PSYCHOLOGICAL FACTORS
IN CHRONIC LOW BACK PAIN

An investigation of the role of physical
and psychological factors in the severity of illness.

By

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DEDICATION

For my wife Carolyn

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Summary

This thesis represents an attempt to evaluate the significance of psychological factors in chronic low back pain. A number of major limitations in previous research were identified. New scales for the assessment of severity of illness, as represented by a degree of disability; and objective physical characteristics (OPC) were constructed and validated. Previously derived scales measuring inappropriate signs, the ratings of pain, depressive symptomatology, general personality traits and specific hypochondriacal fears or beliefs were examined statistically and modified or rejected as appropriate. New scales for the measurement of inappropriate symptomatology and somatic awareness were constructed. Items and scales which were reliable, discriminated chronic back patients from normals and from other clinical groups were used in an examination of severity of illness in a number of cohorts of low back patients presenting for assessment of suitability for treatment to a University Department of Orthopaedic Surgery in the West of Scotland. Multiple regression analysis permitted the evaluation of a number of specific hypotheses concerning principally degree of disability. The evaluation of the contribution of the OPC permitted the subsequent evaluation of various psychological factors. Current psychological distress (depressive symptomatology and heightened somatic awareness) and magnified illness presentation or illness behaviour (inappropriate signs and inappropriate symptoms) doubled the level of prediction by the OPC, and were relatively independent. These four variables proved much more important than ratings of pain, general personality traits or specific hypochondriacal fears or beliefs. (Certain psychological features are as important as physical characteristics in the prediction of severity of illness). The thesis demonstrates that it is possible to construct valid and reliable measures of physical and psychological features of chronic LBP. the nature of illness behaviour which may be markedly affected by previous treatment suggests the need for further examination of doctor patient communication.

ABBREVIATIONS

CLBP	Chronic low back pain patients
D	(Usually) MMPI Depression Scale
df	Degrees of freedom
EPQ	Eysenck Personality Questionnaire
GP/GPS	Patients referred directly from their general practitioner.
Hs	MMPI Hypochondriasis scale.
Hy	MMPI Hysteria scale
IBQ	Illness Behaviour Questionnaire
K	Kappa Coefficient
Mod.Zung	Modified Zung Depression Rating Scale
Mood	Four psychological variables (clinical and psychometric).
MMPI	Minnesota Multiphasic Personality Inventory
MSPQ	Modified Somatic Perception Questionnaire
Non-Backs	Non-Back orthopaedic patients
NTS	Null Test Statistic
OA	Osteo-arthritic patients
O.C.	Problem or secondary referrals.
OPC	Objective Physical Characteristics
PRI	McGill Pain rating Index
Problems	Patients referred from other hospital consultants
R.A.	Rheumatoid-arthritic patients
sig.	Significance level
Zung	Zung Self-Rating Scale

Codes for individual variable names used in the computer analysis are presented as appropriate in the Tables and Appendices. Most being simply 8-letter abbreviations are more-or-less self-explanatory.

I INTRODUCTION

Approximately 50% of the population can expect to suffer from back trouble at some time in their life. In Western society, along with respiratory disease, heart trouble and arthritis or rheumatism, backache is one of the major causes of morbidity disability and perceived threat to health, particularly in the most active middle years of life (Rowe, 1969; Benn & Wood, 1975; Wood & Badley, 1980). Backache causes more time off work than strikes and the incidence of low back pain disability is growing more rapidly than the workforce or than other disabilities. The cost both economically and in terms of human suffering, not only to the patient but his family is considerable. Paradoxically, despite efforts of modern medicine, with its associated technology, the problem appears greatest in the quarter of the world's population living in Western 'civilisation', while the rest of mankind seems to be able to cope with backache despite an almost total lack of technologically orientated medicine, back surgery or social security.

Patients with low back pain (LBP) present a difficult diagnostic problem. Even with the newest and most sophisticated clinical and laboratory techniques, there are a substantial number of patients in which no organic pathology can be detected (Wolkind & Forrest, 1972). Two types of explanation have been offered for this. Firstly, our instruments or techniques may be insufficiently sensitive to detect the organic pathology (Engel, 1959). Alternatively, presentation of pain complaints may be determined by psychological factors. Thus, people in distress, for example may develop physical symptoms as a means of communicating or managing emotional difficulties (Leavitt and Garron, 1979a). There is widespread agreement in the literature that psychological factors are of importance, especially in the chronic pain patient, but controversy surrounds the description and precise significance of such factors (Caldwell and Chase, 1977). An unfortunate consequence of the clinician's search for explanations for treatment has been the adoption of a diagnostic dichotomy of "functional" versus 'organic'. The diagnosis 'functional' is frequently a diagnosis 'by exclusion' rather than one based on the presence of significant psychological features and frequently has pejorative overtones. This simplistic dichotomy is frequently paralleled by the equally inappropriate

division into 'imaginary' and 'real pain'. This thesis represents an attempt to assess patients physically and psychologically. The contribution of both perspectives to the explanation of the patient's severity of illness (as represented by degree of disability) then will be considered.

I GENERAL AIMS OF THESIS

The general aim of the thesis is to examine the relative importance of physical and psychological factors in the prediction of severity of illness as represented by disability. New measures of disability and objective physical characteristics are constructed. The influence of different psychological variables and classes of variable on the prediction of disability are examined, both directly and when differences in gender and objective physical characteristics have been taken into account. The predictive power of subjective pain ratings will also be examined.

The psychological variables represent four main types: general personality traits, specific hypochondriacal fears and beliefs; current psychological stress (as represented by depressive symptomatology and heightened somatic or autonomic awareness), and magnified illness presentation (as represented by inappropriate signs and inappropriate symptoms). New scales to measure somatic awareness and inappropriate symptomatology are constructed.

Hypotheses are presented in terms of individual classes of variable but the results for each type of variable will be examined not only for the class of variable but also for the individual independent variables which comprise it.

<u>Hypotheses</u>

1. Disability will be predicted by the objective physical characteristics of the disease.
2. Disability will be predicted by general personality traits.
3. Disability will be predicted by specific hypochondriacal fears and beliefs.
4. Disability will be predicted by depressive symptomatology and heightened somatic or autonomic awareness.
5. Disability will be predicted by magnified illness presentation.
6. Disability will be predicted by subjective pain ratings.

Following the examination of each hypothesis, the particular independent variable or variables will be examined to determine the magnitude of their specific contribution to explanation of the dependent variable and the extent to which this relationship is attenuated by prior consideration of other independent variables.

The thesis will conclude with brief consideration of other influences on severity of illness; the nature of magnified illness

presentation or illness behaviour will be examined; implications for assessment and treatment of chronic LBP will be suggested; and recommendations for further research will be made.

II LITERATURE REVIEW

II.1 The Nature of Pain

The study of pain has been bedevilled by differences in theoretical focus and definition, and much of the current confusion about chronic pain seems to have its origin in uncertainty about the nature of pain itself. Historically, from the time of Aristotle, pain was distinguished from the five senses and classed as one of the "passions of the soul" (Dallenbach, 1939). Thus Marshall (1894) following Bradley (1888) insisted that pain and pleasure were mere aspects of experience and to be regarded as an affective state and not a sensation. Brodie (1837) wrote that "in 'upper class women' four-fifths of joint pains were hysterical and claimed that the primary factors were 'fear, suggestion and unconscious simulation'" (cited in Merskey & Spear, 1967, p 59). Increasing sophistication in physiology linked pain as a sensation with nerve fibres. The classical approach, based on specificity theory, explained all pain phenomena on the basis of specific nerve impulses which were transmitted over special pathways to a pain centre. Head (1920) made a clear distinction between 'discomfort' and 'pain' anticipating recent statistical studies on the rating of pain which have distinguished clearly emotional and sensory components. More recently, factors determining treatment-seeking and complaint presentation have implied that the nature of pain cannot be understood without an appreciation of the context within which the pain is being presented or evaluated, and marked cultural differences in the expression of pain suggest that not only is the question 'what is the nature of pain' unanswerable, but the formulation of the initial question perhaps needs reconsideration. On the one level 'pain' can be construed as a Platonic idea, the specific manifestations of which are many and various, or on the other hand one can consider the occurrence of pain events, whether physiological, behavioural, emotional, cognitive or socio-economic, and reformulate the initial question into a series of questions about pain phenomena, each answerable within a specific discipline with its associated theoretical assumptions and 'language-games' or rules about language usage. The approach in this thesis will

be that of linguistic parallelism, leaving aside the complex philosophical issues concerning the relationship between mind and body.

II LITERATURE REVIEW

II.2 Incidence and Prevalence of Low Back Pain (LBP)

It has been estimated recently that acute and chronic pain costs the national economy of the U.S.A. between 85 and 90 billion dollars annually and nearly one-third of the American population has persistent or recurrent chronic pain. Over 50 million individuals are either partially or totally disabled for periods of days, weeks or months, and some permanently (Ng, 1981). Furthermore, on the basis of these data, it was estimated that as a result of chronic pain, well over 700 million work days are lost. Of all chronic pain problems, perhaps the most intractable is Low Back Pain (LBP). The LBP patient represents 50% of patients passing through the Rehabilitation Institute of Chicago (Addison, 1981), 64% at the North West Pain Center, Oregon (Seres et al, 1981), 65% at Emery University Pain Control Center (Brena et al, 1981), 50% at University of Virginia Pain Clinic, Charlottesville (Carron and Rowlingson, 1981), 100% at the University of Miami School of Medicine Program (Rosomoff et al, 1981), 23% (with lower extremities) at the University of North Carolina Pain Clinic (Gregg and Ghia, 1981), 67% (with headache) at University of Washington Clinical Pain Service (Murphy , 1981) and 30% at the New Hope Pain Center (Crue and Pinsky, 1981).

LBP is not only the most frequent pain problem, it is also one of the most frequent and costly health problems. It has been described by Finneson as the worst plague of the twentieth century (Neal, 1978). Hult (1954) on the basis of early Swedish research suggested that about two-thirds of all people experience LBP at some time in their lives and over one-third are at some time incapacitated by it, but these figures are probably too conservative (Nachemson, 1976). Rowe (1969) has shown that LBP is the second most common cause of time loss from work (second only to upper respiratory infections) and the incidence of compensable time loss from work would appear to be about 2% of workers per year (Kelsey et al, 1979; Nachemson, 1976). There are some eight million Americans with permanent impairments of the spine and of the chronic health conditions these are the most common and costly during the prime working years (Kelsey et al, 1979; Nachemson, 1976). In Industrial Settings 13-38% of all injury claims involve the low back (Drouin, 1973; Kosiak et al, 1966; Schein, 1968; Sternbach

et al, 1973a;Troup 1965). Cross cultural comparison of costs and and actual incidence of LBP cases is clearly problematic, but it has been reported that at the British Columbia Workers' Compensation Board (BCWCB) over 25,000 new LBP claims are received each year (Satterberg, 1978). Many annual cost figures are stated in millions if not billions of dollars (Wilfing, 1981).

In the United Kingdom, the problem of LBP is of comparable magnitude. Backache causes more time off work than strikes and each year some 12 million working days are lost by a third of a million people with backache. 1.1 million patients consult their family doctor, 487,000 new patients are referred to hospital out patient departments, 34,000 are admitted to hospital and 5,100 have an operation on their back (Benn and Wood, 1975). Other surveys have shown that 25% of all working men are affected each year (Haber, 1971), that one man out of twenty-five changes his work because of back pain (Taylor, 1976). On any one day 0.05% of the British workforce will be off work with back trouble for more than six months (Wood & Hadely, 1980). Between 20 and 35% of all new orthopaedic referrals concern backache. Cumulatively there are 80,000 people in the United Kingdom (about 0.015%) permanently disabled by backache and arguably the worst back cripples result from the 10-15% of operations which fail and lead to repeated back surgery (Waddell et al, 1979). The total annual cost of backache in Britain is at least £320. million. Other international incidence data are presented by Andersson (1983).

Even more disturbing than the incidence and cost figures concerning LBP are recent analyses indicating that the incidence of LBP disability is growing more rapidly than the workforce or other disabilities generally (Brown 1977; Drouin 1973; Kelsey et al, 1979; Kosiak et al, 1966; Tunturi and Patiala, 1980; Wickstrom, 1978).

It is clear that despite increasing sophistication in technological medicine, the problem of LBP, with its associated staggering financial implications and human suffering remains a major challenge for health care professionals.

II LITERATURE REVIEW

II.3 The Nature of Low Back Pain

The Anatomy of the Lumbar Spine

A detailed account of the anatomy and physiology of the lumbar spine is presented in many authoritative textbooks (Jayson, 1976a) and only the briefest of accounts will be presented here.

The lumbar spine is composed of five bony vertebrae extending caudally from the 12th thoracic vertebra, which is the lowest vertebra having an attached rib to the fused vertebrae which form the sacrum. The lumbar vertebrae and sacrum form a curve, concave posteriorly, referred to as the lumbar lordosis. Each vertebra consists of a solid approximately cylindrical vertebral body with a number of bony posterior projections which provide transverse and spinous attachment processes for ligaments binding the stack of vertebrae together with superior and inferior articular processes forming joints between adjacent vertebrae. The inferior articular process of one vertebra and the superior process of the next lower vertebra form the facet or apophyseal joint. The dura-clad spinal nerves, or cauda equina, lie within the spinal canal formed by the vertebral foramina. The pedicles of each vertebrae are arched between the vertebral body and apophyseal joint, creating inferior and superior notches and the nerve roots, serving sensory and motor functions in the lower body leave the spinal canal through the holes or foramina formed by these notches between successive stacked vertebrae.

The vertebrae are separated by intervertebral discs which act like cushions and are structually similar to flattened golf balls having cartilaginous end plates at the disc's interface with the vertebral bodies, a gelatinous centre called the nucleus pulposus, and a spirally arranged fibrous periphery called the annulus fibrosus which is composed of very long-chain organic molecules including collagen and mucupolysaccharides. Hydraulic action allows the healthy disc to distribute weight evenly on the vertebral end plates while allowing movement in all directions (Nachemson, 1975; Parke and Schiff, 1971). The vertebrae are bound together with numerous short ligaments between the vertebral bodies and between the transverse and spinous processes, and by posterior and anterior longitudinal ligaments running the length

of the spinal column.

The bony segments of the spinal column are surrounded by numerous muscle groups which stabilize the column and provide motor power for movement in all planes. Perhaps surprisingly the exact functions of various muscles of the back are not well understood (Basmajian, 1974) but those muscles lying parallel to the spine must have major involvement in flexion/extension of the trunk, while those muscles with oblique orientations must have major involvements in rotation of the trunk and spinal stabilization (Farfan, 1973).

Biomechanics of the Lumbar Spine

The oblique muscles in various combinations provide the motor forces for rotational movements of the trunk, the degree of rotation being limited by the obliquely orientated, wedge shaped apophyseal joints. Flexion and extension of the trunk are brought about by two mechanisms: firstly, by contraction of muscles running parallel to and posterior to the spinal column, with possibly some help from the oblique muscles and; secondly, by a hydraulic "balloon effect" involving the abdomen (Bartelink, 1957). The balloon effect is created by the tightening of the oblique abdominal muscles which causes the soft abdominal contents to push on the pelvic floor and diaphragm, thereby promoting extension of the trunk. This effect is probably important to movements of the trunk because extension brought about only by the muscle groups posterior to the spinal column is limited by the very ineffective mechanics of a first class lever having a very long lever arm to the load and a very short lever arm to the mode of the force.

The muscles posterior to the spine, which provide the motor force on the "short arm" of the lever are of massive size and have been calculated (Farfan, 1973) to be capable of a direct pulling force of 650 pounds. The forces operative on the lumbar discs are maximal at the 4 and 5 levels (Nachemson and Morris, 1964) this being the instant centre of rotation of the body (DePalma and Rothman, 1970) in flexion/extension. It has been suggested, for example, that a 170 pound (12 stone) man lifting 200 pounds (14 stone) can place a load of 2000 pounds (140 stone) on hisL5-S1 disc, but this figure may be somewhat excessive (Farfan, 1973). Nachemson and Morris (1964), using a pressure transducer to measure intradiscal

forces, have reported a loading of 220 kilograms in the third lumbar disc of a man lifting a 50 kilogram weight.

Pathology and the Lumbar Spine

A number of pathological conditions have been implicated in LBP. It has been remarked (Jayson, 1976b p 562) that radiological changes of lumbar spondylosis and apophyseal osteoarthritis are very common but that the associated symptoms are extremely variable. In fact such indications of wear and tear are a reflection of the ageing process. It is not infrequently found that in studies of asymptomatic subjects, marked radiological changes can be demonstrated. Diagnostically, the clinician has to exclude inflammatory disorders, neoplastic disorders, metabolic disorders, Paget's Disease and sources of "referred pain" experienced in the lumbar back but originating with pathology in the pelvic or abdominal viscera. Of the structural disorders possibly implicating LBP, the most frequent is a prolapsed intervertebral disc (Hirsch, 1966). This involves a decrease in the height of the disc and a subsequent degeneration of other parts of the joint. The aetiological processes responsible for disc degeneration are not wholly understood. It has been suggested that an autoimmune reaction may lead to breakdown of intradiscal material (Bobechko and Hirsch, 1965) but this would still require an antecedent breach of the membrane which normally isolates the disc. The recognised diurnal variation in disc height associated with a decrease in water content after a day in the erect position (Brown, 1971) suggests that weight bearing on the disc causes the change. With age, the water content of the disc and the disc height decreases (Brown, 1971), this change being associated with increased viscosity of the nucleus pulposus and derangement of the annulus fibrosus (Ritchie and Fahrni, 1970). With these changes, the disc loses its capacity as a distensible cushion and shock absorber, and the gel of the nucleus pulposus may become extruded through rents in the weakened deranged annulus (Ritchie and Fahrni, 1970).

Trauma, i.e. sudden, unusually high weight loading on the spine would appear to be an insufficient explanation of disc herniation since only 20% or less of disc herniations appear to be preceded directly by trauma (Dillane et al., 1966; Hirsch, 1966) and even those cases are usually lifts of under 50 pounds (McGill,

1968). Such lifts may simply precipitate rending and extrusion of already weakened discs. A number of additional factors lend support to implication of prolonged weight loading and disc degeneration. Firstly, a primary factor leading to disc degeneration is probably the force placed on the discs by the mechanics of man's erect posture, as it has been demonstrated that quadrupeds forced to assume this posture develop disc lesions that would not otherwise develop (Yamada, 1962). Secondly, the maximal forces in the human spine are operative at the L4 - L5 and L5 - S1 levels, and it is at these two levels that 96% of all disc protrusions occur (DePalma and Rothman, 1970). Furthermore, biomechanical considerations indicate that the major forces act on the posterior aspects of the lumbar discs and it is there that the vast majority of breaches of the annulus occur (Wilfling, 1981). The evidence concerning the association between heaviness of work and LBP or disc degeneration is unclear (Nachemson, 1976; Troup, 1965) but will be discussed later.

However, once disc generation has occurred, a well documented chain of other degenerative changes seems to take place. With the decrease in disc height the flexion/extension movements shifts posteriorly (White and Panjabi, 1978) and the wedge shaped apophyseal joints are driven together so that their normal light sliding action is destroyed and a heavily laden grinding action results which soon destroys the smooth cartilaginous surfaces of the joints and results in the development of inflammation and rough, arthritic surfaces. Secondly, the vertebral bodies themselves may come in close contact creating lips or spurs on their anterior or posterior margins (MacNab, 1971).

It seems that pain can be produced in the degenerated joint in a number of ways. The adult disc itself does not appear to be supplied with pain fibres (Hirsch, 1966) but the ligaments containing the disc between the vertebrae and the capsules of the apophyseal joints are richly innervated and can be sources of pain (Frymoyer and Pope, 1978). Secondly, muscle spasm, thought to reflect a splinting reflex protecting a sore joint is often seen in the posterior muscles of patients with LBP and may be a source of pain. Thirdly, a protrusion of nuclear disc material, and/or the lips and spurs formed on the vertebrae, can impinge on

the cauda equina or nerve roots and pain and/or motor and sensory losses then result in the peripheral area innervated by the impinged nerve. This is the pathological mechanism which has been identified as being responsible for the symptom complex known as sciatica (Mixter and Barr, 1934).

Spasm (hyperactivity) of the back muscles is a very frequent observation in patients complaining of LBP. De Palma and Rothman (1970) referred to spasm as a consistent finding and Nashold and Hrubec (1971) systematically documented back muscle spasm clinically in 72% of a series of over 1000 patients. The back muscles of many LBP patients are rigid and boardlike even in a rest posture (Nashold and Hrubec, 1971). Muscle spasm is reported in LBP patients in the acute phase of the disease although with varying incidence. This variability may be explained in part by the assessment procedure. Muscle spasm is usually assessed clinically by palpation "a gross and highly subjective procedure which no doubt suffers a high error rate in differentiating abnormal activity of muscle lying under variable thickness fat pads from the 'normal' muscle tightness resulting from posture and possibly also the patient's tenseness during examination" (Wilfling, 1981, p20). The statistical unreliability of spasm as a clinical rating recently has been demonstrated (Waddell et al., 1982). Many EMG studies of back patients can be found in the literature but these studies involve the qualitative diagnostic use of EMG measures for the detection of denervation of muscle groups by impingements on the nerve roots at the spinal level. Some attention has been paid to muscle tone per se. Wilfling (1981) reports of a series of Japanese studies seeming to demonstrate higher back muscle tension in LBP subjects in comparison with normals during various movements and in various static postures and it has also been found that with prolonged standing LBP subjects showed increases in posterior back muscle EMG, whereas normal subjects showed EMG decreases (Jayasinghe et al., 1978). Some indirect evidence of increased tonus in the back muscles of LBP patients is also available. LBP patients show decreased lumbar lordosis (Farfan, 1973, Nashold and Hrubec, 1971) and a biomechanical analysis has shown that tightening of the posterior back muscles flattens the lordosis (Farfan, 1973).

It has also been shown that the ratio of tonic (slow) muscle volume to phasic (fast) muscle volume is higher in the back muscles of patients with a history of LBP than it is in normal subjects Hafner et al (1966) pharmacologically brought about total muscle paralysis in their patients for 15-20 minutes thrice weekly and reported dramatic enduring relief of LBP symptoms and Schlesinger and Stinchfield (1950) injected the back muscles of their patients with Myanesin, a potent muscle relaxant and reported prompt pain relief in the patients, the relief being permanent in some. Recently biofeedback from the lumbar muscles has been used in gait analysis and in retraining walking at Swedish Hospital in Seattle (Cram and Steger, 1982).

In general, with the exception of clearly identifiable inflammatory, neoplastic or metabolic diseases, Paget's disease and a number of structural abnormalities, the precise cause of chronic back pain is frequently unclear and it still seems true that LBP has "No generally accepted pathological lesion with a scientifically applied therapy" (Fahrni, 1975, p93) and the clinician is frequently presented with a set of signs and symptoms, prominent among which are the complaint of pain and of incapacity or disability, which permits neither a clearcut unequivocal diagnosis nor an associated treatment directed at clearly identified pathology.

II LITERATURE REVIEW

II.4 The Treatment of LBP

If traditional medical methods had been successful in the treatment of LBP then the role of psychological factors perhaps never would have been considered since orthopaedic problems traditionally have been located firmly within physical rather than psychosomatic medicine and it is only relatively recently that chronic pain problems, with their associated physical, social and psychological dimensions, have become an object of study in their own right; particularly in North America where the multi-disciplinary pain clinic has become established as a diagnostic and treatment facility for the chronic pain patient a high proportion of which are chronic LBP patients. It is then the failure of medical treatment to halt the rising incidence and prevalence of permanent disablement secondary to back problems which has demanded the widening perspectives now apparent in consideration of the chronic LBP patient.

Natural History of LBP

Clinical experience suggests that there is a relatively similar course apparent in the history of most LBP patients. Most LBP seems to be of insidious onset or associated with only minor trauma. When the patient presents to the doctor, he usually complains of LBP, perhaps accompanied by buttock or leg pain and reports difficulty in a number of aspects of daily living. Following the taking of a general and medical history the doctor, having excluded other physical disease may question the patient in more detail about the location of the pain and attempt to elucidate influences on the quality or quantity of pain experience. During a physical examination the physician may attempt to localize the pain by palpation, determine restriction in motion of the spine, and identify any sensory or motor losses in the lower extremities. A number of reflexes of the lower body are also elicited and compared bilaterally. The purpose of this examination of signs and elicitation of symptoms is essentially twofold: firstly to exclude serious pathology (discussed above) and secondly to attempt an estimate of the severity of the LBP. What the physician hopes to find during the examination procedure is a series of pain patterns and localizations in the back

coupled with pain and sensory, motor or reflex losses in the extremities which correspond to discrete dermatomes supplied by the nerve roots leaving the vertebral foramen of the painful level. Frequently, however, inconsistencies in the overall "physical" picture emerge and the necessity for consideration of non-physical aspects to the pain presentation becomes apparent (Waddell et al, 1980). Lack of standardization in procedures used to identify individual signs and symptoms, and in the integration of such information into an overall diagnosis is shown by the unreliability of much such clinical information (Waddell et al, 1982).

Conservative Medical Treatment of LBP

Following such a procedure, the general practitioner will almost invariably prescribe analgesics for pain relief and supposed muscle relaxants such as Diazepam for the relief of muscle spasm although there is no convincing evidence that Diazepam or similar drugs have any effect in reducing muscle spasm per se (Chapman and Feather, 1973). The patient is usually also instructed to restrict his activity to varying degrees, supposedly to allow any natural regenerative process to take place, and depending on the severity of the problem, bed rest may be prescribed. The majority of patients recover in 6-8 weeks without the necessity for further more specialized diagnostic assessment or more specific treatment. If the patient's symptoms persist he may be referred directly to an orthopaedic department, department of rheumatology, or sometimes directly to a Back Clinic. Alternatively, if the facilities exist, the patient may be offered physiotherapy (although in the United Kingdom such facilities are usually offered in conjunction with referral to Departments of Orthopaedic Surgery or Rheumatology).

At this "intermediate" stage in treatment, a convincing organic diagnosis is frequently lacking. 86% of all admissions to the British Columbia Workmen's Compensation Board Rehabilitation Clinic had the vague diagnosis of 'low backsprain' (Gunn and Milbrandt, 1976), "sprain" being a term usely used by most general practitioners to indicate that no gross structural damage is evident (Adams, 1962). The term physiotherapy seems to cover a variety of procedures which vary both in their style and in

their objectives. Firstly, there are applications of heat, ultrasound, and massage, which are orientated towards reducing muscle spasm and pain. Secondly a graded series of exercises to "loosen up" the spine may be offered in an attempt to increase ranges of motion and mobility. Thirdly, strengthening exercises, especially for the abdominal muscles needed in the "balloon effect" may be given. In addition, the patient may be taught postures and ways of lifting which in future will place minimal forces on the low back and discs. Corsets or lumbar spine supports of various kinds may also be prescribed to support the lumbar spine and restrict its movement. (In fact, how a corset works is not certain; it is not very effective at immobilizing the spine, but could help by increasing the intra-abdominal pressure so that some body load is transmitted through the abdomen rather than the vertebral column; Bartlelink, 1957). Intermittent or prolonged traction may be applied manually or usually mechanically to the lumbar spine, yet although symptoms are often relieved during the period of traction there is no evidence that intermittent treatment improves the rate of recovery (Mathews and Hickling 1975). Finally there have been several different methods devised for manipulating the lumbar spine (Cyriax, 1969; Maitland, 1973) and it has been suggested that the size of a lumbar disc prolapse can be reduced by manipulation (Mathews and Yates, 1969). Although some patients benefit, "the true value of manipulation remains controversial and, in the lumbar spine, controlled trials (Glover et al, 1974; Doran and Newell, 1975) have failed to show any real advantage over placebo treatment"(Jayson, 1976b,p 579). Furthermore, although conventionally the physiotherapies can be considered as conservative forms of treatment, occasional incidents of severe neurological complications following manipulation due to damage to the vertebral artery have been reported (Smith and Estridge, 1962). Jayson (ibid) in agreement with Nachemson (1976) concludes "With such confusion over the values of these different forms of treatment, they may all be no better than simple ergonomic advice to back pain sufferers on how to protect their spines during bending, lifting, sitting and working" p 579.

In addition to the prescription of analgesics or muscle relaxants (mentioned above) local injections of anaesthetics plus long acting steroids are sometimes used. Extradural injections of large volumes (10 to 50 ml) of dilute anaesthetic and steroid may be given through a lumbar puncture needle into the extradural space or via the sacral hiatus. It has been claimed (Dilke et al, 1978) that this technique produces significant pain relief and earlier return to work. Nerve blocks (O'Neal 1974) have been used both diagnostically and also to "mimic" response to more radical and perhaps irreversible surgical or chemical procedures. It has also been claimed (O'Neal, ibid) that temporary blocks repeated at frequent intervals are especially useful in chronic pain that is due to abnormal reflex phenomena such as nerve root fibrosis and causalgia. Other 'physical' methods of treatment currently in vogue are transcutaneous electrical nerve stimulation (or TENS) and acupuncture.

TENS has been used since the mid-sixties for the relief of pain and for the last ten years, advances in computer technology have led to the proliferation of portable TENS units. Reports of their efficacy have appeared (Augustinsson et al, 1977; Burton, 1976; Loeser et al, 1975; and Shealy, 1974) but most studies have been uncontrolled and suffered from heterogenity of pain sites and lack of documentation of the pain history. Controlled studies have shown the effectiveness of TENS in controlling post operative pain (Hymes et al, 1973; Rosenberg et al, 1978; Vander Ark and McGrath, 1975) but it appears much less useful for long-term pain (Taylor et al, 1981). Furthermore, in an experimental pain study incorporating four levels of dental tooth pulp stimulation, although TENS reliably affected the perception of all levels of dental stimuli, the observed effects appeared small and dependent on the stimulation of a particular anatomical focus (Chapman et al, 1976). In one of the few studies with adequate follow up, Eriksson et al (1979) compared conventional TENS with acupuncture -like TENS in a 2 year follow up study of 123 patients. Approximately 30% were still using conventional TENS at 2 years, but this seems to have been a heterogeneous group and only three of the seventeen patients with no objective signs of somatic illness and a positive psychiatric evaluation were continuing to

use the TENS unit even at 3 months. In a study of chronic benign pain (mainly chronic LBP), it was found that TENS was relatively ineffective for patients with unsuccessful surgery but in the great majority of patients who were not candidates for surgery, the TENS although not producing report or significant pain level or reduction in analgesic usage, did produce markedly increased activity levels at one-year follow up (Sternbach et al, 1976).

In the last ten years, acupuncture has become increasingly employed as a treatment modality, not only within conventional health settings but also as an isolated treatment facility outside the N.H.S. While much of the impetus for the development of such techniques seems to have followed the 'thawing' of cultural relations between China and the West (Chapman 1982), it was recognised (Travell and Rinzler, 1952) much earlier that referred pain may be relieved by intense stimulation applied to "trigger" areas i.e. distal areas whose stimulation changes the intensity of the pain response, since the time of the Korean War it has been known (Sola, 1982) that dry needling of the trigger area, i.e. simply moving needles in and out of the area without injecting any substance, is sometimes effective. Despite the multiplicity of apparently alternative acupuncture pathways, there are strong similarities between at least some of the Eastern systems and Western physiology and there have been studies comparing the techniques (Ghia et al., 1976). There is no general agreement, however, on specific point selection since although the success rate is alledgedly high when the needles are in acupuncture points (Andersson and Holmgren 1975; Smith et al., 1974) other studies using non specific point selection claim equally high success rates (Gaw et al., 1975, Lee et al., 1975). Although reports vary, most studies indicate at least some degree of pain relief in one-half to two-thirds of the patients treated, but little attention has been pain either to appropriate selection of patients or the prediction of response to treatment (Toomey et al., 1977). The latter study, while interesting, suffers from lack of numbers and primitive statistics. A similar evaluation can be made of another study (Mendelson et al., 1978) which, while on a slightly larger sample (n=80), and one of the few to use a range of psychometric measures rather than the usual M.M.P.I. (see below)

because of its inadequate research design, raised as many questions as it answered. Thus although it demonstrated that chronic pain patients scored higher than normals on neuroticism, hostility, hypochondriasis and depression, it said nothing about response to treatment.

Recently, a major review on the evaluation of the clinical effects of acupuncture has appeared (Lewith and Machin, 1982). The article discusses in considerable detail methodological problems inherent in acupuncture research, and suggests that meaningful comparisons between alternative treatments may be made by using 'pain free intervals' with subsequent analysis using life table techniques. Adoption of such an approach ought to make proper evaluation of acupuncture much easier in the future.

Radical Treatment of LBP

If the patient continues to be symptomatic, a number of more specialized investigations may be undertaken (The use of specialized techniques in the identification of pathology is reviewed elsewhere (Waddell, 1982) and will not be reviewed here). If clinical signs suggest that a disc protrusion is compromising a nerve root or the cauda equina, a myelogram may be undertaken to aid in the exact localization of the impingement as an aid to surgery, although frequently it seems to be carried out on a more exploratory basis. 90% of disc prolapses, however, can be diagnosed clinically without any need for myelography. The technique involves the injection of a radio opaque dye into the subarachnoid space when disc protrusions are seen as indentations in the column of dye. The accuracy of the technique and the merits of various types of solvents are reviewed elsewhere (Waddell, 1982). If a consistent picture emerges from the clinical and myographic signs, then surgery (or more recently chemonucleolysis) may well be undertaken.

In the surgical procedure of discectomy, the soft tissue overlying the posterior elements of the vertical column is separated and the vertebral canal entered between the posterior elements of the vertebrae so that the protrusion and nucleus pulposus can be curetted. Laminectomy, i.e. partial or total removal of the bony laminae, may also be undertaken to facilitate access to the spinal canal and provide more space for the cauda

equina and nerve roots in the degenerated joint. Spinal fusion may be used when vertebral instability is found. In such a technique, the vertebra is immobilised by attaching it to another vertebra with various configurations of screws and/or bone-implant bridges.

Chemonucleolysis is a procedure developed relatively recently. Here the nucleosus pulposus of an offending disc is dissolved by injection of the disc (using x-ray guidance of the needle) with chymopapain, an enzyme which selectively destroys the major water-binding material of the disc. While the success rates of chemonucleolysis appear equal to surgery (Norby and Lucas, 1973), it seems to enable faster return to work (McCulloch 1977).

Conclusion

Differences in diagnosis, therapeutic procedures, outcome criteria and lack of appropriate research designs make it difficult to assess the effectiveness of conservative and radical approaches to the physical treatment of LBP. While it has been claimed (Naylor, 1974) that 80% of patients were better after the removal of a proven prolapsed disc, rates based on indices of patient function have been as low as 40% (White, 1969) and 13% (Kosiak et al., 1966). The success rate of spinal fusion has been variously reported, with figures as low as 22% for patients with ambiguous indications for surgery (White, 1969).

A recurrent finding (White, 1966; Waddell et al., 1979) is that the probability of a successful outcome decreases dramatically with multiple surgery.

While conservative and radical approaches to treatment have been successful for a proportion of patients, the increasing prevalence of long-term disability (Seres, 1982) and the advent of the multidisciplinary pain clinic (Ng, 1981) bear testament to the limitations of traditional approaches based on the physical disease model.

II LITERATURE REVIEW

II.5 The Assessment of Severity of Illness

The Assessment of Pain

The assessment of pain can be separated into self-report methods using graphic or verbal ratings; and experimental pain matching techniques in which pain is induced under experimental conditions and then comparison made with, or inference made to, clinical pain.

Graphic and Verbal Ratings

The use of simple rating scales to assess subjective feelings has a long history (Hayes and Patterson, 1921). More recently (Aitken, 1969) the use of a 100 mm line to assess mood has been advocated, and their use in drug trials has also been recommended (Bond and Lader, 1974). The validity and reliability of the Visual Analogue Mood Scale is comprehensively reviewed elsewhere (Luria, 1975) and will not be discussed here.

Visual Analogue Scale for Pain

One of the earliest attempts to obtain a measure of pain severity using such a scale was the subjective Dol Scale (Hardy et al, 1952) devised for use with the Hardy-Wolff-Goodell Dolorimeter. Since then there have been many variations on what is essentially a common theme. The common feature of all such scales is that the subject is given a scale on which he is asked to represent the intensity of his perceived pain by marking the scale. The most basic type of analogue scale is the simple descriptive scale consisting of a line with a numerical or verbal "anchor" at either end to indicate the direction of scoring. More often, sub-divisions along the line are indicated. By convention, the scale is called a visual analogue scale when only endpoint descriptors are used such as "no pain" and "pain as bad as it could possibly be", and a graphic rating scale if levels or degrees of pain are indicated e.g. with words such as 'mild', 'moderate' and 'severe'. While subjects usually have little difficulty using such scales to indicate levels of pain, as with all scales, increasing the sensitivity of the instrument by grading the instrument more finely effectively reduces its reliability. In a comparison of the graphic rating scale with a simple descriptive method it was found (Berry and Huskisson, 1972) that 73% of the patients used only the levels indicated by the descriptive

terms, but this problem did not occur with the analogue scale (where the descriptive words are used only for the ends of the scale). In practice slight differences in the design of such scales seem to have little effect. Perhaps the most widely used is the 10 cm line (Pilowsky and Kaufman, 1965; Pilowsky and Bond, 1969; Sternbach, 1974) for although a number of patients prefer a descriptive scale, as a research tool, the 10 cm line (usually scored on a 0 to 100 scale) has advantages, especially where repeated testing is required. The scoring can assume interval level of measurement, the scale has increased sensitivity, and although it is difficult for some subjects to use this type of scale, clear instructions can help to overcome confusion.
In a comparison of six different types of visual analogue and graphic rating scale (Scott and Huskisson, 1976) only the visual analogue scale and the graphic rating scale used horizontally with words spread out along the length of the line were satisfactory.

Recently (Reading, 1980) however, the unidimensional approach has been seriously questioned. The assumption behind the rating of pain intensity using simple linear scales is that it is possible to assess pain simply by measuring its intensity. As was mentioned above, pain is influenced not only by sensory input, but also culture, emotions, psychological processes and reinforcement contingencies (Sternbach, 1978). In a small study of episiotomy patients (Reading, 1980), present pain intensity, a verbal rating scale (from the McGill Pain Questionnaire, see below), a visual analogue scale and a numerical scale were compared, the relationship between intensity and emotion (state anxiety) was clearly shown and evidence produced to support the inadvisability of reliance on single rating scales and the need to assess various components of pain.

<u>The Pain Drawing</u>

Outlines of the body, posteriorly and anteriorly are frequently presented to patients who are asked to indicate the location of pain. Such information may be used to give some sort of measure of pain intensity, to examine differences in laterality of pain, to record different types of pain or as a visual aid for patients who are finding it difficult to describe the location of their pain. Such a system has been used specifically with low back patients

(Ransford et al, 1976). A scoring system was devised to indicate "psychologic involvement" and rated on the basis of unreal drawings (primarily characterized by poor anatomic localization; "expansion" or "magnification" of pain; particular emphasis and the identification of additional painful areas.) The main justification suggested by its authors was a high correlation with the Hs and Hy scores of the MMPI (see below). This was obtained, however, from a particularly skewed, highly selected population with a large number of previous operations and high incidence of psychological features. In a subsequent study Doxey et al (1979) found a much lower relationship. Recently, in a study of 212 back patients (Von Baeyer et al, 1983) over half of the patients meeting MMPI criteria for psychological involvement in their pain were incorrectly identified as normal using the Pain Drawing. Since the MMPI itself is only weakly related to outcome of treatment, relationships with the MMPI clearly cannot be taken as a validation of the usage of the Pain Drawing as an outcome measure. It would of course be much more relevant to examine its relationship directly with outcome measures. A recent study (Toomey et al, 1982) using the Pain Drawing used enumeration of total sites as a measure of pain extensity and recommended the Pain Drawing as a clinically useful variable for prediction of functional/behavioural disturbance and psychopathology in chronic pain patients. The authors acknowledge that further investigations are needed to clarify the relationship between pain extensity and the physical/anatomical characteristics of pain.

While the original scoring system is cumbersome and perhaps suggestive of a degree of precision not really present, it may have some utility as a screening procedure for patients requiring further psychological assessment and would seem worth including in an assessment battery.

McGill Pain Questionnaire (MPQ)

With the exception of the visual analogue scale, perhaps the most widely used pain rating scale is the MPQ. Melzack and Torgerson (1971) asked subjects to classify 102 pain related words gleaned from the clinical literature into smaller groups describing different aspects of pain experience. On the basis of the subjects' responses, the words were categorised into three major classes and sixteen subclasses. To the sensory, affective and

evaluative classes were added a further miscellaneous group of four subclasses (Melzack, 1975) and four different types of score derived (based on scale-value, rank-value, number of words chosen and a number-word combination of pain intensity). A number of studies have reexamined the structure of the MPQ. Crockett et al (1977) identified five factors which 'overlapped considerably' with the Melzack and Torgerson a priori classification of pain descriptors, but did not support the practice of using total scores derived from the scale as dependent variables. Thus, while the multidimensional nature of pain description was supported, their results suggested a finer categorical breakdown of subjects' endorsements of pain descriptors was needed. Leavett et al (1978) administered 74 verbal descriptors in a randomly ordered sequence to 131 back patients. Seven factors were reported to underlie the patients' responses. Five of the factors were composed entirely of sensory descriptors while the remaining two were defined primarily by sensory and affective descriptors. The stability of these factors however has been questioned on the grounds of the subject: variable ratio (manifestly inadequate) and on overfactoring (Prieto et al., 1980) although identification of the "correct" number of rotated factors would appear to be more of an art than a science. Prieto et al. (1980) identified four factors accounting for the majority of the variance on LBP patients' responses to the MPQ. Three factors were composed solely of sensory, affective and evaluative categories respectively. The fourth factor was defined by both sensory and affective items. While their study was adduced as evidence corroborating the three factor structure of the MPQ, the authors advised replication in a variety of treatment settings. Byrne et al. (1982) using an identical population base (although a later cohort of patients) produced confirmation of the sensory-pressure, evaluative and affective-sensory factors previously identified, although the punishing affect factor was not successfully cross-validated.

A number of studies have investigated the validity of pain descriptors. Gracely et al. (1978), using a series of sensory and affective pain descriptors (but not the MPQ) found that a pharmacological intervention (diazepam), aimed specifically at emotional distress secondary to experimentally induced pain, resulted in changes in the use of affective but not sensory pain descriptors. In a psycho-

physiological study (Dowling, 1983) reactive components of the MPQ were found to relate to skin conductance levels. In a study of oncological patients (Graham et al., 1980), the reliability of the MPQ was confirmed. Kremer & Atkinson (1981) found that chronic benign patients who had reliably higher affective scores on the MPQ also had significantly higher scores on the somatization, depression and anxiety scales of the Brief Symptom Inventory and on the three major infirmity scales of the Sickness Impact Profile. In a later study (Kremer et al., 1983) the affective score proved a better predictor of psychological disturbance than the other scale. Using multiple regression techniques they demonstrated the redundancy of the other scales.

Melzack et al. (1982), however, in a study of acute pain patients found a normal distribution of sensory scores but very low affective scores compared to patients with chronic pain suggesting that the MPQ is affected by chronicity and that the relationship between pain and injury is not only highly variable, but complex. In a study of acute (post episiotomy) pain, Reading (1982) found that acute pain involves less differentiation of sensory, affective and evaluative dimensions than is normally found on chronic pain patients. Factor structure seems to vary not only with chronicity but also with the type of pain patient (Graham et al., 1980; Dubuisson and Melzack, 1976; Kremer et al., 1982; Reading, 1982).

Attempts have been made to translate the MPQ into other languages (Ketovuori & Pontinen, 1981) but differences in descriptions of population, in format, administration and content of the questionnaire, and in shades of meaning "bruised" in translation, make meaningful cross cultural comparison of verbal descriptors almost interpretable. In one unpublished study from the United Kingdom (MacMillan, 1978), on a heterogeneous group of pain patients, some support was found for the factor structure, but problems were identified with the format and method of administration of the questionnaire. In a pilot study for another study (Bienkowski, 1980) in the West of Scotland, the very low endorsement rate of some of the items suggested the inadvisability of using all the words for descriptive purposes. A large 'effort after meaning' seemed to be involved. This was confirmed in a separate pilot study (n=60) for this thesis, when, in the course of a structured psychological interview, an open-ended invitation to provide verbal descriptors of pain produced an

exceedingly limited range. It would seem that its validity in the United Kingdom certainly cannot be taken for granted.

The variation with chronicity, type of pain and perhaps with culture all suggest that the early promise of the original MPQ may not be confirmed as widely as might have been hoped. As far as chronic LBP is concerned, perhaps the most important research finding on the MPQ is the recent study by Atkinson et al. (1982) who carried out two experiments on the use of pain descriptors by chronic pain patients with different medical and/or psychiatric diagnoses. In the first experiment, separate multiple discriminant analyses were employed to examine the differential diagnostic properties of pain language. . None of the analyses generated a discriminant function, indicating that chronic pain patients do not use pain descriptors in a precise and systematic manner. The second experiment demonstrated that as affective disturbance increased within a chronic benign pain population, pain language became more diffuse. They concluded: "Future work with the descriptor technique of pain assessment should better define the relationship between pain chronicity, descriptors and affective status in different diseases." (Atkinson et al., 1982, p 384). Since the MPQ is at present in use fairly widely in North America, as part of assessment batteries in Pain Clinics, in studies of EMG, motion and behavioural assessments following sympathetic nerve blocks (Brena et al., 1980) and in the assessment of ice massage and TENS (Melzack et al., 1980) to detail but a few of its uses, the importance of the MPQ should not be underestimated. In addition to the recommendations by Atkinson et al. above, however, systematic cross-cultural as well as cross-language validation (and reconstruction where necessary) would seem to be a priority.

Low Back Pain Questionnaire (LBPQ) and the Back Pain Classification Scale (BPCS)

Like the MPQ, the Low Back Pain Questionnaire (LBPQ) (Leavitt et al., 1978) comprises verbal descriptors of pain, but differs in that the 74 pain words are listed in random order in an effort to reduce bias inherent in responses to words of similar meaning that have been grouped together. Subjects are encouraged to endorse every item which is descriptive of their pain. The 74 words out

of the original 87 showing satisfactory incidence among LBP patients were factor analysed yielding seven factors. The major factor (38% of the variance) referred almost entirely to emotional discomfort. The second factor (9%) was a mixed emotional and sensory factor while the remaining 5 factors (ranging from 9 to 4.7%, totalling 29% of the variance) were entirely sensory. The results were taken to support the MPQ distinction between sensory classes and others, but to be less supportive of the affective-evaluative distinction. In a later study (Leavitt and Garron, 1979a) in a study of 112 LBP patients, a discriminant function analysis was carried out to identify the best combination of pain terms that would discriminate the functional (50) from the organic (62) groups. The thirteen pain descriptors correctly identified 93.6% of the LBP cases and in a further cohort of 159 new cases, cross-validation shrinkage was only 10.6% and 132 out of the 159 new cases were correctly identified. In further validation studies (Leavitt & Garron, 1979b) predictions based on the classification of patients as either "organic" (false negative) or as "functional" (psychologically disturbed) were confirmed, both in regard to the description of pain prior to treatment, and the response of the patient to conservative medical treatment. Recently the BPCS has been compared with the MMPI Low Back Scale (Hanvik, 1951) and the "Conversion-V" MMPI profile (Schwartz & Krupp, 1971) in a study of 91 LBP patients classified as to the presence or absence of organic findings and psychological disturbance on the basis of objective and independent evaluations. The BPCS (with a 78% Hit rate) was not only the most accurate measure but also was the only scale to exceed base rate. (Had this author been aware of the potential of the BPCS at the time of planning the thesis, he would have included it in the thesis). It has not been used in the United Kingdom.

In another derivation from the MPQ, Reading and Newton (1978) used a card sort method of pain assessment in an attempt to establish the relevance of the words included in the text to check the scaling properties and to assess the internal structure. The paired comparison method permits assessment of reliability and internal consistency and may be of some utility in contexts where a detailed assessment is possible, but the method is too elaborate

for routine clinical use, especially when psychometric expertise is unavailable.

Sensory Matching and Experimental Methods

Sensory matching employs a method of simultaneously comparing experimentally induced pain with the clinical pain. When the two pain sensations are gauged subjectively to be equal, the degree of stimulus producing the experimental pain is considered to be an analogue of the pathological pain. The role of laboratory pain induction methods is reviewed extensively elsewhere (Wolff, 1977). Since it will be argued that experimental methods are of limited value with chronic LBP patients, the methods will only briefly be described.

Since the time of von Frey (1894) experimental human pain induction studies have developed within a psychophysical framework, but it is only since the systematic investigations of Hardy et al. (1940, 1952) with the radiant heat method that research has really proliferated. The psychophysical methodology of the Method of Limits, the Method of Adjustment (or Average Error) and the Method of Constant Stimuli have a long history while Steven's magnitude estimation method (Stevens, 1956) and signal detection theory or SDT (Clark, 1969) are more recent developments in the study of pain. All are described in detail elsewhere (Wolff, 1977, p 274-5). Techniques tend to employ cutaneous, deep somatic and visceral methods. Cutaneous methods involve stimulation of the skin, the most common of which is superficial stimulation. The other methods are less common. Thermal methods include the radiant heat method (Hardy et al., ibid) and the cold pressor method (Hines and Brown, 1932). Although these techniques are cutaneous in so far that stimulation is on the surface of the skin and there is no penetration of the skin, since both cold and heat penetrate the skin and stimulate underlying deeper structures, a case can be made for regarding the procedures as simulating real pain. Electrical methods are widely used. Beecher in his survey of electrical stimulation methods reports that von Helmholtz first introduced the use of Faradic current to produce pain in 1851. A number of technical problems concerning the type of electrical stimulus, the type of electrode and the body locus have however caused difficulties. Chemical methods include the hypertonic saline

method (Wolff et al., 1961; Wolff and Jarvik, 1965), the cantharidin blister technique (Keele and Armstrong, 1964) and ischaemic methods (which will be discussed below). Mechanical methods generally involve the application of pressure to produce pain. A variety of instruments have been derived for this purpose. Gluzek (1944) introduced a kind of air-pump dolorimeter which exerts gradually increasing pressure when applied to the skin over some bone, and Keele (1954) described a spring loaded pressure gauge with a plunger, termed the pressure algometer, which he claimed had been used since Victorian days to induce pain. McCarty's dolorimeter (1965, 1968) and Poser's modification (1962) of Hollander's sphygmomanometer cuff (1939) are other variants.

The attractiveness of accurate quantification of pain stimuli from a scientific point of view is unquestionable. The methodological sophistication of current experimental pain work in the Department of Anesthesiology at the University of Washington, for example, is remarkable (Chapman, 1980). The mathematical developments frompsychophysical methods have produced scaling techniques of great precision and the study of pain threshold has been integrated into sophisticated analyses of circadian and circatrigentan rhythms (Procacci et al., 1972).

Among psychological studies of clinical pain, perhaps the best known is the sub-maximum effort tourniquet technique (Smith et al., 1966; Smith and Beecher, 1969), in fact modified from an earlier method described by Lewis et al. (1931). The procedure involves draining the arm of venous blood, constricting the blood flow by a tourniquet around the upper arm and having the individual perform various exercises with the hand. The ischaemic pain is believed to produce a deep and slowly increasing intensity of pain that is similar to many types of chronic pain. A number of pain estimates are available using this method: the pain threshold-point at which the sensation is construed as painful (described in seconds), clinical pain-point at which the experimentally produced pain is deemed by the patient to be equivalent to the clinical pain (measured in seconds), pain tolerance-maximally tolerated experimental pain (in seconds), and the pain ratio-computed from the ratio of clinical pain to pain tolerance. The general validity of the technique has received some support, in studies of effects of analgesics (Smith and Beecher, 1969, Smith et al., 1966)

and in the assessment of surgical pain (Sternbach et al., 1974). In a later study however (Sternbach et al., 1977) the tourniquet ratios failed to correspond appropriately to analgesic drug dosages and in another study (Parbrook et al., 1973) it was found that pain threshold and pain tolerance tests performed preoperatively did not predict post-operative need for analgesics.

The Relationship Between Clinical and Experimental Pain

The use of experimental methodology and laboratory techniques have led to sophisticated analyses of pain phenomena. These have included mapping of body sensitivity, analyses of neural pathways going from the periphery to central areas and the development of finely controlled methods of stimulation. Theorizing in such studies has tended to focus on the sensory component in pain. It has been shown that the pain ratio correlates with degree of reactive depression and hypochondriasis (Ziesat, 1978b). In a randomised, double-blind cross-over study on healthy male volunteers (Von Graffenfried et al, 1978), anxiety had a marked influence on the test results. The latter authors concluded "using experimental pain models, reliable results are not to be expected as anxiety fluctuates intra-and inter individually in an unpredictable and uncontrollable manner." (Von Graffenfried, ibid, p 253). Thus even with non-clinical patients, there is doubt about the validity of experimental pain methods. Reducing pain reactions in the clinic often involves the reduction of anxiety and the laboratory presents a totally different context in which the complexity of the pain response is partially ignored. It may not, thus, be possible to generalize results from the laboratory to the clinic (Weisenberg, 1980; p 93). Merskey (1974) claims that there is general agreement that thresholds for the complaint of pain are more or less related to physiological factors, although varying to some extent with mood, ethnic group, occupation and sex. Tolerance on the other hand seems much more subject to psychological factors. Thus Petrie (1967) reported that pain threshold remained unchanged after frontal lobotomy, and also after the use of pain-relieving drugs, although pain tolerance increased in both situations. Bloomfield and Hurwitz (1970) in a study of episiotomized women demonstrated pain relief with aspirin, but could obtain no reliable results with tourniquet pain.

Sophistication in pain scaling in experimental situations continues to develop. Gracely and Wolskee (1983) using functional measurement (FM) produced separate scales of pain intensity, verbal magnitude and psychophysical ability. The clinical validity and sensitivity are so far undemonstrated. Recently, the Tursky Pain Perception Profile or PPP (Tursky et al., 1982) has been developed as an evaluation suitable in outpatient or clinical environments. It incorporates measures of sensory threshold with pain connotative judgments, magnitude estimations of controlled nociceptive stimuli, quantified pain descriptors and a pain diary for ongoing evaluation. It would seem to merit further study.

In view of the uncertainty about the relationship between experimental and clinical pain, and the impracticality of including experimental pain measures as part of a routine screening procedure, it was decided that the inclusion of experimental measures on all the subjects would necessitate drastically curtailing the psychometric battery, or omitting important parts of the clinical assessment. Such measures were included in a subgroup of 42 of the patients and some of the results discussed elsewhere (Bienkowski, 1980; Main, 1983).

The Assessment of Physical Characteristics

At present there appears no completely satisfactory method for assessing the severity of low back disorders although traditionally assessment of severity is based on diagnosis (A.A.O.S.; McBride 1963) and is best established and agreed in the relatively small proportion of patients with a clear radiological abnormality. In practice it is common to find wide variation in severity among individuals with identical diagnoses. Unfortunately, in most patients with low back pain it is impossible to reach a definitive diagnosis (Editorial, 1979). Back trouble usually presents as low back pain with or without radiation to the leg. The first task of the clinician is to identify primary neurological presentations usually comprising widespread neurological symptoms. Such patients should be referred for specialized assessment to departments of neurology or neurosurgery. Clearly identifiable spinal deformities, evident on clinical examination and radiograph should be referred to a scoliosis clinic. The clinician is also required to exclude (and of course treat if possible) spinal pathologies such as tumour,

infective and inflammatory conditions. In fact the main value of routine plain radiographs of the lumbar spine is as a screen for such pathology and can be supplemented by an erythrocyte sedimentation rate or ESR. It has been estimated (Waddell, 1982) that 3% of apparent back troubles presenting to an orthopaedic clinic are due to extraspinal causes such as retroperitoneal or pelvic pathology, hip disease, peripheral vascular disease, or primary neurological disease. If there are any suggestive symptoms, a pelvic examination should be performed. All such patients were excluded from the study reported below. The determination of severity about to be discussed is in the context of chronic benign intractable low back pain. The difficulty of reaching a definitive diagnosis with this group has already been remarked upon. The most obvious candidate as a measure of severity would seem to be damage or degeneration determined radiographically. Unfortunately, comparisons of radiographs in patients with low back pain and asymptomatic normal people have shown that clinical severity is not related to radiological degeneration (Magora & Schwartz, 1976; Nachemson, 1975). In practice, severity can be considered in terms of diagnosis (where the most useful distinction is between back pain, back pain and referred leg pain, and root pain; Waddell, 1982), and physical examination of the lumbosacral spine with attention to the lumbar and sacral nerve function; but certain items of clinical history may also be considered. It is beyond the remit of this thesis to discuss the multitude of clinical signs and symptoms which might be considered at this juncture. While individual signs and symptoms have been identified in the clinical literature, the items have seldom been subjected to reliability checks and there are major problems of reliability and scaling with many clinical history items (Waddell et al., 1982). In one of the few studies attempting to quantify severity (Wing et al., 1976) the scale comprised not only items of physical impairment, but also resultant disability, pain and pain effects, thus making it impossible to draw any conclusions about the relationship of the physical impairment to anything else. The vast majority of studies use some sort of pain estimate to rank patients in terms of severity or classify patients into groups showing evidence/no evidence of an organic basis for the low back pain. Nowhere in the literature does there appear to be an assessment of severity, based on objective physical characteristics,

which has been properly validated. For this thesis all major clinical signs and symptoms of physical severity were examined and following studies of several cohorts of back patients and normals, an assessment based on 7 items was developed. The description of the individual variables and the rationale for their acceptance or rejection is presented in Chapter IV.

The Assessment of Disability

The term 'disability' is used in widely differing contexts with markedly different shades of meaning. For the purpose of this thesis, and in particular for the theoretical model later discussed, it is necessary to define the boundaries of the concept. The first distinction is between financial disability and impairment in function. In the North American literature in particular, the term 'disability' is an integral part of a legal and economic system in which an invalid status is ascribed thereby entitling the patient to a wide range of financial benefits (of which continued free medical care is frequently a major component). It is proposed that social and economic effects of chronic pain, and influences upon complaint presentation be discussed separately from impairment in function. (The former will be discussed later in the literature review). Impairment in function can be thought of as limitation of a patients performance when compared with a fit person. (The term 'functional disability' will be avoided although it describes the concept fairly well, as it might be confused with the 'functional-organic' distinction (see Chapter I, when 'functional' is used to denote absence or organic findings or ones of trivial importance).

There are two main purposes of the assessment of disability. In a medical legal context assessment of disability may be used in conjunction with assessment of objective physical disease characteristics to arrive at the basis of a financial settlement or financial compensation. Much of the literature relating to disability is from medico-legal cases in which, typically, assessment of residual disability or impaired function is made following a trauma. In such a case, the sequelae of the injury for the particular patient is compared with rate of recovery considered usual for patients suffering similar trauma and levels of physical damage. The nature of medical legal judgment is beyond this thesis. The explicit purpose of assessment of disability in this thesis is as a measure of severity

of illness. An attempt will be made to quantify limitation in performance and examine statistically the relationship of such disability with other components in the patient's clinical profile. The following review of literature relating to disability will be highly selective as many of the studies are on highly selected medico-legal populations, on heterogeneous patient groups or groups with disorders very different from chronic LBP, or suffer from severe methodological problems in terms of reliability of clinical information or inadequate research design.

Hirschfeld and Behan (1963) in a retrospective review of 300 medico-legal cases subsequent to industrial accidents of injuries concluded that emotional difficulties did not arise from the pain or discomfort of injuries. The accident syndrome was supposed to develop as a result of emotional, socio-economic and sometimes legal reasons. They present an essentially psychosomatic account of the accident process in which a state of conflict or emotional disturbance in the patient is assumed to predate the accident which then gives them a 'physical' excuse to terminate work and allows them to seek attention for physical symptoms rather than their emotional conflicts. They continue"Such clinical data do not appear to be isolated phenomena. Rather they form themselves into a meaningful pattern. Something threatening happens inside of a worker and he seeks pain or injury as a solution", p 195. Their study progresses from the fanciful to the almost unbelievable. "The study revealed that physical injury resulted from a psychological process which is defined and documented. The significance of this process is suggested by the fact that it was identified in almost every case" p 193. The study can be severely criticised in its poor validation (validity was established by finding repetition both in the patient's own history and in similar material collected from other patients), its retrospective nature, its lack of control for bias in assessing the records and the virtual absence of any sensible statistics. While it contains interesting clinical observations, the theoretical model it postulates is totally unsubstantiated by the data.

