. Thus, you should start dubbing within 10 to 90 seconds of the time the tape comes on.

2. Score tape: first observer.

Appendix L

PRESSURE PAIN PROCEDURE

1. Instruction to Patients: I would like you to place the index finger of your (dominant) hand on this flat plastic piece (point). I will place the weighted wedge down on your finger which will cause a sharp pain there. Try to keep the weight on your finger as long as you can. I will ask you to rate the intensity of the pain from time to time by pointing to the words on these lists (point) that best describes the sensations. Afterwards, I will ask you some questions about the thoughts and feelings that occurred to you while you tried to keep the wedge on your hand.

2. Steps:
   a. Place patient's finger in the pressure apparatus. Adjust cushions to ensure a comfortable, snug fit.
   b. Put the weighted wedge down on their finger. Start timing.
   c. Ask for an immediate rating and then every 30 seconds thereafter on the DDS word lists. Record the ratings on the experimental assessment sheet.
   d. When the patient requests termination, stop the watch and have the patient immediately rate the intensity of the pain.
e. If the patient has not lifted the weight after 4 minutes, remove the weight.

f. At termination, tell patients that the wedge will leave a mark that will disappear in a few minutes.

g. Begin tape recorder and SISP.
Appendix M

STRUCTURED INTERVIEW SCHEDULE FOR PAIN

The interview, adapted from Genest (1978), begins as follows:

ONE OF THE THINGS WE ARE INTERESTED IN IN THIS STUDY IS WHAT PEOPLE ARE FEELING AND THINKING ABOUT WHILE THE WEDGE IS PRESSING ON THEIR FINGER. I AM GOING TO ASK A FEW QUESTIONS ABOUT ANY THOUGHTS, FEELINGS OR ANYTHING THAT OCCURRED TO YOU WHILE PRESSURE WAS APPLIED TO YOUR FINGER AND I WOULD LIKE YOU TO ANSWER IN AS MUCH DETAIL AS YOU CAN. OK? TRY TO IMAGINE YOURSELF BACK DURING THE FEW MOMENTS JUST BEFORE THE WEDGE WAS APPLIED TO YOUR FINGER. TELL ME EVERYTHING YOU CAN REMEMBER ABOUT WHAT YOU WERE THINKING AND FEELING AT THAT TIME, EVEN IF YOUR THOUGHTS WERE BRIEF OR RANDOM, AND EVEN IF THEY SEEM TRIVIAL.

Reflect each of the subject's items in turn, paraphrasing them briefly when the subject pauses. If the subject has provided more than three items, reflecting the first, some representative sample of the following ones, and the last item. At any point, if the subject reports having done something non-cognitive (eg., "looked at the tape-recorder", "looked away", "tapped my knee"), respond
with, "WHAT WERE YOU THINKING WHILE YOU... (looked at the
tape-recorder", etc.). Prompt if necessary. See note 1. Then ask:

IS THERE ANYTHING ELSE?

Repeat this question until the subject reports no new cognitions
that occurred before the pressure was applied. Then proceed:

ONCE THE WEDGE WAS PLACED ON YOUR FINGER, WHAT
KIND OF FEELINGS AND THOUGHTS DID YOU HAVE THEN?

Prompt if necessary. Then, repeat until no further responses are
given:

AFTER THAT, WHAT CAN YOU REMEMBER?

And, until no further cognitions are reported, ask:

IS THERE ANYTHING ELSE?

When subject reports they can recall no further information:

AS YOU WERE SITTING THERE, WITH THE WEDGE PRESSING
ON YOUR FINGER, GIVING REPORTS FROM TIME TO TIME,
WHAT ELSE DO YOU RECALL EXPERIENCING, ANY
THOUGHT, FEELING, IMAGE--EVEN FLEETING OR RANDOM?

Finally, ask:

WHAT DO YOU REMEMBER THINKING ABOUT OR FEELING
JUST BEFORE THE WEDGE WAS LIFTED?

Again, until the subject reports no new cognitions, repeat:

IS THERE ANYTHING ELSE?

NOTE 1: If the subject (1) reports being unable to recall
anything when a question is posed, or (2) responds to a question
very briefly or with apparent difficulty in either formulating a
response or remembering, then prompt with a question such as one of the following:

WHAT WERE YOU THINKING ABOUT?
HOW WERE YOU FEELING?
WAS THERE ANYTHING ELSE GOING ON?
CAN YOU TELL ME MORE ABOUT THAT?

If these prompts are insufficient to elicit more than a minimal response from the subject, then assist by "painting a picture" in more detail by describing specific aspects of the situation.

NOTE 2: If it is unclear whether a statement made during the interview is meant to be a report of a cognition that occurred during the pain pressure task or is simply something that the subject is thinking of during the interview, the ambiguity should be resolved by a question such as:

WERE YOU THINKING ABOUT THAT THEN (DURING THE PAIN PRESSURE TASK)?

Request additional clarification if necessary.
Appendix N

SISP SCORING KEY

The spontaneously reported cognitions were coded on a 5-point scale for each of the 6 categories from Genest (1978). The 5-point rating scale had the following anchors:

1. No occurrence of the thought/feeling category
2. Some elements of the thought/feeling category
3. At least one clear occurrence of the thought/feeling category
4. Multiple examples or implication that this thought/feeling category was more than an isolated cognitive event
5. Implication that the thought/feeling category predominated mental activity

The categories, adapted from Genest (1978), were defined as follows:

1. Dissociates Pain From Self
   a. Statement or implied meaning that the pain is limited to one part of the body with the implication or explicit statement that this limitation made the pain less aversive or bothersome.