The second part of the study (Behan and Hirschfeld, 1963) contains some very interesting discussion of social, economic and iatrogenic influences on the persistence of disability, with interesting

recommendations about the role and training of physicians but their conclusions, that chronicity in injury cases be considered psychogenic unless proved otherwise, seems not only to overstate the success rate of technology in the identification of pathology but also rests on the 'diagnosis by exclusion' principle. It will be suggested later in this chapter that 'psychological diagnoses' should be made only on the basis of positive features of psychological disturbance or distress and not simply on the absence of adequate organic findings. The case for a 'not proven' verdict may be considered professionally unacceptable to medicine but, arguably, more honesty might lead to a lessening in excessive treatment, and in repeated treatment failure.

Miller (1961) in his influential series of Royal College of Physicians lectures discussed 200 consecutive cases of head injury referred for medico-legal examination. He found that psychoneurotic complaints were twice as common after industrial accidents as after road accidents and an inverse relationship between the development of accident neurosis and the severity of injury irrespective of the type of breakdown; suggesting a 'protective effect' of severe trauma. He criticised studies attempting to explain the development of accident neurosis simply on the basis of a preexisting neurotic disposition and found no evidence whatsoever of such a disposition in half of those psychiatrically disabled, but he did find a link with social and occupational factors. His suggestion that psychological evaluation could determine whether the psychopathological condition present would allow improvement in the patients' subjective complaints if objective improvement occurs would seem to be a sensible view of the utility of psychological approaches and is fairly similar to the viewpoint of this thesis.

It will be apparent that discussion of disability is frequently synonymous with 'failure to make the recovery predicted on the basis of the identified physical damage'. Krusen and Ford (1958) demonstrated an interaction between long term improvement and receipt of compensation. Patients receiving compensation demonstrated 33% less objective evidence of impairment, received nearly twice as many physical therapy treatments and showed 44% less long-term improvement compared with similar patients not receiving compensation. Other studies (Mensor, 1955; Raaf, 1959; Slepian, 1966) have shown that outcome from conservative physical treatments of lumbar disc surgery (and by

implication, residual disability) to be poorer in patients in which financial disability is involved. In a more recent study Beals and Hickman (1972) examined psychological characteristics of patients after different types of industrial accident and compared them with non-injured workers using standard I.Q. tests, personality measures and a structured interview. They then produced a combined rating based on separate physical, psychological and vocational (or employment) ratings. Using the MMPI and a number of less well known personality inventories, they identified three distinct psychoneurotic reactions. They found a consistent relationship with the severity of each of these reactions and time elapsed since injury. Change from an acute to a chronic psychopathological pattern was primarily a function of time even if the disability remained constant. The utility of these findings in understanding disability is hampered unfortunately by the lack of a properly constructed measure of disability and by the use of somewhat idiosyncratic psychological variables. It is nonetheless an extremely interesting study and showed that reemployment status at 6 months follow up was correlated with physical, psychological and vocational factors (although the way in which the physical, vocational and psychological ratings were combined is open to criticism from the statistical point of view). The findings of the study will be considered further below.

Finally in this section it is proposed to review those studies in which some serious attempt has been made to construct a measure of physical damage or impairment in function. Nashold and Hrubec (1971) produced an 18 item index relating primarily to organic variables. Disability was defined, following factor analysis, on a factor accounting for only 23.1% of the variance of the variables, suggesting a weak level of intercorrelation among the items. More impressive is the index produced by Wing and his colleagues (Wing et al., 1976; Wilfling et al., 1973; Wilfling, 1973; Kokan et al., 1974; Wing 1972; Kokan et al, 1975). Following Garrad and Bennett (1971) they selected twenty variables reflecting various aspects of patients' activities in daily living and, in a study of 141 Workmen's Compensation Board Patients seen 2 years post-operatively, subjected data on the 100/141 patients (i.e. 41 patients could not be traced) to principal components analysis (see below, Chapter III) and taking the first unrotated principal component (which accounted

for 40.1% of the total variance of the 20 items) as the measure of disability, examined the relationships of this measure with a large number of other physical and psychological variables. The items are shown in Appendix 05. After further statistical analysis, they reduced the independent variables to 55, retaining those of the 239 which correlated significantly with the disability index score. The 55 independent correlates of disability were then factor analysed (using principal components analysis with varimax rotation) yielding eight orthogonal (independent) factors which together explained 77% of the total variance. The factors (with percentage of variance and therefore relative importance) were as follows: structural abnormality (23%), immobility (16%); psychometrically defined neuroticism (11%); pain tolerance (8%); operative history (5%); realism in the incorporation of disability into life-goals (5%); nerve-root deficit (5%) and poor physical fitness (4%). These seem to represent a predominantly orthopaedic or structural group (1, 2, 7 and perhaps 5) and a psychological or behavioural group (3, 4, 6 and 8). Using hierarchical group analysis (a type of cluster analysis) the 100 individual patients were sorted into four groups on the basis of these profiles on the eight factors. Group A (n=45) were the least disabled, had fewer orthopaedic problems on examination, had free movement without pain, had a high pain tolerance and striking non-neurotic, but were not very fit and tended to be somewhat frustrated in the attainment of life goals. Group B (n=29) had structural problems, had low pain tolerance, tended to be immobilized by pain despite having had few operations, were surprisingly successful in terms of life goals and non-neurotic. Group C (n=11), the second most disabled group had had numerous operations, showed no nerve root deficits, were immobilized by pain, were unfit, moderately neurotic and unsuccessful in reaching life goals, but had high pain tolerance and showed minimal orthopaedic deficits. Group D (n=16), the most disabled, demonstrated only minimal orthopaedic problems, but were fairly immobile, had had a low number of operations. They were very neurotic, had low pain tolerance and were somewhat unsuccessful im the attainment of life goals.

Their ~~disability of index~~ index of disability was used in the prediction of outcome of lumbar surgery (Kokan et al., 1974; Wilfling et al., 1973) but appears to suffer from a number of limitations.

The structure of the index has not been replicated on any other cohort, the reliability of the individual items is undemonstrated, the power of the items in distinguishing between disability resulting from chronic back pain and simple wear and tear with age has not been shown and the 20 items are less homogeneous in content than is necessary to construct a theoretical model encompassing, physical characteristics, pain, disability and psychological influences or effects. (The index includes not only "orthopaedic" items but also items referring to activities of daily living and cannot therefore be used to distinguish carefully between them.) It is proposed therefore to acknowledge freely the major contribution made by the imaginative and careful work of Wing and his colleagues but attempt to overcome some of the limitations in the construction of their index in a revised index devised for use with a British population. The description and validation of the index is presented in Chapter IV.

Other Measures of Severity

A number of measures of severity have been considered. They have consisted either of measures based on clinical examination with associated technological information or measures based directly or indirectly on the patient's self report, whether of pain, pain or disease related symptomatology or the effects of pain. Problems in using clinical history variables as the basis for a measure of severity have been outlined elsewhere (Waddell et al., 1982).

An alternative approach might be to consider information obtainable from the patient's environment, but not directly from the patient himself. Into this category would come measures of disability or invalidism based on naturalistic observation of the patient in his domestic or social surroundings. Apart from the total impracticality of using such assessment as part of a routine screening procedure (in view of the manpower requirements of such an exercise) there are major problems in patient compliance. Furthermore it would seem virtually impossible, without resorting to a level of subterfuge which would be considered unethical, to safeguard against reactivity of the assessment i.e. distortion in the measurement of the behaviour in question as a function of having an observer present. Much relevant information of a social or domestic nature can be gleaned from interviewing the patient's spouse or significant person in the patient's life. Many of the

chronic pain programmes in North America not only incorporate spouses into the assessment procedure, but include a relative's programme as part of the total package (Ng, 1981). Furthermore in some of the programmes active spouse participation is a necessary condition for acceptance of the patient on the programme. There are major practical problems in the routine incorporation of spouse information in a screening procedure, especially in the context of a primary referral clinic in the National Health Service. It was considered that the amount of missing data that probably would be obtained, especially with patients who had difficulty in taking time off work, was so high that it would be inadvisable to attempt to construct a theoretical model on such a data base. The resources necessary to obtain such missing data were not available at the time the data for the thesis was being collected.

Economic and occupational factors are clearly of importance in chronic pain. These will be discussed in more detail below. Used as the basis for a measure of severity, there are problems in their use as dependent variables. In times of economic recession, for people with a certain range of skills or aptitudes, there may be very little chance of employment in the near future, whether or not they suffer from chronic pain problems. The financial effect of pain will depend on the families current financial status, and for breadwinners on the financial arrangements made for sickness in their employment scheme. At the time of assessment, the financial consequences of the pain-related work loss may be still a matter of future concern rather than present actuality. With low wage earners, there may be little difference financially between being paid for work and receiving unemployment benefit, invalidity benefit or associated rebates.

Loss of occupation, job change or time off work might be obvious candidates as measures of severity. Unfortunately these are subject to all sorts of extraneous influences such as differences in tolerance shown by employers and differences in advice or recommendations by general medical practitioners. Time off work is considered as a subsidiary dependent variable (below, Chapter VI). A serious investigation into occupational factors was beyond the resources of the present study.

II LITERATURE REVIEW

II.6 The Assessment of Psychological Factors in Chronic LBP

Introduction

Approaches to the psychology of chronic LBP have a long history ranging from clinical anecdote based (sometimes loosely on psychodynamic formulation) to methodologically sophisticated studies incorporating specially devised psychological tests. Since the beginning of the century there has been evidence of rudimentary psychological theorizing in the mainstream medical and surgical literature and with the development of psychosomatic medicine, increasingly complex formulations have been apparent. The recent advances in epidemiology and in multivariate statistical techniques have allowed a still wider perspective. It is proposed to begin with a review of the mainstream clinical literature, continue with psychiatric perspectives, focussing on the more important clinical features and then consider psychological studies. A survey of the importance of cognitive influences will be followed by a detailed review of the role of personality structure and more specific self-report measures.

Clinical Approaches

The distinction between clinical and psychiatric or psychological approaches is to an extent arbitary but in view of the fairly major differences in theoretical perspective and in approach to the investigation and evaluation of psychological factors, it would seem advisable to identify the psychological or nonorganic strands in mainstream medical and surgical theorizing before shifting the point of reference. The fundamental difference would seem to be that, in the clinical literature patients are defined, described and treated first and foremost by physical pathology (although it will be later argued that it is possible to mistake abnormal illness behaviour for signs and symptoms of pathology). Psychological features may be commented on during the investigation and the distinction between 'organic' and 'functional' made, but not only is this usually a differential diagnosis, it is frequently a 'diagnosis by exclusion' in that a psychological label is appended not because of the presence of clear psychological features but because the patients signs and symptoms are not considered appropriate for the physical findings. It is perhaps unsurprising that such psychological theorising is frequently simplistic and unsophisticated.

In the psychological and psychiatric literature, by contrast, psychological assessment is taken much more seriously and attempt is made to relate features of the patient's clinical presentation to psychological theory and research findings. (The problems in drawing inferences between chronic LBP and psychiatric populations will be reviewed later).

As early as 1911 it was suggested that some cases of LBP have an "emotional" cause (Chabot, 1911). Discussion about alternative 'causes of' or 'influences on' the presentation of pain symptomatology has been evident in the compensation and medical literature since the beginning of the century, as frequently the courts have to decide on an appropriate financial settlement in cases of back injuries when liability has been demonstrated. The problem in relying exclusively on the claimant's self report as a measure of severity is evident, since there would be considerable financial incentive perhaps in maximising the report of pain and disability. The system developed of defining a particular range of disability as appropriate for the degree of physical impairment although there is no satisfactory or accepted method for relating impairment and disability (Waddell & Main, 1984). Psychological features or 'functional overlay' have been implicated to explain the discrepancy between physical findings and report of disability. The distinction between emotional distress (sometimes accident neurosis) and malingering has itself generated some emotion. The theme of 'nonorganic influences' has occurred with increasing frequency, especially since the Second World War (perhaps because of the magnitude of LBP problems in the armed forces) (Paul, 1950). The assessment of the psychological component has frequently been little more than an unsubstantiated clinical impression, often based on a small number of cases. At times, the 'psychological theorizing' has been more elaborate. As noted elsewhere (Wilfling, 1973) an article was published relatively recently (Meyers, 1967) suggesting a mechanism for the production of LBP reminiscent of the 10th century conceptualization of hysteria as the wandering of the uterus through the body (Ullman & Krasner, 1969, p 115)

> ".....Back pain ... represent a shift of sexual sensuousness to the back in the form of pain ... with therapy when the focus of sensuous experience can be moved out of the back to where it belongs, in the pelvis, the backache disappears" (Meyers, 1967, p 156-7).

Usually, however, theorizing has been less extravagent. Consideration of "psychogenic" pain or pain-prone patients (Engel, 1959) falls more properly into the psychological literature, and can be distinguished from attempts to identify specific signs and symptoms of LBP which have been given a non-organic interpretation.

In standard medical practice, the doctor attempts to locate pathology in the patient and communication between doctor and patient is seen primarily as enabling the doctor to reach a diagnosis. Such an analysis does not take into account, the patient's active and necessary participation in the assessment... It can be assumed that most physical signs contain some non-organic element (Waddell et al., 1980). Wing et al. (1976) found that lumbar flexion correlated with neuroticism and straight leg raising correlated with pain tolerance. Selected physical signs which appeared to have a predominantly non-physical interpretation were described early in this century (Collie, 1913, 1932; Jones & Llewellyn, 1917; McKendrick, 1912). Clinical attention was drawn to these signs later by Walters (1961). Such signs are inappropriate in that they are clearly distinguishable from standard clinical signs of physical pathology (Waddell et al., 1980) and correlate with psychological data (Waddell et al., 1979). The construction and validation of a scale of nonorganic physical signs is described in detail elsewhere (Waddell et al., 1980) and was cross-validated as part of this thesis (Chapter V).

The entire clinical practice of medical diagnosis and management is based on the occurrence of common and hence recognisable patterns of disease. The anatomical and temporal patterns of back pain, its characteristics, and the way in which patients present and describe their symptoms usually approximate to such clinical patterns. Sometimes, however, patients offer descriptions which do not fit general clinical experience. Certain specific symptoms appear to be particularly inappropriate and are related to psychological features (Brown et al., 1954; Walters 1961; Mersley 1965a, 1965b; Wing et al., 1976). They are generally vague, ill-localised and lack the normal relationships to physical activity, time and anatomy. A list of 24 such symptoms were identified from the clinical and medico-legal literature (Main & Waddell, 1982) Unfortunately no attempt previously has been made to construct a scale based on these, or to investigate the relationship between such a scale and other physical or

psychological features. The construction and validation of such a scale was undertaken as part of this thesis (Chapter IV).

Psychiatric Perspectives on Chronic LBP

Psychiatric theorizing has played an important part in the development of psychological approaches to chronic pain, and the adoption of a 'mental illness' as opposed to a 'physical illness' explanation for the persistence of chronic pain has allowed the recognition and treatment of depressive illness and cleared the way for a different set of treatment options for patients who either have insufficient indication for physical treatment or who have exhausted the treatment options from a medical or surgical point of view. Much psychiatric thinking about pain has rested on a theoretical model based on the notion of conversion symptomatology. As a way of conceptualizing the chronic pain patient it has some advantages, because assuming that it is unnecessary to specify the causal mechanisms in detail, it offers an explanatory scheme linking the presence of pain symptomatology of puzzling organic origin with a psychological need identifiable in the patient's psychodynamic profile. Assuming that the patient can be convinced of the situation, other therapeutic foci become available. In their more florid form, such conversion symptoms may be taken to constitute a syndrome called 'conversion hysteria' an example of which is the florid hysterical paralysis. Even allowing for changes in diagnostic criteria over the decades, this particular psychiatric manifestation would appear to be relatively rare today. In a study of 430 patients (Walters, 1961), 26 were considered to have 'psychogenic regional pain' in a pure form, with many more having a mixture of conversion and neurotic symptoms. Schizophrenia occurred in only 4% of the patients with psychotic depression affecting just over 10%. The majority of patients had neuroses or situational states. Unfortunately this study was based on a retrospective examination of a personal clinical series and so the validity and reliability of the data is uncertain. According to a more recent author (Bond, 1979) major psychiatric illnesses such as schizophrenic psychosis and manic depressive psychosis are extremely rare in patients presenting with chronic backache, although organic psychoses can be produced by acute systemic diseases such as infection or disseminated malignancy and so physical pathology must be excluded prior to psychiatric assessment.

The Nature of Depression

The association between depressive symptomatology and chronic pain has long been recognised (Sternbach, 1974). In a study of 200 consecutive admissions to a psychiatric clinic (Merskey and Spear, 1967) it was found that 53% of the patients included pain as one of their complaints, and of those with a diagnosis of depression, 56% had pain as one of their symptoms. In a study of pain clinic patients (Pilowsky et al., 1977) 10% of the patients were classified as having a depressive syndrome with 10% of patients having depression scores in the mild to moderate range. In another study (Melzack and Chapman, 1973) an association was mooted between chronic pain and 'depressive personalities' characterised by intropunitiveness, accident and injury proneness and hypochondriacal traits. This occurrence of depressive symptomatology in pain patients (and particularly chronic pain patients) and the failure of many chronic LBP patients in particular to respond to conventional medical and surgical treatment has led to the study of depressive illness as a possible causal factor in the chronic patient's pain presentation, and to the use of antidepressant medication in the attempted treatment of chronic pain.

There has been much debate in the psychiatric literature about the nature of depression. In everyday usage the term 'depression' is used to cover a wide range of emotional discomfort ranging from feeling 'fed up' to the sort of emotional despair preceding parasuicide and suicide. Attempts have been made to classify and quantify depressive phenomena into unipolar and bipolar depression (the latter characteristic of the depressive phase of a manic-depressive disorder) (Perris, 1966). It makes sense only to consider the nature of unipolar depression in the context of chronic pain. Further attempts at classification have led to the distinction between reactive (or neurotic) depression and endogenous (or psychotic depression) (d'Elia et al., 1974), and the associated distinction between primary and secondary depressive illness. The reactive endogenous dichotomy has been central in the debate on the classification of depressive phenomena

> "Central to the distinction are postulated differences in the underlying causal processes. Reactive depression is is regarded, in general, as being the consequence of life stress whereas endogenous depression is regarded as being the result of a variety of processes intrinsic to the organism."
> (Cooke, 1981; p 181)

The presence of life-stresses considered likely to cause depression is more likely to lead to a differential diagnosis of reactive rather than endogenous depression, but in current clinical practice "vegetative" symptoms such as psychomotor retardation, early morning wakening and loss of appetite are also considered more likely to be a feature of an endogenous rather than a reactive process. Psychiatric diagnoses are normally ascribed on the basis of ratings made during a clinical interview, but more structured rating scales have also been devised. 'Life-event' identification has been criticised (Andrews and Tennant, 1978) from the methodological point of view in that conceptual domains are frequently inadequately specified. Thus in the case of depression, it is necessary to consider which variables characterise the essence of the condition and which variables are merely correlates. Unfortunately no a priori rules exist for doing this (Cooke, 1980). It would seem sensible (Derogatis et al., 1972; Ni Bhrolchain, 1979) to restrict consideration to clinical signs and symptoms. On reviewing the relevant literature in which potential precipitants and symptoms have been treated separately, however, it was concluded that provoking agents were not, in an important way related to the form of depression (Brown and Harris, 1978), thus making differential diagnosis into reactive and endogenous depression on the basis of premorbid life events an untenable proposition.

An alternative to differential diagnosis, has been statistical research attempting to identify different depressive syndromes on the basis of interrelationships among individual depressive symptoms. In a general population study, Cooke (1980) identified four essentially independent depressive syndromes, the first of which was interpreted as being essentially reactive, and similar to the traditional reactive pattern (Kendall, 1976) with the latter (much smaller) syndromes essentially endogenous in quality. It has been argued (Eysenck, 1970a; Garside and Roth, 1978) that there are two discrete steps in the formulation of any classification system; firstly, the classification of symptoms into syndromes; secondly, the generation of a classification of subjects in relation to particular syndromes. Applying this logic, and procedure, to his data Cooke (1980) found that subjects simultaneously experience various degrees of each of these four independent syndromes, thus providing strong reasons for regarding types of depression as dimensional rather than categorical in nature. Any such classification system rests on

the incidence of the various symptoms and this is based on the particular population considered. Thus individual symptoms have differing incidences in psychiatric populations, medical populations and non-patient populations. The dimensions identified are therefore population dependent. Such considerations imply that it is hazardous to draw inferences about one population on the basis of another perhaps very different clinical population. Criticisms have even been levelled at attempts to describe depression rates at psychiatric facilities on the grounds that certain clinical and non-clinical features appear to have disproportionate influence on referral patterns, resulting in biased samples of the total depressed population being found at the agencies (Shepherd et al., 1966; Fahy, 1975). Leighton (1979), on examining psychiatric epidemiology, indicated that quantitatively different syndromes are likely to occur in psychiatric and non-psychiatric populations. In view of the complex methodological problems (sampled above) in arriving at an adequate description of depression, it is hardly surprising that discussion of the role of depression in patients presenting with chronic LBP is confusing.

<u>The Assessment of Depression and Depressive Symptomatology</u>

The design of a measuring instrument is affected by its anticipated use. Scales for the measurement of depression have consisted in the main of clinical rating scales designed to identify psychiatric symptomatology or self-report instruments designed to give a measure of the degree of depression. The best known of the former are perhaps the Hamilton Depression Rating Scale (Hamilton, 1960) the Beck Depression Inventory (Beck et al., 1961) and more recently the Montgomery-Asberg Scale (MADRS) (Montgomery and Asberg, 1979). Examples of the latter are the Wakefield Depression Inventory (Snaith et al., 1971), the Depression Subscale of the Leeds Scales (Snaith et al., 1976), the Zung Self Rating Depression Scale (Zung, 1965) and the Levine-Pilowsky Depression Questionnaire (Pilowsky et al. 1969). There are depression scales in a number of personality inventories such as the M.M.P.I. (see below) and the Kellner-Sheffield (Kellner and Sheffield, 1973) to mention but a few. In general, a lack of comparison studies has led to relatively arbitrary selctions of scales for particular studies (Carroll et al., 1973). A number of studies have compared individual scales with the Hamilton Scale (reviewed

in Hedlund and Vieweg, 1979). A further comparison study (Davies et al, 1975) was restricted in scope. A recent comparison study (Kearns et al., 1982) compared a number of scales and concluded that patient-rated scales had a performance comparable to the interviewer scales, but explicitly qualified their overall findings thus:

> "Finally, it should be stressed that the findings of this study apply to patients suffering from primary depressive illness who have at some time suffered from the disorder of sufficient severity as to lead to hospital admission. The observations in the comparative merits of the scales cannot be taken to apply to milder depressive disorders seen in the setting of community based or out-patient practice, and further research in this area still has to be undertaken". (Kearns et al, 1982, p 49)

It can be concluded that the assessment of measurement of depression is almost as problematic as its classification. It is almost self-evident that whatever the measuring instrument, scores on depression for a chronic pain group will lie between scores for the non-patient population and psychiatric patients. There would seem to be a case for ascribing a diagnosis of depressive illness in the case of patients with severe levels of depression and prescribing psychiatric treatment. For most chronic LBP patients however it would appear sensible to use a measuring instrument capable of producing a range of scores on the basis of which "cut-offs", whether for research or treatment purposes, can be derived if so desired.

Pain and Depression

The reported incidence of depression in patients varies considerably ranging from 83% to 10% (Kramlinger et al., 1983) in different studies. The description of the depression has differed in the proportion of reactive to endogenous depressions and different measuring instruments have been used. Assessment of depressive symptomatology in pain patients has included psychiatric ratings during the interview, such as obtained using the Hamilton Rating Scale (Hamilton, 1960) and the Levine-Pilowsky Depression Questionnaire (Pilowsky & Spalding, 1972), or self-report measures of depression, concentrating on the subjective component of depression (Beck et al., 1961) or the somatic component (Zung, 1965). The omnipresent M.M.P.I. (Dahlstrom & Welsh, 1960) contains a depression scale which contains a mixture of subjective and somatic

items. Given the aforementioned range of assessment instruments, variation in estimates of depression and severity of depressive symptomatology is hardly surprising. That chronic pain and depressive symptomatology co-exist in many patients, however, can be taken as established.

Pain is undoubtedly a common symptom in patients with depressive disorders (Baker & Merskey, 1967; Devine & Merskey, 1965; Merskey, 1965a, 1965b; Merskey & Spear, 1967) and the similarity between the chronic pain syndrome and the depressive syndrome is well recognised (Sternbach, 1978; Von Knorring et al., 1983). It has been suggested that pain and depression may share a common pathogenesis (Von Knorring, 1975; Sternbach, 1974). Pain has been described as a 'conversion symptom' (Engel, 1959), as a 'depressive equivalent' (Lopez Ibor, 1972) as 'masked depression' (Lesse, 1968; Forrest & Wolkind, 1974) and even more tortuously as 'depression without depression' (Lopez Ibor, 1972). According to one author:

> "Depression as a cause for somatic distress is probably one of the least recognised entities in middle-aged and elderly people who complain of chronic low-grade pain". (Mastrovito, 1974, p516)

Behaviourally, there are similarities between pain patients and depressed patients (Fordyce, 1978; Pilowsky & Bassett, 1982).

Antidepressants have been used in the management of chronic pain for many years (Moore, 1980; Sternbach, 1974) but the relationship between their antidepressant action and their effect on pain remains the subject of debate (Ward et al., 1979). Many of the pharmacological investigations have involved headache patients (Diamond & Bates, 1971; Okasha-Ghaleb & Sadek, 1973; Gomersall & Stuart, 1978; Couch et al., 1976; Sherwin, 1979) but the efficacy of tricyclics with musculoskeletal disorders has also been investigated. Tricyclics have been used successfully in various forms of arthritis (MacNeill & Dick, 1976; Gringas, 1976; Scott, 1969) and, in conjunction with lithium carbonate in the treatment of the painful shoulder syndrome (Tyber, 1974). Tricyclics have been used in uncontrolled studies of facial pain (Gessell, 1975; Moore & Nally, 1975) and of peripheral diabetic neuropathy (Davis et al., 1977; Turkington, 1980). No difference between imipramine and placebo, however, was found in the treatment of LBP (Jenkins et al., 1976). In a controlled study of doxepin against placebo in the treatment

of chronic intractible pain, doxepin showed considerable superiority over placebo in pain relief, but there was no connection between the effect on pain and alterations in depression scores (Evans et al., 1973). One controlled study (Ward et al., 1979) reported not only a significant superiority of doxepin over placebo, but also a correlation between analgesic effect and antidepressant effect. A recent double-blind cross-over study of amitriptyline versus placebo (Pilowsky et al., 1982) was carried out on a group of patients referred to a multidisciplinary pain clinic for the management of chronic intractible pain for which no substantial organic cause could be shown. Not only did 20 (38.5%) of the patients withdraw before completion of the 12 week trial, no differences were found in terms of global improvement, subjective reports indicating a greater reduction in pain at 2 weeks and 4 weeks on amitriptyline failed to show a difference at 6 weeks, and none of the baseline measures was predictive of response. The authors concluded:

> "there appears to be little evidence in our study to connect the antidepressant effect of amitriptyline with its effect on pain .... our findings suggest that the efficacy of amitriptyline in relieving chronic pain cannot readily be predicted on the basis of information such as degree of depressed affect, anxiety or illness behaviour profile." (Pilowsky et al., 1982, p 178).

These pharmacological studies indicate that antidepressant medication is not the treatment of choice for the chronic pain patient, although in the small minority of chronic pain patients with severe depressive symptomatology, or in patients in which there is evidence for a clearly endogenous illness (assuming that one accepts the validity of that diagnosis), then it would appear sensible to treat the depression first and then reassessing the patient before deciding the next step.

Differences in patient characteristics and in response to pharmacological treatment both therefore cast doubt on the view that depressive symptomatology is best interpreted as a primary depressive illness. A recent item and subscale analysis of the M.M.P.I. (Watson, 1982) confirmed the distinction between primary depressive illness and depressive symptomatology showing that, while chronic pain patients show a considerable amount of depressive symptomatology they do not have the personality characteristics associated with severe depression. Although clinical impressions have been offered (Melzack & Chapman, 1973) that an association exists between chronic

pain and 'depressive personalities' characterized by intropunitiveness, accident and injury proneness, and hypochondriacal traits, there would appear to be differences between the two clinical groups. Thus when Maruta and his colleagues (Maruta et al., 1976b) compared patients with low back pain to a group with depression, they found the pain patients tended to have more siblings, reported a poorer academic record, with less formal education and a history of having started work earlier in their lives, and to have been more likely to be in blue-collar jobs. In addition, they showed less acceptance of psychological concepts, and dealt with current life stresses through the medium of somatic complaints rather than emotional distress. They concluded that low back pain and depression were distinct disorders requiring quite different treatment approaches. In a recent study (Pilowsky & Bassett, 1982) some of the demographic differences found by Maruta were confirmed. The above findings are offered as evidence for the need to consider an alternative view of the relationship between depressive symptomatology and chronic pain.

The need for more than one theoretical model linking depression and pain is illustrated in Merskey's analysis (Merskey, 1977) recently reviewed by Bond who summarizes three differing perspectives.

> "First, the constitutionally depressive person, that is one who becomes downhearted or depressed easily, tends to feel more pain for any given disorder than someone of a more cheerful disposition. Next, painful physical conditions, especially when chronic, are often associated with depression of mood .... associated with a lowered pain tolerance ....."
> "Last, pain is a relatively common symptom in mental illness of a depressive type in which it is alleged that the development of pain is an unconsciously operated mental defence mechanism which prevents the development of even less tolerable levels of mental pain (depression)."
> Bond (1980a, p 5-6).

The first perspective illustrates the 'depressive personality' analysis. Essentially it views the individual as having a life-long vulnerability to all sorts of stresses. The subject of personality traits will be reviewed later. The third view - the 'mental illness' view while rich in theoretical content is less impressive from an empirical point of view. In patients with a history of psychiatric illness, or in psychologically untypical pain patients, the view may have some utility. The second perspective, in the present author's opinion, would seem to have most utility in

general orthopaedic or rheumatological clinics where according to Skevington (1983a) chronic pain patients' depressive problems seem best construed as a sort of learned helplessness (Seligman, 1975) rather than a fully blown depressive syndrome (Becker, 1977). Uncontrollability is a central feature of the learned helplessness model in explaining the circumstances in which people become depressed, and it also affects people's perceptions of pain (Bowers, 1968). In a comment on sadness and severe depression in terminal illness, Bond (1980b) drew attention to the distinction between sad or depressed mood in the context of an extremely difficult situation, and a severe depressive illness. With slight modification the same perspective can be brought to bear on chronic LBP.

Anxiety and Awareness of Autonomic and Somatic Functioning.

It has been mentioned that both anxiety and depression are concomitants of stages in the natural history of chronic pain. The relationship between depression and depressive symptomatology has already been discussed. A similar distinction can also be made between clinical anxiety and anxious symptomatology. Clinical anxiety is not in general a feature of patients referred to departments of Orthopaedic Surgery or Rheumatology. Specific concern about the nature and prognosis of the condition is frequently expressed at early stages of the illness, but once serious pathology has been excluded and patients have been reassured that chronic backache is not primarily a deteriorating condition, then subjective anxiety is in general supplanted by depressive symptomatology. It has been found (Sternbach, 1974; Wilfling, 1981) that scores of chronic backache patients on neuroticism and anxiety are very similar to scores of the normal non-patient population. However, most scales purporting to measure anxiety contain items reflecting both subjective agitation and somatic awareness (since many of the scales were designed for use with psychiatric populations in which both types of symptom are prevalent). The lack of a strong relationship between anxiety and chronic pain might be the result in part of an attenuating effect on anxiety scores of items reflecting subjective anxiety. Acute pain elicits escape or avoidance behaviour designed to remove or prevent the occurrence of noxious stimulation. Heightened awareness of bodily functioning, one of the accompaniments of increased sympathetic activity could be expected in any situation of threat, danger or stress. The chronic pain patient has failed

in his or her attempt to effect successful pain reduction. It seems not unreasonable to suggest that an important feature in chronic pain may be a sensitizing to all sorts of physiological events, a phenomenon well recognised in behavioural approaches to the treatment of anxiety. There would seem to be a prima facie case for investigation of the phenomenon of heightened body awareness in its own right.

Mandler (Mandler et al., 1958) was the first to attempt to measure the relationship between the perception of body activity and actual physiological functioning. His Autonomic Perception Questionnaire (APQ) was designed to assess the perceived physiological accompaniments of both pleasant and unpleasant feelings. He found that subjects who reported high autonomic reactivity were higher in actual autonomic reactivity than those who reported low autonomic reactivity. He replicated the large variability in rank ordering among the physiological channels found previously (Lacey, 1956) but Mandler's research design made it impossible to estimate whether differential report of a particular channel was also related to autonomic behaviour within that channel, as he used the entire group of subjects in the derivation of the score which he used for comparative purposes. He did establish, however, that the report of internal percepts was correlated with subjective anxiety, as measured by the Manifest Anxiety Scale (Taylor, 1953). The finding that subjects who reported more internal stimulation did so whether the reference was to pleasurable or unpleasurable feelings, is consistent with the work on attribution theory (Schachter & Singer, 1962; Nisbett & Valins, 1972) where in a series of elegant experimental studies, emotional feelings were shown to be a function not only of physiological changes but also of environmental context.

The functional importance of autonomic perception has been suggested sporadically over the last twenty-five years in at least three areas of investigation (Borkovec & O'Brien, 1977). In the study already mentioned (Mandler et al., 1958), greater autonomic reactivity to stress among subjects high in autonomic perception was found, while in another study (Mandler & Kremen, 1958) a low but significant positive correlation was found between degree of reported perception and actual autonomic response to stress. The APQ (Autonomic Perception Questionnaire) has also been used in biofeedback studies of heart-rate control (Bergman & Johnson, 1971; Blanchard et al., 1972) although it has been suggested (McFarland, 1975) that

the relation found between APQ scores and the biofeedback results was probably not a function of the accuracy of autonomic perception. The APQ has been perhaps most widely used in experimental studies of anxiety in humans (Borkovec, 1973a, 1973b; Borkovec, 1976; Borkovec & O'Brien, 1977). As a theoretical construct, autonomic perception has been identified as a derivative of Mowrer's model of learning theory (Mowrer, 1947) in general and with his mediational hypothesis (Rescorla & Soloman, 1967) according to Borkovec (Borkovec, 1976), where the theoretical bases of autonomic perception is considered in detail. Despite a growing body of research on the APQ "Literature has thus far failed to provide a unifying principle to explain the functional nature of its underlying construct." (Borkovec & O'Brien, 1977, p164).

It has been argued that

> "autonomic perception, whatever specific cues may be involved is an important variable contributing to clinically distressing behaviour." (Borkovec, 1976, p306).

While the use of the APQ has some validation, particularly in the experimental study of anxiety, its format is much too cumbersome for routine clinical use, only American college norms are available and in a recent study (Dowling, 1983) no relationship was found between the APQ and pain tolerance.

A number of currently available anxiety scales contain items reflecting 'somatic anxiety' (Lader & Marks, 1971) but none have been derived specifically for chronic backache or even chronic pain patients. It has been shown in a study of depression (Cooke, 1980) that in trying to describe and evaluate symptomatology, it is important to take into account the population on which the original instrument was derived. Since most of the currently available test instruments have been developed for use with psychiatric populations, one would predict a poor range of scores among chronic pain patients. This has been found with the 'somatization' scale of the SCL 90 (Derogatis, 1977) which has been incorporated into the assessment batteries of a number of pain clinics in the U.S.A. The scale proves extremely insensitive in the chronic pain group (De Good, 1982).

A revised (indeed completely changed) measure of autonomic and somatic perception was devised for this study. Its construction and validation is described in detail in Chapter V.

Hysteria and Hypochondriasis

In early psychiatric writings, hysteria, hypochondriasis and melancholia were grouped together and at times referred to collectively as "the vapours" (Pilowsky, 1970). Although in the nineteenth century, the main theoretical problem seemed to be the distinguishing of hypochondriasis from melancholia, the distinction between hysteria and hypochondriasis was also an issue (Unwins, 1833). Some authors maintained that hysteria and hypochondriasis were the same condition:

> "Here are two different names for the same distemper ... What we call hypochondriacal in men, we term hysterical in women". (Dover, 1733; cited in Pilowsky, 1969, p 347)

Hysteria as a clinical syndrome was described initially by Briquet (1849), later by Savill (1909) and more recently by Purtell et al (1953) and Guze & Perley (1963).

> "These investigators delineated a clinical picture which starts early in life; occurs primarily if not exclusively, in women; and is characterized by recurrent symptoms in many organ systems. Included in the clinical history of such patients are dramatically described symptoms, many and varied pains, menstrual disorders, sexual maladjustment, headaches, anxiety symptoms, frequent conversion reactions, excessive hospitalizations and excessive operations. A histrionic manner or attention-getting and manipulative behaviour are common in this disorder". (Guze & Perley, 1963, p 960).

They concluded that hysteria as here defined was a distinctly recognizable syndrome, which was similar in its manifestations from patient to patient and which could be recognized by ordinary clinical examination. They were careful to distinguish the syndrome from a conversion reaction which they use in a solely descriptive manner to describe a heterogeneous group of symptoms such as unexplained blindness, paralyses and fits for example in which clinical examinations, x-rays and laboratory tests are all normal.

Such a description comes extremely close to that which some authors give of hypochondriacal disorders (Pilowsky, 1969). Thus Brown (1936) defines hypochondriasis as 'a bodily complaint for which no adequate physical cause can be found; De Alarcon (1964) talks of 'a physically unjustified body complaint'; Ray and Advani

(1962) refer to symptoms which 'cannot be explained by any organic factors, do not conform to any single specific clinical entity and are refractory; and Richards (1940) says that hypochondriasis 'consists of a simple or diffuse eruption of somatic complaints'. (Pilowsky's extracts). The central feature identified by many writers is the existence of many, changeable and in a sense inappropriate complaints. The clinical literature is replete with pejorative labels such as 'hysterical', 'hypochondriacal', 'functional', 'psychosomatic' and 'psychogenic'. In clinical practice, such shades of meaning seem only of marginal importance in the treatment or management of chronic LBP and it does not seem necessary in the context of this thesis to consider further the clinical validity of the concept of hysteria. The distinction between hysteria and hypochondriasis is considered further elsewhere (Slater, 1965; Walsh 1965).

It is perhaps more common in discussion of chronic pain to find terms such as hypochondriasis, but again it is a term with a variety of usages (Kenyon, 1965; Ladee, 1966; Fischer-Homberger, 1972). It is well described thus:

> "At a popular level, 'hypochondriac' has remained a term of abuse, implying either actual malingering or having imaginary complaints, whereas previously it had been equivalent to mad or senseless, or even a mental disorder due to a disturbance of the digestive tract. Hypochondriasis has also been considered as a psychotic disorder. Finally it has been seen as a type of body image disorder, or even to exist in its own right as a primary nosological disorder.
> But in its modern usage the essential part of any definition would be a morbid preoccupation with one's body or state of health, either mental or physical, with the further implication that this is the subject of complaints to others". (Kenyon, 1976, p1).

Stoeckle (1966) produced a fourfold classification: viz bodily complaints; attitudes and beliefs about the body; concerns about illness; and the act of complaining to the doctor or complaining too often. In the psychiatric literature, the status of hypochondria has been questioned. A case has been made for primary hypochondriasis as a clinical entity not part of other syndromes (Gillespie, 1928) but if it exists as defined by Gillespie, it is a rarity (Kenyon, 1976). In many ways the theoretical problems regarding the measurement and classification of depressive symptomatology are paralleled in the case of hypochondriasis.

Unfortunately there are very few studies of large groups of patients with hypochondriacal symptoms. Two studies showed that the heterogeneous group of hypochondriacal symptoms can be broken down into conventional syndromes without the necessity of a 'primary state' (Ladee, 1966, Kenyon 1964). In one study (Pilowsky, 1970) the nosological status of "primary hypochondrisis" was investigated. 66 patients with the diagnosis were compared with 81 patients who were classified as having 'secondary hypochondriasis' on a variety of social and clinical variables and a number of socioeconomic and clinical differences were found. The author claimed that:

> "These two clusters of clinical features are clearly a strong indication that "secondary" hypochondriasis comprises depressive and anxiety syndromes, while "primary hypochondriasis" does not."
>
> (Pilowsky, 1970, p281)

As has been pointed out however (Kenyon, 1976) there are fatal methodological flaws in the study (lack of independent evaluation and therefore no possibility of excluding observer bias).

A more systematic attempt to measure hypochondriasis was made by Pilowsky (1967) in his derivation of the 'Whiteley Index' a 14 item dichotomous scale constructed somewhat haphazardly from 17 items of an original pool of 20 items, which discriminated significantly between hypochondriacal and non-hypochondriacal patients (three of the seventeen items were excluded so that other information could be punched on the computer tapes!) The Index served as the forerunner of the Illness Behaviour Questionnaire (IBQ). The Whiteley Index, on principal components analysis yielded three factors: bodily preoccupation, disease phobia and conviction of the presence of disease with non-response to reassurance and has been used in the investigation of pain in female patients with malignant disease (Bond, 1971) and in a comparison of the effectiveness of treatment by chiropractors and physicians (Kane et al., 1974). In another principal components analysis (Bianchi, 1973) eight factors were produced of which five were described as dimensions of hypochondriasis but again the study suffered from "fatal" methodological flaws: arbitrary rejection of variables, inadequate subject to variable ratio, lack of conceptual clarity in the choice of variables with associated inadequacy in sampling the theoretical domains.

Currently the most widely used scales are the Hysteria and Hypochondriasis Scales of the MMPI and the seven scales of the Illness Behaviour Questionnaire. These will be reviewed in detail below in the discussion of psychological test instruments.

The Role of Cognitive Factors

Cognitive factors have been studied primarily in connection with the experimental study of pain and will be reviewed only briefly.

Typically studies have incorporated experimental manipulation of attitudes using socio-psychological techniques. The dependent variable is frequently pain threshold or pain tolerance. In a celebrated experiment Nisbett and Schachter (1966) demonstrated a clear relationship between pain tolerance, beliefs concerning the induced physiological arousal, and fear. Horan and Dellinger (1974) found emotive imagery effective in increasing pain tolerance. The role of attentional factors as mediators is reviewed elsewhere (Blitz and Dinnerstein, 1971). It would appear that in certain controlled experiments, pain tolerance is affected by subjects' belief about the situation, but the relevance of these findings for chronic pain patients is as yet unproven.

In an investigation of asymmetry of perception of size, McPherson & Renfrew (1953) found that discs of equal size held simultaneously in each hand tended to be judged unequal, and that, in the majority of subjects, the object held in the dominant hand was perceived as the smaller. In a study of cold-pain, Wolff & Jarvik (1964) found that, in the majority of subjects tested, pain threshold and pain tolerance were higher in the dominant than in the non-dominant hand. In a later study, Haslam (1970) studied perception of size in a group of right-handed and a group of left-handed subjects. For right-handed subjects, a significant relationship was found between these two types of perception. Subjects who tended to underestimate size with the dominant hand also had a higher pain threshold for that hand as compared with the non-dominant hand. Perhaps slightly better known is the "Augmentation-Reduction" concept derived by Petrie (1978b) in which different styles in the cognitive appraisal of stimuli were identified. The process involved was cortical

and suggested a general dimension on which individuals could be placed according to whether they tended to overestimate or underestimate the intensity of presented stimuli. This dimension was shown to generalize across different sensory modalities. The relationship of this dimension to pain tolerance was examined by Vando (1974) who devised the R-A (Reducer-Augmenter) Inventory, a paired choice paper and pencil test yielding a range of scores from 0-142. Following further statistical analysis, 54 of the 142 items were selected. The resulting scale yielded a split-half reliability of 0.89. The good internal consistency was matched by satisfactory test-retest stability. Its relationship with pain tolerance was then examined in a comparison with a number of other psychometric scales. The R.A. Scale correlated 0.84 with pain tolerance, and the other eight variables improved the prediction only marginally. In addition to its high correlation with the pain tolerance measure, the R-A correlated significantly with the EPI E Scale (0.65), with the MMPI Hs Scale (-0.60) and with the average number of hours slept per night (-0.60). More recently the R-A Scale was used in the selection of bioastronauts in the prediction of response to a new environment. Preliminary findings (Rockwell et al., 1974) indicated that the R-A scale separated high problem crew members from low problem crew members. Methodological differences, particularly in the determination of pain threshold have led to debates about procedure (Elton et al., 1978; Petrie, 1978a). It is claimed (Petrie, 1978a) that additional materials and confirmatory studies in the new paperback edition of the 1967 book (Petrie, 1978b) answer the critical objections. The dimension has been linked with styles of managing stress (Goldstein, 1973). Sensitizers and copers tend to respond to external stimulation and cope with stress by trying to deal with it. Reducers or avoiders play down external stimulation and tend to cope with stress by denial and avoidance (Weisenberg, 1977, p1021). It seems that individuals who rely on denial (avoiders) to cope with anxiety respond poorly to surgery when given detailed information about it (Andrew, 1970; De Long, 1970) and show better adjustment to that specific stress when <u>not</u> given information about it (Cohen & Lazarus, 1973). Sensitisers in contrast seem to benefit from prior information. Patients intermediate on the Repression-Sensitization

dimensions, or reporting intermediate levels of pre-operative anxiety seem to recover well irrespective of preparatory information. The link between this dimension and response to experimental pain stimulation has been confirmed (Davidson & Bobey, 1970; Neufeld & Davidson, 1971).

It would seem that the R-A or R-S dimensions would merit further investigation, particularly using the R-A pencil-and-paper version (Vando, 1974). It has not been used, however, to the writer's knowledge in the study of LBP and the internal consistency would need to be replicated and examined in different clinical situations.

Locus of Control

The most widely known cognitive dimension is probably locus of control, sometimes termed Internality-Externality of I.E. An original 60 item forced choice inventory (Rotter et al., 1962) was subsequently shortened to a 23 item version (Rotter 1966). The locus of control construct, an integral part of learning theory (Rotter, 1954), was defined as follows:

> "It refers to the degree to which individuals perceive the events in their lives as being a consequence of their own action, and thereby controllable (internal control), or as being unrelated to their own behaviour, and therefore beyond personal control (external control)". (Lefcourt, 1972, p2)

Even by 1969, a bibliography containing 339 separate entries of immediate relevance to the locus of control construct had been amassed (Throop & MacDonald, 1971) and a number of major review articles (Joe, 1971; Lefcourt, 1966; Lefcourt, 1972). By 1972 there were at least nine different tests of locus of control, with revisions of some (Lefcourt, 1972). In this thesis it will be possible to discuss locus of control only briefly. The nature of Rotter's original scale will be described, with emphasis on research findings perhaps having some relevance to chronic pain; the more recent Health Locus of Control, Multidimensional Health Locus of Control and Pain Locus of Control Scales will then be evaluated.

The original scale is accompanied by test-retest reliability data for various samples over varying time-intervals yielding coefficients between 0.49 and 0.83 (Rotter, 1966). A study of 86 psychiatric patients over a 6 week period (Harrow & Ferrante, 1969) gave a test retest reliability of 0.75 which compares favourably

with data obtained from normal samples (Lefcourt, 1972). Internal consistency estimates of reliability have ranged from 0.65 to 0.79 (Rotter, 1966). Good discrimant validity for the I-E scale was indicated, by low correlations with intelligence, social desirability and political affiliation although in a later study (Minton, 1967) a sex-specific relationship with external control and both conservatism and exaggerated patriotism was noted among females. Although sex differences on the I-E scale among students appeared to be minimal, later studies demonstrated that females scored significantly higher on external control (Feather, 1967; 1968). Furthermore later studies (Altrocchi et al., 1968; Berzins et al, 1970) found a significant relationship between I-E and social desirability. Crne (1971) has argued that the I-E scale favours items dealing with social and political events as opposed to items regarding personal traits, goals or concerns and suggests that the I-E scale fails to include all major aspects of personal control; a view confirmed later (Lao, 1970; Naditch & Demaio, 1975). Factor analytic studies (Mirels, 1970; Gurin et al., 1969; Lao, 1970) demonstrate the multi-dimensional nature of the construct in the distinction between perception of personal control and perception of social or political control.

External control has been found to differentiate between debilitating and facilitating anxiety (Butterfield, 1964) and later studies have confirmed some sort of relationship between locus of control and anxiety (Feather, 1967; Hountras & Scharf, 1970; Platt & Eisenman, 1968; Tolor & Rezaikoff, 1967). A factor analytic study (Ray & Katahn, 1968), however suggested that the anxiety scales and I-E scales, although correlated were conceptually distinct and that the correlation obtained was not due to a hidden anxiety variable within the I-E scale. Attempts have been made to demonstrate a relationship between internal-external control and adjustment (Crego, 1970; Platt & Eisenman, 1968; Warehime & Foulds, 1970). Early studies (Bialer, 1961; Cromwell et al., 1961) had suggested differences between normals and psychopathological groups on locus of control. Shybut (1968), finding relationships between time perspective, locus of control and severity of psychological disturbance implicated

the process of hospitalization in the differences found. Harrow & Ferrante (1969) in a comparison of hospitalized schizophrenic and depressed groups of patients, found the schizophrenics to be more external with a change following treatment towards internality among the depressed patients. The I-E scale has also been correlated with dominance, assertiveness and achievement (Hersch & Scheibe, 1967), neurotic symptomatology (Feather, 1967), sensitization and repression (Altrocchi et al., 1968; Tolor & Reznikoff, 1967), and hostility (Williams & Vantress, 1969). According to Joe (1971):

> "These findings tend to form an orderly cluster which is logically and theoretically consistent with the construct of internal-external control. The findings depict externals, in contract to internals as being relatively anxious, aggressive, dogmatic, less trustful and more suspicious of others, lacking in self-confidence and insight, having low needs for social approval, and having a greater tendency to use sensitizing modes of defences." (Joe, 1971, p 623)

Joe also reviews ethnic group and social class differences, antecedents of internal-external attitudes, reaction to social stimuli, strategy preferences and learning, risk-taking and reaction to threat.

Finally, studies relating locus of control to attempts to control the environment may have a bearing on chronic pain. Early studies (Phares, 1965; Seeman, 1963; Seeman & Evans, 1962) showed that internals exhibited more initiative than externals. Thereis some evidence (Straits & Sechrest, 1963; James et al., 1965) that internals not only control their environment more, but also their own impulses. Phares et al., (1968) concluded that internals were more willing than externals to remedy personality problems. Internals also actively seek information (Davis & Phares, 1967). One could make a reasonable prediction that internal subjects would be more likely than externals to seek ways to overcome chronic pain and its associated disability or alternatively one might predict that externals would prove much more tolerant to the limitations imposed by chronic pain and disability.

Health and Pain Locus of Control Scales

In a review of locus of control research Strickland (1973) identified the relationship between a belief in internal control and physical health as an important new direction. She cited

11 studies in which "positive" relationships had been found but according to Wallston neglected to mention "negative" findings (Marston, 1970; O'Bryan, 1972). Difficulty in making behaviour predictions in specific areas such as health (Wallston & Wallston, 1973) led to the development of the Health Locus of Control Scale (HLC) (Wallston et al., 1976). The 11-item 6-point scale did not correlate with social desirability, had reasonable internal consistency (0.72) and correlated 0.33 with Rotter's I.E. Scale. Normative data was presented on college students, community residents and hypertensive outpatients. In the first validation study, HLC was related to information seeking about health. In a second study, the relationship between patients' satisfaction with one of two weight reduction programmes was examined. Patients whose generalized expectancies were consistent with the orientation of the programme proved more satisfied.

Other studies have used the HLC to predict intention to lose weight (Saltzer, 1978), compliance with an anti-hypertensive medical regimen (Lewis et al., 1978) and as an evaluative tool for assessing post-mastectomy group counseling (Bloom, 1979). In a study of health-related information seeking in a public hypertension screening program (Toner & Manuck, 1979), pamphlet selection was affected by HLC among older white patients although not among younger patients. In the group counseling study (Bloom, 1979) it was found that factor scores were more sensitive to counseling-related changes than the total score and the suggestion made that caution was needed in applying the scale to populations with different health problems. In a recent cross-cultural study of chronic LBP patients (Tait et al., 1982) principal component factor analyses indicated three distinct subscales for the low back patients (a) personal health control, (b) external health control, and (c) control by powerful others (physicians). HLC responses were analyzed with univariate analyses of variance using subscale scores as dependent measures, and country and sex as independent variables. New Zealanders rated themselves as less dependent on physicians' orders and women were seen as having less personal control over their pain conditions than men. The small number of items make the stability of these scales suspect, but the unidimensional nature of the

original HLC has been criticised by others. Lewis et al. (1978) found evidence of low internal consistency for the scale. Following the multi-dimensional conceptualization of locus of control originally proposed by Levenson (1973), Wallston et al., (1978) redeveloped the HLC producing the Multidimensional Health Locus of Control (MHLC) with three subscales (Internal, Powerful Others and Chance). Preliminary evidence for reliability, construct validity and predictive validity of the new scale was presented and the MHLC offered as a more accurate measure of health-related locus of control. Shipley (1981) reported evidence of subscale validity and independence. A recent study (Hartke and Kunce, 1982) in a study of medical patients confirmed the three dimensional factorial structure and offered evidence that educational level may play a significant role in reducing one's dependency on powerful others or fate. Use of locus of health control scales has been advocated by the authors primarily in the context of health education (Wallston & Wallston, 1973) and they consider smoking, birth control and weight loss in particular. The concept is however presented in the wider context of sick-role behaviour with particular emphasis on information-seeking and adherence to medical regimens. Of particular interest are their observations on the training of internality and design of health education programmes specific for different degrees of internality of externality. The significance of these theoretical perspectives for chronic pain, and chronic LBP in particular, await empirical investigation.

Recently the author has come across a Pain Locus of Control Scale (Engstrom, 1982) in use in Los Angeles in a variety of settings. The instrument is not as yet developed to the stage from which it can be discussed from a scientific point of view.

<u>The Role of Personality</u>

<u>Minnesota Multiphasic Personality Inventory (M.M.P.I.)</u>

The most widely used personality test is the MMPI (Lubin et al., 1971; Sundberg & Tyler, 1962) and it is also by far the most extensively used personality test with chronic LBP patients. Although not concerned with discovering basic personality dimensions in the most fundamental sense but rather deciding whether an individual differs significantly from a normal group,

and if so into which of a number of psychiatric categories he should be placed, in many situations the dimensions of personality structure have come to be associated with the MMPI scale. The original inventory was in two forms: a card form containing 550 statements and a booklet form. The individual statements were in a True, False, Cannot Say format and yielded scores on nine clinical scales: Hyponchondriasis (Hs), Depression (D), Hysteria (Hy), Psychopathic personality (Pd), Masculinity-Femininity (Mf) Paranoia (Pa), Psychaesthenia (Pt), Schizophrenia (Sc) and Hypomania (Ma). There were in addition three validity scales: a cannot say scale (?), a lie scale (L) and a Faking Scale (F). The K scale is used as a suppressor scale to provide adjustments on the clinical scales by taking the validity scales into account. A Social Introversion-Extraversion (Si) scale was added and some attempts made to improve its standardisation by widening the representation in the normative samples. Most studies using the full MMPI have used the version based on the 1957 standardisation (Dahlstrom and Welsh, 1960). A large number of additional scales have been produced but it is proposed to mention only those which have been used with chronic pain patients.

Short forms of the MMPI

In view of some of the practical difficulties in ensuring satisfactory completion of such a long inventory, a number of short forms have been devised. The Mini-Mult, a 71 item version in which the items are administered orally was devised (Kincannon, 1968) with a claimed loss in reliability of only 9 percent in comparison with the full MMPI and the conclusion that this loss

> "was not deemed sufficient to mitigate against the use of the Mini-Mult when a standard test could not be obtained". (Kincannon, ibid, p319)

Further cross-validation studies (Lacks, 1970; Lacks & Powell, 1970; Gayton & Wilson, 1971) have reported substantial product-moment correlations between comparable scales of the standard MMPI and the Mini-Mult suggesting that the latter could predict the full MMPI with a high degree of accuracy. Comparisons have also been made with two forms of the Mini-Mult, one extracted from the full MMPI (internal) and one administered separately (external). Kincannon (1968) and Newton (1971) have reported that correlations between standard scale scores of the 'internal' Mini-Mult and the

MMPI are consistently higher than comparable correlations between separately administered 'external' correlations. Statistically such findings are to be expected. Of more importance is the fact that considerable shrinkage occurs with cross-validation (Armentrout, 1970; Armentrout & Rouzer, Gayton et al., 1972, Newton, 1971). The use of grouped data may also mask wider differences in individual profiles (Streiner et al., 1973). They conclude that although the Mini-Mult may have some use as a global index of pathology

> "it is an inadequate substitute for the full MMPI. The low concordance between external Mini-Mult and MMPI High-point codes, ranging from 20 to 24 per cent in these studies, would contraindicate its use as a diagnostic instrument."
> (Streiner et al., 1973, p81)

In a large community study (Fillenbaun & Pfeiffer, 1976) significant sex and race-related differences in answering were found with the Mini-Mult, and concern expressed about instability and undue elevation of the Scale Scores. According to Huisman (1974), in a study of neurological disease,

> "The Mini-Mult's poor performance in predicting useful information for the individual in spite of adequate group prediction suggests weakness in the test rather than sampling differences due to severity of illness."
> (Huisman, 1974, p 149)

In a major review and critique of MMPI short-forms (Hoffman & Butcher, 1975), while noting that the Mini-Mult has generated the greatest body of literature with the widest range of populations, the authors highlight inconsistencies in research findings; influence of age, type and severity of psychiatric disorder and sex on the relative accuracy of the Mini-Mult in predicting the full MMPI Scale scores; the inadequacy of using statistical significance as a criterion of adequacy in comparisons; and particular problems in comparison of high point (diagnostic) codes. They conclude:

> "The results of the present study and those of studies cited earlier indicate that there is insufficient evidence to advocate clinical use of the MMPI short forms."
> (Hoffman & Butcher, 1975, p38)

Graham and Schroeder (1972) added items to the Mini-Mult so that the Mf and Si scales could be included. The Midi-Mult, with 86 items was developed (Dean, 1972) to improve the accuracy of prediction for scales L, F and Ma. Hugo (1971) employed multiple regression techniques to develop a further short form.

Faschingbauer (1974) using cluster analysis developed a 166-item short form, similar in length to the MMPI 168 (Overall et al. 1973, Overall & Gomez-Mont, 1974) based simply on the first 168 items of the MMPI. Diagnostic "hit-rates" for the latter are unimpressive (Hedlund et al., 1977).

Clinical Studies of the MMPI with Particular Emphasis on Chronic Pain

The MMPI has been used in three general ways in the study of chronic LBP. Firstly, it has been used diagnostically to differentiate between patients with organic findings considered adequate to explain the extent of their pain, disability or response to treatment, and patients considered not to have an adequate basis for the persistence of their pain. The latter 'functional' group are sometimes divided into those with some organic findings, but not of a degree considered adequate as an explanation (sometimes given a 'mixed' diagnostic label); and those with no detectable organic basis. Secondly it has been used to describe the clinical features of chronic pain patients, either in a comparison with pain free normals, or in a comparison of different clinical pain groups, or to compare different clinical groups. Thirdly it has been used to predict outcome of treatment, mainly surgical, although also less radical forms of medical treatment, and, more recently, psychological forms of treatment.

Diagnostic Studies

The diagnosis and treatment of patients with chronic LBP are problematic because in a substantial proportion of patients the organic findings are considered insufficient to explain the persistence of the pain. In such cases, physicians often arrive at a diagnosis of 'functional' or 'psychogenic' pain, implying that the patient's experience of pain is occurring in the absence of appropriate peripheral stimulation (Engel, 1959), or there is a discrepancy between the level of expressed pain and the apparent level of noxious stimulation (Sternbach & Fordyce, 1975). Using such criteria, the diagnosis of 'functional' or 'psychogenic' are essentially diagnoses by exclusion in that they are made not as a result of positive identification of psychological features but simply on the basis of lack of adequate organic findings. Such a dichotomous classification not only fails to allow for patients showing both organic findings and psychological disturbance, but also precludes an adequate examination of the degree of severity of

either and renders impossible any investigation of possible interactions between organic and psychological features. The popularity of such a simplistic classificatory system is explained partly by the medical predilection for differential diagnosis as a prelude to treatment, but also by the fact that on the basis of such a system, an alternative causal chain can be found (however tortuous) for clinical presentations which do not accord with the theoretical models relating organic pathology, pain and response to treatment. The equation of the term 'psychogenic' with the diagnosis of 'functional' has been criticized since the term psychogenic

> "includes the unproven assumption of a causative relationship between certain psychological mechanisms and pain symptoms." (McCreary et al., 1977, p 74)

and Szasz (1975) has criticised the term 'psychogenic' since it often involves a disguised value judgment on the part of the diagnostician between 'legitimate' versus 'illegitimate' pain. The earliest studies using the MMPI were attempts to explain differences between organic and functional groups of patients on the basis of personality structure. Hanvik (1951) compared patients with protruded intevertebral discs, with patients having negative physical and laboratory finding. The MMPI scores of the functional group were significantly higher than the scores of the organic group on six clinical scales: hysteria, depression, hypochondriasis, psychopathic deviance, psychasthenia and schizophrenia. Unlike the organic group, the functional groups profile was seen as "neurotic in type, showing the 'conversion-V' configuration" (Hanvik, 1951, p 353). Other studies (Carr et al., 1966; Freeman et al., 1976, McCreary et al., 1977) offer similar findings. Researchers have commonly used the 10 regular clinical scales and three validity scales, but special low back scales have also been devised, the best known of which are the Lb scale (Hanvik, 1951) and the DOR scale (Pichot et al., 1972). The Lb scale was developed specifically to discriminate between functional and organic back pain and in cross-validation with the original optimal cutting score, it was able to identify correctly 70% of new organic patients and 90% of new functional cases. The DOR scale, developed in France with mostly female LBP patients, used as a control group pain-free subjects. When used simultaneously

the DOR and Lb scales detected 80% of the functional LBP patients with only 5% false positives for the organic group. Used independently, the Lb scale discriminated only 43% of the time, while the DOR Scale had a comparable figure of 57%. In another study (Calsyn et al., 1976), the DOR and Lb scales used in combination proved superior to either used alone, yielding a hit rate (functionals correctly identified) of 81%, a false positives (organics incorrectly identified) of 26%, yielding an overall accuracy of 77.4%, for a group in which 56.3% were classified as organic. The importance of determining and reporting base rates is discussed elsewhere (Meehl & Rosen, 1955). This was not done in either of the original DOR or Lb studies which makes it difficult to assess the significance of the accuracy in identification (Calsyn et al., 1976). The weak correlation between the DOR and Lb scales may be a result of the widely differing criterion groups used to establish the scales (Freeman et al., 1976). A case has been made for replacing the dichotomous classification of 'functional' and 'organic' by the trichotomous classification of 'functional', 'mixed' and 'organic' (Louks et al., 1978). The procedure of using an unspecified number of physicians to classify patients into one of three aetiological groups is open to criticism (Bradley et al., 1978). Diagnoses may be validated either by external or internal procedures (Feinstein, 1977) and it is clear that there was no direct external evidence available to physicians to validate diagnoses of 'mixed' and 'functional' pain. The authors conclude: "The failure.... to establish a procedure for the measurement of interdiagnostician agreement with respect to the classification of patients made it impossible to assume that the physicians' judgments were valid". (Bradley et al., 1978, p 574). Finally Sternbach et al (1973a, 1973b) regarded the functional-organic dichotomy of chronic pain as meaningless and the search for MMPI discriminants of this supposed dichotomy therefore as fruitless. In a later study (McCreary et al., 1977) comparing functional versus organic LBP patients, although certain symptoms of emotional disturbance were more characteristic of patients showing relatively little evidence of organic findings,

> "the degree of overlap between the groups was high enough to suggest caution in making predictions and diagnoses about functional versus organic pain solely on the basis of personality data." (McCreary et al., 1977, p73)

In a small study of acute post-operative pain patients and chronic pain of either known or unknown origin (Cox et al., 1978) although the MMPI could discriminate acute pain from chronic pain in general, it could not discriminate chronic pain patients whose pain problems were of known origins from those whose pain had no known organic origins. They concluded:

> "The MMPI is of no value in making a differential diagnoses between these chronic pain patient types." (Cox et al., 1978 p 442)

Recently, Liebeskind & Paul (1977) suggested that investigators have failed to show consistent relationships between various personality dimensions and the presence or absence of organic impairment in chronic pain patients. As a result, the extent to which chronic pain is viewed as psychogenic or functional is being increasingly deemphasized.

Descriptive Studies

Most MMPI studies of chronic pain patients have revealed marked elevations on the three scales constituting the neurotic triad, i.e. the Hypochondriasis (Hs), Depression (D) and Hysteria (Hy) scales (Gentry et al., 1974; Maruta et al., 1976; Polley et al., 1970; Sternbach et al., 1973a, 1973b; Schwartz & Krupp, 1971) This so called 'conversion-V' is often used to identify 'somatization of psychic distress' (Louks et al., 1978) but its clinical validity has been questioned (Carr et al., 1966). In an influential study of LBP (Sternbach et al., 1973b) striking elevations on the Hs., D and Hy scales (approximately 2 sds. above the normal population mean) were found. Recently, trenchant criticisms however have been directed at the notion of homogeneous pain personality. Not only has the traditional 'Conversion-V' been subdivided into two groups dependent on the presence or absence of defensiveness, MMPI configuration sorting rules have been devised to sort patients into six basic personality types (Pichot et al., 1972; Louks et al., 1978). Using such rules it was claimed that combined 'Conversion-V' profiles accounted for 58% of the 'functional' group, 45% of the 'mixed' group and 35% of the 'organic' group. It was claimed that there was unanimous agreement by three raters in the classification of 64 of the 74 patients and the 10 'unclassifiable patients' were thereafter excluded from further psychometric analysis (Louks et al., 1978.) Major deficiencies in such profile sorting

rules have however been identified and doubts have been expressed about the cross-cultural application of the sorting rules particularly with American LBP patients (Bradley et al., 1978).

A further difficulty in having confidence in the clinical validity of the Hs and Hy scales in particular is the fact that the two scales have a noticeable proportion of items in common leading to a disproportionate influence of the common items on profiles containing elevated Hs and Hy scale scores. In fact the very comprehensiveness of the original item pool seems to have led to an obfustication of its clinical potential. Not only have subsidiary scales been devised ad nauseam, its omnipresence has been assumed to guarantee its clinical validity. A basic flaw seems to be behind its current usage. The test was derived originally to differentiate psychiatric patients and normals. Chronic LBP patients certainly show signs of psychological stress but in many respects of course they appear normal. The Hy, D and Hs scales clearly show the ability to characterize at least one part of the psychology of the patient in chronic pain. In general however, they are not markedly hypochondriacal, clinically depressed or hysterical. It has been assumed that elevated Hy, D and Hs scores are evidence of premorbid psychological influences on chronic pain yet studies have shown fall in such scores following successful surgery (Sternbach & Timmermans, 1975). Elevated Hs, D and Hy scores show consistent group differences yet are not sufficiently sensitive enough to prevent a high rate of misclassification if used in the individual case (McCreary et al., 1977). A recent item analysis of the MMPI (Watson, 1982) showed that a significant portion of the pain group exhibited the vague and diffuse somatic complaining characteristic of hypochondriasis (on items of the Hs scale), while the D scale results revealed a considerable amount of depressive symptomatology, they did not support the notion that pain patients have the personality characteristics associated with severe depression and analyses of the Hy and K scales indicated that the pain patients were no more defensive than were either of two control groups and their responses did not confirm to the classic hysterical pattern.

It is known that these scales are affected by chronicity (Sternbach, 1973b) and it can be argued that the distress identified (consistently but not powerfully) by the first three clinical scales may be a function of a normal reaction to chronic ill health rather than an inappropriate or neurotic reaction. It has been argued (Baldwin, 1952; Kendall, 1976; Meyerson, 1957; Nalven & O'Brien, 1964; Taylor, 1970) that it is inappropriate to interpret scores of patients who have chronic health problems as if they had been obtained from a physically normal population. They note that patients with chronic health problems are invariably found to have elevated neurotic triad scores. Such elevations have been found among patients with multiple sclerosis (Baldwin, 1952; Bourestom & Howard, 1965; Lanyon, 1968), reheumatoid arthritis (Bourestom & Howard, 1965; Moos & Solomon, 1964; Nalven & O'Brien, 1964; Spergel et al., 1978), ulcers (Lanyon, 1968; Sullivan & Welsh, 1952), spinal cord injuries (Bourestom & Howard, 1965; Taylor, 1970) and pulmonary disease (Lanyon, 1968). The elevations may be due to the fact that the neurotic scales contain items about ability to work, physical health, past and present symptomatology and pain.

> "Proponents of this view argue that although such items were included in these scales because hypochondriacal, depressed and hysterical patients endorse them more frequently than normals, this does not necessarily mean that chronically ill patients who admit to having poor health and many pains are hypochondriacal, depressed or hysterical." (Watson, 1982, p 368)

In another recent study, the authors concluded

> "The data do not support attempts at defining a low back pain or chronic pain personality profile apart from the emotional disturbance associated with chronic limitation and disruption of activity."
> (Naliboff et al., 1982, p333)

The Prediction of Outcome of Treatment

The history of psychosomatic medicine has been littered with attempts to produce theoretical formulations having some sort of internal consistency. Arguably, the formulations which have stood the test of time have done so because they have had some utility. In the context of chronic pain, utility can be measured in terms of relationship with outcome of treatment.

Blumetti and Modesti (1976) found that patients who were unimproved at least six months after surgery had significantly higher pretreatment scores on the Hs and Hy scales. In another

study (Wilfling et al., 1973) patients with good outcome following spinal fusions had significantly lower scores on the Hs, Hy, D and Lb scales of the MMPI at the time the outcome ratings were made (in fact a retrospective study). In a study of patients with non-chronic back pain (Oostdam et al., 1981) significantly lower preoperative Hs, Hy and D scores were found among patients with a successful surgical outcome. On the basis of psychological variables, these authors claimed that the surgical outcome could be predicted in 79% of their patients. Wiltse and Rocchio (1975) reported that Hs and Hy scales were inversely correlated with functional success after chemonucleolysis. In a study of conservative treatment (McCreary et al., 1979) patients with poor outcomes on two of the three outcome criteria had higher pretreatment Hs scores.

In an early study of rehabilitation (Phillips, 1964) it was reported that in orthopaedic patients, length of convalescent time prior to return to full time employment was correlated positively with Hs, D and Hy scores. Sternbach and Timmermans (1975) compared outcome in two groups of patients. Both groups received psychological treatment and rehabilitation but only one of the groups also received surgery. Patients receiving surgery showed significantly greater reductions on the Hy and Ma (Hypermania) scales. Turner et al. (1981) incorporated Bradley's (1978) multivariate clustering of the MMPI in an outcome and follow-up study of surgery for chronic LBP. Several pre-surgery MMPI scales correlated significantly with overall result and follow-up MMPIs were even more highly correlated with outcome. In particular, patients with fair or poor outcome were more likely to have 1-2-3 (elevated Hs, D and HY) profiles, patients with good outcome showed pre-post decreases on Hs, D and Hy, while patients with poor outcome showed pre-post increases on Hs and Hy. Finally, in a study using both single MMPI scales and code types (McCreary et al., 1979) patients with poor outcome on two of three criteria had significantly higher Hs scores. The predicted high risk code types accurately identified patients with poor response on the same two criteria, but the code-type procedure overpredicted poor response in the good outcome group. In one of the better designed studies (Strassberg et al., 1981) the relationship between the MMPI and the outcome of anesthesiologic or psychiatric programmes were evaluated. Unfortunately random

allocation was not employed and assignment was based primarily on the recommendation of the referring physician and so it is not possible to compare the efficacies of the treatment per se, but multiple regression analyses were used to evaluate the influence of the MMPI in prediction, having partialled out statistically a number of potentially confounding independent variables. For the anesthesiologic patients, the Hy, Mf and Pa scales added significantly to the prediction of subjective outcome (better subjective outcome being associated with the combination of higher Mf scores with lower Hy and Pa scores). For the psychiatric patients, only the Mf scores had significant incremental value. Differential effect of gender was shown (with female patients showing higher scores than males on the Hy and Si scales). Furthermore patients with multiple complaints (two or more body pain sites) were significantly different on 6 of the MMPI scales (with differences greatest on the Hs, D, Hy and Si scales). The chronic pain group in fact included head pain only (n=33), back pain only (n=33); head and back pain (n=17) and any other pain (n=29). A significant discriminant function emerged linking pain site with five of the scales which makes interpretation of the findings for chronic LBP difficult to interpret. Also 92% of the patients with back or back and head pain were female which makes the findings even more difficult to interpret.

A number of reservations, however, have been expressed about the value of the MMPI in the prediction of outcome of treatment. Waring et al. (1976) in a small retrospective study of LBP patients found the MMPI, particularly the Hy and Hs scales to be of no value in predicting surgical outcome. Gentry et al. (1977), in a study of patients with chronic LBP in a study of resumption of employment, self-estimates of resumption of functional activities and perceived pain, found no significant differences between patients with successful versus unsuccessful outcome at 18 months follow-up. McCreary et al. (1979), using poor-risk MMPI code types, although able accurately to identify patients having poor outcome, erroneously labelled as poor risks too many patients that in fact had a good outcome. Cummings et al. (1979) attempted to use the MMPI to predict response to a psychologically oriented treatment program for chronic pain, found none of the scales to differentiate between the improved and unimproved groups. In

the interesting study reviewed above (Strassberg et al, 1981) multiple regression analyses were used also to estimate the value of the MMPI in predicting medical outcome for both an esthesiologic and psychiatric patients separately. In these analyses, the effects of six variables (years in pain, time in treatment, sex, number of pretreatment hospitalizations, number of previous surgeries and number of previous doctors) were partialled out to identify the unique predictive value of the MMPI. Although for psychiatric patients a significant prediction was obtained using the K, Hs and Mf scales; for patients seen in the general anaesthetics department,

> "no combination of MMPI variables was able to predict the medical outcome measure significantly."
> (Strassberg et al., 1981, p 222)

These findings suggest perhaps unsurprisingly that the MMPI bears a relationship with treatment outcome for patients identified as needing and subsequently receiving psychiatric treatment, but that it is unrelated to outcome for the 'non-psychiatric' patients. In the study mentioned above (Turner et al., 1981) a relationship was noted between the Hs, D, Hy profile in particular and outcome of surgery. Perhaps of more interest is that

> "both pre-surgery myelogram and straight leg raising test results were more highly correlated with overall result than any single MMPI scale."
> (Turner et al., 1981, p1).

One wonders whether the relationship between personality trait and outcome would persist if these differences in physical findings were partialled out. Although in a similar study (Pheasant et al., 1979) the MMPI scores were more useful predictors of outcome than the actual degree of organic pathology noted at outcome. Nonetheless the moderate correlations noted would lead to a high level of misclassification in the individual case.

Evaluation of the Clinical use of the MMPI with Chronic LBP Patients.

It is difficult to evaluate a test instrument which has been used in different ways for different purposes with differing chronic pain groups at various stages in the treatment process. It would seem appropriate to consider its utility within the three general frameworks already defined i.e. as an aid to differential diagnosis; as a map of the personality profile of chronic pain patients; and in the prediction of response to treatment. A few general remarks about its validity and reason for its current usage will

conclude the evaluation.

In the field of chronic pain its use initially was seen primarily as an aid to differential diagnosis viz. between 'organic' and 'functional' (or 'psychogenic') pain. Although it is still occasionally used in this way, its use for this purpose is I think largely discredited. There is a division of opinion regarding its continuing use as a descriptive instrument per se. In view of the large number of personality profiles already obtained from chronic LBP sufferers it is difficult to envisage that anything very new is going to emerge. Nonetheless work is in progress by at least two psychologists known personally to the author to generate a further range of scales. In view of the number of test items and niceties of multivariate techniques, it is difficult to see an end to this process unless some external criterion of utility is employed. There would appear a number of major limitations in the construction of the scales (see above). Methodological differences among studies in clinical criteria, exclusion of bias, research design and control of independent variables make comparisons of personality structure difficult. Statistically, relatively consistent finding of group differences in personality structure is parallelled by the recognised insensitivity and corresponding high misclassification rate which ought to proscribe its use in the individual case. Differences in source of patient are important (Cox et al. 1978). Despite the inclusion of a masculinity-femininity scale, the effect of gender differences would appear to be a problem (Sternbach, 1973b, Strassberg et al., 1981). The search for a homogenous personality trait profile would seem to be misconceived. The research seems to show that a consistent profile emerges only when very specific clearly defined clinical sub-groups are studied. This makes the utility of the test in generating fertile hypotheses about the nature of chronic back pain extremely limited. One of the most influential theorists of the last fifteen years, has however advocated the use of the MMPI as part of a proper evaluation of chronic pain problems (Fordyce,(1979) which ought to consist of four components (1) medical assessment (2) behavioural analysis interviews (3) activity diaries and (4) MMPI. In an interesting monograph (Fordyce, 1979) he advocates the use of MMPI profiles to explain certain pain behaviour characteristics and uses MMPI

profiles during case conferences to advise about patients' suitability for treatment and to predict their response to rehabilitation. Its use in conjunction with other information gleaned from clinical interview or observed in clinical settings would seem to be of interest but detailed research with adequate methodological control has so far (to the present author's knowledge) not been undertaken.

The best use of the MMPI as a group test would seem to be in the prediction of outcome, but some of its promise may turn out to be spurious in that few outcome studies have so far controlled for important clinical independent and possibly confounding variables (Strassberg et al., 1981). It is possible to envisage a large number of variables which would correlate either with level of residual disability or reported pain. Interactions have been shown between type of personality profile and choice of outcome measure (McCreary et al., 1979, Turner et al., 1981). Naliboff et al. (1982), in a recent study, examined the relationship between MMPI scales and functional limitation in a variety of chronic illness populations. They concluded:

> "Several kinds of analyses demonstrate that, in general, the MMPI group differences can be accounted for by individual self-rated functional limitation. The data do not support attempts at defining a low back pain or chronic pain personality profile apart from the emotional disturbance associated with chronic limitation and disruption of activity."
>
> (Naliboff et al., 1982, p333)

The MMPI has been extensively used in the study of chronic LBP. Politics of research funding frequently necessitate the incorporation of the most widely used measures. In N. America in particular, where costs can usually be transferred to Insurance Agencies, the MMPI is frequently included routinely as part of the overall assessment procedure in the same way as an x-ray. Psychometricians and psychodiagnosticians frequently are employed almost exclusively for the purpose of interpreting MMPI profiles. In the Mayo Clinic, the procedure is computerized so that within 6 seconds on reading the stack of MMPI cards into a card-reader, a profile with associated interpretation (one of approximately 150 programmed) is available. In circumstances where patient compliance is unproblematic, where routine diagnostics are available and required as part of a patient's assessment of suitability for treatment, it is easy to see why the MMPI has remained popular.

As part of a routine orthopaedic or rheumatological clinic in the National Health Service in the U.K., however, from a practical point of view its use precludes the use of other self-reports, patients show resentment at being required to answer such a large inventory of seemingly irrelevant questions and routine psychodiagnostics are not normally available. Its routine use in North America has led to a haziness in theorizing about the psychology of chronic pain and perhaps a case needs to be made to find more sensitive measures of the emotional and behavioral concomitants of chronic LBP.

Eysenck Personality Questionnaires (M.M.Q.; M.P.I.; E.P.I. & E.P.Q.)

The Eysenck series of questionnaires have been widely used, especially in the United Kingdom, for the assessment of personality structure. There have been, however, only a few studies in connection with chronic LBP or even chronic pain in general. The development of the questionnaires therefore will be mentioned only briefly.

The first questionnaire in the series was the MMQ or Maudsley Medical Questionnaire (Eysenck, 1952). This was a forty-item measure of N (neuroticism or emotionality). This was followed by the MPI or Maudsley Personality Inventory (Eysenck, 1959) which contained scales for the measurement of N and E (extraversion-introversion). The third (and perhaps best known) version, the EPI or Eysenck Personality Inventory (Eysenck and Eysenck, 1964) added the L or "Lie" scale to measure dissimulation, provided two alternative forms (A and B) for repeated testing on the same population and was written in slightly simpler language to extend its range of applicability to intellectually duller subjects. The slight correlation between E and N in the MPI was removed to make the scales orthogonal, and the reliability of the final scales was somewhat higher. The latest version, the EPQ or Eysenck Personality Questionnaire (Eysenck and Eysenck, 1975) contains a P or Psychoticism scale (something of a misnomer). It is claimed (Eysenck and Eysenck, 1975, p5) that the improvements in successive versions of the personality scales have been slight so that correlates of the old E and N scales can be assumed will correlate to approximately the same extent with the revised versions of the scales. This view has been challenged (Claridge et al, 1981) in study of the relation between drug tolerance and personality. Validity

and reliability information is presented in the manual (Eysenck and Eysenck, 1975).

The popularity of the EPI and EPQ is such that terms like 'neuroticism' and 'extraversion' have become part of common parlance. Eysenck (1970b) reviews the literature claiming strong support for the existence of 'two very clearly marked and outstandingly important dimensions', i.e. Extraversion-Introversion and Neuroticism (or Emotionality)-Stability and sketches the relationship of these dimensions to the ancient Galen-Kant-Wundt scheme of the four temperaments, (Eysenck and Eysenck, 1975, p6-7). Originally when this scheme was put forward (Eysenck, 1947) it was contrasted with the sixteen-personality factors of Cattell. In fact the second-order factors of both Cattell (Cattell and Scheier 1961) and Guilford closely resemble Eysenck's factors (Eysenck and Eysenck, 1969). An attractive feature of Eysenck's work is the attempt to link phenomenology with physiology and genetics. Eysenck claims

> "the N factor is closely related to the inherited degree of lability in the autonomic nervous system, while the E factor is closely related to the degree of excitation and inhibition prevalent in the central nervous system."
> (Eysenck and Eysenck, 1975, p8).

He expresses the view that this balance is presumably inherited and may be mediated by the ascending reticular activating system (Eysenck, 1967). Studies on identical twins reared separately (Shields, 1962) have shown a high correlation of scores on both Extraversion and Neuroticism. A detailed list of references to empirical studies of the relation between personality is given in one of Eysenck's most influential books (Eysenck, 1967). Eysenck draws the distinction between personality in its genotypic aspect (to which most of the experimental studies refer) and its phenotypic aspect which is seen as a result of constitutional differences in an individual's interaction with the environment. It is claimed that the EPQ is most appropriately linked with such differences in observable behaviour. In a recent study (Young et al., 1980) using a combination of twin and parent-offspring data, a genotype-environmental analysis by the balanced pedigree method, investigated the nature of the EPQ. The mathematics of the study are beyond the comprehension of the present writer, but the authors claim that the data on the E and N Scales are consistent with a hypothesis of additive gene action, random mating

and environmental effects within families while in the case of the P scale, covariance of parents and offspring is low, irrespective of its basis, genetic or environmental. Data from the L scale is taken to justify further examination as a paradigm of a trait for which social interactions rather than genetic differences, are paramount determinants of individual variability.

The addition of the fore-mentioned L or "Lie" Scale in the EPI and EPQ has increased the complexity of the Eysenckian model and a number of studies have been directed towards the L scale (Eysenck and Eysenck, 1970, Michaelis and Eysenck, 1971, Eysenck et al. 1971) while individual items appear reliable and a fair degree of internal consistency has been reported (Eysenck and Eysenck, 1975) the interpretation of the scale is far from clear. Michaelis and Eysenck (1971) discuss three possible causes for high L scores:

(a) Deliberate 'faking' with intent to deceive the test user.
(b) Response in terms of an ideal self-concept rather than a candid self-appraisal.
(c) Response in terms of an 'honest' but inaccurate and uninsightful self-assessment.

Attempts experimentally to manipulate L-scale scores by varying the experimental conditions from high to low motivation to dissimulate have not clarified the issue (Michaelis and Eysenck, 1971). Although it was originally construed primary as a measure of dissimulation of some sort and was seen best employed as "an empirical correction device, particularly in employment and selection situations", it is recently regarded "as a personality dimension in its own right rather than as a screening device against untruthful replies'(Eysenck, 1980, p2). Recently (Barrett and Kline, 1980a) it has been seen as a measure of 'social desirability'. The lack of conceptual clarity in the L scale highlights the dangers of a radically empirical approach to personality questionnaire construction. The ambiguities in its interpretation and usage will I suspect continue to appear in the literature. Statistical integrity in a collection of items is no guarantee of its clinical utility.

The addition of the P scale (psychoticism or toughmindedness) has done little to clarify the situation. Block (1978) has criticised the P scale on psychometric grounds. In spite of the

clarity of its structure as reported initially (Eysenck and Eysenck, 1975), confirmed in a cross-cultural study (Lojk et al., 1979), it has not always been replicated (Loo, 1979). It has been suggested that apparent structural variations across different studies may be a result of differences in factor analytic technique (Forbes, 1980). Studies have suggested that it should be interpreted as impulsiveness rather than conformity (Loo, 1979; Forbes, 1980) although impulsivity has not always clearly been identified (Barrett and Kline, 1980b). Eysenck himself conceded "The nature of the P variable can only be guessed at." (Eysenck and Eysenck, 1975). It is said to differ profoundly from pathological scales like the MMPI and Eysenck claims that the concern is with personality variables underlying behaviours which become pathological only in extreme cases. Nonetheless Eysenck easily slips into discussion of psychoticism, and psychotic patients, whether male or female, when scores are higher than normal (Eysenck and Eysenck, 1971a, 1971b, 1973b). Sex differences in aggressiveness and hostility are used as a basis for predicting higher P scores in men than women. The opinion is offered:

> "It seems likely that the biological basis of P will be found to be closely related to male sex hormones."
> (Eysenck and Eysenck, 1975, p 13)

Since the concern in this thesis is phenotypic rather than genotypic, physiological studies on drug tolerance will be mentioned only in so far as they have relevance to personality structure per se. The exact technique for determining drug tolerance has developed from procedures derived from Shagass (1954) and generally involves the intravenous injection until the subject is sedated on the basis of EEG changes (Shagass, 1954), G.S.R. (Perez-Reyes et al., 1962) or behavioural unresponsiveness to verbal stimuli (Shagass and Kerenyi, 1958; Claridge and Herrington, 1960). Eysenck originally considered that extraversion alone could account for individual variations in response to psychotropic drugs, based on the hypothesis that the effect of centrally acting drugs is to shift the excitation-inhibition balance considered to underlie introversion-extraversion. A number of studies (reviewed in Claridge et al, 1981) suggested that manifest anxiety and hence aspects of neuroticism could lead to raised tolerance of barbiturates and in one study (Claridge, 1967) an unexpected negative association

was found in normals between neuroticism and sedation threshold. Studies using 'zone analysis' (Eysenck, 1967) have found an interaction between neuroticism and extraversion in the effect of drugs. 'Zone analysis' is a simple procedure in which subjects are divided into high and low, or high, medium and low, depending on their scores on Extraversion and Neuroticism. Using such a technique, Claridge et al. (1981) replicated the previous studies (Rodnight and Gooch, 1963; Claridge and Ross, 1973). In an attempt to combine data from previous subjects, they gathered a group of 118 neurotics on whom complete sedation threshold and personality scales were available, but were forced to concede a major problem with zone-analysis:

> "subdivision of this sample according to personality scores was not entirely successful from a statistical point of view, since there was within the group a heavy preponderance of particular combinations of E and N." (Claridge et al., 1981, p 157).

In a further 'throwaway' comment they concede

> "Admittedly some of the correlations were low and occasionally failed to reach significance." (Claridge et al., 1981, p 157).

They claim that they have demonstrated a significant tendency, if the comparison is confined to individuals with moderate degrees of neuroticism, for introverts to show a greater tolerance of sedation than extraverts. In the presence of either high or low neuroticism the relationship between extraversion and drug tolerance was altered. Discrepancies between results for highly neurotic extraverted normals and patient counterparts were found as were discrepancies between diagnosis and personality structure. Gray (1970) postulated a dimension running across E and N from neurotic introversion to non-neurotic extraversion. He suggested that variations along the anxiety dimension represent different levels of activity in a circuit involving the septum, the hippocampus, and the ascending recticular formation, with the different parts of the system normally being in a state of negative feedback. In their discussion, Claridge et al (1981) state:

> "All of the observed variations in drug response cannot simply be accounted for simply by reference to Eysenck's original postulate or to modifications of his general theory such as that proposed by Gray; it is obvious that very different degrees of extraversion, neuroticism, and combinations of both, can be associated with identical values for the sedation-threshold." (Claridge et al., 1981, p 163).

They suggest that psychoticism may be the missing link and feel also that the high E and high N subgroup merit further scrutiny (Eysenck and Eysenck, 1976; Claridge, 1981) although indicate that three-dimensional zoning of N, E and P may be necessary.

A recent study (Barrett and Kline, 1980a) has upheld the stability and breadth of P, E and N in a factor analytic study with all three factors appearing as first order factors and the results were taken to support the interpretation of P, E and N as 'superfactors' of importance over and above the primary or first-order factors usually found in factor analytic investigations (Eysenck, 1970b) The L factor scale was seen as contributing primarily at a second order level and described as Social Desirability. In another study by the same authors (Barrett and Kline, 1980b) personality structure was investigated in a large Gallup adult quota sample and a student group. The research design was such that stability of structure could be investigated in six groups. The E, N and L items reappeared in second order factors, with E also at the first order. The statistical integrity of the P scale, however, was not maintained in all of the subgroups. It appeared particularly unstable in the female group.

Eysenck Personality Questionnaires and the Study of Pain.

In one of the few studies on pain patients, Bond (1971) examined the relationships between self-reported pain, the E PI, the Cornell Medical Index and the Whiteley Index of Hypochondriasis in a fairly homogeneous group of 61 women with advanced carcinoma of the cervix. The use of visual analogue scales for the reporting of pain in patients with malignant disease had been reported previously (Bond and Pilowsky, 1966; Bond and Pearson, 1969). Three groups of patients emerged. The first group, pain-free, had significantly lower N and higher E scores than patients with pain. Lower N scores have been recorded previously in cancer patients (Kissen and Eysenck, 1962; Huggen, 1968) but the relation to pain was not mentioned. The second group, with high N and low E scores, experienced pain but did not communicate it to the nursing staff and did not receive analgesics. The third group, with both high N and high E scores, experienced pain, and received analgesics. Mean N and E scores of all patients were comparable to normal housewives and L scores did not differ between the three patient groups. Unfortunately not enough information is given to assess

the validity or reliability of allocation to the patient groups, but the results would certainly support the view that pain threshold is related to neuroticism, whereas complaint presentation is related to extraversion. In a later study (Bond, 1973), fifteen patients of each sex who had been admitted to hospital for the treatment of chronic pain by stereotaxic percutaneous cordotomy were investigated. In all cases, pain was localized to one area of the body. Each patient completed the EPI-Form A before surgery and twelve patients completed form B five days after surgery. Pre-and post-operative scores were converted to 'T-Values' to permit the use of Student's t test (Moroney, 1951). As far as neuroticism was concerned, all scores greater than 50 fell when pain had been relieved, the decrease being greatest for those with high pre-operative scores and least for those with low scores. It was also observed that very low pre-operative 'T' scores increased following surgery. Similar trends but no significant differences were found in extraversion scores. Pre and post operative N scores correlated significantly, as did pre-and post-E scores, but E and N did not correlate significantly on either occasion. An interesting theoretical analysis is then presented. Unfortunately in view of the small number of subjects and the strong suspicion that the N score differences could be interpreted simply as statistical regression to the mean, the study has to be taken as inconclusive and the later comment

> "It is concluded that a link between basic neurophysiological and psycho-physiological mechanism underlying pain and aspects of behaviour associated with it may be demonstrated using data from work previously published by the author."
> (Bond, 1976, p311)

is in need of further empirical substantiation.

Evaluation

The structure and experimental basis of Eysenck's model of personality has been reviewed. It would appear to have been used sufficiently widely to be considered seriously. Research has supported the general structure of dimensions of extraversion-introversion and neuroticism-stability. Findings regarding the L and P scales are much less clear. Physiological and pharmacological studies have raised the possibility of a dimension representing essentially an interaction between E and N. Eysenck's zone analysis is an attempt to retrieve his theory in the face of empirical studies casting considerable doubt on the original

simple structure.

As far as chronic pain is concerned, few studies have been carried out and none (to the author's knowledge) of chronic LBP sufferers. It seems possible that E will be predictive of complaint behaviour and N of pain ratings. The relationship of the other dimensions is difficult to predict. The difficulties of operating 'Zone analysis' in practice may make its evaluation difficult. Nonetheless in view of the extensive British norms on the EPQ and lack of norms (and acceptability) of the MMPI in a British context, it would seem sensible to investigate its utility with British chronic LBP sufferers.

Cornell Medical Index

The Cornell Index is a 195 item health questionnaire measuring bodily symptoms, emotional well-being, personal medical history and family medical history (Brodman et al., 1949). Theoretically it is supposed to be capable of identifying patients with severe personality and psychosomatic disturbances from the normal population. It has been used in the study of patients undergoing anterior fusion of the cervical spine (White et al., 1973). No significant correlation was found between psychological "disease" and surgical outcome, although the authors did acknowledge that the test was perhaps not sensitive enough for the purpose (Southwick and White 1983). Sections of the CMI have been used in a few studies. Sternbach et al (1973a) incorporated nine questions from Section J into the ten item Invalidism Scale of his Health Index. They found spinal patients had a greater tendency to adopt an invalid self-concept and life-style than patients with rheumatoid arthritis. Wilfling et al. (1973) found that the E scale (dealing with joint stiffness, pain and bodily deformity) and the I scale (measuring fatigue and exhaustion) differentiated (retrospectively) between good and poor or fair results of lumbar intervertebral fusion. Wiltze and Rocchio (1975) also found the E scale to be of modest value in the prediction of outcome in a group of 130 patients receiving chymopapain injections. There are no British norms for the CMI.

Other Multidimensional Questionnaires

The Middlesex Hospital Questionnaire has been used in a study of 50 men with back pain (Wolkind and Forrest, 1972). Like the MMPI, it is composed of subtests giving independent measures of

free-floating anxiety, phobic anxiety, obsessive-compulsive traits and symptoms, somatic, depressive and hysterical symptoms. The difference between good and poor outcome after three weeks of conservative treatment was identified by the scales of obsession, depression and somatic symptoms. As with the MMPI however though statistically significant differences were obtained, the test is not sufficiently sensitive for use in the individual case, perhaps unsurprising since it was designed primarily as an instrument to identify minor psychiatric illness.

Recently the SCL 90 (Derogatis, 1977) has been adopted by a number of multidisciplinary pain clinics in North America. Unfortunately, like the MMPI, it was not designed specifically for chronic pain patients and so may lack sensitivity. Studies on its utility in the prediction of outcome of treatment are in progress at the University of Virginia in Charlottesville and so its predictive utility as well as its descriptive potential are as yet undetermined. It has recently been used in a study of the psychological effects of chronic painful lesions (Pelz and Merskey, 1982). It is too early to appraise its utility with chronic pain patients.

Hypochondriacal Fears and Beliefs.

There have been two main strands in the development of psychometric measures of hypochondriasis. Factor analytic approaches to the study of depression have frequently identified factors of somatic concern, preoccupation with physical health, prolonged ill-health and multiplicity of complaints (Kessell, 1968; Friedman et al., 1963; Rosenthal and Gudeman, 1967; Hordern et al., 1965; Hunt et al., 1967; Lorr et al., 1967; Kay et al., 1969). The hypochondriasis scale of the MMPI is also essentially a symptom inventory and does not include items tapping individuals' attitudes to disease, or perception of the reactions of other individuals in the patient's environment.

Attempts have been made, however, to assess the individual's perception of disease, and the effects on his life. Mechanic and Volkart (1960) devised a scale to measure the degree to which a person tends to classify himself as ill and adopt the sick-role ("sick-role tendency") and other studies have attempted to examine illness behaviour via the individual's perception of health (Thurlow, 1971; Spilken and Jacobs, 1971). Pritchard (1974, 1979),

in an investigation of patients undergoing haemodialysis or awaiting cardiac surgery, incorporated a 'Response to Illness Questionnaire' (RIQ) to assess both meaning of the illness to the patient and his affective, cognitive and behavioural response styles. Eight dimensions of illness behaviour were produced. This work has not so far been replicated by independent authors or been applied to the study of LBP patients.

Illness Behaviour Questionnaire (IBQ) and Predecessors.

Perhaps best known in the field of chronic pain is the work of Pilowsky. Using Raven's (1950) method of comparative matching, Pilowsky (1967) produced a 20-item questionnaire which was then given to 200 psychiatric patients, 50% of whom had been identified as demonstrating clear hypochondriacal symptomatology. Hypochondriasis was defined as "a persistent preoccupation with disease despite reassurance given after a thorough medical examination" (p20). 17 of the original items discriminated between the two groups and a further three were then excluded because of data-storage problems! The 14 items were then factor analysed. The three emergent factors were described as bodily preoccupation, disease phobia and disease conviction. This Whiteley Index has been used in the investigation of pain in female patients with malignant disease (Bond, 1971) and in a comparison of the effectiveness of treatment by chiropractors and physicians (Kane et al., 1974).

While the Whiteley Index reliably measured hypochondriacal attitudes and provided some elementary dimensions of illness behaviour, it did not cater for broader aspects of response to illness (Pilowsky and Spence 1981). Items therefore were added to evaluate areas of affect, ideation and behaviour which seemed relevant to clinical observations of abnormal illness behaviour. The resultant 52 items (which incorporated the Whiteley Index) dealt primarily with the person's attitudes and feelings about his illness, his perception of the reactions of significant others (including doctors) to himself and his illness, and the patient's own view of his current psychosocial situation. The 52-item IBQ was given to 100 consecutive patients referred for management of intractable pain to the Pain Clinic or the psychiatric service of a large metropolitan hospital (Pilowsky and Spence, 1975). The responses were factor analyzed and yielded seven factors described as: general hypochondriasis, disease conviction,

psychological versus somatic perception of illness, affective inhibition, affective disturbance, denial and irritability. The criteria for factor identification of requiring two items only to load > 0.40 on the factor is in fact far too liberal and the resulting factor structure yielded factors having 9, 6, 4, 2, 3, 3 and 3 item with proportions of variance ranging from 24.8% down to 3.3%. If one assumes that each item contains at least some error, the instability of the small scales clearly emerges. The 52-item version can also be criticized in terms of the unexamined reliability of individual items, and the poor subject to variable ratio (Comrey, 1978). Nonetheless the scales were used in studies of intractible pain and generally physically ill out-patients (Pilowsky and Spence, 1976a), in studies of chronicity (Pilowsky and Spence, 1976b) and in the identification of illness behaviour syndromes associated with intractable pain (Pilowsky and Spence 1976c) and between intractable facial pain and odontogenic pain patients (Speculand et al., 1981). In response to criticism of the length of some of the scales a 62-item version was produced by adding 10 items to the original 52-item version, thus enhancing the smaller scales. The items seem to have been added in a purely arbitrary manner, although it is claimed that "the descriptions that the profiles provide are consistent with earlier work based on the 52-item IBQ" (Pilowsky and Spence, 1981, p4). The 62 item version has been found to differentiate between pain patients and depressed patients (Pilowsky and Bassett, 1982). In studies of site of pain, it appears to differentiate between head or neck pain and low back pain (Gover and Toomey, 1982; Toomey et al., 1982). The scales showed differences in sleep related difficulties in a comparison of organic, non-organic and two other control groups (Skevington, 1983b). Unfortunately no clear pattern emerges perhaps because of the construction of the scales (discussed above and also in Chapters V and VII), perhaps because of differences in factor structure across clinical diseases (Pilowsky et al., 1979; Byrne and White, 1978), sources of referral (Pilowsky et al. 1977 Chapman et al., 1979) or ethnicity (Pilowsky and Spence, 1977).
In this author's opinion, the IBQ needs reconstruction, with particular attention being paid to the incidence and reliability of individual items, and the possibility of a new factor structure (based only on the items retained). This procedure needs to be repeated for

homogeneous clinical groups in a variety of settings. The use of second-order factors (Pilowsky and Spence 1976c) and discriminant function scores (Speculand et al., 1981) should be examined. The utility of an improved version of the scales could then be examined in comparison with other clinical and psychological variables. Perhaps then some of the ambiguities in the findings of studies using the IBQ can be resolved.

Sternbach Health Index

Sternbach (1973b) incorporated a 10-item Invalidism Scale as part of a thirty item Health Index administered in conjunction with the Zung Self-Rating Depression Scale (see below). The thirty-item index comprised three scales of ten dichotomous items, labelled Invalidism, Pain Communication and Pain Games. The Invalidism Scale was derived from Section J of the Cornell Medical Index (Brodman et al., 1949) to which one item was added. The statistical integrity of the Invalidism Scale does not seem to have been investigated. Using the Scale, Sternbach (1973b) found that spinal patients had a greater tendency to adopt an invalid self-concept and life style than did patients with rheumatoid arthritis. According to Sternbach

> "there is more to this than hypochondriasis and depression; we are not merely observing a reaction to an organic defect. There seems to be a half-conscious embarking on a "dropping-out" style of life, seeking only an honorable legitimization in the form of ever more crippling surgeries."
>
> (Sternbach, 1973b,p53-54)

The scale does not appear to have been widely used. It is the subject of another study by the present author, but at the time of writing, the utility of the scale is largely unknown.

II LITERATURE REVIEW

II.7 Socio-cultural Influences on Pain

The relationship between pain and its socio-cultural content is complex

> "Although pain is a trial of the moment, the suffering aroused by it is rooted in each person's cultural background and history, and his or her personal growth and experience of pain through life."
> (Bond, 1980b, p54)

and it is possible to consider it also from historical and theological perspectives (Bond, 1980b). The author even suggests that in certain situations it may protect 'mental and social integrity'. It is proposed in this review to focus rather more narrowly on the influence of demographic influences, developmental considerations, the role of social support and social networks (including the family) and conclude with an appraisal of wider ethnic and cultural factors which have an influence on complaint presentation. Health care-seeking, the sick-role, doctor-patient relationship and iatrogenic influences will be considered in the following section. Implications for the definition of disease, illness and illness behaviour will be deferred until the last section of the literature review.

Demographic Influences

In general it has been shown that chronic pain is more prevalent in large families, in younger children from large families and in members of lower socio-economic classes (Craig, 1980) although in one small study of LBP, the number of siblings and birth-order were not found to be of prognostic importance (Ziesat, 1978a). Social class differences among patients influence the amount of information volunteered by doctors (Pendleton and Bochner, 1980) and influence sick-role expectations, perception of problems (perhaps partly because of restricted education), attitude to doctors, and the occurrence of conversion and hypochondriacal syndromes among chronic pain patients (Pilowsky, 1980). Marital status has been deemed important:

> "substantial differences are shown to exist between marital groups in their mortality rates, illness experience and use of health services. Evidence is presented which suggests that only a small part of the observed variations can be attributed to the selective effects of marriage and remarriage. The main factor appears to be that of the effects of the occupancy of different marital states with this being associated with differences in stress, life styles and social

> support, as well as possible differences in illness behaviour and what is perceived as their relative needs for care from the official services."
>
> (Morgan, 1980, p 633)

Age and gender differences, in interaction with racial differences have been implicated in post cholecystectomy narcotic requirements in a multi-racial setting (Streltzer and Wade, 1981). The most consistent demographic influence has been that of gender with females generally scoring in the direction of greater pain, distress and health care use on a variety of parameters. Women students are more likely to report distress (Mechanic and Greenley, 1976) report more subjective symptoms (Mechanic, 1976), have a higher rate of hospital use (Morgan, 1980) although in the latter study an interaction with marital status was found. In a study of the relationship between life experiences, symptom awareness and consultation rates it was found

> "Women as a group had high symptom levels more frequently than men with comparable life experience measures, and they sought medical help more often than men whom life experience and symptom scores were held constant."
>
> (Otto, 1979, p151)

The reason for such consistent gender difference is unclear. Males and females differ in the amount of information given in response to questions made to doctors (Pendleton and Bochner, 1980). It has been suggested that the higher incidence of chronic illness in females may be in part a reflection of how they define and respond to illness and life situations in general (Mechanic, 1976) or due to differences in communication style:

> "Women are, on the whole, more likely to express their feelings (both pleasant and unpleasant) than men. Men with manifest psychological problems are found to be comparatively rare and, unlike their female counterparts, they show a drop in positive feelings of well-being rather than a rise in unpleasant feelings, as compared with the general population. .....it is concluded that there are underlying differences of a biological and/or social nature which predispose the sexes to show different degrees of affective response, upon which such influences as the frustrations of the housewife role are super-imposed."
>
> (Briscoe, 1982, p1)

The role of gender in pain is clearly exceedingly complex and it is impossible to consider it further in this review. Mechanic (1976) and Briscoe (1982), discuss the matter in depth. Many studies of course comment on, or take into account, demographic factors in their analyses. High variability on clinical indices

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on almost all demographic factors suggests that in the context of pain, consideration of their influence may well have implications for social policy or for the planning of treatment of a more psychological or educational nature than a strictly medical kind. It would seem most appropriate however to consider demographic influences in the context of other socio-psychological variance perhaps of more direct clinical relevance to the understanding of chronic pain.

Developmental Factors

The theoretical framework of social learning theory has led to an examination of the integration of cognitive, behavioural and environmental perspectives in the development of complex behaviour patterns. Factors affecting the adults repertoire of pain expression and coping strategies may have their origins in early experience. Individual differences, supposedly related to constitutional factors, in the distress response to tissue damage is well established in neonates (Craig, 1980). Transformations in infant pain expression from reflexive, diffuse reactions to localized, protective and socially responsive patterns of response have also been documented (Craig, 1983) and a crucial role of maturing cognitive capabilities in recognising facial expressions associated with discrete emotional states has also been shown Izard et al,1983). Early life experiences also seem crucial for the emergence of deviant forms of pain expression (Apley, 1975) and it has been shown that not only direct stress experiences, but also imagined or vicarious stress has an effect on physiological arousal (Craig, 1968).

The crucial role of observational learning in the acquisition of most patterns of personal and interpersonal behaviour is well established (Bandura, 1977; Rosenthal and Zimmerman, 1978) and studies of induced pain make it clear that social models of hypersensitive or stoical pain behaviour serve as powerful influences on pain expression and experience in adult observers (Craig and Weiss, 1971; Craig and Weiss, 1972). The other major mechanism identified in the socialization of pain expression has been that of corrective feedback (Craig, 1980, 1983) a mechanism whereby the child's response to the experience of pain is selectively shaped by the parent, one aspect of a learning mechanism whereby the child is taught the significance of all sorts of sensations and events. Often the threat perceived by the child may be veridical and the

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parents' responses appropriate, but in other families, alarm may be excessive and undue care may foster deviant illness behaviour (Craig, 1983). Parents of children suffering recurrent abdominal pain without known organic origins have been characterized as over-anxious (Hughes and Zimm, 1978), overprotective (Apley, 1975) and having a common fear that the pain indicated a dangerous illness (Stone and Barbero, 1970). The high concordance rates in pain complaints among family members unrelated by biological bonds (Mohamed et al., 1978) would support a 'social learning' viewpoint A more detailed analysis of other possible mechanisms, such as the acquisition of pain language and patterns of family interaction, are reviewed elsewhere (Craig, 1980). In the absence of true prospective studies over a long time period, it is difficult to draw conclusions. In an interesting review of infectious and allergic diseases, it has been suggested that "Acute illnesses in childhood may produce persistent subtle disability with far ranging impacts." (Sloan et al., 1979, p 473). In a study of patients suffering low back pain (Craig, 1978) outcome of surgery was related to report of health problems and attributions of ill-health among the patients' children, and Christiensen and Mortensen (1975) produced evidence that it is the parents' current attitudes toward pain rather than past histories that affect their children's recurrent pain behaviour. It is difficult to arrive at an understanding of the relationship between pain presentation and developmental factors without also considering previous illness experience. This will be considered in the context of iatrogenics and failed treatment later. Weisenberg (1980) broadens the perspective still further in his theoretical framework for variations in pain expression based on a theory of social comparisons and social learning theory.

According to Craig (1980, p37):

> "Family interaction patterns provide for the transmission of societal concepts, standards and normative practices. Parental role-modeling and precedents, children's propensities to attend to and emulate others' actions, and the use of strong controls to ensure conformity to expected roles, yield pain behaviour that is determined by social realities as well as tissue insult."

It would appear that developmental influences have a clear influence on the communication of pain. Of many possible mechanisms, social modeling (and in particular observational learning and parental control) is particularly important. The extent to which

such influences can be distinguished from social support systems, the family, cultural and subcultural contexts is at the moment unclear. As far as chronic pain is concerned, systematic evaluation of developmental factors per se has not been undertaken with sufficient methodological precision to compare the strength of their influence with that of much more potent clinical variables.

Social Support, Social Networks and the Family

Social support has been defined as "information leading the subject to believe that he is cared for and loved, esteemed, and a member of a network of mutual obligations" (Cobb, 1976, p300). The first part of the definition, emotional support, was initially expressed in terms of the individual's needs (Murray, 1938). Need for recognition was also identified by Murray. The group membership aspect of the definition allows the concept of social support to be defined in terms of a match or fit between the individual and his environment, rather than simply in terms of the person alone (French et al., 1974; Moos and Insel, 1974). According to Cobb (1976) social support facilitates coping with crisis and adaptation to change and therefore has an effect primarily in the extent to which it moderates other influences on the individual. Cobb adduces support for this view from the work of Pinneau (1975). Cobb reviews in turn the effect of social support on pregnancy, birth and early life; transitions to adulthood; hospitalization; recovery from illness; life stress; employment termination; bereavement; aging and retirement; and threat of death. Of relevance to this thesis is the review of hospitalization and recovery from illness. Evidence for the former is unfortunately largely inferential. As far as recovery from illness is concerned, the association of cooperative patient behaviour with various components of the social support complex was claimed as "one of the best established facts about the social aspects of medical practice" (Cobb, 1976, p306). Unfortunately no data on chronic pain was mentioned. Some evidence has been found for a protective value of intimate social relationships in depressive illness (Brown et al., 1975) and in the development of psychological symptoms (Miller and Ingham, 1976) and psychiatric patients in particular seem to have particularly impoverished social networks (Silberfield, 1978). In an investigation of life events and social support (Miller et al., 1976) however the number of threatening life events was strongly related to the severity of the

psychological symptoms, but only weakly, if at all, to the severity of the physical symptoms. Non-threatening events seemed to be irrelevant. (Again studies on chronic pain and chronic LBP in particularly lacking, but it may well be that a relationship could be established with the psychological distress associated with chronic pain.)

Definitions of social support rest on description of the social structure or network, which at its simplest may entail investigation of a dyad, and at its more complex an investigation, of immediate family, extended family, friends, acquaintances and social contacts. Although consideration of social networks in a loose sense has clearly been part of sociology since its inception, it is only relatively recently (Barnes, 1954; Bott, 1957) that characteristics of social linkages or networks per se have been considered rather than the attributes of the individuals themselves (Mueller, 1980). Mueller reviews evidence linking network variables to psychiatric disorder from the viewpoints of network structure, the supportiveness of network relationships and recent change or disruption of the network. He concludes that the studies reviewed are more suggestive than definitive and that systematic investigations are needed. Some interesting methodological remarks about research design are made.

The role of the family can be considered not only in the historical sense (in which the patient's definitions of pain and communications about pain can be seen as a product of observational learning and parental 'shaping') but also in a number of other ways. Methodologically, research in the area of health care and the family has embraced a variety of designs and techniques ranging from the use of demographic and census data (Herberger, 1976) and household interview surveys (Miller, 1959) to much more sophisticated model building. Much such theorizing has been an attempt to define the family as a social structure with identifiable characteristics. Such "structural" or "process" variables have then been examined in relation to some other variables such as health care utilization. Such analyses have been in terms of diagnostic labels of malfunction (deficiency, dependency and deprivation) as in the Newcastle study (Miller et al., 1960; Spence et al., 1954); 'family diagnoses' (Haggerty, 1965), multifaceted behavioural models (involving the relationship between predisposing, enabling and need factors and use of the health services) (Andersen, 1968), "Flow Models" (examining various states of stress, illness and consultation over a period

of days (Roghmann and Haggerty, 1972) and four-dimensional paradigms incorporating disease, state of illness and content of care (Crawford, 1971). Longitudinal studies have obvious advantages in the study of the development of patterns of illness (Downes, 1952) and intergenerational analysis has even been employed (Litman, 1971). Longitudinal and intergenerational analyses of family health problems however have remained limited (Litman and Venters, 1979). The latter authors review a number of other problems of method and conclude with a number of interesting recommendations (p384). According to Osterweis et al. (1979)

> "The family unit is being increasingly recognized as a key determinant of individuals' health and illness behaviours." (p287)

In an interesting study of more than 2700 individuals living in almost 800 families, they showed that the set of family context variables was a better predictor of individual medicare use than the set of individual characteristics. Variables previously deemed important (such as family size) were relatively unimportant. Such sociological studies are clearly of some theoretical interest but such analyses have not (to the author's knowledge) been carried out on the families of chronic pain patients and the utility of family characteristics would have to be compared with the utility of individual clinical, psychological or social variables before a meaningful assessment could be made.

The role of the family has also been considered in quite a different context, the context of pain communication. The pain patient demonstrates both verbally and non-verbally, the occurrence of pain, with associated disability ranging in severity from a slight dislocation in every day activities to full-blown invalidism. Although the experience of pain is a private phenomenon, the pain problem exerts its influence on others and is in turn affected in its expression by the social system in which it is located. Frequently the main 'recipients' of the pain communication are the members of the patients' family, and the spouse in particular. The conventional view of pain considers pain in stimulus-response terms. According to this view an antecedent stimulus elicits the pain response (pain behaviour), and the occurrence of the antecedent stimulus is seen as a sufficient condition for the occurrence of the response. Seen from an operant viewpoint, the pain behaviour is maintained because of its consequences. In a family context,

the behaviour of members of the patient's family is seen as having a critical role in maintaining the invalid pattern. The operant approach to pain management is an important ingredient in many chronic pain management programmes (Ng, 1981). The methods include identification and limitation of positive reinforcement of pain behaviour; increase in physical activity; and gradual decrease in and eventual elimination of analgesic intake (Turk and Genest, 1979). Assessment involves the behaviour of family members towards the pain patient and some of the pain clinics insist on a 'relative programme' as part of the overall treatment package. Unfortunately, the frequently expressed clinical opinion that the behaviour of family members is of importance still awaits proper scientific evaluation. Attempts by the present author to devise an assessment system incorporating such information was discontinued after over 60 patients had been interviewed, because of the quantity of 'unobtainable' information or missing data, and the wide variety of domestic contexts. It is easier of course in the context of an inpatient programme to insist on more detailed information from patients themselves, and from others in the patients' environment. As part of a general screening procedure in an orthopaedic or rheumatological clinic, however, access to this type of information remains limited, and is certainly insufficient to evaluate the "operant component", or quantify information along an operant dimension. The general principle of decreasing illness behaviour and increasing "well" behaviour is the foundation of the behavioural approach to chronic pain, but the contribution of the family in particular has not so far been quantified.

Cultural and Ethnic Factors

Differences in the reaction to pain between various cultural and social groups have received a substantial amount of study. Groups studied have included Italians, Irish, Jews and Yankees (Sternbach and Tursky, 1965; Zborowski, 1969; Zola, 1966), Negros (Chapman and Jones, 1944; Merskey and Spear, 1964; Weisenberg et al., 1975; Woodrow et al., 1972), Eskimos and American Indians (Meehan et al., 1954) Puerto Ricans (Weisenberg et al., 1975), socio-ethnic groups in Mexico (Fabrega, 1977) and an assortment of other racial and ethnic groups all over the world. It has been observed (Weisenberg, 1977) that major differences between groups seem to be related to the reaction or tolerance component of pain rather than

threshold discrimination of the pain sensation.

In a major review (Wolff and Langley, 1968), it was acknowledged that there was some experimental evidence that attitudinal factors influenced the response to pain within cultural groups but that:

> "the few existing experimental studies yield equivocal results as to the existance of such (ethnocultural factors) and suffer from anthropological naivete. ..... Consequently, the question as to whether or not there are basic differences between ethnocultural groups in the response to pain remains unanswered."
>
> (Wolff and Langley, 1968, p494)

More recently (Fabrega, 1977), the frequency and length of perceived illness, subjective reports of biological and behavioural symptoms, and the use of medical facilities in response to episodes of illness by female heads of household were compared in two highly distinctive socio-ethnic groups in San Cristobal de las Casas in South-eastern Mexico. Despite differences in socioeconomic status and cultural beliefs about disease and treatment, both groups showed roughly comparable rates of perceived illness, but certain differences were noted. The more prosperous Western group had had more illnesses which had also lasted longer, as well as higher levels of symptoms. The medical actions of the two groups in response to these episodes differed. In another study (Segall, 1976) differences between Anglo-Saxon Protestant and Jewish female patients were found in sick role behaviioural expectations. Pilowsky and Spence (1977) found differences in hypochondriacal concern, disease conviction and somatic view of illness between Greek and Anglo-Saxon patients seen in an Australian General practice. Streltzer and Wade (1981) examined postcholecystectomy narcotic requirements in a multi-ethnic setting. Caucasians and Hawaiians received significantly more analgesics than Filipinos, Japanese or Chinese. While individual factors were deemed of most importance, cultural factors (and interactions with age and sex) account for 11% of the variance.

Such differences have been explained on the basis of differences in family interaction patterns (Craig, 1980) and interpreted from the viewpoint of Festinger's (1954) theory of social comparisons (Weisenberg, 1977). The need to produce versions of test instruments in different languages has been shown in the development of the McGill Pain Questionnaire (see above). Perhaps the need to develop culture specific norms for the various facets of pain presentation has not however been fully appreciated. It is clear that

complaint presentation can be seen as part of a wide complex of interrelating influences. Bond (1980b) had identified neurobiological, psychodynamic, behavioural and ethico-religious paradigms. Methodological limitations in studies on cultural reactions to pain have prevented in general the elucidation of the specific contribution of cultural and ethnic differences. Perhaps the complexity of the network of influences will bedevill more than a rudimentary appraisal of the significance of such differences. Clearly it is important to identify the ethnico-cultural characteristics of the subjects under study and ensure that the interpretation of clinical findings is not clouded by unaccounted-for cultural differences. It is common to standardize test instruments to allow for differences in age and gender. Perhaps culture as well as language should be more carefully considered.

II.8 Health Care Seeking, Complaint Presentation and Doctor-Patient Communication

Studies of health seeking have adopted a variety of methods and approaches. It is proposed in this review to begin with a brief description of the health seeking process; continue with a consideration of factors thought to affect the process; appraise briefly the concept of 'sick-role'; and following an examination of the doctor-patient relationship, conclude with a discussion of the implications of such perspectives for the definition of illness.

The Health-Care Seeking Process

After a review of several previous attempts to describe the health-seeking process, Igun (1979) presents an eleven stage model, which can be precised as follows:

> "symptoms-experience stage; self-treatment stage; communication to significant others stage; assessment of symptoms stage; assumption of sick-role stage; expression of concern stage; assessment of the appropriateness of sources of treatment stage; selection of treatment plan stage; treatment stage; assessment of the effect of treatment on symptoms stage; and recovery and rehabilitation stage." (p445)

Much research in this field can be seen as directed toward one or more of these stages. Comprehensive though the list may appear, Igun seems to miss an extremely important step. The act of consultation itself. It will be argued in this thesis that at least part of the explanation for the persistence of chronic back pain complaints is the failure to appreciate the (at times) ambiguous nature of complaint presentation, an integral part of the consultation process. On the basis of two studies of illness behaviour associated with acute episodes of coronary artery disease, and studies of emergency medical systems and emergency room utilization, Alonzo (1980) tentatively identified a number of dimensions of acute illness behaviour. Between the period of initial awareness of a "health status deviation" and arrival for care in a hospital ward, six intermediary care-seeking phases were identified viz. Prodromal or Warning, Self-Evaluation, Low-Evaluation, Medical-Evaluation, Hospital Travel and Hospital Evaluation. Such phases might perhaps have been considered if not trivial at least unremarkable. The phases are identified as a basis for comparison with the chronic pain patient whose path is much more complex. Following a scenario probably similar to that described, the chronic pain patient may repeat the last three stages many times, seeing different specialists

receiving multiple investigations or treatment, with an ever-increasing sense of hopelessness and despair. Kirscht et al. (1976) have commented on a 'hierarchyof motivations to act' in which symptoms exert a strong directive force but actual consultation behaviour is determined in part by previous experience of symptoms. The complexity of such processes in the individual chronic pain patient and the marked variability in consultation patterns make it difficult to envisage the development of a satisfactory model for the chronic pain patient.

Factors Affecting the Health-Care Seeking Process

Gender differences in consultation behaviour are well documented (Mechanic, 1976) although open to a variety of interpretations. Ingham and Miller (1976a) identified a differential selection process for males and females which could be conceived as operating through a series of filters intervening between the different levels of care that a patient may reach. A discussion concerning different estimates for sex ratios (Goldberg and Huxley 1980) was presented by them in a later review (Ingham and Miller, 1982), where they concluded

> "although the preponderance of women amongst people seeking help from the primary care services is to a large extent attributable to the fact that women tend to suffer from more symptoms of ill health, and to have them more severely (or at least be more willing to acknowledge their existence), there is a further factor involved, namely a greater readiness on the part of women to go to the doctors when they feel ill." (p 162-3)

The prevalence of books currently available on the health of women and the proliferation of Well Women Clinics attest to the importance of gender in consultation behaviour, in receipt of treatment and in satisfaction with treatment. It is not possible to review further such a complex topic. (The effect of differences in general on the results of this thesis are discussed where appropriate.)