   Examples: "My mind was calm; it was just my finger that was hurting". "I just thought about how comfortable I was in the rest of my body. My finger wasn’t going to bug the rest of me".
b. Report of "Objectively observing" or attempting to objectively observe sensations in the painful part with some detachment (i.e., negative affect is not salient).

   Examples: "I think I was trying to feel the pain, to think about what was going on in these fingers". "I was feeling the sensations, the throbbing and the numbness; looking at my finger and feeling it".

c. An expression of distance from the sensations, either physical or psychological.

   Examples: "The pain seemed far away, not really bothersome". "It seemed my arm was experiencing something irrelevant, unimportant".

d. Report of not thinking or thinking about "nothing".

   Examples: "I tried not to think". "It felt like nothing was coming, no input, just sort of an emptiness".

2. Relaxation

   Reference to being drowsy, relaxed, at ease, or in a similar state, either physically or mentally.

   Examples: "I felt calm, just took it easy". "I took a deep breath and felt the tension drain away for awhile". "I just tried to relax".

3. Imagery

   Report of an image, either from memory or fantasy, that does not include pain, or includes pain but without negative affect.
Examples: "I was just imaging that I had smashed my finger and was lying on a hospital bed being taken care of by nice nurses". "I was planning my summer trip home, thinking of all the details".

4. Non-Imagery Distraction

Report of any thought or feeling not related to the pain, or an attempt to ignore or distract attention from the pain, that does not constitute an image (see 3 above).

Examples: "I was going over my appointment schedule for tomorrow". "I kept my thoughts on the sounds from the corridor". "I was tapping my foot".

5. Sense of Control Expressed

a. A statement that the patient could, or felt able to control physical sensations or degree of painfulness.

Examples: "I thought it would be possible to just not think about it; then it shouldn’t really bother me; it wouldn’t hurt me as much". "I felt I could reduce the pain if I tried".

b. A deliberate attempt to use some strategy or technique to affect the sensations, or the attribution of some variation in the sensations, or painfulness, or the awareness of sensations to some action of the patient. Just the use of a strategy is not sufficient; intention to affect the experience must be explicit or implicit (e.g., determined extensive or deliberate use, or statement of intent).
Examples: "I was just trying not to concentrate on my finger, because sometimes when you're conscious about something you can increase your feelings in it". "I started to distract myself...to wiggle my toes...and pinch myself on my right leg. I thought that would help". "When I looked at it it seemed that it hurt more than when I looked away so I turned away". "I was singing this song in my head, and then I noticed that it didn’t bother me as much".

BUT NOT: "I was just looking around the room".
"I was bored and began thinking about a book I'm reading".

c. A statement that the patient could, or felt able to control his reactions to the sensations experienced, that is, that he could persevere despite pain, or could tolerate the aversive stimulation.

Examples: "Oh I can take this. I've got a good tolerance for pain. think it's a snap". "I figured I could control myself--that it would be painful, but what's a bit of pain? I could take it anyway".

d. A deliberate attempt to use some strategy or technique to affect reactions to the sensations, or the attribution of control of reactions to some action of the patient.

Examples: "I was concentrating on saying to myself, 'You've got to keep it on; you've got to keep it on,'
and gritting my teeth, and biting my lip and
pinching my leg--doing anything". "I was able to
stay because I was thinking about how others had
done, and that made me stay in longer".

e. Indication of being in control by being able to terminate.
Example: "I knew I could stop whenever I wanted,
so I just kept going".

6. Catastrophizing
a. An expression of fear, anxiety, or other negative affect,
or "worrythoughts" about possible dire outcomes.
Examples: "I was afraid of what was going to happen
to my finger". "I was thinking that there might be
an electric current or something in there". "I
thought, 'This will hurt'". "I hate pain" (as a
reported cognition). "I thought my arm might be
damaged if I stayed too long".

b. Attention focused on or drawn to pain or other
unpleasant feelings. Either: (a) a statement that the
patient thought of little other than the pain, or could not
attend to anything else; or (b) reference to pain,
discomfort, or unpleasant feelings, or to attempts to
escape from such events or both.
Examples: "Except for the pain, I wasn't really
thinking about anything else". "All I could feel was
the pain". "I couldn't concentrate on anything
else".
Examples: "It's really bugging me now... It was starting to bug me there... Just trying to get away from the thought again... The pain was steady, you know, it was hard". "I was thinking I should think about other things... I was trying not to think about it... It was bothering me more... When I looked at it, it hurt".

c. Termination thoughts. The patient mentions having thought about termination or not terminating (as a conflict, not a resolved decision to stay).

Examples: "All the way through, I was wondering, 'Well, should I stay a little longer?'". "I was thinking, how long could I stand it... 'I wish I could take it out'... kept encouraging myself to stay in". "I really wanted to take it off". "It crossed my mind to take it off, but I just didn't... thinking, 'God, I'd like to take it off'... I was saying to myself, 'You've got to keep it on'... I figured I'd be taking it off soon".

d. Indication of no control over sensations, painfulness, or reactions to sensations.

Examples: "It (the patient's attempt to distract herself from the pain) didn't work. I couldn't concentrate on it". "I wondered whether I would feel a lot of pain anyway (despite attempts to control it)".