The role of the family in chronic pain has already been discussed. Medicine taking is the most frequent of all preventative and illness-related behaviours. Most empirical research on medicine use has focussed on determining the socio-demographic and morbidity characteristics associated with individuals' medicine use. In a recent interesting study on more than 2700 individuals living in nearly 800 families, Osteriweis et al. (1979) showed that other family members' medicine use behaviours were strong predictors of individuals' medicine use, family context variables were better

predictors than the individuals' own characteristics and that these effects were more important than the effects of variables, such as family size, previous considered important.

It might be assumed that simple symptom severity would be an obvious predictor of complaint presentation or treatment seeking and a number of studies have attempted to appraise the significance. Ingham and Miller (1976b) examined the determinants of illness declaration in a study of self-referrals to General Practitioners. They found that self-rated symptom severity was not in fact a very good discriminator of people who consult their general practitioners from those who do not. They found however that threatening life events were reported significantly more frequently among consulters than among non-consulting controls and that consulters who had experienced more threatening life events tended to report more severe psychological symptoms than those who did not. This was not found with physical symptoms or with non-threatening events (Miller et al, 1976). In an Australian study of almost 800 subjects, Otto (1979) found that, among men and women, quality of life experience was significantly related to symptom awareness and to medical help-seeking, though help-seeking was more strongly related to symptom awareness than to life experience scores. They confirmed the gender differences already discussed. Women as a group had high symptom levels more frequently than men with comparable life experience, and they sought medical help more often than men when life experience and symptom scores were held constant, a finding which they attributed to sex role learning. In a study of the prevalence of psychological distress and help-seeking in a college student population, Mechanic and Greenley (1976) found that when the quantity and seriousness of symptomatology had been controlled for, a variety of sociodemographic and sociocultural characteristics still had an influence on health seeking. Furthermore, within different symptom levels, propensities to seek help were related to actual help-seeking. In a study of 251 low-income mothers bringing children for treatment to paediatric clinics, Kirscht et al. (1976) examined the determinants of consultation. A major determinant of seeking care was the presence of symptoms in the child, but once illness had been taken into account the personal situation and characteristics of the mother affected the amount of

care obtained. Hannay and Maddox (1976) in a large random study of new patients registered at a Health Centre examined different types of symptoms presented. These were classified into four groups: physical symptoms for all subjects, mental symptoms for adults, behavioural symptoms for children and social symptoms for adults. They examined the relationship among these groups of symptoms and the action taken, whether no action, an informal or lay referral, and a formal or professional referral. They found that less than a third of all symptoms were referred for professional or formal advice, the highest proportion being for social symptoms. According to Ingham and Miller (1982)

> "The symptoms that finally motivated the help-seeking behaviour may be symptoms either of physical illness or personal stress and patients often attribute them incorrectly." (p172)

Alonzo (1979) considered that the reporting of illness and pathology may be determined by the extent to which the person is able to contain the signs and symptoms of illness within socially defined situations. Several factors were identified as having influence on the process:

> "(a) commitment to and engrossment in situations; (b) tolerance quotient and idiosyncracy credit given by others; (c) power relationships among participants; (d) coping resources of the situations; (e) symptom meaning; (f) the presence of normal processes and chronic diseases; and (g) age and sex as circumstances."
> (Alonzo, 1979, p397)

The Sick Role

Perhaps best known of all sociomedical perspectives on illness is the work relating to the concept of sick-role. The role of the sick person was described by Parsons (1951) in terms of two major rights and two major duties. These four closely interrelated dimensions are described by Segall (1976): (right one) the occupant of the sick role is exempt from responsibility for the incapacity, as it is beyond his control; (right two) he is also exempt from normal social role responsibilities; (duty one) the sick person is expected to recognize that illness is inherently undesirable and that he has an obligation to try to get well; (duty two) he also has an obligation to seek technically competent help and to co-operate in the process of trying to get well." (p47). In the three decades since Parson's theoretical formulation, the sick role concept has been employed frequently and indeed has almost entered

common parlance. Operational definitions of the model have frequently led to the assessment of temporary acute physical illness episodes, and such variables have been used as the major dependent variable in studies of chronic illness and physical disability (Kassebaum and Baumann, 1965; Callahan et al., 1966), aging (Lipman and Sterne, 1969), pregnancy (Rosengren, 1962) and alcoholism (Roman and Trice, 1968). According to Segall (1976) all these studies demonstrate that the dimensions of the sick role model (as originally acknowledged by Parsons) are relative to the nature and severity of illness. Segall (1976) attempted to determine how closely lay expectations regarding the rights and duties of the sick role correspond to the Parsonian conceptual model; and whether systematic sociocultural differences existed in the perception of, and willingness to adopt, the sick role. Anglo-Saxon Protestant and Jewish female patients displayed the same expectations in regard to the sick role, although their perception of the way in which a sick person should "ideally" behave offered little support for Parsons' model. According to Ingham and Miller (1982) any feeling of distress may be attributed by the suffers and in the absence of other ways of coping with the source of distress, the 'sick-role' may be adopted in an attempt to seek relief. This form of illness behaviour (Mechanic, 1962) is an attempt at coping with stress. Wadsworth and Ingham (1981) in discussing this aspect of consulting behaviour, wrote

> "adopting the sick role is a modern institutionalised solution to many present day problems."

Empirical attempts to quantify the 'sick role' have already been discussed in the review of psychometric instruments.

Doctor-Patient Communication

Examination of doctor-patient communication can be seen from two major perspectives: (1) the nature of the communication process and (2) factors affecting communication between doctors and patients.

Perhaps the most influential writer on the subject of doctor-patient communication has been Balint (1957). On the basis of a series of seminars with general practitioners, he produced an analysis of the doctor-patient relationship as seen from a psychotherapeutic standpoint. He believed that a very special

if not unique relationship might develop between patient and doctor over a period of time thus permitting a specific form of psychotherapy. According to an Editorial (1972), his work raised the morale of general practitioners and had a profound effect on general practice (Editorial, 1972). Balint's work has received fairly uncritical acceptance over the years. Recently Sowerby (1977) has drawn attention to the Popperian distinction (Popper, 1963) between conjectures and refutations and from this theoretical standpoint produced a trenchant critique of Balint. Balint had thought that a scientific understanding of human behaviour was possible, not only in descriptive terms, which is true, but in theoretical terms, which is not true since the theoretical conjectures offered by Balint in support of his formulation are irrefutable. Sowerby did not preclude the possibility of artistic expressions of thoughtor feeling but felt it was important to distinguish this from medical science. His charge of 'scientism' can be applied to much theorizing based on psychodynamic premises.

Ley et al (1976) identified two main problems in doctor-patient communication; firstly, patient dissatisfaction with the amount of information received from doctors; and secondly, patients' failure to follow advice given to them. In a review of behavioural bibliotherapy, Dow (1982) has considered the question of intelligibility or readability. Despite the availability of empirically validated measures of readability for many years (Flesch, 1948; Fry, 1968; Klare, 1963), only few studies have investigated characteristics of reading material given to patients (Arkell et al., 1976; Glasgow and Rosen, 1978). In their series of studies on compliance, Ley and his colleagues investigated problems of comprehension and recall of medical information as possible causal factors in poor rates of patient compliance with self-monitoring instructions and adhereing to treatment regimens. In his review of this work, Dow (1982) identified the main findings as: a surprising lack of elementary medical knowledge; active misconceptions about basic bodily functions among the lay population; poor recall of information by patients and the fact that a considerable proportion of doctor/patient communication was largely unintelligible for much of the lay population. One would suspect that the quality and efficiancy of orally presented information is even worse.

Unfortunately it is generally the researcher rather than the patient who defines what counts as a good interview. Recently, in a small study of patients' preferences for different medical students, Thompson (1981) found that patients preferred students who, in terms of the subsequent independent study of the video-tapes, avoided repetition, were sensitive to verbal leads, facilitated history-taking with appropriate encouragement, had adequate control over the interview, were precise and self-assured. In a study of patients attending neurological outpatient clinics with a primary symptom of headache not due to structural disease (Fitzpatrick and Hopkins, 1981), patients were interviewed shortly after their hospital visit, and one year later. Approximately 25% of the patients expressed serious critical comments about the communication received. Dissatisfaction with communication was found to be significantly related to subsequent non-compliance. Recently (Caterinicchio, 1979) the advanced statistical technique of "path analysis" (Land, K.C., 1969) was used to explain the relationship between quantity and quality of interactions, and the dimensions of interpersonal trust in patient-doctor treatment relationships. It was found that the relationships between interpersonal trust in the doctor and level of treatment anxiety, perceived health gains from treatment and the level of treatment of anxiety were augmented by the direct and indirect results of past successful treatment.

Factors affecting complaint presentation per se have already been reviewed. Style of presentation of complaint can be seen as an aspect of doctor-patient communication. Albert (1980) attempted a cognitive analysis of hospital emergency patients. Patients were seen to "present complaints as 'obvious for the seeing' rather than reference the procedures they employed to find a treatable complaint in the first place" (Albert, 1980, p 243). He concluded that patient use and eventual concealment of these procedures created the possibility for lay-professional misunderstandings. The procedures themselves would seem prima facie to be of some interest, but Albert's description of these procedures, elevates obscurity to the level of an art form. Thus "The use of self-formulative devices, references to the general nature of complaints, the construction of a highly specific ambiguity, and the appeal to perceptual availability were found to be among these procedures" (Albert, 1980, p 243). He seems to be saying essentially, that patients adopt certain strategies and styles of complaint presentation

in their communications with doctors in emergency treatment rooms and that obtaining treatment can be seen as the end-point of a series of skilled manipulations of the doctor-patient relationship.

Communication between doctor and the chronic-pain patient has been the subject of a number of clinically interesting if not scientifically rigorous descriptions. Berne (1964) described the sort of counterproductive transactions that occur between doctors and patients. Szasz (1975) and Engel (1959) have also described the way pain is used as a form of communication, coining phrases such as 'painmanship' and 'psychic signature' to capture aspects of the process. Fundamental to these perspectives is a dysfunction between the expressed purpose of the pain complaint and the actual function of the interaction. The purpose is normally to request treatment leading to successful pain reduction, although as the problem becomes more chronic and the amount of previous failed treatment accrues, both the doctor and the patient may develop progressively less confidence in the likelihood that further treatment will be successful. A major purpose of the literature review in the thesis has been to demonstrate that the presentation of pain complaints can be seen not only as the report of a subjective event, but also as a form of communication having many facets. Lack of visable deformity, such as is evident in for example rheumatoid arthritis, unclear precipitating events and chronicity of illness, all contribute to the need for the doctor's 'legitimisation' of the chronic pain problem. The function of the 'sick-role' has already been discussed, and the medical profession plays an important part in the maintenance of this role. Being a patient can have compensations and used as a justification for failure to seek employment, and acceptance of a reduced level of responsibility in the family. Varieties of such 'Pain Games' are discussed by Sternbach (1974b). The family's willingness to accept a patient in the invalid role may be a factor in the patient seeking continued 'legitimization' for his level of disability. The tolerance of those in the patient's environment for the level of disability may also affect the patient's compliance with or active participation in a rehabilitation programme.

The literature on the subject of doctor-patient communication is broadly based, and interesting but in need of much further research. Attempts have been made to systematize and evaluate the interview in primary care medicine (Barsky et al., 1980) and

in that article a review of the literature on such evaluation is presented. Attempts have been made to produce a computer package to facilitate information exchange between patient and doctor. Such a procedure would have advantages certainly in either reducing the time necessary for direct doctor-patient contact, or in permitting different use to be made of the time available (depending on one's purpose). It has been suggested, however, that such a procedure may even be more therapeutic, in that the computer may be a sensitive indicator of those topics about which the patient was most concerned (Dove et al., 1977). It seems unlikely that any single approach to the delivery of advice and treatment by the doctor to the patient will meet the many and varied needs which determine patients' presentation to doctors. It would seem important, however, to increase our understanding of these needs, and as a first step describe them more accurately. As far as the presentation of chronic pain problems is concerned, clarification is needed not only of what the patient needs, but what the medical service can offer. This subject will be discussed in the final chapter of the thesis, in the context of an empirical evaluation of patient's severity of illness.

LITERATURE REVIEW

II.9 Occupational Factors and Back Pain

In this final section in the literature review, the role of occupational factors will be reviewed. (They have already been considered briefly as an aspect of severity of illness). An appraisal of their significance has been deferred until the end of the review because, as with social influences and health care utilization, the scope is vast. The thesis began with some statistics concerning the incidence and prevalence of low back pain and some attempt to appraise its economic significance. Much of the economic cost is of course related to diminished work performance, absence from work or work loss. Incidence of back pain in industrial settings is reviewed by Andersson (1983). Sickness costs and early retirement, however, cannot be measured solely in terms of compensation payments to the individual, they must also include the cost of losses from reorganisation of staff and the deprivation effects on teams due to absence of a key member or diminished efficiency through disability (Anderson 1980). Lack of standard definitions across studies make comparison of occupational effects unreliable. As far as LBP is concerned, the more specific the definition of the criterion group, the greater the residuum of other unspecific conditions and the greater the difficulty in generalizing the findings. Surveys in particular are limited by methodological problems of intermittency of pain, variations in the location of pain and their link with occupational requirements and differences in diagnostic labels (Anderson, 1980). Anderson considers four main relationships between back pain and occupational factors. As far as diagnosis is concerned, the nomenclature is difficult to systematise (Bergquist-Ullman and Latsson 1977); there has been a proliferation in disease-labels e.g. the term fibrositis has been described as a diagnostic scrap-heap (B.M.A., 1953); and since pain remains a subjective phenomenon, the number who admit to having had back pain at sometime in their lives can be elevated to 100% if the criteria for inclusion are broad enough. Estimation of the effects of pain is also problematic. It is known that > 50% of rheumatological complaints are described as back pain on sickness certificates. (This would probably mean a loss in excess of 15,000,000 man days per annum). However periods of absence ascribed to a disease need not always be caused by the disease. Backache which in another individual would be

accepted as part of a systemic disorder, might be designated 'lumbago' in someone with a history of the disorder, thus giving an exaggerated picture of absence from this cause. This seems particularly likely above the age of 45 years and especially in the 55-65 year group. Such findings have been noticed in several occupations (Anderson, 1980). Hospital referral suggests a more serious level of incapacity than general practitioner consultation (the prime purpose of which may be to obtain a medical certificate). Prolonged or repeated absence from work can force the change of job, especially manual workers in inclement conditions. It has been observed however (Parsons, 1951) that it is more creditable to ascribe change to a physical disability such as back pain, fulfilling the criterion of medical responsibility, rather than admit that emotional, intellectual, or social inadequacy might be the dominant factor. Statistics concerning long-term disability, are suspect in terms of their reliability and fear of sanctions may distort accuracy (Anderson, 1980). A number of occupational causes for back pain have been identified. These include occupational trauma, persistent heavy work, and ergonomic stresses and strains resulting from rotational movements, lifting weights and stooping. Difficulties of measuring the real pressure on a disc during heavy work (Troup et al, 1970) or effects of prolonged effort on different components of an intervertebral disc and its related vertebrae and apophyseal joints are extremely complex. There are also problems in the description and classification of types of work. Studies based on job analysis show that differences between work being done by men nominally in the same employment are highly variable (Anderson, 1971). Various surveys suggest that men whose jobs made the greatest demand on their back in terms of muscular effort have a relatively high prevalence of disc disease. The same relationship was found for rheumatic complaints in general, but not for pain of undifferentiated diagnosis. Stooping for long periods has also been shown to be associated with a high prevalence of back pain-spasm in relation to disc disease rather than undifferentiated back pain, but prolonged standing shows no such correlation (Anderson and Dalton, 1973). People in sedentary occupations also tend to have a higher prevalence of all types of back pain. Problems in accurate identification make an evaluation of the importance of acute trauma difficult. It is known that with correct posture it is possible to carry weights

considerably in excess of the maximum recommended by the International Labour Organisation (1966), especially with training, yet lifting an unexpectedly light weight when braced for a heavy weight can be catastrophic. In a recent review, Andersson (1983) reviewed research specifically on the roles of heavy physical work; static work postures; frequent twisting and bending; lifting and forceful movements; repetitive work and vibration, to which reference is made. Psychological work factors identified were job monotony (Svensson and Andersson, 1983; Bergquist-Ullman and Larsson, 1977) and work satisfaction (Westrin, 1970; Magora, 1973; Taylor, 1968).

Difficulties of a technical nature in assessing biomechanic stresses either on bone, on muscle or on ligaments make it difficult to quantify severity of effect. Difficulties in monitoring what at times may be a frequently changing set of physical activities make generalisation difficult. Recent developments in the assessment of work loads (Snook, 1982) derived from Chaffin's (Chaffin et al., 1977) tables of predicted lifting strengths in various postures, certainly seem of value as far as the design of and control over work-environments from the viewpoint of preventative medicine. The development of different types of criteria (biomechanical, physiological, psychophysical and epidemiological) have led to the LIBERTY MUTUAL PRINCIPLES OF TASK REDESIGN (Snook, 1982). A prospective study of controlled work environments in the prevention of LBP in industry would seem to be a feasability. Redesigning tasks with unacceptable work loads is suggested not only for reducing the onset of low back disability, but also for returning the injured worker to the job sooner. A study differentiating workers with and without LBP on the basis of such ergonomic analyses would obviously be of considerable interest but has not to the author's knowledge been undertaken. Were a set of powerful discriminants thus to be identified, their relative importance could then be compared with other physical, clinical, demographic, social and psychological in the prediction of severity of illness, response to treatments and general recovery.

II.10 Conclusion

The nature of pain and of chronic LBP in particular can be considered from a diversity of viewpoints. In the process of this evaluation, some fairly well established procedures for assessment have been critically examined. Anatomy, biomechanics and pathology were reviewed as a precursor to a consideration of the treatment of LBP, since given the increasingly sophisticated techniques both in assessment and treatment, it would seem surprising that the prevalence of LBP disability is still increasing. Treatment has primarily consisted of physical or pharmacological attempts to reduce symptomatology. In the course of planning such treatment, considerable emphasis, not surprisingly, has been placed on the complaint of pain itself. The pain complaint has been construed primarily as the communication of the sensory component of the subjective pain experience, assumed to be the final stage in a succession of events beginning perhaps with actual tissue damage and leading to cortical representation of impulses transmitted via the peripheral nervous system to the central nervous system. The assumption behind much research has been that the failure of treatment has to be understood in terms of failure to diminish satisfactorily such cortical events. Increasing sophistication in the rating of pain using experimental procedures has not so far resulted in significant improvement in the understanding or treatment of chronic pain. Severity of illness can be discussed in terms of pain, physical impairment or its effects, whether disability, time-off work. Frequently physical evaluation is based on signs and symptoms of unknown reliability and validity and related unsystematically to a diagnostic formulation. There seems to be a clear need to examine critically signs and symptoms currently used in LBP to determine their acceptability in the description of chronic LBP and to see the extent to which such information can be used to construct a measure of severity. Previous measures of disability have frequently included physical characteristics and have focussed on the report of pain in different circumstances rather than the effect of the pain on the patient's functioning, thus making examination of the relationship among ratings of pain, physical disease characteristics and disability almost impossible to disentangle. Such clarification would seem worth undertaking.

It would seem that an evaluation of psychological factors would seem worthwhile only against the background of such clarification. Psychological factors have been based frequently on 'diagnoses by exclusion' in that absence of physical findings considered commensurate with level of presented symptomatology or disability has been taken as indicating psychological distress or disturbance. Positive attempts to identify such features have consisted primarily of the identification of symptoms of (usually minor) mental illness, particularly of a depressive type. Unfortunately treatment (primarily pharmacological) of depressive symptomatology has not been particularly successful and the nature of cognitive factors have thus been examined. Unfortunately more such research, on dimensions such as locus of control, has been carried out on non-clinical populations and so the findings for chronic LBP in particular are unknown. Best known of the formal psychological approaches have involved the assessment of personality structure using self-report measures. The best known of such tests, the MMPI, has been used diagnostically, descriptively and predictively with chronic LBP patients. There would appear to be severe limitations to the value of this test, especially on a British population for which there are no norms. Its acknowledged lack of sensitivity in the individual case may be a result of the fact that it was not originally designed for use with chronic pain patients. Nonetheless, the consistent findings of the importance of three of its scales (hysteria, hypochondriasis and depression) suggests it has some validity, although overlap of items on the different scales makes it very difficult to appraise the theoretical worth of the test in understanding chronic LBP. The Eysenck Personality Questionnaire, however, has been constructed on British subjects, and although considerable problems are evident in the interpretation of two of the scales, the remaining scales (Extraversion and Neuroticism) would seem worthy of further investigation with chronic pain patients. It has been suggested that a 'profile' or 'zone' analysis obtained by combining scales is appropriate in certain circumstances, although this has not so far been attempted in the study of chronic pain. The other widely used psychometric test in the study of chronic pain has been the Illness Behaviour Questionnaire, actually measuring beliefs about illness and self-concept rather than illness behaviour per se. The

validity and reliability of the test has never been adequately evaluated on British subjects, but it would certainly seem to merit further consideration.

Socio-cultural influences frequently have been implicated in the development of pain language and behaviour and in their effects on presentation of symptomatology and response to treatment. These have not been examined sufficiently carefully in chronic LBP patients to determine their significance. Arguably subcultural differences may be as important as cultural or ethnic differences. Unfortunately wide scale epidemiological studies of the sort necessary to evaluate such factors do not permit in general the inclusion of physical and psychological assessment of sufficient precision to draw any worthwhile conclusions.

Factors affecting health-care seeking, complaint presentation and doctor-patient communication would seem to be inextricably intertwined with the persistence of chronic LBP attenders. The complexity of such factors and their relationship, for example, with previous treatment is bewildering. Attempts have been made to define various facets of health-care seeking and it is known for example that consistent gender differences are evident. As far as the study of chronic LBP is concerned, it would seem necessary to describe more accurately the nature of magnified illness presentation or illness behaviour, and then determine the relationship of this to disease characteristics and other psychological variables. Since the patient's behaviour can be evaluated at the time of interview and assessment, this context would seem to offer the opportunity to observe one facet of the complex health care seeking process and determine the relationship with the other variables discussed.

Occupational factors have been investigated in a number of industrial settings. Unfortunately, more than a rudimentary analysis of such factors presents considerable problems in a routine orthopaedic or rheumatological clinic. (The same observation might be made of the influence of social factors.)

In conclusion, the literature review would seem to suggest that despite considerable previous research, the significance of psychological factors in LBP remains unclear. It would seem necessary to develop and validate an adequate assessment of the physical disease characteristics and the relationship with severity

of illness, using degree of disability for example as a measure of this. Assuming that severity is not completely explained by the objective physical disease characteristics, it would seem worthwhile to investigate the importance of various types of psychological information in increasing the level of understanding. It would seem sensible to choose as independent variables those claimed to be most important in the clinical or psychological literature, although careful attention should be paid to establishing that the variable or scale in question is appropriate for use with chronic LBP patients. Since investigation of psychological factors might have implications for the selection of suitability of patients for various sorts of treatment, an attempt should be made to determine not only the relationship of variables with severity of illness, but also the extent to which they correlate with other independent variables and may be therefore to an extent redundant. Integration of other information may permit an evaluation of the probable generality of findings, as will cross-validation of any new scale construction on different cohorts of patients. Choice of a research design which will permit integration of previous research with later research would seem an important consideration. Hopefully the combination of careful attention to research methodology and precision of clinical content will lead to minimization of error in the results obtained with the increased likelihood of stability of research findings thus establishing a sound basis for future development.

III METHOD

OVERALL RESEARCH STRATEGY

General aims.

This thesis forms part of a set of studies the general aim of which is to devise psychological screening procedures appropriate for chronic backache presenting to hospital orthopaedic or rheumatological clinics for assessment of suitability for treatment, and to examine the utility of physical and psychological parameters in the prediction of response to various sorts of treatment. This thesis will be concerned specifically with the construction of an assessment attempting to integrate medical and psychological information. The first part of the thesis will be concerned firstly with the construction of four new reliable and valid indices and secondly with cross validation of previously devised assessment materials. The second part of the thesis will comprise an investigation of the utility of physical and psychological parameters in the prediction of severity of illness as represented by functional disability. A particular emphasis will be placed on the identification of redundancy among multiple measures. Testing of specific hypotheses will be followed by an examination of the nature of magnified illness presentation. The thesis will conclude with a discussion of the implications of the findings for assessment and treatment in current medical practice.

Research strategy and logical domains

Since the basic purpose of the study was to evaluate the relative importance of certain types of variable in the prediction of severity of illness, variables representing different conceptual domains were selected.

The major part of the study is concerned with the relative importance of physical and psychological parameters in the prediction of severity of illness as represented principally by disability, where disability is defined as:

"diminished capacity for every day activities and gainful

employment" (Martinat, 1966).

Although disability is the main dependent variable, other dependent variables briefly will be considered. Multiple regression is selected as the main statistical method since it enables the simultaneous evaluation of a number of independent variables and is thus particularly suitable for determination of redundancy among independent variables. The major considerations deciding the particular models tested were both theoretically and clinically based and led to a priori decisions about order of entry of variables into the regression equations. This enabled the assessment both of the particular contribution of the variable (or class of variable) and its incremental utility i.e. the extent to which its contribution to the prediction of the dependent variable could be explained by other independent variables.

Since the general purpose of the studies was to develop screening procedures suitable for use in general orthopaedic practice, an evaluation of the contribution of physical characteristics were considered of paramount importance. Traditionally, psychological factors have been examined using questionnaires designed to examine personality structure on the basis of the patient's self report. Personality traits were assessed using the Eysenck Personality Questionnaire (EPQ). Cognitive structure has also been examined with the locus of control questionnaire. An attempt was made to assess the dimension of internality-externality using a version of locus of control devised in the West of Scotland. It was considered that specific hypochondriacal beliefs and fears might be of relevance and so the Illness Behaviour Questionnaire (IBQ) was employed. The final set of psychometric measures were designed to assess current psychological distress. The Zung Self-Rating Scale (Zung) and the Modified Somatic Perception Questionnaire (MSPQ) were used for this purpose. The psychometric evaluation was supplemented by the clinical ratings of magnified illness presentation in the form of

inappropriate signs and inappropriate symptoms, which can be conceptualized as a type of illness behaviour.

Finally a number of other logical domains such as social and economic factors and medico-legal involvement are briefly considered.

Selection of dependent variables

The severity of backache and sciatica determine the need for, and to some extent the choice of, treatment; improvement or deterioration with time determines the success or failure of treatment. Unfortunately there appears to be no satisfactory or agreed method of assessing severity of backache.

As the primary complaint is of pain and the primary aim of treatment is, in the first instance, to relieve pain, pain might be taken as an index of severity of illness (Beecher, 1959; Sternbach, 1974). The rating of pain has been shown to comprise not only of physiological but psychological components (Merskey and Spear, 1967) and recent statistical evidence (Reading, 1980; Reading, 1982) has confirmed its multidimensional nature (see Chapter II). Given the ambiguity of their interpretation, it was decided to use pain ratings as subsidiary dependent variables rather than the main index of severity. (Their utility as independent variables is considered below in Chapter VI).

Most clinical 'diagnoses' in backache have neither clear diagnostic criteria nor objective confirmation and a simple description of non-specific backache has been deemed preferable (Editorial, 1979). Although the basis of prognosis and medical management, diagnosis is a poor measure of disability in the individual patient, and studies comparing backache patients with asymptomatic subjects show little relationship between radiographical degeneration and clinical severity (Nachemson, 1975; Magora and Schwartz, 1976). Thus degenerative changes may be falsely implicated in the production of pain when they are simply a function of the patient's age.

Physical impairment or loss of faculty would seem, prima facie, to be an obvious candidate for an index of severity. Physical impairment has been defined as "an anatomical or pathological abnormality leading to a loss of normal body activity" (JAMA Special edition, 1958; Garrad and Bennett, 1971). There are, however, problems in constructing an index of physical impairment. Although the frequency of individual physical signs in backache increases with overall severity, the signs are largely unrelated to each other (Chapter IV). This means in effect that an overall index of physical impairment based simply on the interrelationship among physical signs would contain a large amount of unique or error variance since the common variance is so low. Furthermore, although the history of psychosomatic medicine contains attempts to implicate unconscious conflicts and associated defensive structures in the production of pain (Chapter II) such models have never received adequate scientific validation and it seems to make little sense to construct a theoretical model in which an attempt is made to explain physical damage by psychological factors.

A much stronger argument can be made for the use of disability as the principal index of severity of illness. Among chronic backache patients, the distress with which many patients present appears to be related more to the disabling effects of pain rather than report of unremitting agony. By the time a chronic pain patient reaches a specialist orthopaedic or rheumatological clinic, his work, social life, family life, marital or sexual relationships and sleep may all be affected. Most patients find ways to minimize pain but unfortunately this produces patterns of escape and avoidance behaviour which can be troublesome in their own right. Focussing therapeutic effort on what a patient can or cannot do (or, more accurately, is or is not doing) enables the identification of clearcut outcome criteria for treatment. Furthermore it makes theoretical sense to

investigate the relative importance of physical and psychological characteristics in disability, since arguments can be adduced to support a causal link not only between physical impairment and disability, but also between psychological characteristics and disability; although in the latter case the posited directed of causality is much less clearcut. Since previous work on the assessment of disability had incorporated items reflecting both physical impairment and disability into the same measure (Kokan et al, 1975) it was decided that a new measure of disability was necessary. In the construction of this scale, the emphasis was clearly placed on loss of function rather than pain (and so in the interview the patient was asked not "is that activity painful" but "have you reduced, do you avoid, or do you require help with the activity"). The clinical rating was thus based on the patient's self report. The detailed construction and validation of the index is described in Chapter IV.

It was considered that degree of workloss, while clearly related to severity of illness, is also markedly affected by economic and occupational considerations and so it was examined as a secondary dependent variable since a detailed examination of economic and occupational effects was beyond the resources of this study. (Some attempt has been made to consider their influence in Chapters VI and VII).

Selection of independent variables

Demographic, social and occupational variables

Certain demographic and social variables were included primarily to examine the generality of the model. Gender differences are frequently noted in consultation behaviour (Ingham and Miller, 1982). The construction of psychometric manuals attests to the importance of gender and age differences. Age and sex were therefore included. Social class and work type were also included. Since a linear relationship with social class and work type could not be assumed, they were coded as dummy variables for the purpose of the regression analyses (see Chapter VI). A detailed investigation of social

factors was beyond the resources of the study but it was though that amount of time loss from work through backache might serve as an indicator of the worth of pursuing such information in a subsequent study. It was apparent from pilot and previous studies that marital status per se bore little relationship with disability, pain or physical impairment. It was decided not to include such a variable since a serious attempt to evaluate the marital relationship would have to involve interviewing spouses, and detailed spouse interviews were beyond our resources.

In conclusion, the demographic and social factors were included to investigate the generality of the findings, produce as general a model as possible and serve as a pilot investigation for future studies, rather than investigate demographic, social and occupational variables per se. They are considered at the end of Chapter VI.

Assessment of pain

The extent of pain reported by the patient might seem an obvious candidate as the major measure of severity of illness. There have been two major approaches to the assessment of pain: self-rated pain using graphic or verbal measures, and experimental cross-modality matching methods of which the best known are perhaps pain threshold or tolerance tests. The assessment of pain is considered in detail in Chapter II.

In this study a visual analogue scale was used to measure pain severity and the Pain Drawing (Ransford, 1976) used to confirm the patient's description of the location and type of pain, and give a measure of magnified pain perception. In view of the controversy over the statistical properties of the McGill Pain Questionnaire (Chapter II) it was decided not to include it in this study, although it is compared with the visual analogue scale and the Pain Drawing in a subsequent study.

Experimental pain was assessed on a subgroup (n=42) of the patients in the main study, but it was beyond the

resources of the investigators to include it with every patient. It is used in the cross-validation of the MSPQ (Chapter IV).

Clinical illness characteristics

Medical management of the individual patient has to be based on clinical history and physical findings. The underlying assumptions that information obtained from interview and examination provides a reliable measure of abnormality, and that such information distinguishes normal from abnormal have been questioned (Waddell et al, 1982). The low reproducibility of clinical findings among even experienced doctors has been documented in several clinical conditions (Cochrane et al, 1951; Kilpatrick, 1963; Gill et al, 1973; Hall et al, 1976), including backache (Nelson et al, 1979). The few attempts to improve data collection techniques in backache (Nelson et al, 1979; Moll and Wright, 1976; Million et al, 1982) either have been of limited scope or have concentrated on specific aspects of assessment. The reliability of a full clinical history, examination and diagnosis on a sample (n=30) patients has been recently undertaken (Waddell et al, 1982). This was in fact the last of a series of reliability studies in which the assessment proforma was sequentially modified. Many personal and family illness history variables, while occasionally of significance in individual patients, were of low incidence or extremely loosely associated statistically rendering their utility in the construction of a theoretical model extremely problematic. Although specific items from the general somatic enquiry were used in the validation of the MSPQ (Chapter IV), it was considered advisable for the purpose of this thesis to restrict attention to objective physical characteristics, disability, inappropriate symptoms and inappropriate signs. The construction of each of the first three scales is described below (Chapter IV) and the previously derived inappropriate signs (Waddell et al, 1980) is described in Chapter V.

General personality structure

Attempts to identify psychological factors in chronic low back pain have generally involved the use of the Minnesota Multiphasic Personality Inventory (MMPI) (Dahlstrom and Welsh, 1960). Despite its distinguished pedigree, there are considerable limitations in the use of the test (Chapter II). The most widely used personality tests in Britain are the Sixteen Pf questionnaire (Cattell and Eber, 1964) and Eysenck's series of questionnaires. The 16PF , although American in origin, has a set of British norms, but has not been incorporated into any major studies of pain in the United Kingdom. Eysenck's personality questionnaire gives measures of neuroticism and extraversion as well as two little understood scales, a so-called "lie scale" and a psychoticism scale (something of a misnomer). It was decided nonetheless that the latest version of the Eysenckian questionnaires, the EPQ, would be most appropriate for the measurement of general personality structure in this study.

A number of cognitive dimensions have been implicated in the study of pain (Chapter II). Of these, the locus of control scale (Rotter, 1966) would appear to be of some promise. A pilot study in the West of Scotland, however, showed that a significant proportion of patients found difficulty in completing the test, or were irritated by it. A new personal locus of control scale constructed to overcome the problems of the confusion of personal with political control and social desirability bias had been developed with extensive norms for the West of Scotland (Cooke, 1983). The 16-item scale proved much more acceptable than Rotter's original scale. When this study was devised, although the health locus of control scale (Wallston et al, 1976) had been published, it had not been used with chronic pain patients and the more recent multidimensional health locus of control (Wallston et al, 1978) and pain locus of control (Engstom, 1982) had not appeared.

Specific hypochondriacal fears and beliefs

The only two questionnaires used frequently in this clinical domain are the MMPI, yielding hypochondriasis and hysteria scales, and the IBQ. The theoretical and practical limitations of the MMPI have been discussed in detail (Chapter II). Despite doubts about the validation and statistical properties of the IBQ (Chapter II), in view of the potential clinical importance of the dimension (or dimensions) it was decided to include the 62 item IBQ but subject it to a number of analyses prior to decisions about its use in the study. The evaluative process and decisions reached are discussed in detail in Chapter V.

Current psychological distress

As has been noted (Chapter II) serious mental illness, such as schizophrenic psychosis or manic-depressive psychosis, is extremely rare in patients presenting with backache. More commonly, patients present with symptoms suggestive of a neurotic disorder. Since depressive symptomatology is well recognised concomitant of chronic pain (Sternbach, 1974) it was considered important to include a measure of depression. Problems in the measurement of depression have already been discussed and the comparitive features of various depression scales were reviewed (Chapter II). It was decided to use the Zung Self-Rating Depression Scale (Zung, 1965) in this study since it does not include any items specifically concerning pain (and therefore one can investigate empirically the relation between the two); the items refer primarily to symptoms of depression and therefore are likely to be acceptable to non-psychiatric patients; it is preferable to the other well known self-rating scale, the Beck Depression Inventory (Beck et al, 1961) since patients find it easier to complete (Kearns et al, 1982) and its use is advocated by one of the foremost authorities on the psychology of pain (Sternbach, 1974; 1978). Following Blumenthal's suggestion (1975), Cooke (1980) modified the Zung SRS by the addition of three further items. Since West of Scotland norms were

available for the 23 item version, both it and the original 20 item version were incorporated in the study. The use of the dichotomised scale (Sternbach, 1973a) and the original 4-point version is considered in Chapter V.

The need for a specially designed measure of somatic awareness as opposed to a psychiatrically-derived scale of anxiety has been discussed in detail (Chapter II). The construction and validation of the Modified Somatic Perception Questionnaire (MSPQ) is described in Chapter IV.

Selection of subjects

General considerations

In order to construct a theoretical model having clinical value with as general an application as possible, it was decided to examine in the first instance patients having the same general clinical disorder (chronic backache) but having adhered to a number of methodological strictures in order to ensure the validity and reliability of the data collected, design the sample so that it was as representative as possible (given the aforementioned limitations) of the population of patients referred to the hospital department concerned. The statistical properties of newly constructed scales were cross-validated on further samples of the same population and the final theoretical model was examined not only on the main sample, but on sub-samples. Additional sub-groups of subjects of various types were obtained in order to establish discriminative validity and construct validity of the variables concerned.

Groups of patients studied

The main groups of patients studied are represented diagrammatically in Appendix 01. The main study (n=200) is the group of consecutively referred backache patients on which the theoretical model is developed and the main hypotheses tested. As far as the clinical variables are concerned, the general clinical pilot study (n=182) was

used to establish base rates for a number of individual variables, replicate the cohesiveness of the group of inappropriate signs (originally derived from Canadian work), and to establish statistically the separability of inappropriate signs and inappropriate symptoms. The disability clinical pilot study (n=160) was used primarily to construct the disability index, the scale for the assessment of objective physical characteristics and assess the relationship between the two classes of variables. The pilot MSPQ studies (n=334) were used to develop the scale for the measurement of somatic awareness and are described in detail below (Chapter IV). The small pilot MMPI study (n=84) was used to examine the relationships of the "neurotic triad" on the MMPI with the inappropriate signs, pain drawing, MSPQ and Zung Self-Rating Scale. The normality studies (n=435) and reliability studies (n=475) were used to establish the discriminative validity of the clinical (and where appropriate) psychometric scales and either establish reliability data or confirm previously published figures. The details will be presented as each of the major variables is discussed. The additional back sample (n=141), sometimes referred to as "extra backs" was used to replicate the internal consistencies of the main clinical scales. The spinal pathology study (n=73) was included briefly to examine the utility of the inappropriate signs and symptoms on a clinical group suffering from a disease with quite different objective physical characteristics. The non-backs study (n=52); a study of minor orthopaedic conditions (n=25), osteoarthritic patients (n=16) and rheumatoid arthritis patients (n=16) was used primarily to examine the psychological variables in another orthopaedic population. It is discussed only briefly.

<u>Exclusion criteria for main study</u>

1) Patients less than 20 years were excluded because of the higher incidence of spinal pathology in this group

and marked social, economic, occupational and domestic differences from the older group.

2) Patients older than 55 years were excluded as the prevalence of a non-specific mechanical backache rises sharply above the age of 55 years, as does the incidence of spinal pathology but more importantly, the compliance with psychological assessment and reliability of the clinical data appears to decrease markedly above this age.

3) Patients with a history of serious spinal disease were excluded.

4) Patients currently under investigation for, or receiving treatment for other serious physical disease were excluded.

5) Patients with a history of serious psychiatric disorder (leading to formal psychiatric treatment) or who had treatment for a minor psychiatric illness within the previous two years were excluded.

6) Patients had to be born in the United Kingdom with English as their first language.

7) Patients had to be able to read, to write and be willing (and able) to comply with the assessment procedure.

8) Patients smelling strongly of alcohol at the time of assessment were excluded.

Of the initial 332 patients, 34 (10.2%) were excluded because of age, 25 (7.5%) because of difficulties with language, comprehension or compliance, and 73 (22.0%) because of spinal pathology (tumour, infection, inflammatory disease, spondylolisthesis and osteoporotic or traumatic fracture). The

final 200 subjects otherwise are representative of chronic backache (duration of at least 6 months with present episode at least 3 months) related to mechanical derangement of the lumbosacral region due to trauma and/or degenerative changes.

Selected demographic and clinical characteristics of the main study.

Selected demographic and clinical characteristics of the main study (n=200) are presented in Appendix 02 in order to permit some comparison with other studies on backache.

The group consisted of primary referrals (GP backs) and secondary referrals (problem backs). GP backs came from family doctors to a hospital orthopaedic department and the final sample constituted a random sample of approximately one sixth of the patients thus referred during the time period. The hospital serves a mixed residential and industrial area in the West of Scotland with a smaller number of rural patients (some from the Highlands and Islands of Scotland). Problem backs were referred from other orthopaedic and neurological consultants in the Strathclyde region to the Problem Back Clinic at the Western Infirmary, Glasgow. Some 250 patients per annum with difficult backache problems and previous failed treatment are referred to this clinic for assessment. While this is a highly selective group of patients (from population base of about 3 million), it is comparable to groups of patients seen at similarly run clinics in the Robert Jones and Agnes Hunt Orthopaedic Hospital, Oswestry; the Royal National Orthopaedic Hospital, London; and the Harlow Wood Orthopaedic Hospital, Nottingham and Bradford. (There are similar problem Back Clinics in North America and Scandinavia and the patients are comparable in many respects to those seen in the Workmen's Compensation Board Back Assessment and Rehabilitation Clinic in Toronto, Canada.)

Comparison of main clinical backache groups

Selected demographic and clinical characteristics of

the four main clinical groups are presented in Appendix 03.

Brief details of the spinal pathology group are shown in Appendix 04.

2. PRINCIPLES GOVERNING THE SELECTION OF ITEMS AND SCALES

Choice of classes of variable

Items were chosen as representing discrete logical domains or types of information in order that relationships among scales and among classes of variable could be examined without the contamination or prejudicial communality which obtains when examining the relation, for example, between two scales which have items in common or which have items so highly correlated that one is mistaking redundancy for genuine covariation. Clearly the extent to which it is possible in terms of research design to achieve this depends in part on the particular research context.

In this context it was possible a priori to delineate certain logical domains or classes of variable without much difficulty. Thus for example demographic information is clearly different in nature from information obtained during the course of a clinical examination. They can be differentiated not only on the basis of their semantic content but also on the method by which information about them is gathered. Indeed many demographic, economic, social and occupational information can be confirmed or substantiated as matters of fact by pursuing background enquiries. It seems reasonable to infer that relationships which are identified empirically between demographic and occupational variables on the one hand and clinical variables on the other, are worthy of examination and there seems little danger of the aforementioned redundancy.

Clinical information

Within the clinical realm, however, it becomes more difficult to justify the identification of discrete logical classes. One has to be guided in part by current clinical practice, in part by one's theoretical model or models and

in part by statistical evaluation of the inter-relationship among individual items and sets of items. All research however should be an attempt to formulate relationships among variables. In this study, the main general objective was to evaluate the contribution of physical and psychological parameters to our understanding of severity of illness.

It was apparent that in many clinical situations, the clinician is interested in examining not only the possible physical damage with a view to treatment, but has to interpret this in the light of the complaint of pain and other symptomatology presented by the patient. In medico-legal contexts, the amount of compensation is not dependant on the patient's quantitative estimation of pain per se (which in such a context one would expect to be maximal), but on the disability considered to have resulted from the accident and associated physical damage. It should not simply be a consequence, for example, of the normal ageing process.

In order that the relationship between the physical characteristics and the disability could be assessed, two separate pools of items were chosen and the statistical integrity of each pool demonstrated statistically.

Since the beginning of the century, physical signs believed to have a predominantly non-organic interpretation in chronic backache had been identified (see Chapter II). A pool of such items was derived from the literature and subjected to the statistical analysis described below. In a similar manner a set of inappropriate symptoms were identified and used to form the basis of another independent scale. Since the differentiation, on a priori grounds among physical signs, inappropriate signs, inappropriate symptoms is much less clearcut, rigorous statistical analyses were used to confirm the discrete identity of these classes of variable.

Patients' ratings of pain using two different measures were used both as independent and dependent variables at various stages of the analysis and are described below.

Psychometric information

As far as explicitly psychological variables are concerned, there were a number of psychological dimensions previously deemed important in the clinical and psychological literature. The limitations of the widely used MMPI have been discussed in detail above (Chapter II). Since the patients in the study were being assessed during an orthopaedic clinic, there was a practical limitation on the quantity of data which could be obtained from any one patient. Following pilot studies, a psychometric battery was devised to give measures of general personality structure (Eysenck Personality Questionnaire); internality-externality control (following Rotter's (1966) work on locus of control), hypochondriacal fears or beliefs (Pilowsky's (1967) Illness Behaviour Questionnaire), and the Zung Self-Rating Scale (1965) giving a measure of depressive symptomatology. There are published data for each of these scales and, with the exception of modifications mentioned under the heading of individual tests, were used as recommended by the authors. A specific measure of somatic and autonomic awareness (the MSPQ) was however derived and validated for use in the study. Initially there were 5 measures of general personality structure, 7 measures of specific hypondriacal beliefs or fears and 2 measures of psychological distress (the Zung and the MSPQ). It was expected that there would be a large element of redundancy within the psychometric battery but it was unclear from previous published work which of the dimensions (if any) would prove to be of importance in the understanding of severity of illness.

Construction of new scales

Validity of individual items

General principles governing the identification of pools of suitable items have already been discussed. While it is important to select items which reflect the current state of knowledge, it is important to be on guard against widely promulgated but unsubstantiated clinical impressions in the design of research. The approach in the set of studies,

of which this thesis represents a part, has been empirical. Items have been retained which are descriptive of chronic backache specifically. A number of items frequently discussed in the context of backache seem to be descriptive only of the acute stage of the illness (e.g. loss of lordosis and list). A number of clinical signs such as stiffness and certain X-ray findings may be a feature of normal wear and tear, and within a certain age-group fail to differentiate between people with and without backache (Waddell et al, 1982).

Statistically the incidence of individual items in chronic backache and normal controls had to differ significantly. With a number of the clinical variables, cut-offs were chosen so as to minimize the sensitivity and specificity of items. For inclusion in a scale, the base-rates of the item among the chronic low back pain group were examined and, following Comrey's criterion, (Comrey, 1978, p651) items retained having a 15-85% endorsement rate.

Reliability

Test-retest rehability or stability of individual items were assessed by readministration of the questionnaire or repeat clinical examination in two series of patients selected according to the same criteria as the main study. Physical examination and diagnosis were recorded independently by two doctors (n=30). Psychological questionnaires were completed by the patient and repeated 24 hours later (n=40). In the clinical reliability study, the order of examiners was randomized and there was no detectable difference caused by the order of examiners. No systematic differences were found between the two separate completions of the psychometric questionnaires.

Reliability information is presented in the form of percentage agreements, Pearson product-moment correlation coefficients and wherever possible also by Kappa coefficients (Cohen, 1960) which correct for the spurious inflation produced by chance agreement, which can be considerable when raters

use different scale points disproportionately (Bartko and Carpenter, 1976 p308). Fleiss's correction (Fleiss et al, 1969) to Cohen's estimate of variance was used in the calculation of statistical significance. Kappa can vary from -1.0 to +1.0 The levels of agreement achieved for the clinical signs and symptoms in these studies proved satisfactory (Waddell et al, 1982) and compared favourably with values for other physical signs and symptoms (Theodossi et al, 1981).

Scale construction

It is possible to approach the construction of scales from a number of points of view (Nunally, 1978). Generally an attempt is made to define individual items in terms of some composite, the statistical properties of which are used to determine the extent to which it is justified to represent individual item scores by one or a small number of scores. It is possible then to compare a number of different scales (with differing items) to find the particular sub-set of items having the greatest internal-consistency or internal-consistency reliability. Most procedures for reliability assessment depend on Cronbach's Alpha (Cronbach, 1951), but according to Armor (1969), such item analyses using alpha reliability have a number of drawbacks:-

"the mathematical assumptions for alpha reliability are often not met; the usual steps of item analysis - throwing out "bad" items to enhance alpha reliability - may not in fact produce optimum alpha reliability; and item analysis does not include clear and systematic procedures for detecting and taking into account multidimensionality - that is, the presence of mutually independent subclusters of items within the total composite"

(Armor, 1969, p18)

Although no single coefficient has been adopted universally for the assessment of composite reliability, Cronbach's alpha is the most commonly used coefficient. (Differences with other coefficients are normally a result of different

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ways of estimating error components). It has been shown (Novick and Lewis, 1967) that alpha is a conservative estimate of the reliability of a composite. It depends on the assumption that all items in a composite are parallel items, which further implies that all items measure a single underlying scale property equally. A clear violation of these assumptions occurs when the items measure a single property but do so unequally, or measure two or more independent properties either equally or unequally. Furthermore, as the number of items increases, as the number of dimensions increase, and as items contribute differentially to each dimension, the production of optimum scaling becomes progressively more difficult.

Armor (1969) has advocated the use of principal component analyses to compute an optimal reliability coefficient called theta through a series of steps called factor scaling selecting items having high factor loadings. In fact, theta is derived directly from the latent root of the first principal component (although the number of items in the composite also has an effect). The loadings of the items on the first component give an idea of their relative importance and so if a single factor is suggested by the factors, the unrotated first-factor loadings can be used for interpreting the scale. Conversely if, on the grounds of parsimony, one wishes to produce a single value representative of the set of items, the set of items having the highest internal consistency can be found by the computation of theta. As with alpha, it is difficult to establish criteria of acceptability of the value of theta, but the value can be interpreted in a similar fashion to alpha.

Inappropriate signs

At the inception of this study a set of inappropriate (previously termed non-organic) physical signs was devised (Waddell et al, 1980). Indeed much of this work was included in the 182 patient pilot study for this thesis. It was considered

ways of estimating error components). It has been shown (Novick and Lewis, 1967) that alpha is a conservative estimate of the reliability of a composite. It depends on the assumption that all items in a composite are parallel items, which further implies that all items measure a single underlying scale property equally. A clear violation of these assumptions occurs when the items measure a single property but do so unequally, or measure two or more independent properties either equally or unequally. Furthermore, as the number of items increases, as the number of dimensions increase, and as items contribute differentially to each dimension, the production of optimum scaling becomes progressively more difficult.

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advisable to alter the scoring system slightly (to give a score out of eight signs rather than out of five classes of sign) and to attempt a cross-validation of the statistical integrity of the scale. The results are presented in Chapter V.

Pain Scale and Pain Drawing

The distribution of scores in a number of different clinical groups was examined for the Pain Scale.

The relationship of the Pain Drawing with the MMPI was investigated in a comparison of two previous North American studies with a new study of British chronic LBP patients. The original scoring system (Ransford, 1976) is re-examined and the use of different cut-offs for abnormality is discussed (Chapter V).

Illness Behaviour Questionnaire (IBQ)

Studies using various versions of the IBQ were examined and serious methodological shortcomings identified (Chapter II), despite published data claiming satisfactory validity and reliability for the scales. Incidence and reliability of individual items are examined. The internal consistency of each scale is examined and recommendations about the retention/rejection of each of the seven scales is made.

Zung Self-Rating Scale

The reliability of the original 4-point (Zung, 1965) and the dichotomous version (Sternbach, 1974) of the Zung scale are examined. The internal consistency of the 20-item and expanded 23-item version (Based on West of Scotland normative data) are also compared. Finally, scores using both the 20- and 23-item scales are compared on various clinical groups of patients to confirm the validity of the scale.

Eysenck Personality Questionnaire (EPQ)

In view of the extensive research data available on this instrument and its predecessors in the United Kingdom, confirmation of its statistical properties was not considered relevant. A new set of norms, specifically for the 20-55

year age group were constructed however for this thesis. Clinical groups were compared on the four major personality dimensions. The susceptibility of the Lie Scale to age and gender differences led to an attempt to construct a revised set of scores corrected for age and gender. Finally, interaction between dimensions was investigated using 'zone analysis' (Eysenck, 1967) to try to identify additional types of patient. This exercise proved unsuccessful in chronic LBP patients.

Research methodology

The principles governing the construction of new scales and the validation of previously derived scales have already been discussed. A number of practical problems placed limits on research design possibilities. In the first place, the object of the set of studies was to develop valid, reliable and sensitive measures of discrete aspects of backache. A major consideration, therefore, was redundancy or in a predictive sense, incremental validity or utility. In other words, the general object in the derivation of any sort of screening procedure viz the identification of certain types of patients, had to be achieved in as efficient a manner as possible. In view of the potentially vast set of multivariate relationships in a study incorporating a large number of independent variables, it was decided to adopt a cross-sectional design and aim to obtain a sufficiently large number of subjects seen at one point in time to enable the evaluation of the stability of interrelationships across different samples of patients. It was not possible in the context of the major studies reported here to investigate variation across time, such as using repeated measures across time; although the prediction of outcome of treatment for a group of these patients is part of a further study at present in progress.

Covariation and causal inference

The inference of causal relationships from correlation or covariation among variables sampled at the same time

is beset by the 'chicken and egg' problem. Consideration of subgroups of patients at various stages in the illness process may enable an estimate of results likely to be found with a true repeated measures design but any such findings should be regarded as preliminary and subject to confirmation using the appropriate design.

An examination of asymmetry among classes of variables may nonetheless provide a more refined set of theoretical possibilities from which a number of plausible relationships can be investigated. Unfortunately there are no clearcut rules about the construction of such theoretical models and they have to be devised in the light of current clinical or psychological knowledge and basic common sense. Thus for example, assuming a correlation is found between the size of a physical lesion and depressed mood, it makes no sense to investigate the extent to which depressed mood may have caused the physical lesion, but on the other hand, it would not be unreasonable to investigate the effect of physical damage on mood. The relationship between some sets of variables, however, presents more of a problem and the relationship might be construed in terms of stronger or weaker causal relationships. It is well known that physical damage is correlated with disability. While an obvious causal link may be postulated implicating impairment as a causal factor in disability, it is also known that avoidance of walking, for example, will lead to a degree of muscle wasting and joint stiffness which will in turn affect disability. Under such circumstances one has to produce additional evidence to support the choice of particular direction of causal inference, or one has to produce alternative theoretical models with associated hypotheses until it is possible to devise a method of deciding between them.

In this thesis a number of such assumptions concerning direction of causality will be made, with attempts to justify them. Where alternative causal structures seem on a priori

grounds to be equally plausible, an attempt will be made to evaluate each.

Multiple regression as a data-analytic system

In clinical psychology, analysis of variance and analysis of covariance are frequently considered appropriate for the investigation of relationships among variables in group comparison studies. Typically, one or two treatment or experimental groups might be compared with one or more control groups (such as placebo or waiting list controls). The dependent variable might be degree of clinical change or outcome of treatment, while the principal independant variable might be type of drug, drug dosage, or type of therapy (eg comparing pharmacotherapy, psychotherapy or behaviour therapy). Frequently however, there may be other differences among experimental and control groups. Such other independent variables might equally account for the obtained differences between experimental and control groups. In order to be able to test the hypothesis under investigation it becomes imperative to 'control for' such confounding effects.

It may be possible, prior to the experiment, to classify subjects (according to the extraneous or confounding variable) and then randomly assign subjects having the same value of the confounding variable to the various experimental and control groups. Frequently this proves difficult either on ethical or practical grounds. Perhaps more commonly 'allowance' is made for differences among the groups on the extraneous variable by treating it as a covariate and testing the hypothesis under investigation once scores on the dependent variable have been adjusted statistically to remove the effect of differences on the 'unwanted' independent variable.

Analysis of variance (AV) and analysis of covariance (ACV) grew out of the analysis of agronomic data produced by controlled variation of treatment conditions in manipulative experiments. (Indeed, the term 'split-plot analysis', which has now entered common statistical parlance, originally

referred to a particular type of agricultural experiment). Advocates of fixed-model AV (or fixed-model regression) claim that correlation and proportion of variation (squared correlation) measures lack meaning in fixed models since the measures depend on the specific levels of the research factor chosen (fixed) by the investigator and the (fixed) number of cases at each level. Provided the dependency on levels and relative sample sizes of the research factor is acknowledged and understood, however, multiple regression correlational (MRC) methods have considerable advantage. Not only can results using MRC be directly translated into fixed model equivalents (e.g. it is a simple matter to obtain a value for a F-ratio which is identical, within rounding errors to the F-ratio obtained using fixed model analysis on the same data base; (Cohen and Cohen, 1975).), MRC is much more flexible. It enables the investigation of non-linear relations and, of crucial importance in this thesis, enables an estimate of 'effect size' rather than a simple statistical significance level (which of course is critically dependent on size of sample). It is well known that simply increasing numbers of subjects can produce statistical significance for even a very weak relationship. Although traditional AV/ACV yields readily interpretable F and T ratios for significance testing, the difference between means as a measure of effect size only has meaning when units are clearly understood. In behavioral and social sciences, unlike the sort of agricultural study denoted, units may be arbitrary or unfamiliar. In such a context, expressing effect size in terms of proportion of variance has a clear advantage.

Following the above logic, it was considered more appropriate to evaluate the predictive value of various combinations of the independent variables in terms of their proportional contribution to the prediction of the dependent variables. Stepwise multiple regression was considered appropriate since the main purpose of the study was to test a specific

set of theoretical models, having eliminated those variables which proved to be redundant. In testing of the main hypotheses, the order of variables in the regression equation was therefore determined by theoretical considerations. In the examination of the main theoretical model, the contribution of a particular type of information was considered both in terms of its value in predicting directly the dependent variables but also in terms of its redundancy once other information had already been taken into account. Proportion of variance and significance levels are both presented in the tables. The size of the data sets in the main study means that in order for an effect to be significant, it had to add not much more than 1% to the overall prediction (although the relationships of effect size and significance level depend on the amount of variance still to be explained in the dependent variable prior to the insertion of the particular variable into the equation). A case might have been made for a statistic and associated significance estimate based on the proportional increase over the amount of variance already explained but since the object of the study was both to produce as comprehensive an assessment of severity of illness as possible and to devise an assessment system containing as little redundant information as possible, the particular method chosen seemed appropriate. Choosing the second alternative, while not of course altering the figure for the proportion of variance, would have led to increased significance levels for variables early in the theoretical model and decreased significance for later stages. Since the proportion of variance explained by different classes of variables was fairly large, the findings were in general highly significant in any case and would not have been affected by the choice of a different statistic.

A usual additional advantage of MCA is that it permits the inclusion of nominal variables in the regression equation. Each of the values of the variable is essentially treated

as a different variable. The group of variables are then entered as a set of dummy variables at one step in the regression equation. The rationale, procedural details and mathematical justification are described precisely elsewhere (Cohen and Cohen, 1975).

A final advantage of MRC over fixed-model analysis is that independent variables can be considered easily in combination, by their inclusion together as one step in the stepwise multiple regression.

The formula used for the evaluation of the change in R^2 essentially was the test of the null hypothesis that the true population value for the change in R^2 is 0. Following Nie et al,(1980, p413) the hypothesis was tested using the following equation:

$$F \text{ change} = \frac{R^2 \text{ change } (N-p-1)}{q(1-R^2)}$$

where N is the number of cases in the equation, p is the total number of independent variables in the equation, q is the number of variables entered at the particular step and R^2 has its usually meaning in multiple regression. The significance level of the F change is obtained from the F distributionwith q and N-p-1 degrees of freedom

Evaluation of hypotheses

Each of the hypotheses will be considered in turn and data presented to permit its evaluation. A multiple regression model is appropriate for each of the hypotheses. The rationale behind the selection of multiple regression has already been described. The independent variables (or classes) of variable will be discussed both in terms of their contribution to the prediction of the dependent variable or variables and in terms of the significance of the proportional reduction in unexplained variance produced by their inclusion into the regression equation.

CHAPTER IV CONSTRUCTION AND VALIDATION OF NEW ASSESSMENT MATERIALS

IV 1 Chronic disability index

The selection of degree of disability as the principal measure of severity of illness and major dependent variable has already been justified (Chapters I and III).

A previous check-list of disability (Kokan et al, 1975; Wilfling et al, 1973) was used as the basis for a new scale. The items on Wing's disability scale are shown in Appendix 05. The items assess not only disability but items relating to physical impairment and the financial and occupational consequences of disability. Since a major purpose in this study was to examine the relationship between disability and the objective physical characteristics, it was necessary to find a relatively 'pure' measure of disability to prevent the artificial elevation of interrelationships between disability and other parameters as a result of items in common. Physical impairment has been described as an anatomical or pathological abnormality leading to loss of normal bodily ability (J.A.M.A. 1958; Garrad and Bennet, 1971) and is based on the clinical assessment of structural impairment. Disability can be thought of as limitation of a patients' performance when compared with a fit person and is assessed on the basis of the patient's verbal report of his/her difficulties. With these considerations in mind, Wing's scale was examined and variables on the scale used to measure disability. Items relating to work loss, financial consequences, social factors were therefore excluded, as were items concerning physical impairment and pain severity. A number of the items relating to general quality of life were felt to be imprecise and essentially secondary derivatives of more basic functions. Eight items particularly relevant in chronic disability were selected and used as the basis for the eleven items rating scale used in the pilot studies. Originally eleven items were

selected but reliability studies indicated that two of the items ('Picking items off the floor' and 'Repeated bending') were unsatisfactory. The final nine items are shown in Appendix 06. The individual ratings were made by the surgeon on the basis of the patient's descriptions of their difficulties and rated as present or absent. The inter-rater reliability of these ratings is shown in Appendix 07 where the percentage agreement, kappa coefficients and associated statistics are shown for thirty patients rated independently by two surgeons. The significance level for each kappa coefficient is assessed by the computation of a null test statistic which is essentially normally distributed. (See Chapter III). It can be seen that, with the exception of 'heavlift' (help required/avoidance of heavy lifting), all items were satisfactory. 'Heavlift' was retained since, unlike the two items already rejected, it discriminated well between normals and back patients, correlated well with other items, fitted well into the factor structure (see below) and only just failed to reach significance (p=0.06) on evaluation of inter-rater agreement.

Each of the items discriminated well between back patients and normals (Appendix 08). A further consideration of the validity of the items is presented in Appendix 09 where incidences for normals, back patients, non-back orthopaedic patients and spinal pathology patients are shown. The endorsement rate is higher for back patients than normals, females than males, problem backs than routine GP back referrals, osteo-arthritic and rheumatoid arthritic than minor orthopaedic problems, and spinal pathology patients than normals. (Minimal estimates for the spinal pathology group were necessary since a high proportion were unable to walk and it was felt that in such patients attempt at a formal assessment of these items was inappropriate). The figures for spinal pathology and non-back orthopaedic patients are included to demonstrate that a higher endorsement rate than normal is a feature

not only of chronic backache patients but also of patients with other types of serious orthopaedic disease. The inter-correlation among the items are shown in Appendix 10. Following the general principles of scale construction outlined above (Chapter III), the internal consistency of the scale of nine items was examined. The results are shown in Appendix 11. The percentage of variance explained by the first un-rotated principal component in the main study and additional cross-validation group are 36.9% and 43.2% respectively, yielding corresponding values of internal consistency (theta) of 0.79 and 0.82 clearly indicating that the items form a satisfactory homogeneous scale.

The validity of the nine item scale was assessed by a comparison of different sub-groups of patients and normals on the scale (although in view of the problem of missing data estimates, spinal pathology patients were omitted). The results are shown in Appendix 12, where means, standard deviations and selected paired group comparisons are shown. The scale differentiates back patients from normals, males from females, problem backs from routine GP referrals, and a combined group of osteoarthritic and rheumatoid arthritic patients from both normals and patients with minor orthopaedic conditions. (It should be mentioned that the chronic disability index is constructed specifically for patients with chronic backache and modifications would be necessary before the scale could be used as a research instrument for the study of osteoarthritis, rheumatoid arthritis or spinal pathology.

The scale correlated highly (r=0.70) with a similar backache disability self report questionnaire devised in Oswestry (Fairbank et al, 1980) in a small study of 29 patients. The new index constructed above had a higher completion rate, produced a better spread of scores than the Oswestry questionnaire. Furthermore, since the assessment of disability is an integral part of the overall clinical examination and enquiry, it was felt that demonstrably reliable clinical

ratings were preferable to self-report.

IV 2 Objective physical characteristics

Assessment of backache is traditionally based on diagnosis (AAOS, undated; JAMA, 1958; McBride, 1963) and is best established and agreed in the few patients with a clear radiological diagnosis. It is common, however, to find wide variation in severity between individuals with identical diagnosis. Moreover, most clinical 'diagnoses' in backache have no clear diagnostic criteria or objective confirmation and a simple description of non-specific backache is preferable (Editorial, 1979). As mentioned in Chapter 1, comparable studies of patients with backache and asymptomatic subjects show little relationship between radiological degeneration and clinical severity (Nachemson, 1975; Magora and Schwartz, 1976). For these reasons it was decided to base assessment on physical examination of the back, with particular emphasis on the lumbosacral spine and lumbar sacral nerve function. (The problem of differentiating such findings from physical signs of psychological significance will be discussed below (Chapter V and VII). To permit retention, each physical sign had to differentiate backache patients from normals, be reliable on statistical evaluation, be a feature of chronic backache and not merely the acute stages of the illness. For the purpose of this thesis, a further criterion was employed. The item had to increase understanding of the dependent variable. The evaluation of redundancy presented a problem to which allusion had already been made. With highly correlated variables, the determination of redundancy presents little difficulty. One can use the level of bivariate intercorrelation to decide whether a variable is redundant eg if a variable has a correlation with another variable of > 0.71, then the variables have more information in common than they have individually. Alternatively, one might consider the value of a scale statistic with and without the item to determine whether the removal of the item would have any noticeable effect on the scale. In a situation

where one is dealing with variables which intercorrelate only weakly, it is necessary to employ some external criterion against which to evaluate the value of the item. Such a decision can be reached only after consideration of the purpose of gathering the information in the first place. From the clinical point of view, detection of individual clinical signs are important in diagnosis and may serve the basis for some sort of estimate of severity in a medical-legal contest since, although compensation is awarded on the basis of functional disability, an estimate of physical severity may serve as a yardstick against which the judgement about a range of appropriate disability is made. The claimed functional disability can then be compared with the range considered 'appropriate' with the extent of physical damage as determined from the clinical examination. In this thesis there are two purposes in the assessment of objective physical characteristics. Firstly, such assessment will permit the evaluation of the influence of the objective physical characteristics. Secondly, it will permit statistically the removal of the effect of differences in objective physical characteristics on the relationship between the functional disability and psychological variables. Thus any relationships found between disability and psychological factors will not be a result simply in differences in severity of illness, as assessed by the objective physical characteristics. Given the research design employed in the study and the statistical appraisal of results using multiple regression techniques, the fact that a simple scale quantifying physical assessment cannot be constructed becomes irrelevant since the effect of the class of individual variables can be considered jointly. Furthermore it is then eminently reasonable to use disability as the yardstick against which the utility of individual variables can be assessed. In this thesis, the additional criterion for identifying a class of objective physical

characteristics is that the variables increase our understanding of disability. It is perhaps worth remarking here that maximising the extent to which functional disability can be predicted ensures a conservative evaluation of the effects of psychological factors in that every possible allowance has already been made for physical characteristics prior to the consideration of psychological factors. This point is made with some emphasis lest the author be suspected unjustly of circularity in reasoning.

General approach

The initial pool of variables included all the major clinical variables deemed important in the physical assessment of backache. Diagnosis, physical examination of the lumbosacral spine, lumbar and sacral nerve function formed the basis of the assessment but selected items of clinical history - duration of symptoms and time pattern - were also included as they frequently are taken into account in diagnosis and treatment. Of the original seventeen variables, ten were rejected for reasons which will be discussed as the variables are considered in turn. For the rejected variables, limited statistical data will be shown but full reliability and validity data for the final seven variables will of course be presented.

The original list of variables is shown in Appendix 13.

Major problem

Patients usually present with pain in their back with or without pain radiating into the leg. All leg pain however, is not nerve root pain and is not necessarily caused by disc prolapse. Percutaneous needle stimulation of most of the structures of the back (Kellgren, 1938; 1939) either by electrical stimulation or by injection of hypertonic saline solution can give referred pain spreading to the buttocks and thighs, usually posterior and only occasionally spreading much below the knee. This dull, aching ill-localised

referred pain arising from the ligaments, muscles, facet joints, epidural structures or disc may be regarded simply as a spread of backache. It is quite different from the leg pain produced when the needle hits the nerve root. This root pain is a sharper, shooting pain when accurately localized, often contains an element of paraesthesia and, at the L5 or S1 root levels, usually radiates to the ankle or foot. Classification on the basis of the patient's verbal description and pain drawing can be cross-validated by straight leg raising limitation and the presence of root irritation or root compression signs. This permits classification of the major problem into back pain alone, back pain with referred leg pain and nerve root pain. the reliability of this classification proved satisfactory (see below). The mechanical/non-mechanical distinction is of most use in the identification of spinal pathology (Waddell, 1982) and proved of poor reliability and so was not incorporated into the classification.

Previous back surgery

The numbers of previous back operations was usually readily available from the medical history. It could be confirmed by scars on the back. There was no evidence of patients attempting to fabricate the number of such operations.

Operations performed on the lumbar region for back pain were included. Minor skin procedures for excision of superficial skin lumps were excluded unless they were carried out specifically for back pain. Operations in the natal cleft for abscesses were discounted, being unrelated to the spine or to backache.

The variable was coded as the actual numbers of previous lumbar operations.

Sciatic list

A sciatic list where the shoulders were offset from the pelvis was distinguished from a true structural scoliosis with an element of rotation and compensatory curves above and below. A list was measured by dropping the tape as a

plumbline from the lower thoracic convexity and estimating in centimetres how far the tape hung to the side of the gluteal cleft. A list of > 1cm was counted as positive (1) or otherwise the sign was considered absent (0).

Although reasonably reliable (78% interrater agreement; K=0.53, $p < .05$) it proved difficult to include as part of the routine assessment. In 40% of patients with a list, the examiner had written a qualification on the proforma eg 'only on flexion', 'unequal leg lengths' and 'old pelvic fracture'. It had an extremely low incidence in chronic patients (although a higher incidence in acute patients excluded from this thesis). It is included in Appendix 24 as one of the additional items that proved redundant.

Loss of lordosis

The second measure of deformity (loss of lordosis) was measured by tensing a tape-measure between the thoracic and sacral prominences in the midline. If the maximum distance between the concavity of the lumbar lordosis and the tape-measure was 2cms, estimated visually against the centimetre markings of the tape, then lumbar lordosis was considered reduced and scored positive (1) otherwise it was scored negatively (0).

Again there proved considerable difficulty with the use of this variable. There is no agreed method of measurement. It had extremely low incidence in the chronic group, and, like sciatic list may be a feature largely of the acute stage of the illness. Pilot studies suggested a differential sex incidence. It also is included in Appendix 24 as one of the additional items that proved largely redundant.

Lumbar flexion

Lumbar flexion has been identified by rheumatologists as being the clinically most important spinal movement (Moll and Wright, 1976). It is certainly the most important movement in the recognition of spinal pathology (Waddell, 1982).

Lumbar flexion is traditionally measured by how far

the fingertips reach to the ground. It is, however, a compound movement influenced by spinal flexion, hip flexion, hamstring tightness, and nerve root irritation. It is quite possible to have a full range of lumbar movements while only reaching the fingers to the lower thigh; or, conversely, it is possible to touch the toes with a solid bony fusion of the entire lumbar spine in ankylosing spondylitis. More direct measurement of spinal flexion using a skin-marking technique was developed by rheumatologists (MacRae and Wright, 1969; Moll and Wright, 1971). They showed it to be reliable and confirmed its validity by demonstrating of a very high level of agreement between the skin marking measurements and radiological measurements of actual bony lumbar movements.

It was measured with the patients standing erect but relaxed with feet together and back to the examiner. A simple centimetre tape measure in a spring-loaded case was used. A mark was made on the skin in the mid-line at the level of the dimples of Venus, which approximates to L5. A second mark was made in the midline 10cms above and a third mark 5cms below this initial mark. The 15cms between upper and lower marks was taken as the resting measure. The patient was then asked to bend straight forward and reach down with both hands as far as possible towards the toes and the distance between the upper and lower marks was then remeasured. The difference between the final and the original resting measure was taken as the measure of lumbar flexion.

Catch

A 'Catch' was recognised as a break in the normal lumbar-pelvic rhythm on returning from the flexed to the erect position. It was scored as present (1) or absent (0). Following initial studies it proved reliable among trained observers (92% inter-rater agreement, 1 K=0.82, $p < .001$) but extremely difficult to teach and learn. In view of its uncertain clinical validity (interpretation) and its redundancy in the prediction of severity of illness, again it was included only in the

comparison of the final 7 item scale with the 14 item scale Appendix 24.

Lateral flexion

Lateral flexion was measured in the midaxillary line between two skin marks 10cms apart at the levels of the two upper marks used for measuring lumbar flexion. The patient was then asked to lean straight across to the opposite side with the fingers reaching down the side of the thigh and the increase in distance between the two marks was measured. The normal increase was taken as 3cms (from study of normals). A value of less than this was counted as limited and scored positively (1). Otherwise it was scored negatively (0).

Lateral flexion proved the least reliable of the variables (70% inter-rated agreement, $K=0.41$, $p < .05$) but proved inapplicable with overweight patients (subcutaneous fat) and is again of problematic interpretation. According to the rheumatological literature its clinical utility is much less than that of lumbar flexion. In view of its redundancy when included among the 7 additional items (Appendix 24) it was considered that the addition of further complexity necessary in order to include it was unjustified.

Lumbar tenderness

Tenderness was examined in the standard clinical manner with the patient lying prone and relaxed. Lumbar tenderness was defined as localised tenderness to firm, deep palpation over L1 S1 or over the paravertebral muscles within 5cms of the midline. It was scored as present (1) or absent (0). When differentiated from localised buttock tenderness it proved highly reliable (100% although localisation per se was of low reliability.) It was originally decided that for anatomical and physiological reasons, generalized nonanatomical tenderness was best interpreted as an inappropriate sign (Waddell et al, 1980). In fact, localised lumbar tenderness also correlated with inappropriate signs ($r = 0.28$) and with inappropriate symptoms ($r = 0.18$) and so, given its

lack of relationship with other objective physical characteristics and its redundancy (Appendix 24) it was rejected.

Straight leg raising (left and right separately)

Straight leg raising was estimated by passive raising of the leg with the knee held straight by the examiner and the patient lying supine and relaxed with the head on a single pillow. The onset of pain was found to be somewhat unreliable and so the maximum tolerated straight leg raising was used. (Patients could distinguish between straight leg raising limited by hamstring tightness, back pain and radiating leg pain). Following studies of range in movement in normals and reliability trials (see below); straight leg raising was considered positive (scored 1) if the maximum angle obtained was $< 75^{o}$ from the horizontal. Each leg was assessed and scored independently estimated usually to the nearest 5^{o}.

The above measure was taken as the formal measure of straight leg raising, but this was always checked while the patient was distracted in a non-painful, non-emotional and non-surprising manner. This was usually achieved by asking the patient to sit upon the examination couch at the end of examination while the legs were still straight out in front. If the patient was able to sit up in this manner, then the original limitation of straight leg raising on formal examination was given a psychological interpretation. For any discrepancy to count as significant, it had to be at least 30^{o}. (A conservative estimate). If such a discrepancy were found, straight leg raising as a physical characteristic was considered to be greater than the normal lower limit of 75^{o} and the distraction straight leg raising as an in-appropriate sign was scored as positive.

Root compression signs

Complete paralysis and anaesthesia are rare and usually there are more subtle changes of partial weakness or slight sensory change which can only be demonstrated by comparison

with the normal leg. In this thesis, root compression signs were taken to be wasting or muscle weakness or sensory alteration or reflex depression (but not decreased calf circumference, or a depressed ankle jerk alone). Motor and sensory changes due to nerve root compression should at least approximate to a myotomal and dermatomal pattern. (Regional sensory changes affecting an entire leg in a stocking pattern or generalized jerky giving way of many muscle groups - most commonly affecting ankle plantar and dorsiflexor responses despite an ability to walk on toes and heels - should be discounted as nonanatomical (Waddell et al, 1980; and Chapter V). the variable was scored as positive (1) if any of the four major signs were present.

Motor weakness

Motor weakness was estimated in the standard clinical fashion for each of the main myotomes, placing particular emphasis on L4, L5 and S1. It was included as a separate variable in the clinical pilot study but replaced by root irritation signs in the main study in view of its rarity. It was retained only for examination of its incremental validity in the comparison of the 14 and 7 variable assessments (Appendix 24).

Root irritation signs

According to Waddell,

'Traditional teaching places too much emphasis on the classic neurological signs of root compression-gross paralysis, anaesthesia and reflex loss. These are the end stage of nerve compression producing electrical failure. Diagnosis must not await this possibly irreversible state but should place greater emphasis on the earlier and commoner signs of root irritation. The key feature of such signs (straight leg raising, well leg raising and bowstring) is the reproduction of radiating root pain or paraesthesia when an irritable nerve is stimulated'.

(Waddell G, 1982, p212)

For this thesis, root irritation signs were taken to be supine straight leg raising limited to 45° by pain in the leg or cross-over pain in the symptomatic leg on supine well leg raising or thigh pain or calf and foot paraesthesia on bowstring pressure over the popliteal nerve. If any of these major signs were present, the variable was scored as positive (1); although if there was marked improvement of at least 30-40° in straight leg raising under conditions of distraction the apparent restriction on formal testing was interpreted as an inappropriate sign (see Chapter V) rather than a sign of nerve root irritation.

Since such information is already taken into account in the classification of major problem and in the estimation of straight leg raising this would explain why it proved redundant (Appendix 24).

Duration of symptomatology

Duration of symptomatology was included and though an item of clinical history rather than a physical characteristic per se would seem to require little justification for inclusion as a variable. It was coded as the number of months since first onset of the present episode. Following assessment of the reliability of different methods of assessing aspects of clinical history (Waddell et al, 1982) it was asked as an open-ended question.

In fact duration and severity (functional disability) were only moderately correlated (r=0.19). This is perhaps not unsurprising since low back pain of the type included in this thesis is primarily a mechanical disorder rather than a progressive pathological process. Regression analysis of disability showed that both total duration and duration of present episode were redundant (although it was important in the regression of the amount of work loss, Chapter VI). It was not therefore retained for the main analysis.

Time pattern

The time course and pattern is one of the fundamental descriptors or characteristics of physical illness. Clinical experience, psychological theory (Sternbach, 1974) and understanding of the social sequelae of pain (Fordyce, 1976) would seem to support Nachemson's distinction into acute, recurring and chronic time patterns (Nachemson, 1976). Acute was defined as a single episode of $<$ 3 months duration with no significant previous history of low back pain. Chronic was taken to be a present episode of $>$ 3 months duration irrespective of the past history. Recurrent was taken as a present or recent episode of $<$ 3 months duration but with a history of at least one previous significant episode of back trouble.

Unfortunately time pattern is the only physical characteristic which can be based entirely on unsubstantiated patient report. There is no objective confirmation possible from physical examination, although in a legal context there would be some sort of confirmation from consideration of time off work. There would be an argument for constructing the index specifically on chronic physical characteristics with examination at a single point in time being taken as reasonably representative of the chronic state. The possibility of modifying this in recurrent cases eg by making allowance for periodicity of the recurrent episodes, for the severity of attacks or considering the extent of 'residual symptoms' between acute attacks and the point in time at which the examination took place was considered. This proved extremely complex and beyond the resources of the present study. (It seemed very doubtful whether the gain in precision would be commensurate with the effort involved and the delay which such an analysis would occasion).

It seemed a reasonable compromise simply to grade time pattern as acute, recurring or chronic and in fact acute patients were excluded from the study. It was considered important however to try to ensure that the point of examination

should be reasonably representative of the long-term state and no attempt should be made to construct the physical characteristics at points unrepresentative of the chronic phase ie during acute phases or exacerbation.

If the present acute attack occurred after a number of years of freedom from symptoms and lack of disability or work loss, then the presentation was regarded as acute (and therefore excluded) rather than recurrent.

Variables rejected after initial reliability studies

The list of rejected variables, with an attempt to summarise the main reasons for rejection, is presented in Appendix 14.

The list of variables retained with their codes is shown in Appendix 15. The reliability of the major variables is shown in Appendix 16. The dichotomisations necessary to compute the kappa coefficients for flexion and straight leg raising were determined from consideration of the cut-offs which maximally discriminated low back pain patients from normals. The effect of scaling upon accuracy is shown in Appendix 17.

The frequencies and cumulative frequencies for each of the variables are shown in Appendix 18 and 19 respectively. Where appropriate, figures for normal controls are also shown. For the normals in view of the exclusion criteria for normal controls, some of the variables are clearly not applicable. The cumulative percentages are presented only for those variables when such information is not easily abstracted from a consideration of Appendix 18.

The intercorrelations of six of the seven variables are shown in Appendix 20 as well as their correlations with functional disability, pain rating using a visual analogue scale and amount of time lost from work. Factor analysis confirmed the inadvisability of attempting to construct a scale from such a low-level of intercorrelations. Each of the variables showed evidence of a relationship with at least one of the dependent variables. Root compression

signs were retained in view of their clinical importance but it was considered also that the lack of relationship with other variables, and with disability in particular, might be explained in part by the unusually low incidence of these signs in the clinical pilot study.

The major purpose of the thesis is an examination of psychological factors in backache. In order to arrive at such an evaluation, it has been necessary to construct (and validate) measures of functional disability and objective physical characteristics (OPC). In the decision to reject a number of the OPC variables, redundancy or lack of incremental validity has been of major importance. The extent to which functional disability can be predicted by the OPC forms the first hypothesis in the thesis, but the major importance is in the validation of the attempt to maximise the importance of OPC before considering the psychological variables. It is important at this juncture, therefore, to consider the relationship between these two classes of variable in the main study.

The incidence of the major variables are presented in Appendices 21 and 22. These appendices are directly comparable with appendices 18 and 19 respectively. As expected, the incidence of root compression signs proved higher in the main study.

The intercorrelation matrix for the six OPC variables with three possible dependent variables are presented in Appendix 23 where it can be seen that the correlations of the OPC variables with disability in particular are higher than in the clinical pilot study (Appendix 20). If one assumes that the relationships between the OPC variables and disability are two samples of a population of such relationships it would be reasonable to conclude (admittedly speculatively) that the most likely set of values for the 'true' relationships between OPC and disability would be between the two sets of relationships given in Appendices 20 and 23. It seems

likely that, if bias exists in using the OPC variables as a major covariate set to remove the effect of such differences in physical characteristics prior to consideration of psychological factors, the effect would be to over estimate rather than under estimate the effect of OPC on disability. A conservative approach is being adopted on purpose to the estimation of the importance of psychological factors.

The evidence for the unnecessity of retaining many of the OPC variables (referred to above in the discussion of, and reasons for rejection of, individual variables) is presented in Appendix 24. Three possible dependent variables are considered. Viz disability, pain scale and amount of workloss, and the ability of the final seven OPC items to predict the main and the subsidiary dependent variables is compared with the larger fourteen item battery from which the problematic variables have not been excluded. Consideration of the ratio of variance in the dependant variable explained by the seven and fourteen item batteries suggests that the considerable additional effort and increase in complexity occasioned by the inclusion of the additional variables is unnecessary.

IV 4 Inappropriate symptomatology

The clinical description of inappropriate symptomatology has already been described (Chapter II). 24 such symptoms were initially identified from a review of the clinical and the medical literature.

Twenty-two experienced orthopaedic and neurosurgical consultants then rated the degree of inappropriateness of each symptom. The results are shown in Appendix 25 and the incidence of each symptom examined in back patients (182 patients pilot study) and in normal controls. The test-retest reliability was also examined. (The nature of the control group and reliability study are discussed in Chapter III). Following these studies, a number of items were rejected on the grounds of clinical ambiguity (22 consultant study),

a number because of low reliability, a number because of rarity (in back patients) and a number because of high incidence in normals. Finally a number were of questionable psychological interpretation (182 patient pilot study; Waddell et al, 1980). The excluded items and principal reasons for exclusion are documented in Appendix 26 from which statistics have been omitted. Detailed statistics are presented only for the seven variables which were retained. The list of variables is shown in Appendix 27. The reliability of the individual items is shown in Appendix 28 where it can be seen that on the basis of percentage agreement and kappa coefficients, all variables are clearly of acceptable reliability. The validity of the symptoms was examined in a comparison of incidence among normal patients and low back pain patients. The results are shown in Appendix 29 where five of the symptoms clearly differentiate normals from patients. The other two variables, had they been rated as positive in any of the normals would have led to exclusion as a normal control and so it is meaningless to ask about the extent to which normals and low back patients differ on these variables.

The correlation matrix of the seven variables is shown in Appendix 30 and the internal consistency (theta) with factor loadings on the first unrotated principal component shown in Appendix 31. They form a less homogeneous group than the items of disability (this chapter) or the inappropriate signs (Chapter V) but are sufficiently homogenerous to permit retention as a scale.

In order to validate further the integrity of this group of variables it was considered necessary to demonstrate that they were statistically separable not only from the objective physical characteristics but also from inappropriate signs (Waddell et al, 1980). The comparison with objective physical characteristics is shown in Appendices 32 and 33. In view of the clinical similarity, although statistical separability of the two straight leg raising items, results

are presented with and without the second straight leg raising item.

In Appendix 32, a principal component analysis, with orthogonal rotation was carried out on six OPC items and the seven inappropriate symptoms. The analysis was then repeated on five OPC items (omitting SLR right) with the seven inappropriate symptoms. Consideration of the first and second factors (thirteen items) demonstrates that with the exception of previous surgery (prev surg) and time pattern (time patt) the items cluster as would be predicted. The findings are little affected by the removal of SLR right (twelve item analysis). It seems that the items of clinical history (previous surgery and time pattern) are capable also of psychological interpretation. As far as previous surgery is concerned, justifiction for including it as an item of physical impairment has already been made, but of course it is well known that the incidence of psychological problems increases with the amount of previous surgery (Waddell et al, 1979). Attempt has been made also to justify the inclusion of time pattern (essentially into chronic and recurrent) but of course it was the only OPC item based on subjective report of clinical history (see above). The analysis was repeated using only the OPC items based on physical examination, and the seven inappropriate symtoms. The results are shown in Appendix 33 where the items of OPC and inappropriate symptomatology are clearly distinguishable.

A similar analysis was carried out to compare the separability of inappropriate symptoms from inappropriate signs. The results are presented in Appendix 34. Pain at the tip of the tail-bone seems to fit both sets of variable, but with this exception the integrity of the symptoms would seem to be demonstrated. Since pain at the tip of the tailbone is rated on the basis of self report rather than elicited on the basis of self examination, it was considered appropriate to retain it as one of the symptoms. (In the earlier pilot

study, it had alligned itself much more clearly with the symptoms).

The incidence of each of the symptoms in normals, backache patients, nonback orthopaedic controls and spinal pathology patients is shown in Appendix 35. These symptoms appear with varying incidence in other clinical groups, but while they are inappropriate as far as low back pain patients are concerned, the scale is designed to be disease specific, for while some of the items may be considered inappropriate in other clinical disorders, there will alsmost certainly be additional inappropriate items identifiable in other disorders. This matter is considered further in Chapters VII and VIII. The distribution of scores out of seven is shown in Appendices 36 and 37.

Finally, differences on the score out of seven is considered for several groups of subjects Appendix 38. Using the scale backache patients are distinguished from normals, males from females and GP from problem referrals.

In conclusion, there is generally agreement that some symptoms in backache are inappropriate. Seven such symptoms have survived checks on reliability, validity and clinical integrity. They are distinguishable from objective physical characteristics determined from clinical examination, appear to have some overlap with items based on clinical history, and in general are fairly clearly distinguishable from inappropriate signs. Like inappropriate signs, they are perhaps best understood as a type of magnified illness presentation or illness behaviour distinguishable from physical pathology. They will be discussed in more detail in Chapter VI and VII.

IV 4 Modified Somatic Perception Questionnaire (MSPQ)

In view of the limitations of presently available scales for the measurement of perception of body functioning (Chapter II) it was decided to derive a new instrument specifically for patients with chronic backache. The derivation and con-

struction of the new scale now will be described.

Preliminary studies

First pilot study

An initial pool of 75 items drawn from seven questionnaires measuring aspects of anxiety were given independently to three senior clinical psychologists who were asked to identify those items which, on the basis of their clinical experience, were characteristic of patients presenting for the treatment of anxiety. Items selected by at least one of the raters were obtained and items referring to subjective agitation were excluded.

The resulting 43 item questionnaire, shown in Appendix 39 was given to a group of 72 consecutively referred patients attending departments of clinical psychology in one of five hospitals for the treatment of anxiety. The descriptive characteristics of this group are presented in Appendix 40.

On the basis of this study, 11 of the items were rejected because of low incidence, ambiguity (patients found them difficult to understand) or redundancy (correlation of $>$ 0.71 with other items. The specific reason for rejection is shown in Appendix 41.

On the basis of the first pilot study several changes in format were also introduced. Firstly, the use of a ten point numerical rating proved difficult for a significant number of patients. Examination of the clustering of scores at different points of the scale suggested that a four point scale would suffice. Secondly, since there was a perfect correlation between the 'extent' and 'frequency' ratings in 20% of the patients and a very high correlation (R>0.5) in a further 10% of the patients, it was decided to abandon the rating of frequency. Thirdly, the instructions were simplified and presented in a 'boxed' format with verbal descriptions of each scale point. Finally, since several patients in the pilot study reported flatulence, this was added to the 32 items to give the 33 item questionnaire

MSPQ used in the remaining studies. It is shown in Appendix 42.

Second Pilot Study

The revised questionnaire was given then to a second cohort of anxious patients (n=72) referred consecutively as before. Selected demographic and clinical characteristics of this group are shown also in Appendix 40 (above). In each of the pilot studies the patient was classified according to age, sex and principal diagnosis (made on the basis of the presenting complaint). (A comparison of the referrals to the different psychology departments showed no significant differences on any of these variables and so there is no reason to suppose that the samples of anxious patients were in any way unrepresentative of the population of such patients). In a number of instances patients were ascribed more than one diagnosis (in most cases agoraphobia and social phobia) and so the diagnostic categories total more than 100%.

Discriminant Validity Study

The incidence of individual items among the anxious patients (second pilot study) were compared with the incidences in a group of 100 visitors (consecutively obtained cohort) to two wards of a district general hospital. The exclusion criteria and general descriptive characteristics of this normal control group are shown in Appendix 43. Since the reliability of such information is unknown (Waddell et al, 1982), no further analysis of the control group characteristics is presented.

In view of the importance of distinguishing between perception of normal body functioning and heightened body awareness it was felt important to retain only those items which clearly differentiated between anxious groups and normals.

Each of the 33 items was examined to find the extent to which it differentiated between anxious patients and normals. The results are shown in Appendix 44 where it can

be seen that only 'blushing' and 'flatulence' failed to differentiate between the groups. Further examination of the distribution of scores indicated that a further three items occurred in $> 20\%$ of normals or in $< 25\%$ of anxious patients, and so, despite the statistical significance difference between the two groups, if used for the purpose of classification, would misclassify a large proportion of cases. 'Feeling hot in a particular part of the body', 'Desire to pass water', and 'Hands shaking' were therefore rejected.

Reliability Study

The MSPQ was administered to 40 consecutively referred patients with chronic backache who were asked to repeat the questionnaire at home the next day. Four patients were either unable or unwilling to complete this task satisfactorily. They were replaced by a further four patients consecutively referred. The demographic and clinical characteristics of the cohort of 200 patients from which these came is described above (Chapter III). There is no reason to suppose that the sample of 40 was in any way unrepresentative of the 200 patient cohort.

The test retest reliabilities were examined by means of Pearson product movement correlation coefficients and Kappa coefficients (which are generally used to measure inter-rater agreement but in this context can be thought of as making a correction for chance agreement, although the parallel is not an exact one). To maximize the reliability of the final scale, a conservative estimate deliberately was employed. A variable was rejected if it had a retest correlation of < 0.60 or a Kappa value failing to reach significance at the $p < .01$ level. With the exception of 'heart missing beats' and 'breathing becoming faster', all the variables met the criteria for reliability.

Parallel Form Study

The 33 items were reordered randomly and both forms of the questionnaire given to an unselected consecutive

series of 20 backache patients. Using Fisher's exact probability test (Armitage, 1971) the distribution of scores did not differ significantly on any of the items and the total scores (out of 99) correlated highly (r=0.89) on the two versions. It was concluded that there was no need to investigate further possibile order effects among the items.

Main Studies

Pilot Study of Chronic Backache Patients

The 33 item version of the questionnaire was then administered to 102 consecutively referred patients presenting with chronic backache. The demographic and clinical characteristics of this group are shown in Appendix 45.

The inclusion and exclusion criteria for this cohort were the same as in the main study (Chapter III).

Scale Construction

The incidence of scores for each of the items was examined to determine which items would have to be excluded as either being too common or too rare for the purpose of factor analysis Comrey (1978) 15 of the 33 items were endorsed by $<15\%$ of the back patients, although 8 of these were already excluded following the second pilot study (above). It should be mentioned that adopting Comrey criterion for factor analysis may lead to the retention of different items among different clinical populations. The 13 item scale about to be described is appropriate for patients with chronic backache. The 13 final items comprise a fairly heterogeneous collection of somatic and autonomic symptoms. The scale is shown in Appendix 46. The intercorrelations of the items of the 13 items are shown in Appendix 47.

Internal Consistency

Following Armor (1969) theta was selected in preference to alpha as a measure of internal consistency (or construct validity). The internal consistency was evaluated firstly in the pilot group of 102 chronic backache patients and cross-validated in a further series of 200 patients. The

theta values of 0.79 and 0.77 respectively suggest that the 13 items form a satisfactory scale. The values of theta, lambda (the first latent root), the percentage of variance accounted for by the first unrotated principal component and factor loadings for the two samples are shown in Appendix 48. Results for males and females are presented separately for reasons which will be discussed below.

Effect of Gender

In view of the frequently reported differences of males and females on all sorts of symptomatology (Ingham and Miller 1982) it was decided to examine differences between the sexes on the individual items of the MSPQ and on differences in interrelationships among items (Comparison of the individual items is shown in Appendix 49 when it can be seen that the scores for females in general are higher and where there is a significant difference, females score higher). Perhaps of more importance than the significance levels, which are dependent on the size of the sample, are the proportions of variance in the individual items explained by gender difference which in the pilot back group (n=102) ranged from 0 to 9%, and so although gender does not have a major effect, it seemed appropriate to examine the matter further.

Cursory examination of the correlation matrices separately for males and females suggested a different pattern of relationships among the individual items. The equality of covariance matrices therefore was assessed using Box's 'M' test based on likelihood ratios. (Mardia et al, 1979). (Using this procedure, the product of the number of subjects and the natural logarithm of the determinant of the covariance matrix for the entire sample is compared with the sample computation calculated separately for each of the sexes). In fact, differences between males and females proved highly significant for both the pilot study (n=102) and the main study (n=200).

In Appendix 48 it can be seen that the internal consistencies for the two groups of males are 0.79 and 0.78; while the

comparable figures for females are 0.85 and 0.83 respectively.

For the final scale, the factor score was computed from the square root of the average of the squares of the factor loadings in the two studies (for males and females separately).

As far as an overall measure of extent of somatic awareness is concerned, these differences in factor loadings are relatively trivial, but for the construction of factor scores, the sex differences would be of slightly more importance. Were any attempt made to produce an even shorter scale, as for example, by using only the highest loading items, then the differences between males and females would be of more importance.

Validity

There are a number of ways in which validity might be assessed.

Face Validity

Individually the items would appear to have face validity. Each represents a symptom which the patient is asked to rate directly. The final set of items were drawn originally from several questionnaires and rating scales, each of which, to a greater or lesser extent, were subject to validity checks. Furthermore, each of the items discriminates significantly between anxious patients and normals, and is sufficiently common among backache patients to be used for descriptive purposes.

Construct Validity

Considerable effort has been put into achieving construct validity of the scale and this is described above. The integration of differences between males and females in an overall measure of extent is also described above.

Content Validity

In view of its construction it was not considered relevant to compare the MSPQ with psychometric anxiety per se (which comprises both subjective and somatic anxiety). Since the scale does not include items relating to subjective anxiety,

but comprises only items of body awareness, it then becomes possible to examine the relationship between heightened somatic awareness and various sorts of psychological distress without artifificially elevating the relationships because of items in common, as happens for example, in the Minnesota Multiphasic Personality Inventory (MMPI) with the Hysteria and Hypochondriasis Scales (Graham, 1977).

The correlation between the MSPQ, the Zung Depression Inventory (Zung, 1965) and the first three clinical scales of the MMPI were investigated in a small study of 25 backache patients. Results are shown in appendix 50 where it can be seen that heightened somatic awareness shares variance with the MMPI Hysteria and Hypochondriasis Scales, and with the Zung (essentially a self-rating scale measuring depressive symptomatology) but is not related to the MMPI Depression Scale (which is much more heterogeneous in content than the Zung). It would appear therefore to have some relationship with emotional distress.

Clinical Validity

It was possible also to compare a number of the individual MSPQ items (and the factor score) with clinical symptomatology rated independently by an orthopaedic surgeon during the clinical assessment. The design of the study precluded a direct comparison of each MSPQ item with a corresponding clinical rating but for eleven of the 13 items some sort of comparison was possible. The results are shown in Appendix 51 where the correlation of the individual clinical ratings with the MSPQ factor score is also presented.

Experimental Validity

In a small experimental study on a sample of 42 of the 200 back patients in the main study, the MSPQ factor score and three of the individual MSPQ items were compared with pain threshold, tolerance and ratio, using ischaemic pain produced by Sternbach's (Sternbach, 1978) adaptation of the submaximum effort tourniquet technique; the McGill

Pain Questionnaire (Melzack, 1975) and electromyographic readings from the erector spinae muscles following Floyd (Floyd and Silver, 1955) with biceps as a non back pain related 'control site'. Further procedural details are outlined elsewhere (Bienkowski, 1980).

The results are shown in Appendix 52. The results are difficult to interpret but heightened somatic awareness would appear to have no relationship with experimental pain using the submaximum effort tourniquet test, confirming Sternbach's strictures (Sternbach, 1974) on the dangers of underestimating the differences between experimental and clinical pain.

Heightened somatic awareness is also clearly related to the rating of pain using verbal descriptors . although for reasons which are unclear, perceived tension in specific muscle groups bears a far closer relationship to pain ratings than does generalized somatic and autonomic awareness. Given the small number of subjects in the experimental group it is perhaps hazardous to read too much into these findings. The relationship between the McGill and the MSPQ will be examined however in a further study of 120 patients, the data for which has just been collected (Main, in preparation

There would appear to be no relationship between somatic awareness and muscle tension in the biceps. The significant negative relationships between specific and generalized somatic awareness and muscle tension when standing are difficult to interpret and seem to merit further investigation.

Predictive Validity

The question of redundancy across types of psychological information is seldom considered. The MSPQ has been shown to be important in the understanding of functional disability in chronic backache (Main and Waddell, 1982) and in conjunction with depressive symptomatology appears to be a far more sensitive measure of psychological distress than traditional psychometric measures of personality traits (Main 1984) It is at present included in studies of the outcome of

spinal fusion and chemonucleosis and is to be included in studies of the outcome of response to treatment in multi-disciplinary pain clinics.

Discriminant Validity

The number of items endorsed in normals and in various clinical groups are presented in Appendices 53 and 54. In Appendix 53 the percentage of each group endorsing a particular number of items is shown. In Appendix 54 the cumulative percentages are depicted.

Finally the mean number of items endorsed by different clinical groups is shown in Appendix 55. This information is accompanied by a number of paired comparisons.

It can be seen that the MSPQ differentiates backache patients from normals (as would be expected from its construction), and that males and females are significantly different in their rates of endorsement. The test also differentiates, however, between routine back referrals (GP's) and problem back referrals (problems); and between backache and osteoarthritic or rheumatoid patients.

Conclusion

The statistical properties of this new scale have been described in this chapter. The scale plays an important part in the testing of the hypotheses and the related theoretical models. It will be discussed more fully in Chapters VI and VII).

CHAPTER V CROSS-VALIDATION OF OTHER ASSESSMENT MATERIALS

Inappropriate signs

Clinical descriptions of inappropriate signs have already been reviewed (Chapter II) and the standardization of a set of inappropriate signs (previously termed 'nonorganic signs') has been previously published (Waddell et al, 1980; Waddell et al, 1982). The original eight signs were scored according to a scoring system which combined the signs into three sets of two and two individual signs giving five types of physical sign. The description of each of the variables is given in Appendix 56, and are shown in Figures 1 to 6.

Original pilot studies had determined that certain physical signs were inadequate. The reason for rejection for these signs is shown in Appendix 57. Although satisfactory data on this scale had been previously published, it was decided, for the purpose of this thesis, to attempt some cross validation of the scale in order to permit comparison with the new scales described above (Chapter IV) and to confirm the change in the scoring system (scored as individual items instead of as type of sign (see above)). The reliability of the individual items is shown in Appendix 58 where all items can be seen to have a satisfactory value for inter-rater agreement. The ability of the items to differentiate between backache patients and normals is shown in Appendix 59 where it can be seen that the signs are specific to backache.
The relationship between inappropriate signs and other clinical data (derived from the 182 pilot study) is shown in Appendix 60 and with the first three scales of the MMPI in Appendix 61. From the last two scales it can be seen that the inappropriate signs scale (based on the final items described below) has some relationship with 'psychological variables'. This relationship will be investigated in more detail later (Chapters VI and VII).

The construction of the scale now will be described. As before (Chapters III and IV) the method of scale construction

was principal-component analysis using theta as the measure of internal consistency. Following examination of the incidence of the individual signs on backache it was necessary, following Comrey's criterion (See Chapter III) to exclude one of the items, 'regional sensory signs' on account of its rarity. The correlations among the remaining seven signs are shown in Appendix 62.

The internal consistency of the seven item scale is shown in Appendix 63 for the main study (0.83) and for the cross- validation series (0.87). It is of importance for the theoretical arguments developed later (Chapter IV). The inappropriate signs are compared with all the original items of objective physical examination (only some of which were used for the final scale) in Appendix 64. With the exception of localised lumbar tenderness (which was excluded from the final scale), the inappropriate signs and items of objective physical examination are clearly separable. A further comparison of the inappropriate signs with the objective physical examination items included in the test of the theoretical model (Chapter VI and VII) is presented in Appendix 65. The results are presented with the two straight leg raising items included (L.H. side of table) and with only one (R.H. side of Table) since although statistically non-redundant, it might be considered that, on theoretical grounds, including both the straight leg raising items in a factor analysis would artifically elevate the separability of the two sets of signs. In fact, the results proved almost identical. The sets of inappropriate signs and objective physical examination items are clearly separate.

The incidence of the individual inappropriate signs in normals and in various clinical groups is shown in Appendix 66. The distribution of scores out of seven as shown in Appendices 67 (as percentages) and 68 (as cumulative percentages). The means and standard deviations of various groups, with associated paired comparisons are presented in Appendix

69 where it can be seen that inappropriate signs are a feature of backache patients rather than normals. Females score significantly higher than males but the problem backs are not different from the routine GP referrals. The differential importance of inappropriate signs in the prediction of disability for males and females will be discussed in Chapters VI and VII.

Pain Scale

The rating of pain using visual analogue scales has already been reviewed (Chapter II). Despite ambiguities in its interpretation, it is perhaps the most widely used type of pain assessment in medicine. The distribution of scores (using the 100mm scoring system) for various clinical groups is shown in Appendix 70. The research design precluded the investigation of pain scores among normals since they were excluded from the control group if they reported current pain. The non-back orthopaedic controls are used for comparison purposes. Problem backs report significantly more pain than routine GP referrals; females score higher than males; patients with osteoarthritis or rheumatoid arthritis have comparable scores to chronic low back pain patients; osteoarthritic and rheumatoid arthritic patients score significantly higher than patients undergoing minor orthopaedic procedures and rheumatoid patients score significantly higher than osteoarthritic patients. The scale would seem therefore to have some validity.

Pain Drawing

The Pain Drawing used in this study and its scoring system is presented in Appendices 71 and 72.

The Pain Drawing is part of a set of further studies and only a brief consideration of its validity and scaling characteristics will be presented here. It has been used in a number of North American studies in conjunction with the MMPI. The limitations of the MMPI have already been discussed (Chapter II). In a group of 109 patients, an organic/psychogenic diagnosis made on the basis of MMPI

profiles was compared with scores on the Pain Drawing (using >2 as the cut-off). The results are presented in Appendix 73. The sensitivity and specificity of the pain drawing using the MMPI dichotomisation as the criterion is shown. With that group of patients there appears a fairly close relationship with the MMPI. Results from a second North American study are shown in Appendix 74. In this case, although there is still a significant association between the Pain Drawing and the MMPI-based psychologist's evaluation ($p < .02$), there is also a high level of misclassification. A comparable examination of the relationship between MMPI-based evaluation and the Pain Drawing is shown in Appendix 75 for a sample of British low back pain patients (n=54). Although there is a fair measure of agreement shown on the absence of psychological features, there is very little agreement shown on their presence. The interpretation of the relationship between the two tests, therefore, is still a matter of conjecture.

Using Ransford's scoring system (Ransford, 1976) the utility of the test is shown in Appendix 76. Although there is a high level of agreement on the side of pain (92%) and in discrimination between referred leg pain and root pain (96%) there is less agreement on the overall anatomical pain pattern (76%). The test-retest reliability is also shown. The advisability of using a cut-off (either at >2 or at >3) in preferance to the total score is indicated.

A more detailed analysis of the effect of scaling at this stage was beyond the resources of the present investigator. The scores out of seven are shown for various clinical groups in Appendices 77 and 78 where it can be seen that only a small proportion of patients have a score of >2. The statistical limitations of using such a short scale as a major variable is one of the reasons that the pain drawing will not be considered in detail. Its lack of incremental validity is considered in Chapter VI and VII. Given the aforementioned limitations, the test does differentiate females from males,

problem backs from routine GP referrals, osteoarthritic and rheumatoid patients from patients with minor orthopaedic problems and rheumatoid from osteoarthritic patients. (Appendix 79) and so, like the pain scale, it would appear to have some validity.

Illness Behaviour Questionnaire (IBQ)

Research using the IBQ has already been reviewed (Chapter II) and a number of problems (or missing information) regarding its construction and validation have been identified. It was decided that a major re-examination of the questionnaire was necessary prior to its inclusion in the thesis. Since no new items had been added to the first two scales in the development of the new 62 item version from the old 52 item version, it might have appeared hardly necessary to re-examine those, but since virtually no examination of the statistical characteristics of the scales on a British Sample of patients has been published, it was decided to include all seven scales in the general reappraisal. The 62 item questionnaire is shown in Appendix 80 (the 52 item version in fact consists simply of the first 52 items of the 62 item version). The factor loadings on the original 52 item version are shown in Appendix 81 where a number of limitations clearly can be seen. Firstly, the number of items on the scales varies considerably; secondly, the shorter scales account for extremely small proportions of variance, and thirdly, the inclusion of a demographic variable (age) on factor seven seems puzzling. (The third limitation will be considered when scale 7 is considered). An attempt by Pilowsky to validate the patients scores by requesting a relative or friend also to complete the questionnaire as they thought it would have been answered by the patient is in Appendix 82. The test-related reliability of the scales using Pilowsky's 'ad hoc' measure of scale construction are reproduced in Appendix 83.

The seven scales will now be considered in turn, beginning with the scales rejected for inclusion in the thesis. Enough

evidence to permit rejection of the scale will be presented.

Scales rejected for use in thesis

Scale 2 Disease Conviction

The incidence of individual items in normals and back patients is presented in Appendix 84 where items 10 and 40 do not appear to differentiate between backache patients and normals. The difference between these two items is further shown by the correlation matrix (Appendix 85). The extremely low level of intercorrelation produces an unsatisfactory level of internal consistency (Appendix 86) where the extremely low factor loadings of items 10 and 40 are evident. When the items are subject to varimax rotation (Appendix 87) the separate identity of the two sets of items is clearly demonstrated. The analysis indicates that the scale of disease conviction is non-unitary and should not be used as representative of a single dimension.

Scale 3 Psychological vs Somatic Concern

The incidence of items on the 52 item version of the scale is shown in Appendix 88, and endorsement among back patients is so low on items 11 and 44 that these items should not be used for any further scale construction. The correlation matrix for the 5 items on the 62 item version is shown in Appendix 89. Only items 16 and 46 intercorrelate to any meaningful degree. This lack of association is reflected in the values for internal consistency shown in Appendices 90 and 91 where a consideration of the factor loadings confirms the non-homogeneity of the scale. Interestingly, the addition of the extra item reduces the internal consistency of the scale. For the above reasons, it was decided not to use the scale.

Scale 6 Denial

The incidence of the individual items, with the additional item, is shown in Appendix 92. The incidence of these items among back patients is more acceptable for scale construction and the correlation matrix (Appendix 93) seems a little

more promising but although the internal consistency (0.58) is higher than for the previously rejected scales, the factor loadings demonstrate that item 41 clearly does not belong on the scale. A case might have been made for simply omitting that item but this would make comparability with other studies impossible. Furthermore it would leave only a three-item scale, with the effect of producing an extremely limited range of scores. The scale therefore was not included.

Scale 7 Irritability

The frequency of the individual items for the 52 and 62 item versions are shown in Appendix 94. The distribution of frequencies suggests that the items hold more promise for the construction of a scale but the inclusion of age as a dichotomous variable is unsatisfactory on theoretical grounds since it makes it exceedingly problematic to examine the relationship between the scale and demographic factors. The correlation matrix, the factor loadings and the internal consistencies are shown in Appendix 95. It can be seen that on statistical as well as theoretical grounds, age should not be included. Nonetheless the internal consistency excluding age is actually higher than when including it. This suggests that scale should be reconstructed and validated without the inclusion of age. (Age can be taken into account in the production of normative data). Unlike the previously rejected scales, scale 7 at least holds some promise but since a major reconstruction of the IBQ is beyond the remit of the thesis, it was considered safer to retain only those scales about which there were no major theoretical or statistical concerns. The scale was therefore excluded.

A summary of the reasons for rejection of the scales is shown in ~~Table~~ Appendix 96.

Scales retained for use in thesis

Scale 1 General Hypochondriasis

The incidence of individual items among normals and backache patients is shown in ~~Table~~ Appendix 97. While the incidence

of some of the items is a cause for concern (particularly 24 and 38, but also 9, 20 and 32), the percentage of variance accounted for by the first factor on Pilowsky's original factor analysis suggested the probability of a meaningful dimension. The reliability of the individual items and the scale are shown in ~~Table~~ Appendix 98 and they appear acceptable. The correlation matrix is shown in ~~Table~~ Appendix 99. The factor loadings and internal consistency are shown in ~~Table~~ Appendix 100. Despite the low incidence of some of the items and relatively low level of some of the intercorrelations, the size of the factor loadings are reasonably similar and the level of internal consistency just acceptable. Thus although it would be possible to improve on the scale, it was decided to retain it in its present form in this thesis as a major construction of the IBQ is beyond the resources for this thesis.

Means and standard deviations of scores of normals and of different clinical groups are shown in ~~Table~~ Appendix 101, selected paired group comparisons are also presented. It can be seen that although the difference between the total back group and the normals just reached statistical significance, no other differences among clinical groups were apparent (which anticipates some of the findings in Chapters V and VI).

Scale 4 Affective Inhibition

The incidence of scores in normals and in back patients is presented in Appendix 102. The incidences in the two groups appear fairly similar. The reliability of the individual items and scale was included above in Appendix 98. With a qualification concerning the reliability of item 62, the items and scale appear fairly reliable. The correlation matrix, factor loadings and internal consistency is shown in Appendix 103. The items appear to intercorrelate reasonably well. The internal consistency is not high but acceptable and the factor loadings reasonable although item 58 loads

somewhat lower. (The negative values for item 22 were simply a function of the scaling of the item and are of no statistical consequence). Means, standard deviations and selected paired group comparisons are shown in Appendix 104 where perhaps somewhat surprisingly, the scale fails to differentiate back patients from normals and discriminate among groups of back patients. Indeed, the scores are elevated only for osteoarthritic and rheumatoid arthritic patients. (These findings again anticipate the relative lack of promise for use of the scale with back patients).

Scale 5 Dysphoria (Affective Disturbance)

The incidence of the individual items in normals and in back patients are shown in Appendix 105. Each of the items has a higher endorsement rate among backache patients. The reliability of the individual items and the scale is shown above in Appendix 98 and would appear to be acceptable. The intercorrelations and factor loadings of the individual items are shown in Appendix 106. Those and the internal consistency of the scale are acceptable. Means, standard deviations and selected paired group comparisons of normals and various clinical groups are shown in Appendix 107. Unlike the previous scales, this scale differentiates between normals and back patients, within back patients and between sexes; although not between back patients and arthritic patients. (Although the statistics are not included in the Table, the scale also differentiated between arthritic patients and normals).

Conclusion

On statistical grounds, the IBQ has considerable limitations. Four scales as presently constructed are inadequate and there are problems with two of the remaining three scales. Work is at present being undertaken on a reconstruction and restandardization of the test for a British population but could not be completed for this thesis. Since the second-order scales are constructed from the first seven scales it was

decided to defer consideration of them until the test had been reconstructed. While a case easily could be made for the rejection of Scale 1, it has been included in view of its potential clinical importance. Although Scale 4 (Affective disinhibition) may prove to be more relevant in arthritis than in backache, it was retained for the thesis in view of its relatively acceptable statistical properties. Scale 5 (Affective disturbance) alone seems acceptable with little or no qualification.

DEPRESSIVE SYMPTOMATOLOGY

The original Zung self-rated depressive scale (Zung, 1965), sometimes referred to as the Zung, in this thesis is shown in Appendix 108. It was originally designed as self-report questionnaire incorporating four-scale points. It was redesigned in dichotomous form for use with pain patients (Sternbach, 1974) in order to be similar in format to the rest of his Health Index. The values for different clinical groups shown by him (Sternbach et al, 1973a; 1973b) were based on the dichotomous scale, although no extensive reconstruction of the instrument appears to have been undertaken.

The scale has an established pedigree (Chapter II) which confirms its validity as a measure of depressive symptomatology. The studies upon which this thesis is based were designed using the dichotomized version since it might afford some comparison with the work of Sternbach (1973a; 1973b; 1974; 1976) as at the inception of the research, Sternbach was one of the three or four foremost authorities on the psychology of pain. It was decided, however, to investigate the reliability of various versions of the scale in a small study of 20 patients who were given both the four-point Zung and the dichotomized Zung. The results are shown in Appendix 109.

The reliabilities are evaluated using Kappa coefficients, with associated statistics and significance levels. 'Nvar', an error estimate, is of less interest than the Null test

statistic, or NTS, which is distributed approximately normally. Consideration of the p values for Zung (four point) and ZD (artifically dichotomized, post hoc) marginally worsens the significance level; but the HIB (originally dichotomized scale) compares favourably with both the Zung and the ZD. Three of the twenty items on the HIB were unreliable; but given the greater number of unreliable items on the Zung, it would appear acceptable as a dichotomous scale. The reliability of the 20 point dichotomous scale is shown in Appendix 109.

The population used for comparison of back patients was from the same population basis as that upon which a new 23 item version had been developed (Cooke, 1980). The incidence of the individual items on the original scale and on the additional 3 items is shown in Appendix 110. the scores out of 20 and out of 23 are shown in Appendices 111 and 112 (percentages respectively and in Appendices 113 and 114 (cumulative percentages). The close correspondence between the 20 and 23 item versions can be clearly seen in each pair of comparisons.

The factor loadings of individual items and the internal consistency of the total scales are shown in Appendix 115 where it can be seen that, although the internal consistency of the 20 item scale is quite satisfactory (0.79) the 23 item scale used in the results (Chapter VI, VII) represents a slight improvement (0.81).

Finally, a comparison of the scores on various clinical groups (Appendix 116) confirms its validity. Females score significantly higher than males; problem backs higher than routine GP referrals and patients with osteo and rheumatoid arthritis significantly higher than minor orthopaedic conditions. The comparability of scores of arthritic and backache patients suggests that this sort of depressive symptomatology is a feature of chronic pain in general rather than backache specifically. Given the generally accepted value of this scale (Chapter II) it was not considered necessary to design

any further cross-validation for this thesis. (The relationship between chronic pain and the different depressive syndromes identified in the general population by Cooke (Cooke, 1980) is the subject of a further 120 patient study).

CROSS-VALIDATION OF OTHER ASSESSMENT MATERIALS

V 5. Eysenck Personality Questionnaire (EPQ)

In view of the extensive research on British subjects which led to the construction of this questionnaire (Chapter II) it was considered unnecessary to re-examine the statistical integrity of the scale or validate its use on a British population. The test-retest reliabilities and internal consistency reliabilities of the scale are reproduced in Appendices 117 and 118 respectively.

In view of the restricted age range (20 to 55 years) of back patients selected for assessment, the population norms for each scale were recalculated, separately for males and females. These are used as the basis for the group comparisons on each of the scales.

The figures for extraversion are shown in Appendix 119. The scale differentiates neither back patients from normals, nor male back patients from female back patients, nor problem back patients from routine GP referrals. The only difference is that patients with osteo or rheumatoid arthritis are more introverted than patients with mild orthopaedic problems.

Data for the Neuroticism Scale are shown in Appendix 120. Back patients are significantly less neurotic than normals, and this finding holds for both males and females. This confirms the inadvisability of using heightened neuroticism as a major theoretical construct in the study of chronic pain.

Similarly, using the psychoticism scale, a significant difference is found between back patients and normals for both sexes with the results demonstrating that back patients are less disurbed than the normal population, again confirming

that personality traits seem of little promise in explaining chronic backache (Appendix 121).

The so called 'Lie Scale', the interpretation of which has already been discussed (Chapter II) is the only scale which shows much initial promise in differentiating chronic pain patients from normals. The results are shown in Appendix 122, where both male and female patients score higher than their normal counterparts, female back patients higher than male back patients, problem backs higher than GP referrals, and rheumatoid arthritis patients higher than osteoarthritis patients. The explanation for these differences (and particularly the RA/OA difference) is explained by marked differences in the RA and OA group in age and sex. Indeed, the scale seems unduly susceptible to such influences.

In view of the Lie Scale finding, an attempt was made to reconstruct each of the scales by standardising scores within sex and decile age groups. Reanalysis of the data confirmed suspicions about the influence of extraneous variables. In view of this finding, the opinion was sought from the authors of the EPQ. They advised against using age and sex corrected scores and suggested that in the clinical use of the EPQ

'there are <u>patterns</u> of scores that should help rather than merely individual scores on the factors.

For example, high P and N with low E and exceptionally low L suggests addicts of all kinds, also personality disorders. High P, medium N and high L suggests schizoid or schizophrenic subjects etc.

Finally, we have found that there are subjects who record high lie scores but who do not change their scores on the other factors accordingly, hence we never extrapolate'. Eysenck (1980)

Despite considerable difficulties in attempting to carry out the sort of profile analysis or zone analysis (Eysenck,

1967) suggested, criteria based on standard deviations of individual scale scores permitted a very crude assignment to types and an operational measure was found for repressors, schizoids and addicts or personality disorder. Only 3 addicts were identified and 9 schizoids (all of whom were male). An examination of the means and standard deviations of the scores of the 17 repressors on the major clinical variables gave no suggestion that they were in any way different from the rest of the chronic pain patients. The investigation of such personality types therefore was abandoned.

The above considerations suggest that despite some promise of early work on the EPI (Bond, 1971), the questionnaire seems to hold little promise for use with chronic pain patients. In view of the colossal quantity of research using the instrument however, it was decided to retain the questionnaire. following Eysenck's further remark,

'I fear I could expand endlessly on what we now regard as a personality dimension in its own right rather than as a screening device against untruthful replies'. (Eysenck, 1980)'

High scorers were not excluded from the study and further investigation of the Lie Scale was not undertaken.

VI RESULTS

Introduction

The major hypotheses of the study have been described in Chapter I. Justification for selection and rejection of particular variables has already been presented. The research design is such that the stepwise multiple regression model, with a priori orders of entry into the regression equation, is the most appropriate. With the exception of the EPQ, each scale has either been constructed for this study or been cross-validated. Statistical confirmation of adequacy of scales has involved test-retest relability, discriminant validity, determination of scaling properties, assessment of clinical validity and internal consistency. An additional criterion, however, has been employed:- incremental validity (the converse of redundancy). It was realized initially that much of the information (particularly among the psychometric measures) would prove redundant and one of the aims of the study was to design a psychological battery appropriate for routine use in a general orthopaedic or rheumatological clinic. In such circumstances a variable, although correlating highly with disability might tell us no more than an alternative variable at an earlier stage in the regression equation. Had the order of entry of the two variables into the equation been reversed, the other variable might have been deemed redundant. There is no simple answer to this problem. It is however possible to make explicit the assumptions made in the design of each set of regression analyses.

(1) In view of the importance of identifying possible serious physical pathology, the clinician has to begin with a clinical history and physical examination. The assessment of objective physical characte istics were therefore considered first. This has the effect of 'loading the dice' against subsequent variables in that some of

the variance explained in the dependent variable by them may have already been removed because of shared variance with the OPC. While the order of the different classes of independent variables was decided on theoretical and clinical, rather than statistical grounds, the effect of inputting later variables before the OPC is also shown.

2. In so far as is possible, the effect of each new independent variable is shown at each possible stage in the regression equation.

3. The determination of dependent and independent variables was at times difficult, (especially with ratings of pain) but again the principle of parsimony has been employed. In fact the importance of pain ratings both as dependent and as independent variables is shown.

The reason for rejection for a number of variables has been discussed in the context of the particular type of variable (Chapters IV and V). Prior to assessment of the hypotheses, the reasons for rejection of the variables will be summarized.

The reasons for rejecting clinical information are shown in Table 01. The exclusion of age may seem surprising and were one to consider the total range of patients (ie including patients below 18 and above 55) then age might well be of importance. There are strong reasons, however, for limiting such an assessment procedure to the ages included in this study (Chapter III) and within this age range, age appears to have little or no effect in the prediction of functional disability.

Height and weight had been found from the 182 patient pilot study to be irrelevant and were not included in this study.

Reasons for excluding psychometric variables and scales are shown in Table 02. These have been discussed extensively in Chapter V.

A summary of the correlation coefficients of the major variables with the major dependent variables (disability) and secondary dependent variables (pain scale and time off work) is presented in Table 03. The high correlation with gender led to the examination of sex-interactions with the independent variables and the decision to include gender as the first step in the theoretical analyses (in order to produce a general model of the relationships among functional disability, physical characteristics and psychological factors having taken account of male-female differences).

Design of regression tables

Wherever possible the design of regression tables has been standardized. In the test of the six major hypotheses, the dependent variable is disability. The influence of the independent variable is considered directly (first in the regression equation); then after sex (second stage in the equation); after differences in objective physical characteristics have been taken into account (third stage), after current psychological distress or mood ie depressive symptomatology and somatic awareness (fourth stage) and finally after magnified illness presentation or illness behaviour ie signs and inappropriate symptoms (fifth stage). Thus, measures of the independent variable's direct influence and also its incremental validity (or non-redundancy) are obtained. The choice of statistic is discussed in Chapter III.

It is perhaps worth reiterating that the regression analyses have been designed to examine particular theoretical models and redundancy has to be considered in that light. Every patient receives a physical examination, it is therefore logical to look at the additional variance explained by psychological features. There are statistical and theoretical

limitations on the number of psychological features which can be examined in a study. Examination of the initial correlation matrix showed that depressive symptomatology and somatic awareness were highly correlated with disability. The value of other psychometrically obtained (or self report) psychological measures were therefore compared with them. Inappropriate symptomatology could be easily incorporated into the initial physical assessment.

The value of each independent variable in the prediction of disability is therefore considered, directly, then successively after successive statistical allowance has been made for gender, OPC and the two major classes (psychometric and clinical) of psychological variable. The actual variables used as 'covariates' are shown in Appendix 123.

Evaluation of Hypotheses

Hypothesis No 1:

Disability will be predicted by objective physical disease characteristics.

It is of paramount importance to ensure that any relationships found between psychological factors and disability are not simply a function of unaccounted variation in the fundamental disease characteristics. This hypothesis is of importance in establishing that the method of quantifying the objective physical characteristics is relevant to the understanding of disability. It would be absurd to offer a theoretical model in which there was no relationship between OPC and disability.

The relationship of the 7 item OPC with disability, pain scale and work loss was shown above in Appendix 24. In the main study 33.7% of the variation in disability is explained by OPC. This represents a highly significant level of prediction (significance of F-Ratio $< .001$). It represents the maximum amount of variance which could be gathered efficiently from the OPC variables (see Chapter IV) and would seem to

serve as a sound basis upon which more developed theoretical models (and associated hypotheses) can be built (using OPC as a set or covariates). Since the OPC assessment was specifically developed for this study, the hypothesis is in a sense artifactual, but in terms of inter-validity it is important to establish that there is a relationship between OPC and disability and to attempt further to quantify the strength of the relationship. The relationship between these two sets of variables has been used as the basis for an index of bodily impairment and is discussed in a forthcoming publication (Waddell and Main, 1984). The index is not presented as part of this thesis. The main purpose of the OPC assessment has been to establish a sound physical background against which the influence of psychological factors can be evaluated. Using the multiple regression methodology, the extent to which the OPC items independently form a homogeneous scale is of no material importance as for most of the analyses, the class of items serves as a covariate.

Hypothesis No.2

Functional disability will be explained by general personality traits.

The influence of general personality traits is shown in Table 04. In each case the influence of the psychometric variable is considered directly; after differences in sex are ruled out; after sex and OPC and so on. For the purpose of this analysis, 'mood' refers to current psychological stress (determined by the inclusion of depressive symptomatology and somatic awareness at the same step in the regression analysis) and illness behaviour refers to magnified illness presentation (determined by the inclusion of inappropriate signs and inappropriate symptoms at the same step in the regression analysis).

In considering Table 04 and subsequent tables the 'size of the effect' is best seen by examination of the $\%R^2$ changes.

Since the F Ratio is based not on the proportional increase in variance explained but on the proportional reduction in unexplained variance, it can be seen that on occasion the contribution of the variable later in the regression equation results in a higher F-Ratio and associated significance level.

Extraversion (EPQ)

The relationship between extraversion and disability is minimal even when placed first in the regression equation. When differences in OPC and gender are taken into account, the contribution is incalculable. Most previous research into extraversion has been on other populations than chronic pain patients. In reconstructing the norms of the EPQ for use in this thesis it was shown (Chapter V) that the extraversion scale failed to differentiate back patients from normals, nor indeed problem back patients from routine GP referrals. It would appear that the scale is insensitive within the chronic back patient population as well. This suggests that previous research (Bond, 1973) showing a relationship between pain and extraversion demonstrates a specific rather than a general effect; viz on female terminal cancer patients and their requests for analgesics. It may be that extraversion is related to treatment seeking, complaint presentation or some other facet of illness behaviour in a context in which, for example, there is an immediate and highly predictable relationship between the request for treatment and its delivery. The strength of such a relationship is unknown. Results from this study certainly demonstrate that there is no significant relationship between the personality trait of extraversion and severity of illness as measured by ratings based on subjectively reported disability.

Neuroticism (EPQ)

The results for neuroticism are shown in the same table. It has a stronger relationship with disability than did

extraversion. It explains 7.0% initially with this value dropping to 3.2% once differences in gender and OPC are taken into account. The prior addition of current psychological stress or mood (depressive symptomatology and heightened somatic awareness) reduces its contribution to 1.0% which represents a non-significance increase in prediction. Clearly neuroticism, depressive symptomatology and heightened somatic awareness overlap in their prediction of disability. Given the nature of the items which comprise the neuroticism scale this is perhaps hardly surprising, but the result is of some importance since it demonstrates that the apparent relationship between disability and neuroticism may be interpretated perhaps more plausibly as the result of current psychological stess, rather than as the result of longstanding personality problems. Of course it could be argued that longstanding personality problems, with the associated assumed deficiency in coping skills, might lead directly to the current psychological stress. Adopting the law of parsimony, however, it does not seem necessary to indulge in such elaborate theorizing. Coping with chronic pain and its associated disability is a clearly identified stress. The relative weakness of neuroticism as an explanatory variable can be seen by a comparison of Table 04 with the comparable figures for depressive symptomatology and somatic awareness shown in Table 07.

This view is supported by the normative data shown in Appendix 120. As a group, chronic back patients are in fact significantly less neurotic than normals, and this finding holds for both males and females. Although the difference reaches statistical significance, the actual difference in mean scores is very small and so it would perhaps have been inadvisable to overinterpret the finding. It certainly would appear that neuroticism as a longstanding trait is of little importance in the prediction of severity of illness.

Psychoticism (EPQ)

The contribution of this variable to the prediction of disability is shown also in Table 04. The explanatory power is negligible and in view of the considerable problems in its clinical interpretation (Chapter II) it seems unnecessary to consider it further. It was shown in Appendix 121 that back pain patients are if anything less disturbed (using this variable as a criterion) than normals, although the differences are slight.

Lie Scale (EPQ)

The 'Lie Scale' predicts 1.8% of the disability score when entered first into the equation, but this failed to reach statistical significance. Its contribution decreases successively with the prior introduction of the other independent variables. Although recently interpreted as a personality dimension in its own right, it originally was conceived of as a validity scale, a 'faking good' measure. The final regression structures were therefore re-run excluding patients in the highest 25% of scores on the Lie Scale. The regression structure and associated statistics proved virtually identical and so the matter was examined no further. The Lie Scale does not appear to be important in the prediction of severity of illness. It does however appear to have some discriminating power in differentiating back patients from normals, shows gender differences and also discriminates problem backs from GP referrals (Chapter V). It seems also unduly susceptible to age. The authors of the EPQ however advised against gender and age standardization of the scale and recommended instead a 'zone analysis'.

Zone Analysis (EPQ variables)

Following the recommendations of the authors of the EPQ an attempt was made to identify sub-groups of patients shown particular combinations of E, N, P and L scores. The attempt, described in Chapter V, was unsuccessful and led

led to no useful classification system using which the use of EPQ information might be extended. There are therefore no results to report.

Locus of Control

The locus of control scale devised to distinguish personal from political control not only showed no relationship with disability; and it correlated significantly with none of the major variables. Indeed its distribution of scores was so close in shape to a normal distribution that the data looked as if it had been created by the generation of random numbers. This particular locus of control scale tells us nothing about disability. The concept of attempting to relate the general cognitive-dimension of external-internal control to disability would appear to be misguided. The more specific health locus of control, multidimensional health locus of control and pain locus of control (Chapter II) seem of more promise but are as yet unexamined using regression models in general or the prediction of disability in particular.

Conclusion

The influence of the individual general personality variables has been considered and the hypothesis relating level of disability and general personality traits receives little support. The only variable showing any relationship with disability is neuroticism and this relationship disappears once differences in gender and objective physical characteritics have been taken into account. Further limitations in the variable have been discussed.

The combined influence of the general personality variables is shown in Table 06 where the five variables together predict 9.8% of the variance of disability. The relationship remains of significance when differences in gender have been controlled but falls to 4.9% (nonsignificant) when differences in objective disease characteristics have been taken into account. (Such influence as there is is explained almost entirely by neuro-

ticism).

The hypothesis of a relationship between disability and general personality variables therefore is initially confirmed but this is artifactual and disappears once differences in gender and objective physical disease characteristics have been taken into account.

Hypothesis No. 3

Disability will be explained by specific hypochondriacal fears and beliefs.

In view of the statistical inadequacies of other hypochondriacal scales (Chapter V), the only variables retained for this stage in the analysis were general hypochondriasis (IBQ1), Affective Inhibition (IBQ4) and Affective Disturbance (IBQ5). The results are shown in Table 05 the interpretation of which is identical to the preceding table.

General hypochondriases (IBQ1)

General hypochondriasis makes a weak but statistically significant contribution initially to the prediction of disability. This relationship is weakened with the prior insertion of sex and OPC differences. Its relationship with disability virtually disappears with the introduction of current psychological stress (mood) and illness behaviour (inappropriate signs and inappropriate symptoms) into the equation. It was shown in Appendix 101 (discussed in Chapter V) that back patients differed significantly from normals on this scale, although the size of the effect, in terms of differences in mean, was small; and within the chronic back group no discriminative power was evident. The hypothesis, as measured by this variable, receives some support, although the association with disability is weak and the contribution non-unique. (It may prove a better predictor of response to psychological methods of management, although this hypothesis is as yet untested). Beliefs about illness per se and changes in self-image as a result of pain and disability seem surprisingly

unimportant and perhaps contrary to prediction. Most of the questions are phrased in terms of 'illness' and it may be that the majority of patients (certainly in the West of Scotland) do not construe chronic backache as an illness and therefore differentiate back-related disability from disability related to other forms of ill-health. Thus, they may not see themselves as 'invalids' but as having a back-related disability. It may also be that the questions are too 'psychological' in nature or subject to a 'faking-good' bias. The matter would seem to merit further consideration.

Affective Inhibition (IBQ4)

It was shown in Appendix 104 (discussed in Chapter V) that the scale failed to differentiate between back patients and normals; and among groups of back patients. It can be seen from Table 04 that its contribution to the prediction of disability, even when placed first in the regression equation is minimal and it would appear therefore to have no relevance to the understanding of severity of illness. Questions concerning the uniqueness or non-redundancy of its contribution do not therefore arise.

Affective Disturbance (IBQ5)

It was shown in Appendix 104 (discussed in Chapter V) that, unlike the previously discussed IBQ scales, the scale differentiates between normals and back patients; within back patients and between sexes. In Table 05 it can be seen that this scale also seems more promising in the prediction of disability. Its initial level of prediction of 5.5% falls only to 3.2% (still statistically significant) when controls for sex and OPC differences are incorporated. However, like neuroticism, it clearly overlaps with the 'mood' variables (depressive symptomatology and heightened somatic awareness) and the relationship with disability is marked attenuated indicating its redundancy when used in combination with the 'mood' variables.

The hypothesis is therefore supported for general hypochondriasis and for affective disturbance, but not for affective inhibition; although the relationship of both with disability is attenuated with control for gender and OPC differences, and disappears when current psychological stess (mood) is taken into account. The effect of these variables in combination in Table 06 where they are also compared with the joint contribution of general personality variables. The combined initial contribution of 6.1% (significant) falls to 4.6% (still significant) with control for gender and OPC, but disappears with the introduction of 'mood' variables. The comparable figures for the general personality variables are 9.8% initially falling to 4.9% (non-significant) after sex and OPC control and then to 1.9% after 'mood' variables. (The apparent discrepancies between percentages of variances and significance levels in the two groups is explained by difference in the numbers of variables in the two classes).

Hypothesis No. 4

Disability will be predicted by depressive symptomatology and heightened somatic awareness.

For reasons outlined in earlier chapters, depressive symptomatology and heightened somatic awareness were considered the most appropriate measures of current psychological stress (designated as 'mood' in the tables). The influence of these two variables singly and jointly on disability is shown in Table 07. In view of the significant interactions with sex (unlike previous variables), interaction terms are included for each of the major variables. The influence of the four variables in combination is also shown in the right hand third of the table. The data can be interpreted in exactly the same way as the previous regression tables.

Depressive symptomatology (+ interaction) is highly predictive of disability and still explains 8.0% of the variance when differences in sex, OPC and magnified illness

presentation (illness behaviour) are included. The figures for somatic awareness are of comparable magnitude and the relationship with disability remains significant even at the last stage in the equation. As expected, the variables in combination represent a powerful influence on disability. The final value of 10.3% demonstrates that depressive symptomatology and somatic awareness have variance in common.

The findings are consistent with the literature indicating the importance of depressive symptomatology in chronic pain patients. The results for depressive symptomatology using the scale used in this thesis offer strong confirmation of the hypothesis. Results for somatic awareness are of comparable magnitude. Although the two variables unsurprisingly, intercorrelate, when used in combination produce an even higher level of prediction. It is apparent from Table 07 that there is overlap in variance between the 'mood' variables and the illness behaviour variables, but a case for retaining all four variables can clearly be made. The relationship between the variables is discussed later in this chapter, in Chapter VII and elsewhere (Main and Waddell, 1983).

Hypothesis No. 5

Disability will be predicted by magnified illness presentation (illness behaviour)

The influence of magnified illness presentation, or clinically assessed illness behaviour as represented by inappropriate signs and inappropriate symptoms is shown in Table 08. The interpretation of the Table is as previously. Once again the independent variables are shown singly and in combination. Inappropriate symptoms are highly predictive of disability (38%) even when differences in sex, OPC and current psychological stress are controlled (7.1%). The comparable figures for inappropriate signs are 30.5 and 3.8%. When the variables are considered jointly, the initial prediction level of 45.2% reduces to 8.4% when the usual

controls have been applied. Once again there would appear to be a degree of overlap between the two variables.

The hypothesis is therefore strongly supported whether inappropriate symptoms, inappropriate signs or the two variables in combination are used as predictors. They would seem of comparable importance to the 'mood' variables in the prediction of disability. They share variance in common with the 'mood' variables but still make a noteworthy unique contribution to the prediction equation. The significance of these findings will be considered further below.

Hypothesis No.6

Disability will be predicted by subjective pain ratings

The results are shown in Table 09.

As would perhaps be expected, subjective pain ratings are predictive of disability and the Pain Scale and Pain Drawing predict 14.7% and 9.3% respectively. The prediction level falls slightly after control for gender but drops dramatically (to 2.5% and 1.5%) once differences in OPC are incorporated. This seems to demonstrate that, assuming a proper physical assessment has been carried out, subjective pain rating adds little to the understanding of disability. Indeed the introduction of the psychological stress variables (mood) effectively eliminates the utility of pain ratings.

A comparison of the figures for pain ratings just outlined compared with the same figures for the major independent variables in Table 13 demonstrates that they are much less important in the prediction of disability than are the major psychological variables (whether psychometric or clinical).

This although the hypothesis of a relationship between disability and the rating of pain is confirmed when a visual analogue scale or the Pain Drawing is used, the information gained about the prediction of disability is largely redundant once gender, and more importantly OPC differences are taken into account. Problems in the quantification of pain were

reviewed in detail in Chapter II and problems in an undimensional interpretation of pain were highlighted. It would appear that the sensory component in the ratings may be accounted for by OPC differences and the remaining (and much smaller) affective component proves entirely redundant when depressive symptomatology and heightened somatic awareness are taken into account. The value of rating of pain per se, certainly using these two scales, must therefore be seriously questioned. Whether the Melzack Pain Questionnaire (Chapter II) will represent an improvement is a matter for emperical evaluation (which will be undertaken by this author in a later study for which the data has been collected).

ADDITIONAL ANALYSIS

The influence of other clinical history variables

The influence of three other clinical history variables is shown in Table 10. As before, the dependent variable is disability and the interpretation of the table is the same as that of the preceding tables. The independent variables, considered separately are: duration of symptoms, source of referral and time off work.

Duration of symptoms

Duration of symptoms is predictive of disability, explaining 3.3% initially but falling to a nonsignificant level with controls for gender and OPC. This modest influence is at first sight surprising until it is realized that acute patients have been excluded from the study. It may be that once the pain and its associated disability have become chronic then the actual duration of symptomatology becomes of less importance. Clinical history variables in general have poor reliability (Waddell et al, 1982) and this may contribute to the poor level of prediction. Duration of present episode rather than duration of symptomatology has been considered in a later study, but particularly with patients having intermittent exacerbations on a chronic lower but still detectable pain

level, this variable also is somewhat problematic.

Source of referral

Source of referral is of importance in the prediction of disability in this study. Patients from a medico-legal source of referral were excluded and so the distinction is that between patients referred directly from their general practitioner, and patients referred secondarily from other hospital specialists (primarily neurosurgeons or orthopaedic surgeons). Unfortunately it is difficult to generalize about the importance of such a variable, in that its importance may be widely variable from clinic to clinic since it will depend not only on the primary care agents' use of the specialist facility but also on the referral acceptance policy. The final composition of the clinical cohort under investigation will depend also on liaison arrangements among specialists, and the receiving surgeon's credentials as a specialist. The latter may also vary with the passage of time as the reputation of the specialist becomes established (or tarnished). In this study there were clear differences between routine GP referrals and problem referrals on almost all of the major variables. Much of the difference would seem to be accounted for by differences in physical and diagnostic problems in that the initial proportion of variance accounted for by the variable (15.4%) dropped markedly to (4.6%) once OPC differences had been taken into account. The incremental value of source of referral as a predictor once other differences on the major variables have been removed falls to 0.8% which reaches significance (in view of the large number of cases and the relatively small amount of variance in disability remaining to be explained), but is hardly worth interpreting.

Time off work

Unlike duration of symptomatology, this variable is probably of reasonable reliability and had it been intended to use this as a major variable, its reliability would have

been assessed formally. It was clear from the initial pilot study of 182 patients that there were major problems with its clinical validity. Quite simply, not only are there a series of reasons for absence from work for a particular duration, in some instances there may be several factors operating simultaneously, and some of these may have nothing to do with the severity of their illness per se. However there is not surprisingly a strong association between disability and time off work, although the initial prediction of 31.8% is markedly reduced to 12.1% (once sex and OPC differences are removed) and falls to 4.3% once the 4 major psychological variables are included.

Additional analyses.

The influence of social factors

The influence of social factors in the prediction of disability are shown in Table 11 which can be interpreted in a similar way to the previous table. For the purpose of this analysis, social class and work-type were coded as continuous variables, rather than as dummy variables. The analysis proved difficult because of the marked sex difference in social class (somewhat surprising) and worktype (unsurprising). This necessitated the inclusion of interaction terms which contributed a large amount of variance. Unfortunately this had the effect of lowering the tolerance level for the inclusion of later items with the result that in order to evaluate the influence of social class and work type later in the regression equation it was necessary to exclude the interaction terms (sex x MSPQ and sex x Cooke 1). the results are therefore tentative but suggest an influence of social class and heaviness of job on the amount of disability. Since these variables are but a first attempt to look at the 'social domain' further interpretation is not offered.

The effects of social factors on disability, self-rated pain and work loss (time off work) are shown in Table 12.

The same qualifications about statistical interpretation made for the previous table must be made. The relationships of social factors with disability have already been described. Social factors also have some relationship with self-rated pain although the significance of the relationship disappears once differences in sex and OPC have been taken into account. A much stronger relationship is evident between amount of work loss and disability. This is to be expected, for it would be remarkable if social class, and work type were not related to degree of work loss, in view of the widely differing demands in terms of strength, mobility and agility of different jobs (and across social classes).

As discussed under limitations of the thesis (Chapter VII) these data should be considered as preliminary information pending the development of a satisfactory assessment of social and occupational factors.

Importance of the major types of independent variable

An attempt is made to integrate the findings of several previous tables in Table 13. This table differs in structure from the previous tables. The effect of each of the six classes of independent variable, quite separately, is considered in the prediction of disability when the variables are entered together either first in the regression equation (left hand side of the table) or after differences in sex and OPC have been taken into account. The relative weakness of general personality variables and hypochondriacal fears and beliefs can be clearly seen (4.1% and 4.6%) when compared with depressive symptoms (13.4%) somatic awareness (21.1%) inappropriate signs (13.4%) and inappropriate symptoms (16.2%). The figures for pain scale and pain drawing (discussed above) were 2.5% and 1.5%.

Perhaps this table can be considered a summary of the important results of the thesis and as a justification for a change in emphasis in the type of psychological factor traditionally considered in chronic low back pain. This

is discussed further in Chapter VII

The Nature of Magnified Illness Presentation (MIP)

A case has been made (Chapter II) for considering MIP as one facet of consultation behaviour. The determinants of illness behaviour are complex and may include a wide variety of personal, social and environmental factors. An attempt is made to evaluate the extent to which the inappropriate signs and symptoms themselves are explained by clinical, occupational and psychological variables. The signs and symptoms are considered separately as dependent variables in Table 14. The rating of pain is of comparable predictive value for signs and symptoms, explaining 12.6% and 12.9% of the variances respectively. The additional contributions for objective physical characteristics (OPC) and disability are also comparable. The first three variables predict a total of 41% and 46.3% of the inappropriate signs and inappropriate symptom scores, confirming their clinical validity and suggesting a complex interrelationship among the variables. The additional contributions of duration of symptomatology and time off work are negligible. General personality variables are of no incremental value but there is evidence of a contribution of specific hypochondriacal fears and current psychological distress (labelled mood) which reach statistical significance in the case of inappropriate symptoms.

Clearly there is a danger in a cross-sectional study using a variety of independent and dependent variables to exploit the flexibility of multivariate techniques to the point of meaninglessness if not absurdity. Certainly circularily of argument must be avoided. A brief analysis of inappropriate signs and inappropriate symptoms is presented at this point in that a case has been made (Chapter II) for considering such phenomena as facets of consultation behaviour or health-care seeking, the determinants of which are surely varied and complex. As with the social data just described, this analysis

is very much a preliminary attempt to consider a little understood phenomenon. Assuming that we can assume the pain scale gives a measure of perceived pain intensity (and as was pointed out in Chapter II there are strong objections to such a simple interpretation), it would seem that pain intensity, OPC and degree of disability are all important determinants of both inappropriate signs and inappropriate symptoms. In a later study (Waddell et al, 1984) it is shown that the amount of previous conservative treatment (by definition mainly failed treatment) is also an important predictor particularly of inappropriate symptomatology. This suggests that magnified illness behaviour or presentation may be at least in part an iatrogenic phenomenon. The importance of inappropriate signs and symptoms in the prediction of outcome of treatment is at present under investigation but data are not at present available. The nature of illness behaviour and its relationship with disease is discussed more generally in Chapter VII.

The effect of gender on many facets of illness presentation was considered in Chapter II and an attempt has been made to take into account statistically gender differences whenever possible throughout the thesis. The preceding analysis was repeated for males and females separately. The results are shown in Table 15. Once again the dependent variables are inappropriate signs and inappropriate symptoms, considered separately. Some interesting findings emerge. The influence of OPC is much more marked on both the dependent variables among females than among males. The inappropriateness of these signs and symptoms was defined initially in terms of knowledge of anatomy and physiology, and variation with time and activity. These data suggest that females tend to respond much less specifically to pain problems than males, or perhaps given a pain problem are either much more insistant in their complaint presentation (to the extent

that they exhibit a much more general 'cry for help'), or become much more easily sensitized to a wide range of symptomatology. However, it is perhaps sufficient at this stage simply to document the findings and leave the interpretation to await further research. While the influence of disability, social class and worktype are of comparable importance in the two sexes, depressive symptomatology seems more important among males and somatic awareness among females in the prediction of inappropriate signs and symptoms. (The results of a subsequent study already mentioned showed that symptoms are affected by the amount of failed conservative treatment while, particularly among men, medico-legal factors have a relationship with inappropriate signs).

Early references to inappropriate symptomatology in the medico-legal literature (Chapter II) discussed such clinical phenomena in the context of fraud and malingering. It was beyond the remit of this thesis to examine the matter in depth, but although referrals from medico-legal sources were excluded from the study, there were a number of patients in whose pain problem medico-legal factors (past, present or planned) could be identified. It was decided to examine the extent to which the inappropriate signs and inappropriate symptoms, separately could be explained by the presence of medico-legal factors. The results are shown in Table 16. A small but significant relationship with signs of 2.8% is apparent but disappears when OPC, mood, disability and social factors are also taken into account. The influence on inappropriate symptoms is negligible. There is no evidence of any substantial relationship between magnified illness presentation therefore and medico-legal involvement in this study, but the subject merits a more careful study. (As discussed in the next chapter, it may be possible to identify a separate set of inappropriate symptoms specific to medico-legal circumstances).

VII DISCUSSION

Resume of aims and methodology of study

This thesis represents the main part of a series of studies carried out with the objective of improving methods of assessment, evaluating the importance of psychological factors and designing efficient screening procedures for patients being investigated for chronic low back pain. A major concern has been to identify items which are reliable and are a feature of chronic low back pain. The construction of new scales has been undertaken in order to represent different types of clinical information, and scales produced by other investigators have been examined to assess their statistical properties and their utility in the context of chronic low back pain. The significance of various types of information has been examined in the prediction of severity of illness as represented principally by functional disability. The evaluation has consisted in the investigation of a number of linked hypothesis, and further analysis, enabling the consideration of the relative significance of physical and psychological factors, and leading to a general discussion about the significance of the findings for the assessment and treatment of chronic low back pain.

Evaluation of hypotheses

The relationship among the objective physical characteristics and disability is of importance since failure to identify the important physical characteristics would have serious consequences for the evaluation of psychological factors. Simply, without such a safeguard, any relationship found between disability and a psychological factor could be given an alternative interpretation, viz it could be the result of differences in the objective physical characteristics of the illness. It is contended that, with its acknowledged limitations, the quantification of OPC, in the understanding of disability, in this study is the best currently available and while the OPC assessment will undoubtedly be improved in the future, there is no alternative

method which stands up to scientific scrutiny that is currently available. Indeed the fact that OPC evluated by the present method accounts for approximately 30% of the variance compares favourably with level of prediction in many epidemiological models, where the critical models are constructed on 10% variance and even less. A deliberate attempt has been made to maximise the OPC variance not to overvalue the importance of the OPC, but to guard against spuriously elevated values for the relationship between psychological factors and disability.

The minimal contribution of personality trait measures deserves comment since many previous attempts to evaluate psychological factors have relied solely on such information (Chapter II). It is contended that methodological inadequacies have been responsible for many of the previous findings. In particular, the false dichotomy into 'organic' and 'functional' has been responsible for inadequate quantification of physical characteristics with an equally restricted conceptualisation of psychological features. Over reliance on experimental and socio-psychological findings in non-clinical situations has produced measures of inadequate sensitivity for the clinical situation. Reliance on statistical significance rather than size of effect has also led to much irrelevant theorizing. The only personality measure showing any promise in this study is neuroticism but its (relative small) importance is explained by neuroticism items having variance in common with measures of current psychological distress. Its redundancy in addition to measures of depressive symptomatology and somatic awareness is clearly shown. The previous findings (Bond, 1971, 1973) of a relationship between pain and extraversion would seem to be explained by the particular clinical characteristics of the patients, who were inpatients, with extraversion being related to certain illness behaviours in that ward situation.

The Lie Scale and Psychoticism Scales seem quite uninterpretable in the context of predicting severity of illness.

Each investigator must decide on some sort of minimal statistical relationship upon which a theoretical model can be constructed. It is argued that in the clinical context, clinical variables (both physical and psychological) swamp subtle personality trait differences and this stresses the importance of testing out empirically the utility of psychological scales derived from different populations, under different conditions and frequently for different purposes. The locus of control scale in this study proved useless. It may be that more recent locus of control scales viz health locus of control; multidimensional health locus of control and pain locus of control (Chapter II) will be of some use. Further studies by the present author are in the process of examining this.

On theoretical grounds, one might suppose that scales measuring hypochondriacal fears or beliefs would be of more importance. Major statistical problems have limited the number of such variables it has been possible to evaluate. General hypochondriasis and affective disturbance showed an initial, fairly small, relationship with disability but the influence of general hypochondriasis disappeared once differences in sex and objective physical characteristics had been taken into account. As with the more general personality measures, the effects were completely redundant once depressive symptomatology and somatic awareness had been put into the equation. The concept of general hypochondriasis (as measured using the IBQ) would appear to be of virtually no value in the understanding of disability. (To construct a theoretical model based even on its initial predictive value of 2.9% would be irresponsible).

The first set of results suggests the need for a radical reconsideration of the nature of psychological factors in chronic pain. Disability needs to be understood not on the basis of presenting personality traits but on the stress imposed by chronic pain and the context in which the communication of pain is presented.

The finding of a relationship between depressive symptomatology and disability is expected. This study has shown that such a relationship is not explained by differences in objective physical characteristics. It shows further that currently experienced depressive symptoms are much more powerful predictors of disability thatn pre-existent personality traits. Somatic awareness is of comparable significance although depressive symptomatology and somatic awareness have variance in common (the importance of utilizing both scales will be discussed below). The current psychological stress variables (mood) explain about five times as much variance as either general personality variables or hypochondriacal fears and beliefs.

Magnified illness presentation, in the form of inappropriate signs and symptoms, is also highly predictive of disability, and although there is clearly shared variance in the prediction of disability, the variables increase the overall prediction by a further 8.4%

Finally, the utility of the rating of pain is examined. Initially both the Pain Scale and the Pain Drawing are better predictors of disability than any of the personality trait measures, but are less powerful than the other psycholoigcal measures. Their redundancy is clearly demonstrated.

<u>The influence of other clinical history and social variables.</u>

Interestingly, when considering chronic low back patients, duration of symptomatology is relatively unimportant. Since patients with physical pathology were excluded, the patient cohort left sufferers from a non-deteriorating disease characterized sometimes by intermittent 'flare-ups' but with no tendency to become progressively worse physically with the passage of time. Duration of symptomatology may be much more important in the acute phase of the illness. Major problems in the quantification of time course have been discussed in detail elsewhere (Waddell et al, 1982).

Source of referral defines in part the nature of the clinical

population of subjects. Since this will be variable from department to department, from hospital to hospital and from culture to culture, all one can really attempt is a careful description of the major clinical characteristics of the group (to permit comparison with other studies), and clear inclusion/exclusion criteria for patients in the study. From a practical point of view, failure to organize special back clinics (enabling a more intensive assessment for back patients than for minor orthopaedic conditions) may lead to inadequate physical and psychological assessment and bad treatment or management decisions.

The relationship between low back pain and complaint presentations is undoubtedly affected by financial and occupational circumstances. Such effects are of major importance at the time of a recession. At the time of writing (1983) the economic climate and unemployment rates are matters of grave concern. An adequate evaluation of social and occupational factors was beyond the resources of this study (although further studies by the same research team are now under way). Reasons for time off work are varied and can be a function simply of a relatively arbitary decision taken at GP level. The significance, economically and psychologically, of losing work time will vary from individual to individual. On the basis of this study, time off work and disability are clearly related. With some individuals, disability makes return to their previous employment quite impossible, with others, the decision to stay off work might be better understood as a psychological phenomenon.

Some tentative data concerning the influence of social factors on several dependent variables was presented. Limitations of attempts to tap the 'social' domain in this study have been acknowledged. The subject would seem to merit further investigation. Areas of investigation might include familial differences in styles of pain expression and complaint presentation; the identification of disproportionate pain effects under different social conditions; the effect of changing financial circumstance;

social dependence within the family and a detailed analysis of occupational characteristics.

Relative importance of the major types of independent variable in the prediction of disability.

The examination of traditional personality trait measures, current psychological stress and magnified illness presentation suggest the need for a radical revision of the way in which clinical psychologists are attempting to increase the understanding of chronic pain phenomena. A shift of emphasis towards understanding the nature of complaint presentation is needed and further research also on the iatrogenic process itself. The distinction (however difficult) between physical disease characteristics and illness behaviour is of paramount importance, but the assessment of illness behaviour, unlike personality profile determination, cannot be understood without taking into account the nature of the communication process itself.

The nature of magnified illness presentation

The examination of gender differences in inappropriate signs and inappropriate symptoms simply draws attention to a clear-cut difference between males and females in the relative importance of depressive symptomatology and somatic awareness to the prediction of inappropriate signs and inappropriate symptoms. Gender differences in complaint presentation and treatment seeking have already been reviewed in Chapter II.

'Magnified' responses to physical examination and reporting of 'magnified' reports of symptomatology would also appear to be markedly affected by gender. An attempt to explain such findings is of necessity speculative at this juncture, but it may be that females higher sensitivity to physiological events and increase emotional lability in combination with a greater tendency to label physiological events according to environmental cues may predispose them to a vague and more diffuse perception of the location and nature of pain perceived as necessitating treatment. Clearly such matters merit further

study and it might be prudent to resist too much speculation.

It has not been possible to examine properly the significance of medico-legal factors in this study. They are of major importance in North America (Seres, 1982). There is no evidence that magnified illness presentation per se is evidence of malingering. The present cohort of patients did not include patients under review for compensation. It may be that a separate set of inappropriate medico-legal symptoms can be found. Given the emphasis throughout the thesis on the influence of situational factors on complaint presentation, it would be surprising if major financial considerations did not have a clear effect on symptom presentation. At present, no one has demonstrated clearly variables which unambiguously would serve as the basis for such an assessment.

Limitations of the present study

Perhaps the single biggest limitation in the study is the fact that its design is cross-sectional i.e. based on a fairly wide ranging assessment battery, but (with exception of some of the validity and reliability trials for the development of some of the scales) constructed on data obtained from patients at a single point in their clinical history. Resources of time and staffing precluded either a longitudinal or a prospective analysis as part of the thesis. (A propsective study on the outcome of spinal surgery and of chemonucleolysis is in fact under way). Estimation of physical characteristics and degree of disability are particularly different in patients with recurrent exacerbations, although attempts have been made to allow for this in the construction of the scales (Waddell and Main, 1984).

Time constraints led to a narrower assessment protocol than the author would have liked. The experimental measures of pain tolerance, pain threshold etc. were available only on a subgroup of the main cohort of patients. It was not possible to cross-validate the self-report and information given in the interview with information from spouses, relatives or significant others in the patient's environment. In practice, the assessment

procedure took approximately two hours, which is approaching the maximum time possible in terms of patient compliance and in running such an out-patient assessment clininc in the NHS.

Reasons have been presented for the use of clinically rated disability as the major measure of severity of illness, although an effort has been made to consider briefly other dependent variables. Arguably it would have been better to derive an objective measure of disability using some form of clinical assessment of activities in a simulated work environment, rather than use a clinical rating based on the patients self-report of function. Such an assessment is only possible either with greater staffing and physical resources in an out-patient assessment clinic, or by admitting the patient for in-patient assessment. The cost of such an assessment on every new referral would be prohibitive in the National Health Service, certainly under present staffing and funding arrangements.

The dependent and independent variables were selected on the basis of their probable relevance in the context of assessment of suitability for surgery or chemonucleolysis. In selecting patients for psychological methods of management, some different variables monitoring for example coping skills, self-monitoring capability or compliance, might be incorporated. It might be considered of paramount importance to interview a spouse or relative.

The particular problems in constructing a measure of physical severity have been acknowledged. Indeed the version of the scale used in the thesis is slightly changed from that used in a preliminary analysis of the thesis results (Main and Waddell, 1982). Since the revised 7 item version, the author has been piloting further studies of the role of surface EMG in the paraspinal muscles in the back. This work is still at a preliminary state but it is hoped that it might prove of value in further depicting the physical status of the patient.

It would have been of theoretical interest to include

the MMPI and submaximum tourniquet test on all patients, although for reasons outlined on the literature review, the author would anticipate neither to be of much value. A collaborative study, however, is at present planned with a hospital in Canada to examine the incremental value, if any, of the MMPI when used in conjunction with the assessment battery described in this thesis.

The 'modular' approach to research design clearly has limitations. It is necessary to select variables having some validity in their relationship with the domain of variables which they are taken to represent. The selection of 'modules' in this thesis was to an extent arbitrary, but there is not only a practical but a theoretical limit to the number of different types of information about which it is feasible to draw conclusions in such a study. Although assignment to modules is also somewhat arbitrary, attempt has been made wherever possible to produce empirical verification using appropriate statistical techniques, or to articulate as clearly as possible the reason for choosing one method of clustering variables as opposed to another. In-appropriate signs and inappropriate symptoms were differentiated from each other, and from objective physical characteristics; psychometric variables were chosen as representative of different types of information, although it is conceded that the distinctions are at times difficult; only a rudimentary attempt was made to assess social and occupational information and it is freely acknowledged that new scales are needed for these variable domains. (At the inception of these studies, no suitably constructed or validated scales were available). Given these limitations, however, it is contended that the data (with cross-validation data) do permit some conclusions to be drawn about the relationship between physical factors, psychological factors and severity of illness.

The use of multiple-regression procedures has been advocated in preference to small group designs. It is acknowledged that

such powerful multivariate techniques are subject to a number of constraints. Statistical analysis does not necessarily permit clinical interpretation. The number of independent variables was therefore restricted to permit such clinical interpretation. The final set of variables in the main series of regression analyses were in fact reduced from between 350 and 400 different variables, in sequential analysis; subject to the proviso that serendipidous findings be ruled out by the use of additional cohorts of patients to cross-validate the results. The use of non-linear regression techniques has been advocated in circumstances where marked deviation from linearity is suspected between two variables. Investigation of all possible pairs of bivariate relationships in the data prior to regression analysis was beyond the strength of the present investigator. Scaling of variables and the use of dummy variable coding for nominal variables were included to minimize distortion. These are discussed where appropriate in the text.

With such a large number of variables, a large number of both questions and answers are possible. Attempt was made in the thesis to test and number of specific hypotheses and derive related questions of clinical interest capable of answer using this data base. Many variables and groups of variables bore some relationship with the dependent variable and the subsidiary dependent variables. Not only was initial selection of variables necessary, an a priori ordering was necessary. This resulted in clustering certain variables in 'modules' as described above, and in deciding on an order of entry into the regression equations. In the determination of redundancy of information this is clearly of critical importance. Justification for the particular orders of entry has already been made, but of course many others based on different a priori orders are possible and permit answers to related clinical questions. Using incremental validity (the converse of redundancy) did permit the identification of a number of non-redundant types

of information which combined to give a fairly high level of prediction overall.

Limitations of cross-sectional designs have been admitted and causality cannot be legitimately inferred from simple correlation or covariation. At a simple intuitive level, however, a degree of causal asymmetry is identifiable. Thus, in general, it seems fair to assume that physical damage with associated disability is a precursor of rather than a result of psychological distress. The contribution of psychological factors to the prediction of severity of illness has therefore been undertaken either directly or following differences in physical characteristics. It seems to make little sense to reverse the analysis. It is contended therefore that the a priori ordering has some clinical plausibility.

The purpose in establishing the relationship between physical and psychological factors was to identify syndromes and then examine interrelationships. Classification of individuals according to these syndromes has been discussed in a forthcoming publication (Main and Waddell, 1984) but is not included in this thesis.

The generality of the findings of the thesis is as yet unknown. The high incidence of pathological, radiological or mechanical abnormalities in the under 20 age group (43%) and in the over 55 year group (46%), compared with 12% for the 20-55 year group (Waddell, 1982) led to their exclusion from this study. A study of such age groups would certainly be of interest. The necessity of restricting the study to patients having English as their first language made it impossible to investigate ethnic differences. In this study, new referrals only were considered although the problem referrals had frequently been seen by other orthopaedic surgeons or neurosurgeons. It has been found in a subsequent study (Waddell et al, 1984) that the amount of failed conservative treatment is predictive of the amount of inappropriate symptomatology. The iatrogenic effects of repeated consultation and failed treatment are little

understood but are clearly important. It was not possible to investigate them in this thesis but they are discussed elsewhere (Main and Waddell, 1983; Waddell et al, 1984). The final important exclusion criterion was that of current medico-legal involvement. Although medico-legal factors were taken into account in this study (Chapter VI) they proved relatively unimportant. Patients referred from a medico-legal source on the other hand were excluded from the study. It may be that a set of inappropriate medico-legal symptoms await identification and differentiation from other signs and symptoms.

Implications of results.

Give the aforementioned limitations of the data and research designs employed, the results have implications for the design of research into the psychology of chronic low back pain, for the role of clinical psychologists in the understanding, treatment and management of low back pain, and for the assessment of suitability for treatment.

Design of research into the psychology of LBP

It is of critical importance that psychological evaluation takes place with adequate medical assessment. Pilot studies for this thesis demonstrated conclusively that many standard clinical signs are so rare or unreliable as to be of little use descriptively or predictively in chronic LBP. It has been shown however, that it is possible to construct valid and reliable measures provided adequate statistical and clinical safeguards are employed. Furthermore it has been shown that it is possible to distinguish different classes of variable, thus permitting an evaluation of their independent and combined contributions to the severity of illness. It has been shown that prior to theory building it is necessary to examine the utility of the instrument on the population in question. Psychometric tests in particular seem to need such verification. One well known test, the IBQ, frequently used in studies of pain patients, would appear to have considerable limitations as far as the

population examined in this thesis is concerned. It is important also to examine the effect of age and gender on scores as sensitivity of test instruments may vary widely for different age-gender samples and require normative data taking such variation into account. In studies of physical characteristics in the back, it is important also to consider normal 'wear-and-tear' with age which may lead to positive findings in asymptomatic subjects.

The use of multivariate methods, multiple regression and factor analysis in particular, have been an important facet of this thesis. To enable such analyses, large samples of patients are required, with particular emphasis to the subject variable ratio in factor analysis. The use of such parametric methods enables powerful analysis, although always with a margin of error. It is important therefore that such 'probabilistic' analyses should be accompanied by sufficient information to determine the margin of error, and wherever possible cross-validation should be attempted on a different cohort of subjects. The specific advantage of multiple regression in this thesis is that it has allowed the estimation of the relative importance of different sorts of independent variable, and permitted the unique contribution of types of variable having controlled for other differences. Specifically it has permitted the evaluation of a number of psychological variables, having controlled for differences in the objective physical characteristics of the disease. The other advantage of such research designs is that it is possible to subsequently modify the set of theoretical models as better dependent or independent variables are devised, thus permitting a consolidation of previous research findings with new assessment 'tools'

<u>2. Role of clinical psychology in the understanding, treatment and management of LBP</u>

Traditionally clinical psychologists interested in chronic LBP have directed their attention primarily towards the assessment of pain (frequently using experimental methods) or towards

personality structure, mainly using the MMPI or the IBQ but also using other test instruments, and clinical ratings. The utility of experimental analogues of chronic clinical pain has been questioned (Chapter II). In view of the difficulties of incorporating them into routine assessment, not only their validity, but their utility needs to be established. The pain rating measures used in this thesis (pain scale and the pain drawing) proved relatively weak predictors of disability and their limitations as measures of severity in their own right have been outlined.

The statistical integrity and validity of the McGill Pain Questionnaire has not been adequately demonstrated in the United Kingdom. The Low Back Pain Classification Scale, may prove to be of value as a simple screener for psychological distress or disturbance, but it is as yet untested in the British Market. Presumably psychologists will continue to have an interest in the quantification of pain, but it would seem that the area of distress and the way in which it is communicated might prove of more value.

The production of new personality tests will undoubtedly continue to engage a number of clinical psychologists, and at least personality tests provide a slightly different set of information from the over researched MMPI, but the results from this thesis suggest that general personality traits per se are in fact very weak predictors of severity of illness. More specific traits such as general hypochondriasis also seem relatively unimportant. This may be partly because of the inadequacies in the most widely used test instruments or because the search for the explanation for inappropriate levels of disability in terms of long-standing personality structure is misguided. (The practice of labelling patients as 'hysterical' or 'hypochondriacal' certainly does not seem of value in a routine assessment procedure). Results from this thesis have shown that depressive symptomatology and symptoms of heightened somatic awareness

are much more sensitive indicators of psychological factors in chronic LBP. Further development of assessment materials are certainly needed. Three primary contenders, for example, might be investigation of communication styles, coping skills and pain locus of control. The clinical psychologist also has a collaborative role and using a combination of research and clinical skills may help in the development of non-psychological methods or in the design of evaluative clinical research into chronic LBP. Psychological methods of treatment are beyond the scope of this thesis, but there is clearly much systematic evaluation needed not only of psychological approaches to treatment and management but also of multidisciplinary approaches to the treatment and management of chronic LBP, such as those employed in the multidisciplinary pain clinics.

Assessment of suitability for treatment

This thesis has attempted to demonstrate that it is possible to quantify some of the physical and psychological features of chronic LBP. Four scales have been developed, modified, or cross-validated as part of the thesis. It has been shown that it is possible to distinguish physical disease characteristics from psychological distress (whether the latter is presented in the form of self reported symptomatology or as inappropriate responses to physical examination). During the course of the thesis, these have been integrated into a fairly simple and efficient screening procedure, having a high compliance rate as far as patients are concerned. It is claimed that the separate quantification of physical and psychological parameters can form the basis of a first-stage screening procedure to identify those patients in whom a more detailed psychological assessment is needed, either as a precursor to medical and surgical treatment or management, or with a view to assessing their suitability for psychological treatment or management programmes per se. It is clear that severity of illness can be viewed from a number of perspectives. This thesis shows that it is necessary to consider the patient from medical and psychological perspectives.

More research is obviously needed into social, occupational and medico-legal variables. The extent of their additional contribution is as yet unknown but it certainly seems likely that at least a part of their effect may be found in the production of psychological distress in its various forms.

Suggestions for further research arising from this thesis

Perhaps the most interesting yet most elusive finding from the thesis concerns the nature of magnified illness presentation, in the form of inappropriate signs and inappropriate symptoms. These have been identified in the context of chronic LBP. It may be that in other disorders (eg gynaecological disorders) a similar differentiation can be made between appropriate and inappropriate signs and symptoms, and that the illness behaviour described in the chronic LBP is simply a style of responding to illness which can be identified in other diseases. A multitude of factors shape the individual's use of health services and decision to seek treatment. With the chronic LBP patient, the effect of repeated failed treatment (whether surgical or conservative) may affect not only beliefs about illness and the efficacy of treatment, but also the manner of presentation of symptoms. The style of presentation may in turn affect the doctor's appraisal of the significance or severity of the LBP. The use of longitudinal studies, perhaps incorporating single-case methodology may provide help in clarifying this complex process. Approaches to the investigation of doctor-patient communication such as Transactional Analysis may prove illuminating. Unfortunately production of even a satisfactory description far less interpretation of such social interaction is problematic. Quantification of such interchanges may prove extremely difficult and it is certainly hard to envisage such analysis as being part of any routine screening procedure, since the doctor would have to include characteristics of his or her own communication as part of the appraisal. Undoubtedly however, further attempts could and should be made to describe adequately the patient's history

of consultation and treatment. The identification of inappropriate signs and inappropriate symptoms is clearly only a very small step in this direction.

The role of gender in complaint presentation and health care seeking was reviewed in Chapter II. Attempt has been made throughout the thesis to take gender differences into account. Males and females appear to differ somewhat in the relative importance of the four major psychological variables in the prediction of severity of illness. Sex differences have therefore been integrated into the general regression models. The subject certainly merits further research. Adopting an interactive view, one might conclude that some of the differences obtained were a function of the patient being the same sex or not as the doctor. Since no female doctors took part in the study, it was not possible to examine this much further. Degree of self disclosure and readiness to confide in the doctor may be important, although it seems unlikely that it would be feasible to take this into account in a screening assessment. At a second stage screening procedure such as that for suitability for a pain management programme, or for individual counselling, it would be an important consideration. Gender differences, therefore, would certainly merit further research, although the clinical significance of such differences remains to be determined.

It has been commented as a limitation to this thesis that patients from medico-legal sources had been excluded from the thesis. A major reason for this was that frequently patients are advised by their legal counsel against disclosing information capable of a psychological interpretation. Also from the research design point of view the inclusion of a subgroup of patients from medico-legal sources would have proved problematic. It has been suggested that there may be a set of inappropriate symptoms specific to the medical-legal situation and this may well merit further investigation.

A detailed investigation of social, occupational and financial effects was not possible in this thesis. Clearly this has to be undertaken although the difficulty of the task is considerable. Variation in circumstances and large quantities of information obtainable only from subgroups of the population make the production of even a rudimentary typology a daunting task. The assessment of disability clearly overlaps with the estimation of the effects of pain which may vary not only from situation to situation, but also phasically across time.

Coping skills per se have not been properly evaluated in chronic LPB patients. This is perhaps surprising since it is well known that a proportion of patients in the community with fairly high levels of pain and disability do not seek treatment. Patients show wide-ranging skills in coping with chronic pain problems and this might well prove a useful line of research enquiry, not only from a theoretical but from a practical point of view.

Limitations have been acknowledged in the assessment tools used in this thesis. The assessment of objective physical characteristics were based primarily, although not exclusively on examination of the back. A number of clinical signs were rejected properly as unreliable. Improvement in the measurement of a number of these might permit their inclusion in a later development. Muscular spasm for example is normally assessed by palpation. Electromyographic readings from the surface of the skin over the paraspinal muscles are being investigated by the author at the moment to determine their utility as an additional measure of physical severity. It would be surprising if the assessment of physical characteristics were not to be continually developed. An in situ objective measure of disability has also been mentioned as an alternative to clinical ratings based on a self-report, or even to a self-report.

Psychometrically, the proliferation of new tests ensures

that there will always be the possibility of new psychological tools, but one of the lessons of this thesis is that tools certainly have to be validated upon, if not constructed for, the particular patient populations being considered. New measures of locus of control, particularly the pain locus of control might prove of value, particularly in the prediction of patient's actual participation in management programmes in which self-monitoring or self-control play a part.

Finally, two obvious extensions to the work described in the thesis would be the prediction of the outcome of medical or surgical treatment, and response to other sorts of treatment and management. The assessment battery has in fact been incorporated into an outcome study at present nearing completion in the West of Scotland. The latter is more problematic. The author is engaged in pilot studies attempting to systematise, describe and evaluate hypnosis and back pain education classes. Variables sufficiently sensitive for successive monitoring need to be devised and classes of variable relevant to the evaluation of such diverse techniques as the delivery of ergonomic advice, the use of various physiotherapeutic approaches and other sorts of rehabilitation need to be identified.

Conclusion

The thesis has attempted to answer a number of specific questions. In so doing it has cast down on some of the medical and psychological approaches to the assessment of the chronic LBP patient. It has made a contribution to the determination of the sorts of variables important in the understanding of severity of illness, but in so doing has roused a large number of other questions which would seem to merit an answer. A number of specific suggestions has been made for research directions which might follow from the findings of this thesis. These vary from extremely specific observations about the presentation of back pain complaints to extremely wide-ranging reflections on the nature of the consultation process and the nature of

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A detailed investigation of social, occupational and financial effects was not possible in this thesis. Clearly this has to be undertaken although the difficulty of the task is considerable. Variation in circumstances and large quantities of information obtainable only from subgroups of the population make the production of even a rudimentary typology a daunting task. The assessment of disability clearly overlaps with the estimation of the effects of pain which may vary not only from situation to situation, but also phasically across time.

Coping skills per se have not been properly evaluated in chronic LPB patients. This is perhaps surprising since it is well known that a proportion of patients in the community with fairly high levels of pain and disability do not seek treatment. Patients show wide-ranging skills in coping with chronic pain problems and this might well prove a useful line of research enquiry, not only from a theoretical but from a practical point of view.

Limitations have been acknowledged in the assessment tools used in this thesis. the assessment of objective physical characteristics were based primarily, although not exclusively on examination of the back. A number of clinical signs were rejected properly as unreliable. Improvement in the measurement of a number of these might permit their inclusion in a later development. Muscular spasm for example is normally assessed by palpation. Electromyographic readings from the surface of the skin over the paraspinal muscles are being investigated by the author at the moment to determine their utility as an additional measure of physical severity. It would be surprising if the assessment of physical characteristics were not to be continually developed. An in situ objective measure of disability has also been mentioned as an alternative to clinical ratings based on a self-report, or even to a self-report.

Psychometrically, the proliferation of new tests ensures

that there will always be the possibility of new psychological tools, but one of the lessons of this thesis is that tools certainly have to be validated upon, if not constructed for, the particular patient populations being considered. New measures of locus of cntrol, particularly the pain locus of control might prove of value, particularly in the prediction of patient's actual participation in management programmes in which self-monitoring or self-control play a part.

Finally, two obvious extensions to the work described in the thesis would be the prediction of the outcome of medical or surgical treatment, and response to other sorts of treatment and management. The assessment battery has in fact been incorporated into an outcome study at present nearing completion in the West of Scotland. The latter is more problematic. The author is engaged in pilot studies attempting to systematise, describe and evaluate hypnosis and back pain education classes. Variables sufficiently sensitive for successive monitoring need to be devised and classes of variable relevant to the evaluation of such diverse techniques as the delivery of ergonomic advice, the use of various physiotherapeutic approaches and other sorts of rehabilitation need to be identified.

Conclusion

The thesis has attempted to answer a number of specific questions. In so doing it has cast down on some of the medical and psychological approaches to the assessment of the chronic LBP patient. It has made a contribution to the determination of the sorts of variables important in the understanding of severity of illness, but in so doing has roused a large number of other questions which would seem to merit an answer. A number of specific suggestions has been made for research directions which might follow from the findings of this thesis. These vary from extremely specific observations about the presentation of back pain complaints to extremely wide-ranging reflections on the nature of the consultation process and the nature of

disease and illness. The boundaries between medicine, psychology and sociology are becoming increasingly blurred. It would seem important to try to retain the concepts of physical impairment and distress in any understanding of the suffering chronic LBP patient. Holistic medicine is becoming somewhat fashionable in the 1980's. It has been observed that today's heterodoxy becomes tomorrow's orthodoxy. Whether or not this proves to be the case, this thesis has attempted to show that psychological factors have to be taken seriously in any attempt to understand severity of illness in the chronic LBP patient. Failure to appreciate the distinction between disease and suffering on the one hand, and the difference between the experience of pain and the seeking of treatment on the other hand; have been responsible for much inappropriate and unsuccessful treatment in LBP patients. It is hoped that this thesis may contribute some clarification of these issues, help establish the role of systematic psychological inquiry in the field of chronic LBP, and support the case for a genuine multidisciplinary approach to the LBP patient.

TABLE 01

THEORETICAL MODEL WITH DISABILITY AS DEPENDENT VARIABLE

Reasons for excluding clinical information

	A	B	C	D	E	F
Age				*		
Duration of symptoms				*		
Duration of present episode				*		
Pain scale			*	*		
Tenderness - Lumbar	*	*	*	*	*	
Buttock		*	*	*	*	
Lateral flexion	*	*	*	*		
Catch	*	*	*	*		
Loss of lordosis	*			*		*
List	*			*		*
Root irritation				*		(*)

A No clinically accepted method of measurement

B Unsatisfactory reliability (inter-rater agreement)

C Ambiguity in clinical interpretation

D Redundancy (no incremental validity in prediction of disability)

E Strong suggestion of a significant non-physical component

F Doubtful validity (feature of acute rather than chronic backache)

TABLE 02

THEORETICAL MODEL WITH DISABILITY AS DEPENDENT VARIABLE

Reasons for excluding psychometric variables & scales

	A	B	C	D	E	F
EYSENCK						
Neuroticism					*	
Extraversion		*	*			
Psychoticism		*	*			
Lie Scale			*			
Locus of control		*	*			
IBQ+ 1		*		*		
2	*					
3	*					
4				*		
5				*		
6	*					
7	*					

A Inadequate statistical construction (internal consistency)

B Doubtful clinical validity (insignificant correlation with disability)

C Redundant (no incremental validity after sex and OPC considered)

D Trivial overall contribution to theoretical model

E Significant predictor of disability, but of insufficient magnitude to justify a new class of variable

F On theoretical and statistical grounds, best considered as an alternative dependent variable

+ 62 item version of IBQ (see Chapter V)

TABLE 03

THEORETICAL MODEL: CORRELATIONS OF MAJOR VARIABLES

(Main Study, n = 200)

INDEPENDENT VARIABLES	DEPENDENT VARIABLES		
	Disability r	Painscale r	Time Off Work r
Sex	-22	-20	-08
Age	07	-10	14
Duration	19	11	13
Major problem	*	*	*
Lumbar flexion	-32	-16	-17
Straight leg raising, left	-25	-15	-09
Straight leg raising, right	-27	-19	-12
Root compression	22	12	-01
Previous surgery	41	25	38
Time pattern	35	32	28
Depressed mood	49	23	29
Somatic awareness	52	29	29
EPQE	-10	-05	-07
EPQN	26	05	13
EPQP	10	-06	06
EPQL	19	13	09
Locus of control	-01	01	10
IBQ 1	18	-04	08
SIBQ 4	8	-07	00
SIBQ 5	24	07	13
Inappropriate signs	56	34	36
Inappropriate symptoms	62	37	38
Pain drawing	30	27	08

* As a nominal variable, it was coded as a dummy for the regression analyses.

Figures are Pearson product moment correlations X 100.

TABLE 04

THEORETICAL MODEL, THE PREDICTION OF SEVERITY OF ILLNESS
THE INFLUENCE OF INDIVIDUAL PERSONALITY VARIABLES 1 GENERAL
DEPENDENT VARIABLE - DISABILITY

Order in Regression	INDEPENDENT VARIABLES														
	EPQ Extraversion			EPQ Neuroticism			EPQ Psychoticism			EPQ Lie Scale			Locus of Control		
	$\%R^2$	F		%R2	F		%R2	F		%R2	F		%R2	F	
Equation	Change	Ratio	Sig	Change	Ratio	Sig	Change	Ratio	Sig	Change	Ratio	Sig	Change	Ratio	Sig
First	1.1	2.20	NS	7.0	10.54	<.001	1.1	2.20	NS	1.8	2.57	NS	0	-	NS
After sex	0.9	1.86	NS	5.4	8.23	<.005	1.5	3.12	NS	1.0	1.31	NS	0	-	NS
After sex, OPC.	0	-	NS	3.2	6.11	<.025	1.3	4.00	<.05	0.9	1.65	NS	0	-	NS
After sex, OPC, mood.	0	-	NS	1.0	2.31	NS	0	-	NS	0.7	1.60	NS	0.4	1.93	NS
After sex, OPC, mood & illness behaviour	0	-	NS	1.0	3.18	NS	0	-	NS	0.1	0.32	NS	0.3	1.82	NS

TABLE 05

THEORETICAL MODEL, THE PREDICTION OF SEVERITY OF ILLNESS, THE INFLUENCE OF INDIVIDUAL PERSONALITY VARIABLES 2 HYPOCHONDRIACAL DEPENDENT VARIABLE - DISABILITY

Order in Regression Equation	INDEPENDENT VARIABLES								
	IBQ 1 General Hypoch.			IBQ 4 Affective Inhibition			IBQ 5 Affective Disturbance		
	%R^2 Change	F Ratio	Sig	%R^2 Change	F Ratio	Sig	%R^2 Change	F Ratio	Sig
First	2.9	5.91	<.025	0.8	1.59	NS	5.5	11.52	<.001
After sex	2.3	4.83	<.05	0.7	1.45	NS	4.4	9.45	<.005
After sex & OPC	1.8	5.59	<.025	0.9	2.75	NS	3.2	10.18	<.005
After sex, OPC & mood	0.5	2.41	NS	0	-	NS	0.5	2.35	NS
After sex, OPC mood & illness behaviour	0.3	1.82	NS	0	-	NS	0.1	0.60	NS

TABLE 06

THEORETICAL MODEL: PREDICTION OF SEVERITY OF ILLNESS. THE INFLUENCE OF PERSONALITY (SUMMARY)

DEPENDENT VARIABLE : DISABILITY

Order in Regression Equation	DEPENDENT VARIABLES					
	General Personality[1]			Hypochondriacal Fears[2] & Beliefs		
	%R^2Ch	F ratio	Sig	%R^2Ch	F ratio	Sig
First	9.8	4.22	<.001	6.1	4.24	<.01
After sex	7.7	2.32	<.05	4.9	3.49	<.025
After sex & OPC	4.9	1.83	NS	4.6	5.13	<.005
After sex, OPC & mood	1.9	0.85	NS	0.1	1.28	NS
After sex, OPC, mood & illness behaviour	1.6	0.92	NS	0.1	0.20	NS

[1] General Personality: Extraversion, neuroticism, psychoticism, lie scale and locus of control.

[2] Hypochondriacal Fears & Beliefs : General hypochondriasis (Scale 1) Affective inhibition (Scale 4) and affective disturbance (Scale 5)

THEORETICAL MODEL - THE PREDICTION OF SEVERITY OF ILLNESS

THE INFLUENCE OF MOOD

DEPENDENT VARIABLE - DISABILITY

Order in Regression Equation	INDEPENDENT VARIABLES								
	Depressive Symptoms + interaction with sex (SEXCOOKE)			Somatic Awareness (MSPQ) + interaction with sex (SEXMSPQ)			Mood (all four variables)		
	%R^2Ch	F ratio	Sig	%R^2Ch	F ratio	Sig	%R^2Ch	F ratio	Sig
First	23.4+	60.49	<.001	26.5+	71.39	<.001	40.4	33.05	<.001
After sex	25.5	35.40	<.001	32.8	50.86	<.001	37.3	30.82	<.001
After sex & OPC	13.4	27.51	<.001	21.1	32.17	<.001	22.5	27.67	<.001
After sex, OPC & illness behaviour	8.0	22.72	<.001	7.1	19.62	<.001	10.3	15.57	<.001

+ Interactions with sex are not included when the independent variable is put in first in the equation.

THEORETICAL MODEL - THE PREDICTION OF SEVERITY OF ILLNESS

THE INFLUENCE OF ILLNESS BEHAVIOUR

DEPENDENT VARIABLE - DISABILITY

Order in Regression Equation	INDEPENDENT VARIABLES								
	Inappropriate Symptoms			Inappropriate Signs			Illness Behaviour (symptoms & signs)		
	$\%R^2Ch$	F ratio	Sig	$\%R^2Ch$	F ratio	Sig	$\%R^2Ch$	F ratio	Sig
First	38.0	121.4	<.001	30.5	86.89	<.001	45.2	81.24	<.001
After sex	34.2	108.8	<.001	27.8	80.18	<.001	45.1	80.83	<.001
After sex & OPC	16.2	69.48	<.001	13.4	51.45	<.001	20.9	50.10	<.001
After sex, OPC & mood	7.1	43.17	<.001	3.8	20.9	<.001	8.4	26.54	<.001

TABLE 09

THEORETICAL MODEL, THE PREDICTION OF SEVERITY OF ILLNESS, THE INFLUENCE OF RATING OF PAIN

DEPENDENT VARIABLE - DISABILITY

Order in Regression Equation	INDEPENDENT VARIABLES					
	Pain Scale			Pain Drawing		
	%R^2 Change	F Ratio	Sig	%R^2 Change	F Ratio	Sig
First	14.7	34.12	<.001	9.3	20.30	<.001
After sex	12.6	29.73	<.001	6.8	15.00	<.001
After sex & OPC	2.5	7.86	<.01	1.5	4.64	<.05
After sex, OPC & mood	0.5	2.41	NS	0.3	1.44	NS
After sex, OPC mood & illness behaviour	0.1	0.60	NS	0.1	0.62	NS

THEORETICAL MODEL, THE PREDICTION OF SEVERITY OF ILLNESS, THE INFLUENCE OF DURATION OF SYMPTOMS, SOURCE OF REFERRAL AND TIME OFF WORK

DEPENDENT VARIABLE - DISABILITY

Order in Regression Equation	INDEPENDENT VARIABLES								
	Duration of Symptoms			Source of Referral			Time off Work		
	$\%R^2$ Change	F Ratio	Sig	$\%R^2$ Change	F Ratio	Sig	$\%R^2$ Change	F Ratio	Sig
First	3.3	6.76	< .01	15.4	36.04	< .001	31.8	90.99	< .001
After sex	3.1	6.57	< .025	15.8	38.29	< .001	30.2	90.28	< .001
After sex & OPC	1.0	3.07	NS	4.6	14.99	< .001	12.1	45.34	< .001
After sex, OPC & mood	0.7	3.39	NS	2.6	13.29	< .001	6.3	35.80	< .001
After sex, OPC mood & illness behaviour	0.3	1.82	NS	0.8	4.94	< .05	4.3	30.17	< .001

TABLE 11

THEORETICAL MODEL, THE PREDICTION OF SEVERITY OF ILLNESS,
THE INFLUENCE OF SOCIAL FACTORS
DEPENDENT VARIABLE - DISABILITY

Order in Regression Equation	INDEPENDENT VARIABLES								
	Social Class			Work Type			Total		
	$\%R^2$ Change	F Ratio	Sig	$\%R^2$ Change	F Ratio	Sig	$\%R^2$ Change	F Ratio	Sig
First	7.1	2.97	<.025	8.7	4.65	<.001	9.3	2.16	<.025
After sex	15.9*	6.05	<.001	6.1*	3.29	<.025	21.6*	4.93	<.001
After sex, OPC	6.6*	1.97	NS	3.3*	2.07	NS	13.3*	4.39	<.001
After sex, OPC, mood	2.7+	2.70	<.025	2.3+	3.95	<.05	5.0+	2.90	<.05
After sex, OPC, mood & illness behaviour	2.0+	1.86	NS	2.4+	3.88	<.05	4.9+	3.74	<.001

* Includes interaction with sex

\+ Insufficient tolerance to include sex-interaction terms

THEORETICAL MODEL, THE PREDICTION OF SEVERITY OF ILLNESS,
THE INFLUENCE OF SOCIAL FACTORS
DEPENDENT VARIABLES: DISABILITY, SELF-RATED PAIN
AND WORK LOSS

Order in Regression Equation	Disability			Pain Scale			Work Loss		
	$\%R^2$ Change	F Ratio	Sig	$\%R^2$ Change	F Ratio	Sig	$\%R^2$ Change	F Ratio	Sig
First	9.3	2.16	< .025	9.2	2.14	< .025	16.9	4.29	< .001
After sex	21.6*	4.93	< .001	21.0*	4.52	< .001	21.6*	8.90	< .001
After sex, OPC	13.3*	4.39	< .001	11.8*	2.75	< .005	14.7*	4.70	< .001
After sex, OPC mood	5.0+	2.90	< .005	4.3+	1.14	NS	13.1+	4.30	< .001
After sex, OPC mood & illness behaviour	4.9+	3.74	< .001	4.5+	1.23	NS	12.9+	4.31	< .001

* Including interaction with sex

\+ Insufficient tolerance to include social sex-interaction terms

TABLE 13

THEORETICAL MODEL: THE PREDICTION OF SEVERITY OF ILLNESS

A SUMMARY OF THE MAIN FINDINGS

(Main Study, n = 200)

DEPENDENT VARIABLE - DISABILITY

Place in Regression Equation

INDEPENDENT VARIABLES	First		After sex and objective physical characteristics	
	$\%R^2$ Ch	Sig	$\%R^2$ Ch	Sig
General Personality	9.8	<.001	4.1	<.05
Hypochondriacal fears and beliefs	6.1	<.01	4.6	<.05
Depressive symptoms*	23.4	<.001	13.4	<.001
Somatic awareness*	26.5	<.001	21.1	<.001
Inappropriate signs	30.5	<.001	13.4	<.001
Inappropriate symptoms	38.0	<.001	16.2	<.001

* Includes interaction term for interaction with sex.

$\%R^2$ = Percentage change in R^2 with addition of the item or class.

Sig = Significance of proportional reduction in unexplained variance

TABLE 14

THE NATURE OF MAGNIFIED ILLNESS PRESENTATION

DEPENDENT VARIABLES: INAPPROPRIATE SIGNS & INAPPROPRIATE SYMPTOMS

(Main Study, n=200)

Independent Variables	Signs			Symptoms		
	%R^2 Change	F Ratio	Sig	%R^2 Change	F Ratio	Sig
Pain scale	12.6	28.54	< .001	12.9	29.32	< .001
OPC	14.0	3.26	< .001	15.4	4.04	< .001
Disability	14.4	45.56	< .001	18.0	62.69	< .001
Duration of symptoms	0	0	NS	0	0	NS
Time off work	0	0	NS	0	0	NS
EPQE, N, P, L & MR score	0.8	0.49	NS	1.7	1.18	NS
IBQ1, SIBQ 4, SIBQ 5	1.0	1.03	NS	3.3	4.01	< .01
Mood	2.4	1.90	NS	7.9	8.42	< .001

TABLE 15

THE NATURE OF MAGNIFIED ILLNESS PRESENTATION

FURTHER ANALYSIS
(Main Study, n=200)

INDEPENDENT VARIABLES / Order in Regression Equation	DEPENDENT VARIABLES: INAPPROPRIATE SIGNS				INAPPROPRIATE SYMPTOMS			
	Males		Females		Males		Females	
	$\%R^2$ Ch	Sig	$\%R^2$ Ch	Sig	$\%R^2$ Ch	Sig	$\%R^2$ Ch	Sig
Objective physical characteristics	16.4	<.05	38.8	<.001	18.9	<.01	32.9	<.005
Depressive symptomatology	12.6	<.001	3.3	NS	3.3	<.05	1.1	NS
Somatic awareness	1.0	NS	8.1	<.005	7.6	<.001	15.8	<.001
Disability	11.7	<.001	7.9	<.001	11.5	<.001	9.0	<.001
Social class and worktype	0.0	NS	0.7	NS	0.4	NS	1.3	NS

$\%R^2$ = Percentage change in R^2 with addition of the items or class.

Sig = Significance of proportional reduction in unexplained variance.

TABLE 16

THEORETICAL MODEL: THE NATURE OF ILLNESS BEHAVIOUR

THE INFLUENCE OF MEDICO-LEGAL FACTORS

DEPENDENT VARIABLES - INAPPROPRIATE

SIGNS AND INAPPROPRIATE SYMPTOMS

(Main Study, n = 200)

INDEPENDENT VARIABLE	Signs			Symptoms		
	n 200			n 200		
Medico-Legal factor involved	$\%R^2$ Ch	F	Sig	$\%R^2$ Ch	F	Sig
(a) Entered after sex	2.8	5.86	<.025	1.1	2.20	NS
(b) Entered after sex, OPC, mood, disability & social factors	0.2	0.62	NS	0.1	0.42	NS

FIGURE 1

FIGURE 2

FIGURE 3

FIGURE 4

FIGURE 5

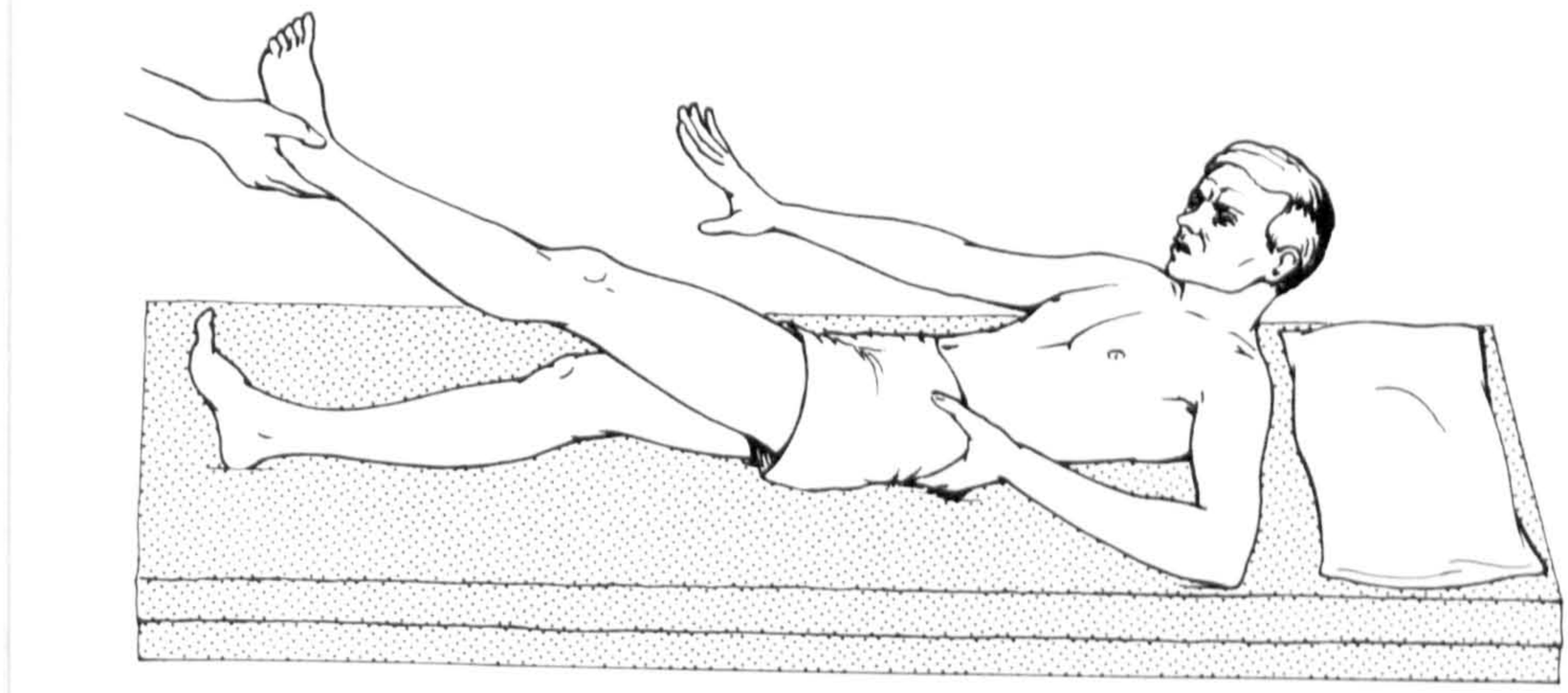

FIGURE 6

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LIST OF APPENDICES

TEXT CUT OFF IN ORIGINAL

MAIN GROUPS & NUMBERS OF PATIENTS STUDIED

Type of Study	Total n	Physical Characteristics (OPC)	Inappropriate Signs	Inappropriate Symptoms	Pain Drawing	Pain Scale
Pilot clinical (general)	182	-	+	+	+	-
Pilot clinical (disability)	160	+	-	-	-	-
Pilot MSPQ	334	-	-	-	-	-
Pilot MMPI	84	-	+	-	+	-
Normality (5 groups)	435	155	80	77*	-	-
Reliability (7 groups)	475	32	50	30	50	30
Main	200	+	+	+	+	+
Additional back sample	141	-	+	+	-	-
Spinal pathology	73	-	+	+	-	-
Non-backs	52	-	-	+	+	+

* Same group

MAIN GROUPS & NUMBERS OF PATIENTS STUDIED

Type of Study	Disability	MSPQ	EPQ	Depressed Mood	IBQ
Pilot clinical (general)	-	-	-	-	-
Pilot clinical (disability)	+	-	-	-	-
Pilot MSPQ	-	+	-	-	-
Pilot MMPI	-	-	-	-	-
Normality (5 groups	77*	100	-	40*	40*
Reliability (7 groups	59	40**	-	40**	40**
Main	+	+	-	+	+
Additional back sample	+	-	-	-	-
Spinal pathology	-	-	-	-	-
Non-backs	+	+	+	+	+

* and ** Same groups

SELECTED DEMOGRAPHIC & CLINICAL CHARACTERISTICS

(Main Study, n = 200)

		Total	Males	Females	GPs	Problems
	n	200	117	83	79	121
	%					
AGE IN YEARS		39.2+/-9.0	39.3+/-9.0	38.9+/-9.1	39.0+/-9.2	39.0+/-9.0
SEX (% Male)		59	100	0	57	40
SOCIAL CLASS	1	7.6	5.2	11.7	14	4
(REG. GEN. CLASSIF.)	2	21.1	12.9	34.8	21	21
	3N	9.7	4.3	18.8	13	8
	3M	31.4	41.4	14.5	28	33
	4	14.6	16.4	11.6	8	18
	5	15.7	19.8	8.7	15	16
SOURCE OF REFERRAL						
GP		39.5	38.5	41.1	100	0
Problem		60.5	61.5	59.0	0	100

		Total	Males	Females	GPs	Problems
MAJOR PRESENTING PROBLEM						
Back pain		20.5	24.3	15.0	21	20
Back & referred leg pain		55.4	48.7	65.0	53	56
Root pain		24.1	27.0	19.9	23	24
DURATION OF SYMPTOMS (in months)						
3-12 months		15.0	14.8	15.4	24	8
1-5 years		31.1	33.9	26.9	29	32
> 5 years		53.9	51.3	57.7	47	60
NUMBER OF PREVIOUS	0	85.0	88.0	80.7	100	75
BACK OPERATIONS	1	9.5	6.8	13.3	0	15
	2	4.0	3.4	4.8	0	7
	3	1.5	1.7	1.2	0	3
TIME PATTERN	Recurring	28.0	31.6	22.9	43	18
	Chronic	72.0	68.4	77.1	57	82
TYPE OF WORK	Sedentary	19.4	17.1	22.8	26	15
	Housewife	12.8	0	31.6	18	9
	Driving	8.2	12.8	1.3	9	8
	Light manual	28.6	23.9	35.8	23	32
	Heavy manual	31.1	46.2	8.9	23	36
TIME OFF WORK (Continuously, in months)		10.3+/-17.1	9.3+/-13.2	12.3+/-23.2	5.3+/-12.0	14.7+/-19.1

SELECTED DEMOGRAPHIC & CLINICAL CHARACTERISTICS
(COMPARISON OF MAIN STUDY (n = 200) WITH CLINICAL PILOT STUDY (n = 160) AND EXTRA BACKS (141)

	Clinical Pilot (General) 182	Clinical Pilot (Disability) 160	Main Study 200	Additional Group 141
AGE IN YEARS	43.0+/-14.8	37.4+/-9.9	39.2+/-9.0	40.2+/-8.4
SEX (% Male)	52	50	59	54
SOCIAL CLASS 1	NK	2.0	7.6	5.3
2	NK	18.7	21.1	14.9
3N	NK	14.7	9.7	8.8
3M	NK	21.3	31.4	17.3
4	NK	20.0	14.6	20.1
5	NK	22.0	15.7	33.5
SOURCE OF REFERRAL				
GP	55	50	39.5	39.7
Problem	45	50	60.5	60.3

		Clinical Pilot (General)	Clinical Pilot (Disability)	Main Study	Additional Group
MAJOR PRESENTING PROBLEM					
Back pain		27	33.1	20.5	29.3
Back & referred leg pain		45	45.0	55.4	48.6
Root pain		27	21.9	24.1	22.1
DURATION OF SYMPTOMS (in months)					
3-12 months		29	17.5	15.0	18.4
1-5 years		29	41.8	31.1	34.9
> 5 years		42	40.7	53.9	44.7
NUMBER OF PREVIOUS	0	81	91.9	85.0	85.8
BACK OPERATIONS	1	13	6.9	9.5	9.2
	2	6	1.2	4.0	2.8
	3	0	0	1.5	2.1
TIME PATTERN	Acute	19	0	0	4.3
	Recurring	34	24.0	28.0	36.2
	Chronic	47	76.0	72.0	59.5
TYPE OF WORK	Sedentary	19	14.4	19.4	19.9
	Housewife	24	16.2	12.8	14.0
	Driving	10	3.1	8.2	2.2
	Light manual	22	30.0	28.6	26.5
	Heavy manual	22	36.2	31.1	37.5
TIME OFF WORK (Continuously in months)		8.0+/-15.4	8.3+/-15.7	10.3+/-17.1	13.2+/-20.3

SPINAL PATHOLOGY: DEMOGRAPHIC & CLINICAL CHARACTERISTICS (n = 73)

SEX	Male	70%
	Female	30%
AGE (years)		44.4 +/-17.7
SOURCE OF REFERRAL		
	G.P. (Primary)	40%
	Problem (Secondary)	60%
MAJOR PROBLEM		
	Backache +/- referred leg pain	75%
	Neurological	13%
	Spinal deformity	11%
DIAGNOSIS		
	Tumour	28%
	Infection	11%
	Miscellaneous inflammatory	15%
	Neurological	9%
	Spinal deformity	10%
	Old fracture	15%
	Spondylolisthesis	12%

APPENDIX 05

WING'S ANALYSIS OF DISABILITY

FACTOR LOADINGS

(POST-FUSION COMPENSATION PATIENTS, n = 100)

Items of disability	Factor Loading
Inability to partake of social activities	+0.83
Inability to pick things off floor without discomfort	+0.81
Severity of low back pain	+0.80
Patient's opinion of the value of last surgery	-0.75
Ability to sit without discomfort	-0.75
Ability to walk normally	-0.74
Ability to ride car or bus without discomfort	-0.73
Sleep disturbance	+0.70
General quality of life as affected by low back pain	-0.70
Impairment of sex life by low back pain	+0.64
Degree of tenderness	+0.64
Ability to work normally	-0.63
Time loss from work in previous two years	+0.63
Self-care ability	-0.52
Willingness of patient to accept surgery again under similar circumstances to last operation	-0.50
Frequency of pain at 'tip of tailbone'	+0.40
Ability to do household chores	-0.40
Mean monthly family income	-0.40
Quantity of sex life	-0.30
General financial circumstances	-0.22

APPENDIX 06

CHRONIC DISABILITY INDEX USED IN THE STUDY

Code	Variable Description
HEAVLIFT	Help required or avoidance of heavy lifting.
SITHALF	Sitting generally limited to half-an-hour.
TRAVHALF	Travelling in car/bus generally limited to half-an-hour.
STANDHAF	Standing generally limited to half-an-hour.
WALKHALF	Walking generally limited to half-an-hour.
SLEEPDIS	Sleeping disturbed regularly by back pain.
MISSSOC	Frequently restricted or avoidance of social activities because of back.
SEXLIFE	Restriction in sexual activities because of back.
HELPSOX	Help often required with socks, tights or shoe-laces.

DISABILITY

RELIABILITY OF INDIVIDUAL ITEMS

Variable Label	Name	n	% Agreement	K	NTS	p
HEAVLIFT	Heavy lifting	30	83	0.47	1.90	p = .06
SITHALF	Sitting for ½ hour	30	73	0.41	2.01	p < .05
TRAVHALF	Travelling for ½ hour	30	80	0.59	3.25	p < .01
STANDHAF	Standing for ½ hour	30	80	0.55	2.93	p < .05
WALKHALF	Walking for ½ hour	30	83	0.66	3.58	p < .001
SLEEPDIS	Sleep disturbed	30	83	0.65	3.35	p < .01
MISSSOC	Disturbed social life	30	83	0.67	3.45	p < .001
SEXLIFE	Sex life problems	30	80	0.59	2.96	p < .05
HELPSOX	Help reqd. with socks, tights etc.	30	90	0.78	4.24	p < .001

K = Kappa coefficient
NTS = Null test statistic
p = Significance level

APPENDIX 08

DISABILITY: COMPARISON OF NORMALS (n = 77) AND BACK PATIENTS (Main Study, n = 200)

	Chi^2	df	Sig.
HEAVLIFT	131.71	1	p < .0005
SITHALF	83.18	1	p < .0005
TRAVHALF	88.87	1	p < .0005
STANDHAF	11.53	1	p < .001
WALKHALF	33.65	1	p < .0005
SLEEPDIS	32.97	1	p < .0005
MISSSOC	63.68	1	p < .0005
SEXLIFE	3.99	1	p < .05
HELPSOX	19.58	1	p < .0005

DISABILITY INDEX (INCIDENCE OF INDIVIDUAL ITEMS)

Population			Normals		Backache				Non-backs			Spinal Pathology
				Total	Males	Females	GPs	Problems	Minor	OA	RA	
		n	77	200	117	83	79	121	20	16	16	73
Item												
Heavy lifting	1	%	5	80	76	85	70	87	0	66.7	100	62
Sitting	2	%	6	67	65	70	57	73	10	62.5	50	61
Travelling	3	%	0	63	58	70	50	71	10	43.7	56.2	67
Standing	4	%	6	24	18	33	9	34	35	81.2	100	>40*
Walking	5	%	1	36	34	40	21	47	30	81.2	100	>40*
Sleep	6	%	13	51	46	57	38	59	10	81.2	81.2	56
Social life	7	%	1	53	49	60	34	66	15	62.5	87.5	53
Sex life	8	%	10	22	20	24	8	31	0	6.2	6.2	>40*
Help with socks etc.	9	%	0	22	18	28	9	30	10	18.7	62.5	33

* Minimal estimates

APPENDIX IO

DISABILITY: INDIVIDUAL ITEMS

CORRELATION MATRIX

(Main Study, n = 200)

	HEAVLIFT	SITHALF	TRAVHALF	STANDHAF	WALKHALF	SLEEPDIS	MISSSOC	SEXLIFE	HELPSOX
HEAVLIFT		27	39	29	29	20	27	12	28
SITHALF	27		53	26	13	15	34	17	14
TRAVHALF	39	53		24	24	28	32	16	21
STANDHAF	29	26	24		62	38	36	30	44
WALKHALF	29	13	24	62		35	34	14	29
SLEEPDIS	20	15	28	38	35		29	28	30
MISSSOC	27	34	32	36	34	29		30	35
SEXLIFE	12	17	16	30	14	28	30		25
HELPSOX	28	14	21	44	29	30	35	25	

The figures are Pearson product moment correlations X 100.

DISABILITY INDEX: FACTOR LOADINGS ON 1st UNROTATED PRINCIPAL COMPONENT

Sample	Main Study	Additional Group
n	200	141
HEAVLIFT	0.56	0.31
SITHALF	0.53	0.61
TRAVHALF	0.61	0.62
STANDHAF	0.74	0.72
WALKHALF	0.65	0.73
SLEEPDIS	0.59	0.73
MISSSOC	0.66	0.71
SEXLIFE	0.47	0.72
HELPSOX	0.61	0.65
Percentage of variance	36.9	43.2
Latent root (λ)	3.32	3.89
Internal consistency (θ)	0.79	0.82

DISABILITY: SCORES OUT OF NINE

COMPARISON OF NORMALS AND CLINICAL GROUPS

	n	$\bar{X}$	s.d.
Normals	77	0.34	1.09
Backs (total)	194	3.94	2.46
Backs (males)	115	3.53	2.30
Backs (females)	79	4.54	2.58
Backs (GPs)	76	2.79	2.02
Backs (problems)	118	4.69	2.44
Nonbacks (minor)	20	1.20	1.47
Nonbacks (OA)	16	4.63	2.03
Nonbacks (RA)	16	6.31	1.25

PAIRED GROUP COMPARISONS

	t	df *	p
Normals vs backs (total)	13.38	269	< .001
Normals vs backs (GPs)	10.47	151	< .001
Normals vs backs (problems)	15.81	193	< .001
Backs (males vs females)	-2.55	107	< .02
Backs (GPs vs problems)	4.80	135	< .001
Backs (total) vs nonbacks (OA+RA)	3.37	224	< .001
Nonbacks (minor vs OA+RA)	14.95	21	< .001
Nonbacks (OA vs RA)	-0.05	30	NS

* Where variances are significantly different, a separate variance estimate instead of a pooled variance estimate is used in the calculation of the t-test.

APPENDIX 13

OBJECTIVE PHYSICAL CHARACTERISTICS

ORIGINAL LIST OF VARIABLES

Variable	Code
Major Problem	MAJPROB
Previous lumbar operations	PREVSURG
Sciatic list	LIST
Loss of lordosis	LOSSLORD
Lumbar flexion	FLEXCMS
Catch	CATCH
Muscle spasm	SPASM
Guarded movements	GUARD
Lateral flexion	LATFLEX
Lumbar tenderness	LUMBTEND
Straight leg raising (left)	SLRLEFT
Straight leg raising (right)	SLRRIGHT
Root compression signs	ROOTCOMP
Root irritation signs	ROOTIRR (Main Study)
Motor weakness	MOTORW (Clinical Study)
Duration of symptoms	DURN
Time pattern	TIMEPATT

OBJECTIVE PHYSICAL CHARACTERISTICS

REJECTED VARIABLES PRIOR TO EVALUATION OF MAIN HYPOTHESIS

Variable	Reasons for Rejection		
	Reliability	Validity	Redundancy
Muscle spasm	+		NK
Guarded movements	+		NK
Sciatic list		+	+
Loss of lordosis		+	+
Catch		+	+
Lateral flexion	+	+	+
Lumbar tenderness		+	+
Root irritation signs			+
Motor weakness			+
Duration of symptoms			+

OBJECTIVE PHYSICAL CHARACTERISTICS

Variable	Code
Major problem	MAJPROB
Lumbar flexion in cms	FLEXCMS
Straight leg raising (left)	SLRLEFT
Straight leg raising (right)	SLRRIGHT
Root compression signs	ROOTCOMP
Number of previous back operations	PREVSURG
Time pattern	TIMEPATT

OBJECTIVE PHYSICAL CHARACTERISTICS

RELIABILITY OF INDIVIDUAL ITEMS

(Reliability Study, n = 32)

Variable	n	% Agreement	K	NTS	p
Major problem	32	93.3	0.77	4.02	< .001
Flexion (to within 1 cm)	32	90.0	0.81**	4.35	< .001
Straight leg raising (to within 15°)	64*	93.3	0.68**	3.88	< .001
Root compression	32	93.3	0.62	3.74	< .001
Previous surgery	32	100	1.00	-	< .001
Time pattern	32	96.7	0.90	4.94	< .001

* Left and right legs combined

** Owing to the small number of subjects; K, NTS and p are calculated on dichotomised variables, based on clinically important cut-offs.

K Kappa coefficient

NTS Null test statistic

p Probability

OBJECTIVE PHYSICAL CHARACTERISTICS

CONTINUOUS VARIABLES, EXTENT OF AGREEMENT

(Reliability Study, n = 32)

Variable	Scaling	Percentage	Cumulative Percentage
FLEXION			
	Exact	46.7	46.7
	Within 0.5 cms	40.0	86.7
	Within 1.0 cms	3.3	90.0
	Within 1.5 cms	10.0	100.0
STRAIGHT LEG RAISING (RIGHT & LEFT LEGS COMBINED)			
	Exact	20.0	20.0
	Within 5°	33.3	53.3
	Within 10°	30.0	83.3
	Within 15°	10.0	93.3
	Within 20°	6.7	100.0

OBJECTIVE PHYSICAL CHARACTERISTICS

FREQUENCIES OF INDIVIDUAL VARIABLES (PERCENTAGE)

(Clinical Pilot Study, n = 160 and Normals, n = 155)

	Total	Male	Female	GPs	Problems	Normals
n	160	80	80	80	80	155
MAJOR PROBLEM						NA
Back pain	33.1	32.9	33.3	35.4	28.4	-
Back pain & referred leg pain	45.0	42.1	47.6	43.0	46.3	-
Root pain	21.9	25.0	19.0	21.5	25.4	-
FLEXION (in cms)						
0	0	0	0	0	0	0
1	1.3	1.4	1.2	0	3.1	0
2	7.1	8.2	6.2	3.9	12.3	0
3	2.6	4.1	1.2	1.3	4.6	0
4	18.8	12.3	24.7	17.1	20.0	3.2
5	12.3	13.7	11.1	9.2	13.8	29.0
6	39.0	46.6	32.1	46.1	29.2	47.1
7	18.8	13.7	23.5	22.4	16.9	20.7
STRAIGHT LEG RAISING (LEFT)						
< 30°	0	0	0	0	0	0
30–44°	1.2	2.6	0	0	1.5	0
45–59°	5.0	6.6	3.6	3.8	7.5	0
60–74°	15.7	18.4	13.1	12.7	19.4	1.9
75–90°	78.1	72.4	83.3	83.5	71.6	98.1
STRAIGHT LEG RAISING (RIGHT)						
< 30°	0	0	0	0	0	0
30–44°	1.2	1.3	1.2	0	3.0	0
45–59°	4.4	6.6	2.4	2.5	7.4	0
60–74°	18.8	17.1	20.2	16.5	19.5	1.9
75–90°	75.6	75.0	76.2	81.0	70.1	98.1

OBJECTIVE PHYSICAL CHARACTERISTICS

FREQUENCY OF INDIVIDUAL VARIABLES

(PERCENTAGE)

(Clinical Pilot Study, n = 160)

	Total	Male	Female	GPs	Problem	Normals
n	160	80	80	80	80	
ROOT COMPRESSION SIGNS						NA
None	90.4	87.5	92.9	89.5	90.0	
Minor/doubtful	3.2	4.2	2.4	3.9	3.0	
Definite	6.4	8.3	4.8	6.6	6.1	
PREVIOUS BACK OPERATIONS						NA
0	91.9	92.1	91.7	97.5	86.6	
1	6.9	6.6	7.1	2.5	10.4	
2	1.2	1.3	1.2	0	3.0	
TIME PATTERN						NA
Acute	-	-	-	-	-	
Recurring	23.7	23.7	23.8	32.9	16.4	
Chronic	76.3	76.3	76.2	67.1	83.6	

OBJECTIVE PHYSICAL CHARACTERISTICS

FREQUENCIES OF INDIVIDUAL VARIABLES

(CUMULATIVE PERCENTAGES)

(Clinical Pilot Study, n = 160)

	Total	Male	Female	GPs	Problems	Normals
n	160	80	80	80	80	155
MAJOR PROBLEM						NA
Back pain	33.1	32.9	33.3	35.4	28.4	-
Back pain & referred leg pain	48.1	75.0	81.0	78.5	74.6	-
Root pain	100	100	100	100	100	-
FLEXION (in cms)						
0	0	0	0	0	0	0
1	1.3	1.4	1.2	0	3.1	0
2	8.4	9.6	7.4	3.9	15.4	0
3	11.0	13.7	8.6	5.3	20.0	0
4	29.9	26.0	33.3	22.4	40.0	3.2
5	42.2	39.7	44.4	31.6	53.8	32.2
6	81.2	86.3	76.5	77.6	83.1	79.4
7	100	100	100	100	100	100
STRAIGHT LEG RAISING (LEFT)						
< 30°	0	0	0	0	0	0
30–44°	1.2	2.6	0	0	1.5	0
45–59°	6.2	9.2	3.6	3.8	9.0	0
60–74°	21.9	27.6	16.7	16.5	28.4	1.9
75–90°	100	100	100	100	100	100
STRAIGHT LEG RAISING (RIGHT)						
< 30°	0	0	0	0	0	0
30–44°	1.2	1.3	1.2	0	3.0	0
45–59°	5.6	7.9	3.6	2.5	10.4	0
60–74°	24.4	25.0	23.8	19.0	29.9	1.9
75–90°	100	100	100	100	100	100

OBJECTIVE PHYSICAL CHARACTERISTICS** AND MAJOR DEPENDENT VARIABLES

CORRELATION MATRIX

(Clinical Pilot Study, n = 160)

	FLEXCMS	SLRLEFT	SLRRIGHT	ROOTCOMP	PREVSURG	TIMEPATT	DISABILITY	PAIN SCALE	WORK LOSS
FLEXCMS *		28	31	-04	27	17	37	26	38
SLRLEFT *	28		63	33	32	06	35	08	21
SLRRIGHT *	31	63		14	06	05	35	03	05
ROOTCOMP	-04	33	14		25	-04	05	-08	06
PREVSURG	27	32	06	25		12	27	22	46
TIMEPATT	17	06	05	-04	12		06	20	22

* Signs reversed in correlation matrix

** 'Major problem', a nominal variable, is excluded from this table.

The figures are Pearson product moment correlation coefficients X 100

OBJECTIVE PHYSICAL CHARACTERISTICS

FREQUENCIES OF INDIVIDUAL VARIABLES

(PERCENTAGE)

(Main Study, n = 200)

	Total	Male	Female	GPs	Problem
n	200	117	83	79	121
MAJOR PROBLEM					
Back pain	20.7	24.3	15.2	21.1	20.3
Back pain & referred leg pain	55.7	48.7	65.9	55.3	56.0
Root pain	23.7	27.0	19.0	23.7	23.7
FLEXION (in cms)					
0	0.5	0	1.3	1.3	0
1	3.1	3.5	2.5	1.3	4.2
2	6.7	5.2	8.9	3.9	8.5
3	9.8	5.2	16.5	6.6	11.9
4	11.3	11.3	11.4	9.2	12.7
5	20.6	21.7	19.0	15.8	23.7
6	24.7	28.7	19.0	30.3	21.2
7	23.2	24.3	21.5	31.6	17.8
STRAIGHT LEG RAISING (LEFT)					
< 30°	0	0	0	0	0
30–44°	4.1	5.2	2.6	5.3	3.4
45–59°	2.1	0.9	3.8	1.3	2.6
60–74°	21.3	20.9	21.8	13.1	26.5
75–90°	72.5	73.0	71.8	80.3	67.5
STRAIGHT LEG RAISING (RIGHT)					
< 30°	1.0	1.7	0	1.3	0.9
30–44°	2.6	3.5	1.3	1.3	3.4
45–59°	2.1	2.6	1.3	2.7	1.7
60–74°	20.7	21.8	19.2	17.1	23.1
75–90°	73.6	70.4	78.2	77.6	70.9

OBJECTIVE PHYSICAL CHARACTERISTICS

FREQUENCIES OF INDIVIDUAL VARIABLES

(PERCENTAGE)

(Main Study, n = 200)

	Total	Male	Female	GPs	Problem
n	200	117	83	79	121
ROOT COMPRESSION SIGNS					
None	79.3	81.7	75.6	90.8	71.8
Minor/doubtful	8.8	5.2	14.1	5.3	11.1
Definite	11.9	13.0	10.3	3.9	17.1
PREVIOUS BACK OPERATIONS					
0	84.5	87.8	79.7	98.7	75.4
1	9.8	7.0	13.9	1.3	15.3
2	4.1	3.5	5.1	0	6.8
3	1.5	1.7	1.3	0	2.5
TIME PATTERN					
Acute	-	-	-	-	-
Recurring	27.8	31.3	22.8	44.7	16.9
Chronic	72.2	68.7	77.2	55.3	83.1

OBJECTIVE PHYSICAL CHARACTERISTICS
FREQUENCIES OF INDIVIDUAL VARIABLES
(CUMULATIVE PERCENTAGE)
(Main Study, n = 200)

	Total	Male	Female	GPs	Problem
n	200	117	83	79	121
MAJOR PROBLEM					
Back pain	20.7	24.3	15.2	21.1	20.3
Back pain & referred leg pain	78.4	73.0	81.0	76.4	76.3
Root pain	100	100	100	100	100
FLEXION (in cms)					
0	0.5	0	1.3	1.3	0
1	3.6	3.5	3.8	2.6	4.2
2	10.3	8.7	12.7	6.6	12.7
3	20.1	13.9	29.1	13.2	24.6
4	31.5	25.2	40.5	22.4	37.3
5	52.1	47.0	59.5	38.2	61.0
6	76.8	75.7	78.5	68.4	82.2
7	100	100	100	100	100
STRAIGHT LEG RAISING (LEFT)					
< 30°	0	0	0	0	0
30–44°	4.1	5.2	2.6	5.3	3.4
45–59°	6.2	6.1	6.4	6.6	6.0
60–74°	27.5	27.0	28.2	19.7	32.5
75–90°	100	100	100	100	100
STRAIGHT LEG RAISING (RIGHT)					
< 30°	1.0	1.7	0	1.3	0.9
30–44°	3.6	5.2	1.3	2.6	4.3
45–59°	5.7	7.8	2.6	5.3	6.0
60–74°	26.4	29.6	21.8	22.4	29.1
75–90°	100	100	100	100	100

OBJECTIVE PHYSICAL CHARACTERISTICS AND MAJOR DEPENDENT VARIABLES

CORRELATION MATRIX

(Main Study, n = 200)

	FLEXCMS	SLRLEFT	SLRRIGHT	ROOTCOMP	PREVSURG	TIMEPATT	DISABILITY	PAIN SCALE	WORK LOSS
FLEXCMS *		40	37	33	33	09	33	16	17
SLRLEFT *	40		60	24	09	10	25	15	09
SLRRIGHT *	37	60		25	15	06	27	19	12
ROOTCOMP	33	24	25		06	-07	22	12	-02
PREVSURG	33	09	15	06		18	41	25	38
TIMEPATT	09	10	06	-07	18		35	32	38

* Signs reversed in correlation matrix.

'Major problem', a nominal variable, is excluded from this table.

The figures are Pearson product moment correlations X 100.

OBJECTIVE PHYSICAL CHARACTERISTICS VALIDITY - RELATIONSHIP WITH FUNCTIONAL DISABILITY, SELF-RATED PAIN AND WORK LOSS COMPARISON OF 7 AND 14 ITEM BATTERIES

(Clinical Pilot Study, n = 160; and Main Study, n = 200)

	ADJUSTED R^2					
	Disability		Pain Scale		Work Loss	
	160	200	160	200	160	200
Final battery (7 items)	27.9	33.7	8.8	13.3	25.8	17.4
Extended battery* (14 items)	32.0	39.5	10.7	14.5	27.1	19.6
Ratio**	0.87	0.85	0.82	0.92	0.95	0.89

* Additional items –

Root irritation signs (200)/Major weakness (160)

Loss of lordosis

List

Lateral flexion

Catch

Lumbar tenderness

Duration of symptoms

** Ratio of variance in dependent variable explained by the 7 and 14 item batteries.

INAPPROPRIATE SYMPTOMS: INITIAL PILOT STUDY

RANKING OF INAPPROPRIATENESS BY ORTHOPAEDIC AND NEUROSURGICAL CONSULTANTS (n = 22)

Symptom	Rating				
	None	Minor	Moderate	Major	Uncertain
Cyclical symptoms	-	1	7	11	8
Non-anatomical pain patterns	-	2	8	10	2
Non-anatomical sensory patterns	-	5	3	12	2
Multiple hospitals/doctors	-	5	8	9	-
Written list of symptoms	1	5	8	7	1
No response to any treatment	1	4	6	8	3
Pain unrelated to activity	3	4	10	4	1
Fainting with pain	1	5	7	6	3
Leg jumping/difficult to control	3	6	8	5	0
Insistance on surgery	2	5	9	4	2
Starting with direct blow to back	3	2	5	7	5
Repeated emergency admissions	4	4	4	7	3
Walking aids	5	4	2	7	4
Non-episodic pain	4	5	7	2	4
Reactions to/intolerance of treatment	2	6	5	4	5
Pethidine etc. more than a few days	9	2	4	5	2

Symptom	Rating				
	None	Minor	Moderate	Major	Uncertain
Leg collapsing	6	10	5	-	1
Help required dressing/undressing	10	6	1	3	2
Flattery/seductiveness	3	4	4	1	10
Back locking	12	7	1	1	1
Latent period prior to onset	9	6	2	-	5
Leg dragging	13	7	1	-	1
Severe reaction to myelogram	10	6	1	-	5

Added later

Pain at tip of tailbone

Major sexual dysfunction

APPENDIX 26

INAPPROPRIATE SYMPTOMS - ITEMS EXCLUDED PRIOR TO MAIN STUDY

	Rarity (In Back Pain Patients)	High Incidence in Normals	Non-Psychological (182 Pilot Survey)	Low Reliability (Test Retest)	Clinical Ambiguity or Redundancy
Cyclical symptoms				*	*
Written list	*				*
No response to treatment				*	*
Pain unrelated to activity				*	*
Fainting with pain	*				
Leg jumping/difficult to control		*	*		
Insistance on surgery	*		*	*	*
Pethidine etc, more than few days	*				
Help required dressing	*				*
Flattery/seductiveness				*	*
Back locking		*	*		*
Latent period prior to onset					
Leg dragging					*
Severe reaction to myelogram		*	*		*

INAPPROPRIATE SYMPTOMS - FINAL LIST OF VARIABLES

Name	Code
Pain at tip of tailbone	TAILBONE
Whole leg pain	WHOLELEG
Whole leg numbness	LEGNUMB
Whole leg giving way	LEGCOLL
No pain free spells	PAINFREE
Intolerance of treatment	INTOLER
Emergency admissions	EMERGADM

APPENDIX 28

INAPPROPRIATE SYMPTOMS: RELIABILITY OF INDIVIDUAL ITEMS

	n	% Agreement	K	NTS	Sig.
Pain at tip of tailbone	30	80	0.58	3.20	p<.01
Whole leg pain	30	90	0.67	3.20	p<.01
Whole leg numbness	30	100	1.00	-	p<.001
Whole leg giving way	30	95	0.89	3.89	p<.001
No pain free spells	30	87	0.59	3.02	p<.01
Intolerance of treatment	30	90	0.52	2.72	p<.01
Emergency admissions	30	90	0.62	2.81	p<.01

INAPPROPRIATE SYMPTOMS: DISCRIMINATION BETWEEN NORMALS (n = 77) AND BACK PATIENTS (Mai

	Chi^2
TAILBONE	14.32
WHOLELEG	8.01
LEGNUMB	4.07
LEGCOLL	31.18
PAINFREE	20.40
INTOLER	Not Applicable
EMERGADM	Not Applicable

INAPPROPRIATE SYMPTOMS: CORRELATION MATRIX

MAIN STUDY (n = 200)

	Pain at tip of tailbone	Whole leg pain	Whole leg numbness	Whole leg giving way	No pain free spells	Intolerance of treatment	Emergency admission
Pain at tip of tailbone		24	16	20	10	05	16
Whole leg pain	24		43	28	32	11	28
Whole leg numbness	16	43		22	23	12	16
Whole leg giving way	20	28	22		18	11	20
No pain free spells	10	32	23	18		30	22
Intolerance of treatment	05	11	12	11	30		32
Emergency admission	16	28	16	20	22	32	

Figures are Pearson product moment correlations X 100

INAPPROPRIATE SYMPTOMS: FACTOR LOADINGS ON 1ST UNROTATED PRINCIPAL COMPONENT

	Main Study (n = 200)	Extra Backs (n = 141)
Pain at tip of tailbone	0.43	0.68
Whole leg pain	0.71	0.70
Whole leg numbness	0.61	0.73
Whole leg giving way	0.61	0.59
No pain free spells	0.47	0.37
Intolerance of treatment	0.60	0.63
Emergency admissions to hospital	0.54	0.47
% variance	32.7	36.8
Latent root (λ)	2.29	2.57
Internal consistency (θ)	0.64	0.71

INAPPROPRIATE SYMPTOMS: RELATIONSHIP WITH OBJECTIVE PHYSICAL CHARACTERISTICS

PRINCIPAL COMPONENT ANALYSIS

(Main Study, n = 200)

VARIMAX ROTATED FACTOR LOADINGS

		13 Items		12 Items	
		First Factor	Second Factor	First Factor	Second Factor
Objective Physical Characteristics	FLEXCMS	-.17	.72	-.12	.81
	SLRLEFT	-.07	.77	-.05	.67
	SLRRIGHT	-.08	.77	-	-
	ROOTCOMP	-.15	-.58	-.20	-.63
	PREVSURG	.45	-.29	.42	-.41
	TIMEPATT	.51	.09	.51	-0
Inappropriate Symptoms	TAILBONE	.43	-.02	.43	-.01
	WHOLELEG	.66	.01	.67	-.01
	LEGNUMB	.58	.13	.60	.13
	PAINFREE	.67	.12	.67	.08
	INTOLER	.50	-.11	.48	-.20
	EMERGADM	.54	-.23	.51	-.31
	LEGCOLL	.44	-.12	.45	-.08
Percentage of variance		20.5	17.3	21.9	15.3

INAPPROPRIATE SYMPTOMS: RELATIONSHIP WITH OBJECTIVE PHYSICAL CHARACTERISTICS (EXAMINATION ALONE). PRINCIPAL COMPONENT ANALYSIS

(Main Study, n = 200)

VARIMAX ROTATED FACTOR LOADINGS

		11 Items		10 Items	
		First Factor	Second Factor	First Factor	Second Factor
Objective Physical Examination	FLEXCMS	-0.14	0.70	-0.14	0.79
	SLRLEFT	-0.09	0.79	-0.09	0.71
	SLRRIGHT	-0.09	0.78	-	-
	ROOTCOMP	-0.14	-0.58	-0.14	-0.67
Inappropriate Symptoms	TAILBONE	0.46	-0.02	0.46	0.01
	WHOLELEG	0.70	0	0.71	0
	LEGNUMB	0.61	0.13	0.62	0.15
	PAINFREE	0.63	0.10	0.62	0.09
	INTOLER	0.48	-0.10	0.47	-0.16
	EMERGADM	0.57	-0.21	0.57	-0.27
	LEGCOLL	0.51	-0.14	0.52	-0.09
Percentage of variance		21.3	19.6	23.5	17.1

INAPPROPRIATE SYMPTOMS: SEPARABILITY FROM INAPPROPRIATE SIGNS

VARIMAX ROTATED FACTOR MATRIX

		Factor 1	Factor 2
Inappropriate Signs	Superficial tenderness	0.57	0.20
	nonanatomical tenderness	0.67	0.27
	Axial loading	0.66	0.18
	Simulated rotation	0.70	0.00
	Distraction straight leg raising	0.73	0.05
	Regional weakness	0.66	0.28
	Overreaction to examination	0.75	0.25
Inappropriate Symptoms	Pain at tip of tailbone	0.30	0.31
	Whole leg pain	-0.01	0.81
	Whole leg numbness	0.05	0.68
	Whole leg giving way	0.37	0.38
	No pain free spells	0.31	0.48
	Intolerance of treatment	0.21	0.38
	Emergency admissions	0.16	0.55
Latent root (λ)		3.60	2.33
% total variance		25.7	16.6

INAPPROPRIATE SYMPTOMS: INCIDENCE OF INDIVIDUAL ITEMS

	Normals	Backache (Main Study)					Nonbacks			Spinal Pathology
		Total	Males	Females	GP	Problem	Minor	OA	RA	
n	77	200	117	83	79	121	20	16	16	73
Pain at tip of tailbone %	18	42.5	33.3	55.4	38.0	45.5	-	-	-	32
Whole leg pain %	8	22.5	13.7	34.9	13.9	28.1	15	37.5	37.5	11
Whole leg numbness %	13	24.0	17.1	33.7	13.9	30.6	0	6.2	6.2	27
Whole leg giving way %	5	39.5	34.2	47.0	26.6	47.9	10.0	25.0	25.0	33
No pain free spells %	4	29.0	25.6	33.7	16.5	37.2	35.0	62.5	50.0	18
Intolerance of treatment %	NA	24.5	23.9	25.3	5.1	37.2	5.0	12.5	18.7	14
Emergency admission %	NA	16.5	11.1	24.1	7.6	22.3	0	0	0	21

NA Not applicable

INAPPROPRIATE SYMPTOMS: SCORE OUT OF SEVEN

(PERCENTAGES)

Scores	n	Normals			Backache			Spinal Pathology
			Total	Males	Total	Females	GP	
		77	200	117	83	121	79	53
0		57	20.0	27.4	9.6	7.4	39.2	31
1		29	27.5	27.4	27.7	28.1	26.6	22
2		8	22.0	25.6	16.9	27.3	13.9	16
3		1	12.0	9.4	15.7	9.9	15.2	11
4		5	11.0	6.0	18.1	14.9	5.1	10
5		0	4.0	0.9	8.4	6.6	0	5
6		0	3.5	3.4	3.6	5.8	0	4
7		0	0	0	0	0	0	1

INAPPROPRIATE SYMPTOMS: SCORE OUT OF SEVEN

(CUMULATIVE PERCENTAGES)

Scores	n	Normals		Spinal Pathology		Backache			
			Total		Males		Females	GP	Problem
		77	200	53	117	121	83	79	121
0		57	20.0	31	27.4	7.4	9.6	39.2	7.4
1		86	47.5	53	54.7	35.5	37.3	65.8	35.5
2		94	69.5	69	80.3	62.8	54.2	79.7	62.8
3		95	81.5	80	89.7	72.7	69.9	94.9	72.7
4		100	92.5	90	95.7	87.6	88.0	100	87.6
5		100	96.5	95	96.6	94.2	96.4	100	94.2
6		100	100	99	100	100	100	100	100
7		100	100	100	100	100	100	100	100

INAPPROPRIATE SYMPTOMS: SCORE OUT OF SEVEN

COMPARISON OF NORMALS (n = 77) AND BACK PATIENTS (MAIN STUDY, n = 200)

	n	$\bar{X}$	s.d.
Normals	77	0.69	1.03
Backache (total)	200	1.93	1.60
Backache (males)	117	1.56	1.47
Backache (females)	83	2.45	1.65
Backache (GPs)	79	1.20	1.26
Backache (problems)	121	2.40	1.63

SELECTED PAIRED GROUP COMPARISONS

	t	df*	p
Normals v total	6.29	274	< .01
Normals v GPs	2.75	153	< .01
Normals v problems	8.18	195	< .01
Males v females	3.90	197	< .01
GPs v problems	5.22	192	< .001

* Where variances were significantly different, a separate variance estimate was employed.

M.A.P.Q. - PILOT

I N S T R U C T I O N S

In this questionnaire we are attempting to find out the extent to which people become aware of sensations in their body when they are anxious.

We should like you to think back to the last time you felt very anxious, then look at the list of items over the page. As you will see, there are 43 items, each referring to a different body sensation which you may notice when you are anxious. There are no right or wrong answers.

Firstly, please answer YES or NO to each item by scoring out the answer which does not apply.

Secondly, please indicate, for those items which you did notice (i.e., answered 'YES') the EXTENT to which you were aware of them by selecting a number from 1 to 10 and entering the answer in Column A.

e.g.

1	2	3	4	5	6	7	8	9	10
mildly aware			moderately aware				extremely aware		

Thus 1, 2 or 3 indicates that you were mildly aware of the sensation, and 3 suggests more awareness than 2 which suggests more awareness than 1 etc.

Thirdly, we should like to find out how often you have been aware of the sensation when anxious. Please select a number between 1 and 10 to give some indication of the frequency, and enter in Column B

1	2	3	4	5	6	7	8	9	10
hardly ever			50% of the time					always	

Finally, it would help us considerably to have a little information about yourself:-

Age: _____

Sex: _____

What situation were you imagining when filling in this questionnaire?

_____

_____

MAIN AUTONOMIC PERCEPTION QUESTIONNAIRE (Pilot)

1.	Heart rate increase	YES/NO	A	B
2.	More intense	YES/NO	A	B
3.	Missing beats	YES/NO	A	B
4.	Feeling hot all over	YES/NO	A	B
5.	Feeling cold all over	YES/NO	A	B
6.	Hot in particular part If Yes, please name	YES/NO	A	B
7.	Cold in particular part If Yes, please name	YES/NO	A	B
8.	Blushing	YES/NO	A	B
9.	Fear that going to blush	YES/NO	A	B
10.	Sweating all over	YES/NO	A	B
11.	Sweating in part of body If Yes, please name	YES/NO	A	B
12.	Aware of pulse in neck	YES/NO	A	B
13.	Pounding in head	YES/NO	A	B
14.	Dizziness	YES/NO	A	B
15.	Blurring of vision	YES/NO	A	B
16.	Double vision	YES/NO	A	B
17.	Other visual disturbances If Yes, please specify	YES/NO	A	B
18.	Feel that going to faint	YES/NO	A	B
19.	Everything appears unreal	YES/NO	A	B
20.	Nausea	YES/NO	A	B
21.	Butterflies in stomach	YES/NO		B
22.	Pain/ache in stomach	YES/NO	A	B
23.	Stomach churning	YES/NO	A	B
24.	Desire to pass water	YES/NO	A	B
25.	Desire to defecate	YES/NO	A	B

26. Diarrhoea	YES/NO	A	B
27. Mouth becoming dry	YES/NO	A	B
28. Difficulty in swallowing	YES/NO	A	B
29. Muscles in neck ache	YES/NO	A	B
30. Teeth clenching	YES/NO	A	B
31. Lump in throat	YES/NO	A	B
32. Choked up feeling	YES/NO	A	B
33. Difficulty breathing	YES/NO	A	B
34. Difficulty talking	YES/NO	A	B
35. Breathing increase	YES/NO	A	B
36. Breathing becoming shallow	YES/NO	A	B
37. Hands shaking	YES/NO	A	B
38. Legs feeling weak	YES/NO	A	B
39. Muscles twitching/jumping	YES/NO	A	B
40. Stiffness in parts of body If so, please specify	YES/NO	A	B
41. Tense feeling across forehead	YES/NO	A	B
42. Tense feeling in jaw muscles	YES/NO	A	B
43. Pains in other parts of body If so, please specify	YES/NO	A	B

If there are any other sensations of which you are aware when anxious, please indicate below.

MSPQ : FIRST AND SECOND PILOT STUDIES

FIRST PILOT STUDY (anxious patients)

Number of cases 72

Sex 63.9% female 36.1% male

Age $\bar{X}$ 33.14 s.d. = 7.92

Diagnosis*	generalized anxiety state	19.4%
	agoraphobia	37.3%
	social phobia	34.3%
	specific fear or phobia	26.9%

SECOND PILOT STUDY (anxious patients)

Number of cases 72

Sex 56.9% female 43.1% male

Age $\bar{X}$ 32.06 s.d. = 8.12

Diagnosis*	generalized anxiety state	19.7%
	isolated panic attacks	21.1%
	agoraphobia	31.0%
	social phobia	28.2%
	specific fear or phobia	16.9%

* The diagnoses are not mutually exclusive

MSPQ: ITEMS REJECTED AFTER FIRST PILOT STUDY

Name	Reason for Rejection		
	Low Incidence	Clinical Ambiguity	Redundancy
Feeling cold all over	*		
Cold in particular part	*		
Fear that going to blush		*	
Double vision	*		
Other visual disturbances	*		
Teeth clenching		*	
Lump in throat		*	
Choked up feeling		*	
Difficulty talking		*	
Stiffness in parts of body	*		*
Pains in other parts of body		*	

MSPQ

Please describe how you have felt during the PAST WEEK by making a check mark ( ) in the appropriate box. Please answer ALL questions. Do not think too long before answering.

	Not at all	A little/ slightly	A great deal/ quite a bit	Extremely/ could not have been worse
Pounding in head				
Mouth becoming dry				
Flatulence (wind)				
Heart beating louder				
Sweating in a particular part of body				
Blurring of vision				
Breathing becomes faster				
Sweating all over				
Heart rate increasing				
Stomach churning				
Difficulty in breathing				
Muscles twitching or jumping				
Feeling hot all over				
Feeling faint				
Butterflies in stomach				
Muscles in neck aching				
Tense feeling in jaw muscles				
Blushing				
Dizziness				
Diarrhoea				
Tense feeling across forehead				
Hands shaking				
Heart missing beats				
Pulse in neck				
Everything appearing unreal				
Desire to pass water				
Legs feel weak				
Nausea				
Pain or ache in stomach				
Difficulty in swallowing				
Feeling hot in particular part of body				
Breathing becomes shallow				
Desire to defecate (open bowels)				

MSPQ: NORMAL CONTROL GROUP

EXCLUSION CRITERIA AND DESCRIPTIVE CHARACTERISTICS

Exclusion Criteria:

Previous back surgery
Significant back pain episode in previous year
Not having English as native language
Recurring psychiatric treatment
Smelling of alcohol
Mentally handicapped
Unable to read

Descriptive Characteristics

Sex Female 55% Male 45%

Age: 38.24 yrs s.d. 10.89 yrs

Family history of chronic pain or illness	19%
Paramedical occupations	24%
Previous psychiatric treatment	3%
Problems with alcohol	0%
Work injuries in previous year	5%
Involved in medico-legal proceedings	0%
Trouble with other joints	22%
Trouble with neck	8%
Headache	22%
Dizziness	16%
Trouble with eyes (excluding glasses)	16%
Hand shakiness	0%
Excessive sweating	11%
Chest pain	8%
Difficulty breathing	3%
Loss of appetite	8%
Indigestion	27%
Weight problem	16%
Trouble with bowels	8%
Urinary problems	8%
Menstrual problems	5%

MSPQ : DISCRIMINANT VALIDITY OF INDIVIDUAL ITEMS IN ANXIOUS PATIENTS (n = 72) AND NORMALS (n = 100)

Item	Chi^2	Significance
Heart rate increasing	62.42	p < .001
Heart beating louder	32.18	p < .001
Heart missing beats	16.04	p < .001
Feeling hot all over	39.49	p < .001
Feeling hot in a particular part of body	12.74	p < .001
Blushing	3.39	NS
Sweating all over	42.73	p < .001
Sweating in a particular part of body	11.87	p < .001
Pulse in neck	15.18	p < .001
Pounding in head	19.90	p < .001
Dizziness	34.60	p < .001
Blurring of vision	16.83	p < .001
Feeling faint	50.96	p < .001
Everything appearing unreal	40.12	p < .001
Nausea	54.64	p < .001
Butterflies in stomach	51.73	p < .001
Pain or ache in stomach	19.74	p < .001
Stomach churning	42.91	p < .001
Desire to pass water	18.72	p < .001
Desire to defecate (open bowels)	9.40	p < .01
Diarrhoea	5.40	p < .05
Mouth becoming dry	52.93	p < .001
Difficulty swallowing	48.89	p < .001
Muscles in neck aching	20.10	p < .001
Difficulty breathing	32.18	p < .001
Breathing becomes faster	41.67	p < .001
Breathing becomes shallow	23.11	p < .001
Hands shaking	37.68	p < .001
Legs feel weak	52.96	p < .001
Muscles twitching or jumping	44.22	p < .001
Tense feeling across forehead	39.45	p < .001
Tense feeling in jaw muscles	48.48	p < .001
Flatulence (wind)	3.07	NS

For the purpose of calculating chi-squares, the scale was dichotomised (0 v rest) with one degree of freedom in each case.

APPENDIX 45

MSPQ: PILOT STUDY ON BACK PATIENTS (n = 102)

DESCRIPTIVE AND CLINICAL CHARACTERISTICS

Sex:	Female 46.1%	Male 53.9%
Age	39.2 yrs	s.d. 12.7 yrs
Social Class	1 Professional	11%
	2 Semi-professional	28%
	3 Skilled : non-manual	17%
	3 Skilled : manual	27%
	4 Semi-skilled	10%
	5 Unskilled	5%
	Other	2%
	Not known	2%
Paramedical occupation		16%
Previous back operations		0%
Previous significant back pain episode		60%
Length of present episode	< 3 months	42.2% *
	4-6 months	20.0%
	7m - 1 yr	15.6%
	1-2 yrs	11.1%
	> 2 yrs	11.1%
Degree of work loss	None	34.9%
	1-3 months	43.4%
	4-6 months	9.6%
	7m - 1 yr	9.6%
	1-2 yrs	3.6%
Current medication	Analgesics	48.4%
	Minor tranquilisers	14.3%
	Hypnotics	4.4%
	Major sedatives	1.1%
	Antidepressants	0%

* To fulfil criterion of chronicity, patients whose current pain episode was < 3 months had to have had at least 3 months back pain in toto (i.e. including previous episodes).

APPENDIX 46

MSPQ: FINAL LIST OF VARIABLES USED

Name	Abbreviation
Feeling hot all over	HOTGEN
Sweating all over	SWEATGEN
Dizziness	DIZZY
Blurring of vision	VISBLUR
Feeling faint	FAINT
Nausea	NAUSEA
Pain or ache in stomach	PAINSTOM
Stomach churning	CHURNSTO
Mouth becoming dry	MOUTHDRY
Muscles in neck aching	NECKMUSC
Legs feeling weak	LEGSWEAK
Muscles twitching or jumping	TWITCHES
Tense feeling across forehead	TENSFORE

MSPQ: PILOT STUDY ON BACK PATIENTS (n = 102)

CORRELATION MATRIX

	HOTGEN	SWEATGEN	DIZZY	VISBLUR	FAINT	NAUSEA	PAINSTOM	CHURNSTO	MOUTHDRY	NECKMUSC	LEGSWEAK	TWITCHES	TENSFORE
HOTGEN		56	21	13	35	41	07	12	30	28	28	-01	18
SWEATGEN	56		16	15	14	32	18	21	17	25	25	11	05
DIZZY	21	16		55	37	34	38	20	26	36	38	20	55
VISBLUR	13	15	55		43	28	36	16	16	14	25	07	21
FAINT	35	14	37	43		39	23	17	27	19	28	12	22
NAUSEA	41	32	34	28	39		31	04	41	28	56	20	33
PAINSTOM	07	18	38	36	23	31		54	13	33	32	21	50
CHURNSTO	12	21	20	16	17	04	54		35	37	35	12	13
MOUTHDRY	30	17	26	16	27	41	13	35		10	23	28	21
NECKMUSC	28	25	36	14	19	28	33	37	10		30	27	45
LEGSWEAK	28	25	38	25	28	56	32	35	23	30		40	45
TWITCHES	-01	11	20	07	12	20	21	12	28	27	40		45
TENSFORE	18	05	55	21	22	33	50	13	21	45	45	45	

Correlations are Pearson product moment correlations X 100.

MSPQ: FACTOR LOADINGS AND INTERNAL CONSISTENCIES

Variable	Pilot Backs (n = 102)		Main Study (n = 200)	
	Males (n = 55)	Females (n = 47)	Males (n = 117)	Females (n = 83)
Feeling hot all over	.21	.51	.69	.61
Sweating all over	.26	.50	.56	.61
Dizzyness	.62	.72	.66	.60
Blurring of vision	.01	.70	.38	.45
Feeling faint	.12	.68	.48	.59
Nausea	.74	.67	.36	.38
Pain in stomach	.63	.60	.50	.46
Churning in stomach	.54	.38	.22	.56
Mouth becoming dry	.33	.51	.49	.72
Neck muscles aching	.65	.53	.55	.46
Legs feeling weak	.63	.72	.53	.66
Muscles twitching or jumping	.56	.46	.52	.64
Tense feeling across forehead	.86	.66	.66	.60
% of total variance	28.6	35.8	27.3	32.9
Latent root (λ)	3.71	4.65	3.54	4.27
Internal consistency (θ)	0.79	0.85	0.78	0.83

MSPQ: PILOT STUDY ON BACK PATIENTS (n = 102)

ANALYSIS OF VARIANCE: INDIVIDUAL ITEMS BY GENDER

Variable	Females			Males			Eta^2	Significance
	n	$\bar{X}$	s.d.	n	$\bar{X}$	s.d.		
Feeling hot all over	46	0.39	0.65	54	0.11	0.37	0.07	$p < .009$
Sweating all over	47	0.45	0.65	55	0.29	0.71	0.01	NS
Dizzyness	46	0.35	0.57	55	0.22	0.42	0.02	NS
Blurring of vision	47	0.32	0.59	55	0.16	0.42	0.02	NS
Feeling faint	47	0.30	0.51	55	0.13	0.39	0.04	NS
Nausea	47	0.40	0.61	55	0.11	0.31	0.09	$p < .003$
Pain in stomach	46	0.37	0.74	54	0.24	0.54	0.01	NS
Churning in stomach	47	0.19	0.58	55	0.20	0.49	0.00	NS
Mouth becoming dry	47	0.38	0.68	54	0.19	0.48	0.03	NS
Neck muscles aching	47	0.51	0.79	54	0.44	0.77	0.00	NS
Legs feeling weak	46	0.85	0.84	55	0.49	0.60	0.06	$p < .02$
Muscles twitching or jumping	45	0.40	0.69	55	0.29	0.53	0.01	NS
Tense feeling across forehead	46	0.24	0.57	54	0.17	0.47	0.01	NS

APPENDIX 50

MSPQ: VALIDITY (PILOT STUDY OF BACK PATIENTS, n = 25)

CORRELATIONS WITH MMPI SCALES AND ZUNG DEPRESSION INVENTORY

	MSPQ (factor score)
MMPI Hypochondriasis Scale (Hs)	0.61
MMPI Depression Scale (D)	0.36
MMPI Hysteria Scale (Hy)	0.03
Zung Depression Inventory	0.54

Figures are pearson product moment correlation coefficients.

MSPQ: VALIDITY

CORRELATIONS WITH CLINICAL RATINGS

(Main Study, n = 200)

MSPQ Individual Item	Clinical Equivalent Item	Correlation of Individual Items	Correlation of clinical Item with MSPQ Factor Score
Feeling hot all over	None	-	-
Sweating all over	Excess sweating	0.50	0.34
Dizzyness	Dizzyness	0.58	0.41
Blurring of vision	Difficulty with eyes	0.35	0.47
Feeling faint	Blackouts	0.29	0.20
Nausea	Loss of enjoyment of food	0.25	0.42
Pain in stomach	Indigestion	0.25	0.10
Churning in stomach	Indigestion	0.10	0.10
Mouth becoming dry	None	-	-
Neck muscles aching	Trouble with neck	0.44	0.27
Legs feeling weak	Leg giving way	0.34	0.64
Muscles twitching & jumping	None	-	-
Tense feeling across forehead	Headache	0.32	0.33

Figures shown are Pearson product moment correlations.

MSPQ: VALIDITY, RELATION WITH MUSCLE TENSION, PAIN THRESHOLD & TOLERANCE AND THE McGILL PAIN QUESTIONNAIRE (EXPERIMENTAL STUDY, n = 42)

	MSPQ Factor Score	Tension In Forehead	Tension In Jaw Muscles	Neck Muscles Aching
Muscle tension (standing)	-0.41*	-0.31	-0.71	-0.40*
Muscle tension (sitting)	-0.29	-0.20	-0.09	0.13
Muscle tension (biceps)	0.07	-0.06	-0.12	0.02
Pain threshold	-0.03	0.04	-0.11	-0.20
Pain tolerance	-0.02	-0.03	-0.06	-0.16
Pain ratio	0.04	-0.03	-0.11	-0.03
PRI:Sensory	0.26	0.12	0.39*	0.38*
PRI:Affective	0.06	0.34*	0.32*	0.31*
PRI:Evaluative	0.19	0.37*	0.35*	0.22
PRI:Miscellaneous	0.26	0.52**	0.50**	0.47**
PRI:Total	0.26	0.34*	0.49**	0.46**
No. words chosen	0.29	0.25	0.33*	0.34*
Present pain intensity	0.09	0.04	-0.04	0.01

* $p < .05$

** $p < .01$

The figures are Pearson product moment correlation coefficients.

PRI is the McGill Pain Rating Index.

MSPQ: DISTRIBUTION OF SCORES (PERCENTAGE)

	Normals		Backache				Nonbacks		
		Total	Male	Female	GP	Problem	Minor	OA	RA
Score out of 13 n	100	200	117	83	79	121	20	16	16
0	37	14.8	13.5	16.7	23.3	9.5	20.0	28.6	12.5
1	27	13.2	16.2	9.0	17.8	10.3	25.0	21.4	6.2
2	12	12.2	18.0	3.8	11.0	12.9	25.0	14.3	12.5
3	8	12.2	14.4	9.0	11.0	12.9	10.0	14.3	31.2
4	9	12.7	11.7	14.1	6.8	16.4	5.0	7.1	6.2
5	2	7.4	7.2	7.7	6.8	7.8	0	7.1	12.5
6	3	6.3	7.2	5.1	6.8	6.0	5.0	0	0
7	1	5.8	3.6	9.0	2.7	7.8	5.0	7.1	6.2
8	0	3.7	1.8	6.4	2.7	4.3	0	0	6.2
9	1	5.8	1.8	11.5	6.8	5.2	0	0	0
10	0	2.6	3.6	1.3	4.1	1.7	5.0	0	0
11	0	1.6	0	3.8	0	2.6	0	0	0
12	0	1.1	0.9	1.3	0	1.7	0	0	0
13	0	0.5	0	1.3	0	0.9	0	0	6.2

MSPQ: DISTRIBUTION OF SCORES (CUMULATIVE PERCENTAGE)

	Normals		Backache				Nonbacks		
		Total	Male	Female	GP	Problem	Minor	OA	RA
Score out of 13 n	100	200	117	83	79	121	20	16	16
0	37	14.8	13.5	16.7	23.3	9.5	20.0	28.6	12.5
1	64	28.0	29.7	25.6	41.1	19.8	45.0	50.0	18.7
2	76	40.2	47.7	29.5	52.1	32.8	70.0	64.3	31.2
3	84	52.4	62.2	38.5	63.0	45.7	80.0	78.6	62.5
4	93	65.1	73.9	52.6	69.9	62.1	85.0	85.7	68.7
5	95	72.5	81.1	60.3	76.7	69.8	85.0	92.9	81.2
6	98	78.8	88.3	65.4	83.6	75.9	90.0	92.9	81.2
7	99	84.7	91.9	74.4	86.3	83.6	95.0	100	87.5
8	99	88.4	93.7	80.8	89.0	87.9	95.0	100	93.7
9	100	94.2	95.5	92.3	95.9	93.1	95.0	100	93.7
10	100	96.8	99.1	93.6	100	94.8	100	100	93.7
11	100	98.4	99.1	97.4	100	97.4	100	100	93.7
12	100	99.5	100	98.7	100	99.1	100	100	93.7
13	100	100	100	100	100	100	100	100	100

MSPQ: SCORE OUT OF THIRTEEN
COMPARISON OF NORMALS AND CLINICAL GROUPS

	n	$\bar{X}$	s.d.
Normals	100	1.55	1.85
Backs (total)	189	3.86	3.15
Backs (males)	111	3.24	2.70
Backs (females)	78	4.74	3.54
Backs (GPs)	73	3.19	3.09
Backs (problems)	116	4.28	3.13
Nonbacks (minor)	20	2.40	2.60
Nonbacks (OA)	16	2.07	2.13
Nonbacks (RA)	16	3.88	3.28

PAIRED GROUP COMPARISONS

	t	df*	p
Normals vs backs (total)	6.72	287	< .001
Normals vs backs (GPs)	4.32	171	< .001
Normals vs backs (problems)	7.61	214	< .001
Backs (males vs females)	4.16	182	< .001
Backs (GPs vs problems)	2.50	162	< .02
Backs (total) vs Nonbacks (OA+RA)	3.03	217	< .001
Nonbacks (minor vs OA+RA)	0.98	46	NS
Nonbacks (OA vs RA)	1.49	28	NS

* Where variances are significantly different, a separate variance estimate instead of a pooled variance estimate is used in the calculation of the t-test.

INAPPROPRIATE SIGNS: EXAMINATION TECHNIQUE

Tenderness

Tenderness related to physical disease is usually localized to a particular skeletal or neuromuscular structure. Nonorganic tenderness (Figure 1) may be either superficial or nonanatomical.

Superficial

The skin is tender to light pinch over a wide area of lumbar skin. A localized band in a posterior primary ramus distribution may be caused by nerve irritation and should be discounted.

Nonanatomical

Deep tenderness is felt over a wide area, is not localized to one structure, and often extends to the thoracic spine, sacrum, or pelvis.

Simulation Tests

These give the patient the impression that a particular examination is being carried out when in fact it is not. Usually this is based on movement producing pain. On formal examination a particular movement causes the patient to report pain; that movement is then simulated without actually being performed. If pain is reported, a non-organic influence is suggested. It is essential to minimize suggestion.

Axial Loading

Low-back pain is reported on vertical loading over the standing patient's skull by the examiner's hands (see Figure 2). Neck pain is common and should be discounted.

Rotation

Back pain is reported when shoulders and pelvis are passively rotated in the same plane as the patient stands relaxed with the feet together (see Figure 3). In the presence of root irritation, leg pain may be produced and should be discounted.

Distraction Tests

A positive physical finding is demonstrated in the routine manner; this finding is then checked while the patient's attention is distracted. The distraction must be nonpainful, nonemotional, and nonsurprising. In its simplest and most effective form this consists of indirect observation, i.e., simply observing the patient throughout the period that he is in the examiner's presence, while he is unaware that he is being examined. During examination, parts of the body other than the particular part being overtly tested should be observed. Any finding that is consistently present is likely to be physically based. Findings that are present only on formal examination and disappear at other times may have a nonorganic component.

Straight Leg Raising

Straight leg raising (SLR) is the most useful distraction test. The patient whose back pain has a nonorganic component shows marked improvement in straight leg raising on distraction as compared with formal testing. There are several variations based on sitting (Figure 4). This is commonly known as the "flip test".

Regional Disturbances

Regional disturbances involve a widespread region of neighboring parts such as the leg below the knee, the entire leg, or a quarter or half the body. The essential feature is divergence from accepted neuroanatomy.

Weakness

Weakness is demonstrated on formal testing by a partial cogwheel "giving way" of many muscle groups that cannot be explained on a localized neurologic basis.

Sensory

Sensory disturbances (Figure 5) include diminished sensation to light touch, pinprick, and sometimes other modalities fitting a "stocking" rather than a dermatomal pattern. "Giving way" and sensory changes commonly affect the same area, and there may be associated nonanatomic regional tenderness. Care must be taken, particularly in patients who have spinal stenosis or who have had repeated spinal surgery, not to mistake multiple root involvement for a regional disturbance.

Overreaction

Overreaction during examination may take the form of disproportionate verbalization, facial expression, muscle tension and tremor, collapsing, or sweating (Figure 6). The response to procedures such as venipuncture or myelography provides additional information. Judgements should, however, be made with caution, minimizing the examiner's own emotional reaction; there are considerable cultural variations, and it is very easy to introduce observer bias or to provoke this type of response unconsciously.

INAPPROPRIATE SIGNS: EXCLUDED ITEMS

Signs	Reason for not including: Observer bias	Lower reproducibility	Less stability	Overlapping better tests	Little additional value and confusing to learn
Patient's manner	+	+	+		
Contradictory clinical evidence	+	+	+		
Knee flexion during straight leg raising		+	+	+	
Opposite leg lifting during straight leg raising		+	+	+	
Strength of grip		+	+	+	
Thumb extension (EPL)		+	+	+	
Orbicularis strength		+	+	+	
Pretibial tenderness		+	+	+	
Middorsal tenderness		+		+	
Simulated bowstring		+			
Distraction spinal movement		+			
Distraction tenderness		+	+		
Discrepant weakness		+	+		
Lumbar sensory changes		+		+	
Simulated straight leg raising					+
Distraction weakness					+

INAPPROPRIATE SIGNS: RELIABILITY OF INDIVIDUAL ITEMS

Variable	n	% Agreement	K	NTS	Significance
Superficial tenderness	50	80	0.60	4.20	p < .001
Nonanatomical tenderness	50	80	0.59	3.98	p < .001
Axial loading	50	78	0.55	3.89	p < .001
Simulated rotation	50	80	0.58	3.93	p < .001
Distraction straight leg raising	50	86	0.67	4.09	p < .001
Regional weakness	50	84	0.67	4.55	p < .001
Overreaction	50	82	0.60	3.75	p < .001

K - Kappa Coefficient

NTS - Null Test Statistic

INAPPROPRIATE SIGNS: INDIVIDUAL ITEMS

DISCRIMINATION BETWEEN BACK PATIENTS (MAIN STUDY, n = 200) AND NORMALS (n = 80)

	Chi^2	df	p
Superficial tenderness	14.45	1	< .001
Nonanatomical tenderness	13.21	1	< .001
Axial loading	21.06	1	< .001
Simulated rotation	17.05	1	< .001
Distraction straight leg raising	12.44	1	< .001
Regional weakness	18.12	1	< .001
Overreaction to examination	23.23	1	< .001

APPENDIX 60

INAPPROPRIATE SIGNS: VALIDITY

RELATIONSHIPS OF TOTAL SCORE AND OTHER CLINICAL DATA (Pilot Studies; n = 182)

	r
Inappropriate history	0.50
General somatic and neurotic symptoms	0.54
Invalidism behaviour	0.31
Pain drawing	0.27
Surgeon's ratings - nonorganic component	0.69
Psychological unsuitability for surgery	0.73

r - Pearson product moment correlation coefficient with inappropriate signs total score

APPENDIX 61

INAPPROPRIATE SIGNS: VALIDITY

RELATIONSHIP OF INDIVIDUAL ITEMS WITH THE M.M.P.I. (Pilot Studies, n = 84)

	MMPI Scale		
	Hs	D	Hy
Tenderness	0.22		0.29
Simulation	0.20	0.23	0.20
Distraction		0.29	0.23
Regional	0.19		0.22
Overreaction		0.18	

Figures are Pearson product moment correlations.

INAPPROPRIATE SIGNS: CORRELATION MATRIX

(MAIN STUDY, n = 200)

	Superficial tenderness	Nonanatomical tenderness	Axial loading	Simulated rotation	Distraction straight leg raising	Regional weakness	Overreaction to examination
Superficial tenderness		51	26	32	30	30	42
Nonanatomical tenderness	51		45	38	42	43	47
Axial loading	26	45		42	37	37	46
Simulated rotation	32	38	42		40	32	38
Distraction straight leg raising	30	42	37	40		53	51
Regional weakness	30	43	37	32	53		56
Overreaction to examination	42	47	46	38	51	56	

Values are Pearson correlation coefficients X 100

INAPPROPRIATE SIGNS: FACTOR LOADINGS ON FIRST UNROTATED PRINCIPAL COMPONENT

Variables		Main Study	Extra Backs
	n	200	141
Superficial tenderness		0.62	0.74
Nonanatomical tenderness		0.75	0.86
Axial loading		0.67	0.75
Simulated rotation		0.64	0.67
Distraction straight leg raising		0.72	0.63
Regional weakness		0.72	0.74
Overreaction to examination		0.79	0.80
Percentage of variance		49.6	55.4
Latent root (λ)		3.47	3.88
Internal consistency (θ)		0.83	0.87

INAPPROPRIATE SIGNS: COMPARISON WITH OBJECTIVE PHYSICAL EXAMINATION (8 ITEMS);* PRINCIPAL COMPONENT ANALYSIS

(Main Study, n = 200)

VARIMAX ROTATED FACTOR LOADINGS

		First Factor	Second Factor
Objective Physical Examination	List	.04	.64
	Loss of lordosis	-.08	.52
	Flexion	-.14	-.63
	Flexion pattern	.15	.53
	Lateral flexion	-.04	.68
	Straight leg raising (left)	-.08	-.60
	Localised lumbar tenderness	-.40	.26
	Root compression signs	-.17	.56
Inappropriate Signs	Superficial tenderness	.63	-.07
	Nonanatomical tenderness	.77	-.03
	Axial loading	.66	.04
	Simulated rotation	.63	.01
	Distraction straight leg raising	.70	.11
	Regional weakness	.69	.16
	Overreaction to examination	.78	.07
Percentage of total variance		24.3	17.6

* 'Major problem', as a nominal variable is excluded from the factor analysis.

INAPPROPRIATE SIGNS: COMPARISON WITH OBJECTIVE PHYSICAL EXAMINATION (FINAL ITEMS)*

PRINCIPAL COMPONENT ANALYSIS (Main Study, n = 200)

VARIMAX ROTATED FACTOR LOADINGS

		11 Variables		10 variables	
		First Factor	Second Factor	First Factor	Second Factor
Objective Physical Examination	Flexion	-.14	.71	-.16	.79
	SLR left	-.07	.79	-.09	.71
	SLR right	-.11	.78	-	-
	Root compression signs	-.18	.60	-.17	-.70
Inappropriate Signs	Superficial tenderness	.63	-.01	.63	.01
	Nonanatomical tenderness	.76	.06	.75	.07
	Axial loading	.68	.02	.68	.07
	Simulated rotation	.64	-.04	.64	-.03
	Distraction SLR	.71	-.05	.70	-.06
	Regional weakness	.69	.16	.70	-.18
	Overreaction to examination	.79	.05	.79	-.06
Percentage of total variance		32.0	19.4	35.0	16.7

* 'Major problem', as a nominal variable, is excluded from the factor analysis.

INAPPROPRIATE SIGNS: INCIDENCE OF INDIVIDUAL ITEMS

Variable		Normals	Backache (Main Study)					Spinal Pathology
			Total	Males	Females	GP	Problems	
	n	80	200	117	83	79	121	73
Superficial tenderness	%	0	16.0	9.4	25.3	10.1	19.8	8
Nonanatomical tenderness	%	2.5	19.5	13.7	27.7	13.9	23.1	11
Axial loading	%	1.3	24.5	19.7	31.3	17.7	28.9	12
Simulated rotation	%	0	18.5	15.4	22.9	10.1	24.0	4
Distraction straight leg raising	%	0	14.0	15.4	12.0	6.3	19.0	1
Regional weakness	%	0	19.5	16.2	24.1	6.3	28.1	8
Overreaction	%	2.5	28.5	23.9	34.9	15.2	37.2	11

INAPPROPRIATE SIGNS: DISTRIBUTION OF SCORES (PERCENTAGE)

Score out of 7		Normals	Backache				Spinal Pathology
			Total	Males	Females	GP Problem	
	n	80	200	117	83	79 121	73
0	%	96.2	52.5	61.5	39.8	22.8 42.1	70
1	%	2.5	15.0	11.1	20.5	32.9 16.5	18
2	%	0	9.5	10.3	8.4	16.5 11.6	7
3	%	1.3	5.0	4.3	6.0	11.4 6.6	1
4	%	0	6.0	3.4	9.6	10.1 6.6	4
5	%	0	6.0	3.4	9.6	3.8 7.4	0
6	%	0	4.5	3.4	6.0	2.5 6.6	0
7	%	0	1.5	2.6	0	0 2.5	0

APPENDIX 68

INAPPROPRIATE SIGNS: DISTRIBUTION OF SCORES (CUMULATIVE PERCENTAGE)

Score out of 7	n	Normals		Backache				Spinal Pathology
				Total	Males	Females		
		80		200	117	83		73
0	1	96.2		52.5	61.5	39.8	22.8	70
1	2	98.7		67.5	72.6	60.2	55.7	88
2	3	98.7		77.0	82.9	68.7	72.2	95
3	4	100		82.0	87.2	74.7	83.5	96
4	5	100		88.0	90.6	84.3	93.7	100
5	6	100		94.0	94.0	94.0	97.5	100
6	7	100		98.5	97.4	100	100	100
7	8	100		100	100	100	100	100

INAPPROPRIATE SIGNS: SCORE OUT OF SEVEN

COMPARISON OF BACK PATIENTS

(MAIN STUDIES) AND NORMALS

	n	$\bar{X}$	s.d.
Normals	80	0.06	0.37
Backache (total)	200	1.41	1.96
Backache (males)	117	1.14	1.88
Backache (females)	83	1.78	2.02
Backache (GPs)	79	1.75	1.57
Backache (problems)	121	1.80	2.13

PAIRWISE COMPARISONS (SELECTED GROUPS)

	t	df *	p
Total v normals	6.10	277	< .01
GPs v normals	9.31	177	< .01
Problems v normals	7.20	198	< .01
Males v females	2.29	197	< .05
Problems v GPs	0.18	197	NS

* Where variances significantly differ, a separate variance estimate is used in place of a pooled variance estimate in the calculation of the t-test.

PAIN SCALE: SCORES IN CLINICAL GROUPS

	n	$\bar{X}$	s.d.
Normals	Not applicable		
Backs (total)	166	59.5	28.0
Backs (males)	95	55.3	27.0
Backs (females)	71	65.1	28.7
Backs (GPs)	60	52.3	28.9
Backs (problems)	106	63.6	26.8
Nonbacks (minor)	19	25.1	27.9
Nonbacks (OA)	16	62.3	24.8
Nonbacks (RA)	16	77.2	21.4

PAIRED GROUP COMPARISONS

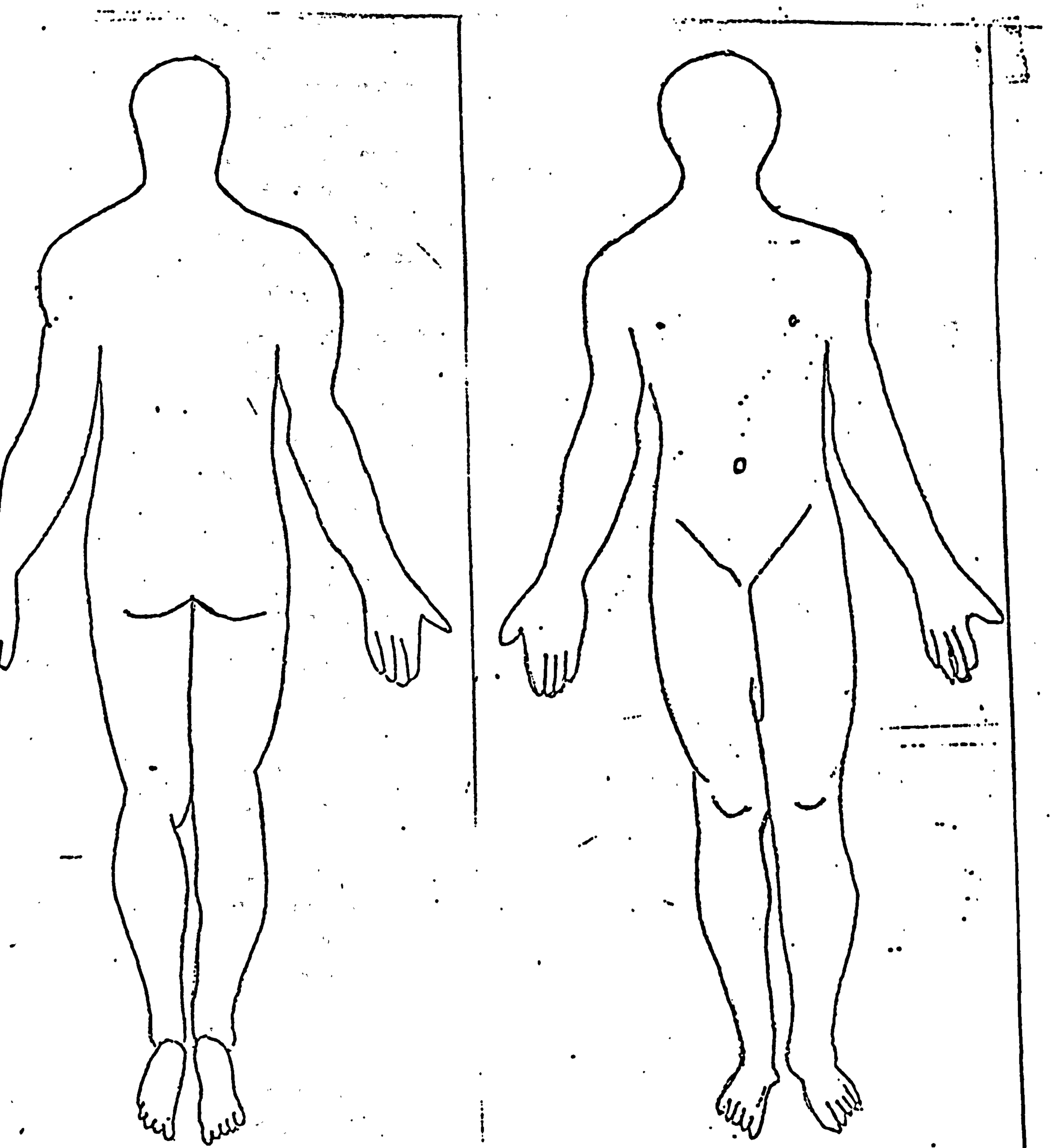
	t	df*	p
Backs (males vs females)	-2.55	138	< .02
Backs (GPs vs problems)	2.19	110	< .04
Backs (total) vs nonbacks (OA+RA)	1.92	196	NS
Nonbacks (minor vs OA+RA)	5.80	34	< .001
Nonbacks (OA vs RA)	1.82	30	NS

* Where variances significantly differ, a separate variance estimate is used in place of a pooled variance estimate in the calculation of the t-test.

PAIN DRAWING

Mark the areas on your body where you feel these sensations. Use the symbols. Mark all the affected areas.

	====		oooo		xxxx		///
NUMBNESS	====	PINS & NEEDLES	oooo	ACHE	xxxx	PAIN	///
	====		oooo		xxxx		///



APPENDIX 72

PAIN DRAWING: SCORING SYSTEM

(From Ransford et al, 1976)

A patient with poor psychometrics may show this by:

1. Unreal drawings (poor anatomic localization, scores 2 unless indicated; bilateral pain not weighted unless indicated)
   a. Total leg pain
   b. Lateral whole leg pain (trochanteric area and lateral thigh allowed)
   c. Circumferential thigh pain
   d. Bilateral anterior tibial area pain (unilateral allowed)
   e. Circumferential foot pain (scores 1)
   f. Bilateral foot pain (scores 1)
   g. Use of all four modalities suggested in instructions (we feel patient in unlikely to have "burning areas", stabbing pain, pins and needles, and numbness all together; scores 1)

2. Drawings showing "expansion" or "magnification" of pain (may also represent unrelated symptomatology; bilateral pain not weighted)
   a. Back pain radiating to iliac crest, groin, or anterior perineum (each scores 1; coccygeal pain allowed)
   b. Anterior knee pain (scores 1)
   c. Anterior ankle pain (scores 1)
   d. Pain drawn outside the outline (Figure 3); this is a particularly good indication of magnification (scores 1 or 2 depending on extent)

3. "I Particularly Hurt Here" indicators (Figures 4 and 5)
   Some patients needing to make sure the physician is fully aware of the extent of symptoms may: (each category scores 1; multiple use of each category is not weighted)
   a. Add explanatory notes
   b. Circle painful areas
   c. Draw lines to demarcate painful areas
   d. Use arrows
   e. Go to excessive trouble and detail in demonstrating the pain areas (using the symbols suggested)

4. "Look How Bad I Am" indicators (Figure 3)
   Additional painful areas in the trunk, head, neck, or upper extremities drawn in. Tendency toward total body pain (scores 1 if limited to small areas, otherwise scores 2)

PAIN DRAWING: VALIDITY

COMPARISON WITH MMPI (A)

(AFTER RANSFORD ET AL, 1976)*

MMPI - BASED PSYCHOLOGIST'S EVALUATION

		Organic	Psychogenic	
Pain Drawing Score	0-2	22	6	n = 28
	3+	6	75	n = 81
		n = 28	n = 81	n = 109

$Chi^2 = 55.2$; df = 1; p < .001

PAIN DRAWING - MMPI COMPARISON	
Overall	89.0
Hit-Rate	92.6
Miss-Rate	7.4
Correct Rejection Rate	78.6
False Alarm Rate	21.4

* Reproduced with permission

PAIN DRAWING: VALIDITY

COMPARISON WITH MMPI (B)

(FROM DOXEY ET AL, 1979; TABLE 4)*

MMPI - BASED PSYCHOLOGIST'S EVALUATION

		Organic	Psychogenic	
Pain Drawing Score	0-2	14 Correct-Rejection	6 Miss	n = 20
	3+	10 False Alarm	19 Hit	n = 29
		n = 24	n = 25	n = 49

$Chi^2 = 5.97$; df = 1; $p < .02$

PAIN DRAWING - MMPI CORRESPONDENCE	
Overall	67.3
Hit-Rate	76.0
Miss-Rate	24.0
Correct Rejection Rate	58.3
False Alarm Rate	41.7

* Reproduced with permission

PAIN DRAWING: VALIDITY

COMPARISON WITH MMPI (C)

(WADDELL & MAIN, UNPUBLISHED DATA)

MMPI - BASED EVALUATION

		Organic	Psychogenic	
Pain Drawing Score	0-2	32	14	n = 46
	3+	5	3	n = 8
		n = 37	n = 17	n = 54

$Chi^2 = 0.16$; df = 1; p = NS

PAIN DRAWING - MMPI COMPARISON	
Overall	64.8
Hit-Rate	17.6
Miss-Rate	82.4
Correct Rejection Rate	86.5
False Alarm Rate	13.5

PAIN DRAWING: CLINICAL VALIDITY AND RETEST RELIABILITY

(a) VALIDITY: PATIENT-SURGEON AGREEMENT (n = 25)

	Agreement
Overall anatomical pain pattern	76%
Agreement on side of pain	92%
Discrimination between referred leg pain and root pain	96%

(b) TEST-RETEST RELIABILITY (AFTER ONE WEEK) (n = 25)

(1) Correlation	0.91
(2) Percentage agreement (on total score)	72
(3) Percentage agreement (using 2 and >2 as cut off)	92
(4) Percentage agreement (using 3 and >3 as cut off)	92
(5) Percentage of patients showing confusion in pain laterality	6

PAIN DRAWING: INCIDENCE IN CLINICAL GROUPS

(PERCENTAGE)

		Backs				Nonbacks			
	Total	Males	Females	GPs	Problems	Minor	OA	RA
Score	n = 177	102	75	64	113	20	16	16
0	40.1	46.1	32.0	50	34.5	76.5	56.2	25.0
1	28.8	32.4	24.0	26.6	30.1	17.6	31.2	18.7
2	20.3	17.6	24.0	20.3	20.4	0	12.5	25.0
3	4.5	2.9	6.7	0	7.1	5.9	0	18.7
4	2.8	0	6.7	0	4.4	0	0	12.5
5	1.7	0	4.0	1.6	1.8	0	0	0
6	0	0	0	0	0	0	0	0
7	1.7	1.0	2.7	1.6	1.8	0	0	0

Spinal Pathology
52
48.1
38.5
7.6
0
1.9
3.8
0
0

PAIN DRAWING: INCIDENCES IN CLINICAL GROUPS

(CUMULATIVE PERCENTAGES)

		Backs				Nonbacks			Spinal Pathology
	Total	Males	Females	GPs	Problems	Minor	OA	RA	
Score n	177	102	75	64	113	20	16	16	52
0	40.1	46.1	32.0	50	34.5	76.5	56.2	25.0	48.1
1	68.9	78.4	56.0	76.6	64.6	94.1	87.4	43.7	86.6
2	89.3	96.1	80.0	96.9	85.0	94.1	100	68.7	94.2
3	93.8	99.0	86.7	96.9	92.0	100	100	87.5	94.2
4	96.6	99.0	93.3	96.9	96.5	100	100	100	96.1
5	98.3	99.0	97.3	98.4	98.2	100	100	100	100
6	98.3	99.0	97.3	98.4	98.2	100	100	100	100
7	100	100	100	100	100	100	100	100	100

PAIN DRAWING: SCORES IN CLINICAL GROUPS

	n	$\bar{X}$	s.d.
Normals	Not applicable		
Backs (total)	177	1.15	1.38
Backs (males)	102	0.83	1.04
Backs (females)	75	1.57	1.65
Backs (GPs)	64	0.86	1.23
Backs (problems)	113	1.31	1.44
Nonbacks (minor)	17	0.35	0.79
Nonbacks (OA)	16	0.56	0.73
Nonbacks (RA)	16	1.75	1.39

PAIRED GROUP COMPARISONS

	t	df*	p
Backs (males vs females)	-3.17	108	< .003
Backs (GPs vs problems)	2.30	140	< .02
Backs (total) vs nonbacks (OA+RA)	0.04	207	NS
Nonbacks (minor vs OA+RA)	2.76	45	< .008
Nonbacks (OA vs RA)	3.03	30	< .005

* Where variances significantly differ, a separate variance estimate is used in place of a pooled variance estimate in the calculation of the t-test.

ILLNESS BEHAVIOUR QUESTIONNAIRE (IBQ)
(FROM PILOWSKY, 1981; APPENDIX A, TABLE 1)

Here are some questions about you and your illness. Circle either YES or NO to indicate your answer to each question.

1.	Do you worry a lot about your health?	YES NO
2.	Do you think there is something seriously wrong with your body?	YES NO
3.	Does your illness interfere with your life a great deal?	YES NO
4.	Are you easy to get on with when you are ill?	YES NO
5.	Does your family have a history of illness?	YES NO
6.	Do you think you are more liable to illness than other people?	YES NO
7.	If the doctor told you that he could find nothing wrong with you would you believe him?	YES NO
8.	Is it easy for you to forget about yourself and think about all sorts of other things?	YES NO
9.	If you feel ill and someone tells you that you are looking better, do you become annoyed?	YES NO
10.	Do you find that you are often aware of various things happening in your body?	YES NO
11.	Do you ever think of your illness as a punishment for something you have done wrong in the past?	YES NO
12.	Do you have trouble with your nerves?	YES NO
13.	If you feel ill or worried, can you be easily cheered up by the doctor?	YES NO
14.	Do you think that other people realise what its like to be sick?	YES NO
15.	Does it upset you to talk to the doctor about your illness?	YES NO
16.	Are you bothered by many pains and aches?	YES NO
17.	Does your illness affect the way you get on with your family or friends a great deal?	YES NO
18.	Do you find that you get anxious easily?	YES NO
19.	Do you know anybody who has had the same illness as you?	YES NO
20.	Are you more sensitive to pain than other people?	YES NO

21. Are you afraid of illness? YES NO
22. Can you express your personal feelings easily to other people? YES NO
23. Do people feel sorry for you when you are ill? YES NO
24. Do you think that you worry about your health more than most people? YES NO
25. Do you find that your illness affects your sexual relations? YES NO
26. Do you experience a lot of pain with your illness? YES NO
27. Except for your illness, do you have any problems in your life? YES NO
28. Do you care whether or not people realise you are sick? YES NO
29. Do you find that you get jealous of other people's good health? YES NO
30. Do you ever have silly thoughts about your health which you can't get out of your mind, no matter how hard you try? YES NO
31. Do you have any financial problems? YES NO
32. Are you upset by the way people take your illness? YES NO
33. Is it hard for you to believe the doctor when he tells you there is nothing for you to worry about? YES NO
34. Do you often worry about the possibility that you have got a serious illness? YES NO
35. Are you sleeping well? YES NO
36. When you are angry, do you tend to bottle up your feelings? YES NO
37. Do you often think that you might suddenly fall ill? YES NO
38. If a disease is brought to your attention (through the radio, television, newspapers or someone you know) do you worry about getting it yourself? YES NO
39. Do you get the feeling that people are not taking your illness seriously enough? YES NO
40. Are you upset by the appearance of your face or body? YES NO
41. Do you find that you are bothered by many different symptoms? YES NO
42. Do you frequently try to explain to others how you are feeling? YES NO

43. Do you have any family problems? YES NO
44. Do you think there is something the matter with your mind? YES NO
45. Are you eating well? YES NO
46. Is your bad health the biggest difficulty of your life? YES NO
47. Do you find that you get sad easily? YES NO
48. Do you worry or fuss over small details that seem unimportant to others? YES NO
49. Are you always a co-operative patient? YES NO
50. Do you often have the symptoms of a very serious disease? YES NO
51. Do you find that you get angry easily? YES NO
52. Do you have any work problems? YES NO
53. Do you prefer to keep your feelings to yourself? YES NO
54. Do you often find that you get depressed? YES NO
55. Would all your worries be over if you were physically healthy? YES NO
56. Are you more irritable towards other people? YES NO
57. Do you think that your symptoms may be caused by worry? YES NO
58. Is it easy for you to let people know when you are cross with them? YES NO
59. Is it hard for you to relax? YES NO
60. Do you have personal worries which are not caused by physical illness? YES NO
61. Do you often find that you lose patience with other people? YES NO
62. Is it hard for you to show people your personal feelings? YES NO

IBQ: 52 ITEM QUESTIONNAIRE,
ITEM LOADINGS FOR 100 PAIN CLINIC PATIENTS
(FROM PILOWSKY, 1981; APPENDIX C, TABLE 1)

Item	Questions	Loading	% Variance
	Factor 1		24.8
9	If you feel ill and someone tells you that you are looking better do you feel annoyed?	.55	
20	Are you more sensitive to pain than other people?	.57	
21	Are you afraid of illness?	.51	
24	Do you think you worry about your health more than most people?	.73	
29	Do you find you get jealous of others good health?	.71	
30	Do you ever have silly thoughts about your health which you can't get out of your mind, no matter how hard you try?	.49	
32	Are you upset by the way people take your illness?	.45	
37	Do you often think you might suddenly fall ill?	.55	
38	If a disease if brought to your attention (through the radio, T.V., newspapers or someone you know) do you worry about getting it yourself?	.42	
	Factor 2		10.0
2	Do you think there is something seriously wrong with your body?	.56	
3	Does your illness interfere with your life a great deal?	.49	
7	If the doctor told you that he could find nothing wrong with you would you believe him?	-.48	
10	Do you find that you are often aware of various things happening in your body?	.68	
35	Are you sleeping well?	-.43	
41	Do you find that you are bothered by many different symptoms?	.48	

Item	Questions	Loading	% Variance
	Factor 3		7.6
11	Do you ever think of your illness as a punishment for something you have done wrong in the past?	.62	
16	Are you bothered by many pains and aches?	-.53	
44	Do you think there is something the matter with your mind?	.55	
46	Is your bad health the biggest difficulty in you life?	-.56	
	Factor 4		6.8
22	Can you express your personal feelings easily to other people?	-.59	
36	When you are angry, do you tend to bottle up your feelings	.63	
	Factor 5		6.5
12	Do you have trouble with your nerves?	.75	
18	Do you find that you get anxious easily?	.69	
47	Do you find that you get sad easily?	.52	
	Factor 6		4.3
27	Except for your illness, do you have any problems in your life?	.77	
31	Do you have any financial problems?	.57	
43	Do you have any family problems?	.63	
	Factor 7		3.3
4	Are you easy to get on with when you are ill?	-.61	
17	Does your illness affect the way you get on with your family or friends a great deal?	.41	
51	Do you find you get angry easily?	.73	
	Age (40 years)	-.62	
		Total Variance -	63.3%

IBQ: VALIDITY IBQ 62-ITEM AND WHITELEY INDEX CORRELATIONS[1] BETWEEN PATIENT'S SCORES AND RELATIVE/FRIEND'S SCORES[2].

(FROM PILOWSKY, 1981; APPENDIX E, TABLE 1)

IBQ Scale	Correlations	N = 42 Sig. (p)
1. General hypochondriasis	0.50	< 0.002
2. Disease conviction	0.57	< 0.001
3. Psychological versus somatic concern	0.65	< 0.001
4. Affective inhibition	0.59	< 0.001
5. Affective disturbance	0.75	< 0.001
6. Denial	0.78	< 0.001
7. Irritability	0.56	< 0.001
8. Whiteley Index of Hypochondriasis	0.62	< 0.001

[1]Correlations corrected for attenuation of patient's score.

[2]The relative or friend was requested to complete the IBQ as they thought it should have been answered by the patient.

IBQ: RELIABILITY IBQ 62-ITEM AND WHITELEY INDEX

TEST-RETEST RELIABILITY

(FROM PILOWSKY, 1981; APPENDIX E, TABLE 2)

IBQ Scale	Correlations	N = 42 Sig. (p)
1. General hypochondriasis	0.87	< 0.001
2. Disease conviction	0.76	< 0.001
3. Psychological versus somatic concern	0.76	< 0.001
4. Affective inhibition	0.67	< 0.001
5. Affective disturbance	0.87	< 0.001
6. Denial	0.86	< 0.001
7. Irritability	0.84	< 0.001
8. Whiteley Index of Hypochondriasis	0.85	< 0.001

IBQ: SCALE 2, DISEASE CONVICTION

FREQUENCY OF INDIVIDUAL ITEMS

(% ENDORSEMENT)

Item No.	Normals (n = 40)	Back Patients (Main Study) (n = 200)
2	2.5	20.6
3	5.0	61.9
7	90.0	62.6
10	41.0	37.2
35	80.0	44.0
40	15.0	11.0

IBQ : SCALE 2, DISEASE CONVICTION

CORRELATION MATRIX

(MAIN STUDY, n = 200)

	02	03	07	10	35	40
02		25	-18	-01	-28	08
03	25		-18	02	-30	05
07	-18	-18		-03	12	-18
10	-01	02	-03		03	26
35	-28	-30	12	03		-05
40	08	05	-18	26		

Figures are Pearson product moment correlations x 100

IBQ: SCALE 2, DISEASE CONVICTION

FACTOR LOADINGS ON FIRST UNROTATED PRINCIPAL COMPONENT AND INTERNAL CONSISTENCY

(MAIN STUDY, n = 200)

Item No.	Factor Loadings
02	0.66
03	0.66
07	-0.53
10	0.13
35	-0.64
40	0.34
Percentage of variance	28.6
Latent root (λ)	1.69
Internal consistency (θ)	0.48

IBQ: SCALE 2, DISEASE CONVICTION

FACTOR STRUCTURE, VARIMAX ROTATION

(MAIN STUDY, n = 200)

Item No.	First Factor	Second Factor
02	0.68	0.03
03	0.69	0.01
07	-0.45	-0.33
10	-0.11	0.75
35	-0.71	0.08
41	0.11	0.78
Percentage of total variance	27.8	21.5
Latent root (λ)	1.67	1.29

IBQ: SCALE 3, PSYCHOLOGICAL VS SOMATIC CONCERN

INCIDENCE (PERCENTAGE)

Item No.	Normals (n = 40)	Back Patients (Main Study) (n = 200)
11	10.0	4.5
16	10.0	64.1
44	2.5	1.5
46	5.3	60.8

IBQ: SCALE 3, PSYCHOLOGICAL VS SOMATIC CONCERN

CORRELATION MATRIX

(MAIN STUDY, n = 200)

	11	16	44	46
11		06	17	08
16	06		09	36
44	17	09		-07
46	08	36	-07	

Figures are Pearson product moment correlation coefficients x 100.

IBQ: SCALE 3, PSYCHOLOGICAL VS SOMATIC CONCERN

FACTOR LOADINGS ON FIRST UNROTATED PRINCIPAL COMPONENT AND INTERNAL CONSISTENCY

(MAIN STUDY, n = 200)

Item No.	Factor Loadings
11	0.36
16	0.80
44	0.21
46	0.76
Percentage of variance	34.9
Latent root (λ)	1.40
Internal consistency (θ)	0.38

IBQ: SCALE 3, PSYCHOLOGICAL VS SOMATIC CONCERN (WITH ADDITIONAL ITEM) FACTOR LOADINGS ON FIRST UNROTATED PRINCIPAL COMPONENT AND INTERNAL CONSISTENCY (MAIN STUDY, n = 200)

Item No.	Factor Loadings
11	0.36
16	0.80
44	0.23
46	0.75
57	0.04
Percentage of variance	27.9
Latent root (λ)	1.40
Internal consistency (θ)	0.36

IBQ: SCALE 6, DENIAL

FREQUENCY OF INDIVIDUAL ITEMS

(PERCENTAGE ENDORSEMENT)

Item No.	Normals (n = 40)	Back Patients (Main Study) (n = 200)
27	12.8	19.5
31	12.5	14.5
43	5.0	15.6
Additional items on 62 item version		
60	30.0	24.9

IBQ: SCALE 6, DENIAL

CORRELATION MATRIX

(MAIN STUDY, n = 200)

	27	31	41	60 *
27		29	-05	-54
31	29		-07	29
41	-05	-07		02
60B*	-54	29	02	

* Additional item on 62 item version

Figures are Pearson product moment correlation coefficients x 100.

FACTOR LOADINGS (ON FIRST UNROTATED PRINCIPAL COMPONENT)

AND INTERNAL CONSISTENCY

Item No.	Factor Loadings
27	0.82
31	0.63
41	-0.13
60B	-0.82

Percentage of variance	=	44.1
Latent root (λ)	=	1.77
Internal consistency (θ)	=	0.58

IBQ: SCALE 7, IRRITABILITY

FREQUENCY OF INDIVIDUAL ITEMS

(PERCENTAGE ENDORSEMENT)

Item No.	Normals (n = 40)	Back Patients (Main Study) (n = 200)
4	71.8	44.7
17	7.5	39.0
51	25.0	40.0
Age (< 40)	N.A.	N.A.
Additional items on 62 item version		
56	14.3	28.1
61	40.0	45.2

IBQ: SCALE 7, IRRITABILITY

CORRELATION MATRIX

(MAIN STUDY, n = 200)

	04	17	51	56*	61*	Age (<40 yrs)
04		49	14	45	43	00
17	49		13	00	-09	35
51	14	13		-33	-82	16
56*	45	00	33		-11	-10
61*	43	-09	-82	-11		-11
Age	00	35	16	-10	-11	

* Additional items on 62 item version

Figures are Pearson product moment correlation coefficients x 100.

FACTOR LOADINGS ON PRINCIPAL COMPONENTS AND INTERNAL CONSISTENCIES

Item No.	Unrotated Solution		Varimax (Rotated Solution)	
	First Factor	Second Factor	First Factor	Second Factor
04	-.73	.12	-73	12
17	.60	-.29	-60	29
51	.74	-.01	74	00
56	.69	.17	69	17
61	.74	.16	74	16
Age	.04	.95	03	95
		Including Age	Excluding Age	
Percentage of variance		41.5	49.8	
Latent root (λ)		2.49	2.49	
Internal consistency (θ)		0.72	0.75	

IBQ: SCALES, REASONS FOR REJECTION FROM FINAL ANALYSIS

Scale No.	Name	Reason for Rejection
2	Disease conviction	Poor correlation matrix, low internal consistency, scale comprises 2 distinct scales.
3	Psychological vs somatic concern	Unsatisfactory incidence of individual items (both in normals & back patients) poor correlation matrix and very low internal consistency.
6	Denial	Poor correlation matrix, low internal consistency.
7	Irritability	Scale construction (demographic variable included as part of psychological scale) - unsatisfactory both on theoretical and statistical grounds.

IBQ: SCALE 1, GENERAL HYPOCHONDRIASIS

FREQUENCY OF INDIVIDUAL ITEMS

(% ENDORSEMENT)

Item No.	Normals (n = 40)	Back Patients (Main Study) (n = 200)
9	5.0	10.5
20	5.1	10.3
21	22.5	24.0
24	2.5	5.5
29	5.0	16.0
30	22.5	27.5
32	0	10.1
37	10.0	14.0
38	15.0	5.0

IBQ: RELIABILITY (TEST-RETEST) OF INDIVIDUAL VARIABLES SCALES 1, 4 AND 5 (n = 40)

Scale	Item No	% Agreement	Pearson Corr.	K.[1]	NTS[1]	P
1	9	95.2	0.69	0.64	2.51	<.05
1	20	90.5	0.61	0.61	2.80	<.01
1	21	85.7	0.51	0.50	1.75	NS
1	24	100.0	1.0	1.00	NA	<.001
1	29	100.0	1.0	1.00	NA	<.001
1	30	81.0	0.79	0.50	1.73	NS
1	32	85.7	*	0.32	1.38	NS
1	37	90.5	0.67	0.62	2.36	<.05
1	38	95.2	*	*	*	
4	22	85.7	0.88	0.67	2.69	<.01
4	36	85.7	*	0.67	3.00	<.01
4	58	85.7	0.71	0.67	2.69	<.01
4	62	76.2	0.49	0.48	2.18	<.05
5	12	90.5	0.77	0.74	3.10	<.01
5	18	76.2	0.51	0.48	1.62	NS
5	47	85.7	0.64	0.63	2.83	<.01
4	59	85.7	0.75	0.72	2.97	<.01

RELIABILITY OF SCALES Pearson Correlation	
1	0.79
4	0.81
5	0.78

* Figure incalculable owing to lack of variation in scores on one of the testing occasions.

[1] The use of Kappa and the interpretation of the Null Test Statistic (NTS) are discussed in Chapter III

IBQ : SCALE 1, GENERAL HYPOCHONDRIASIS

CORRELATION MATRIX

(MAIN STUDY, n = 200)

	09	20	21	24	29	30	32	37	38
09		-19	-14	-15	-32	12	-25	19	-01
20	-19		-18	10	03	-04	06	-11	-28
21	-14	-18		-28	-10	04	18	-39	35
24	-15	10	-28		-05	-04	16	08	10
29	-32	03	-10	-05		33	-40	19	-12
30	12	-04	04	-04	33		14	02	-15
32	-25	06	18	16	-40	14		-05	-06
37	19	-11	-39	08	19	02	-05		-29
38	-01	-28	35	10	-12	-15	-06	-29	

Figures are Pearson product moment correlation coefficients x 100

IBQ: SCALE 1, GENERAL HYPOCHONDRIASIS

FACTOR LOADINGS ON FIRST UNROTATED PRINCIPAL COMPONENT AND INTERNAL CONSISTENCY (MAIN STUDY, n = 200)

Item No.	Factor Loadings
09	0.50
20	0.50
21	0.40
24	0.56
29	0.59
30	0.60
32	0.47
37	0.38
38	0.34
Percentage of Variance	24.1
Latent root (λ)	2.16
Internal consistency(θ)	0.61

IBQ: SCALE 1, GENERAL HYPOCHONDRIASIS

Items 9,20,21,24,29,30,32,37,38			
	n	$\bar{X}$	s.d.
W. of Scotland normals	40	0.85	1.43
Backs (total)	200	1.23	1.45
Backs (males)	117	1.11	1.24
Backs (females)	83	1.40	1.70
Backs (GPs)	79	1.19	1.48
Backs (problems)	121	1.26	1.44
Nonbacks (minor)	20	1.35	1.81
Nonbacks (OA)	16	0.81	0.91
Nonbacks (RA)	16	1.19	1.52

SELECTED PAIRED GROUP COMPARISONS

Groups	t	df*	p
Backs (total) vs normals	1.51	238	<.05
Backs (GPs) vs normals	1.19	117	NS
Backs (problems) vs normals	1.55	159	NS
Backs (GPs vs problems)	0.33	198	NS
Backs (males vs females)	-1.44	191	NS
Backs (total) vs nonbacks (OA+RA)	0.85	230	NS
Nonbacks (minor vs OA+RA)	-0.76	30	NS
Nonbacks (OA vs RA)	0.85	25	NS

* Where variances significantly differ, a separate variance estimate rather than a pooled variance estimate is used for the t-test.

IBQ: SCALE 4, AFFECTIVE INHIBITION

FREQUENCY OF INDIVIDUAL ITEMS

(PERCENTAGE ENDORSEMENT)

Item No.	Normals (n = 40)	Back Patients (Main Study) (n = 200)
22	70.0	68.5
36	62.5	48.2
Additional items on 62 item version		
58	70.0	63.5
62	38.5	40.5

IBQ: SCALE 4, AFFECTIVE INHIBITION

CORRELATION MATRIX

(MAIN STUDY, n = 200)

	22	36	58 *	62*
22		-26	-20	-49
36	-26		12	41
58 *	-20	12		23
62*	-49	41	23	

* Additional items on 62 item version

Figures are Pearson product moment correlation coefficients x 100.

FACTOR LOADINGS (ON FIRST UNROTATED PRINCIPAL COMPONENT)

AND INTERNAL CONSISTENCY

Item No.	Factor Loadings
22	-0.75
36	0.66
58	0.47
62	0.83
Percentage of variance =	47.4
Latent root (λ) =	1.90
Internal consistency (θ) =	0.63

IBQ: SCALE 4, AFFECTIVE INHIBITION

	Items 22,36,58,62		
	n	$\bar{X}$	s.d.
W. of Scotland normals	39	1.62	1.29
Backs (total)	190	1.57	1.27
Backs (males)	110	1.52	1.28
Backs (females)	78	1.68	1.26
Backs (GPs)	72	1.60	1.30
Backs (problems)	118	1.58	1.26
Nonbacks (minor)	20	1.30	0.98
Nonbacks (OA)	16	1.88	1.59
Nonbacks (RA)	16	2.69	1.35

SELECTED PAIRED GROUP COMPARISONS

Groups	t	df*	p
Backs (total) vs normals	0.22	227	NS
Backs (GPs) vs normals	0.31	113	NS
Backs (problems) vs normals	0.24	157	NS
Backs (GPs vs problems)	0.10	188	NS
Backs (males vs females)	-0.86	167	NS
Backs (total) vs nonbacks (OA+RA)	2.83	220	<.01
Nonbacks (minor vs OA+RA)	2.85	50	<.007
Nonbacks (OA vs RA)	1.56	29	NS

* Where variances significantly differ, a separate variance estimate rather than a pooled variance estimate is used for the t-test.

IBQ: SCALE 5, AFFECTIVE DISTURBANCE

FREQUENCY OF INDIVIDUAL ITEMS

(PERCENTAGE ENDORSEMENT)

Item No.	Normals (n = 40)	Back Patients (Main Study) (n = 200)
12	15.0	28.1
18	27.5	46.2
47	25.0	38.2
59*	25.0	53.8

* Additional item on 62 item version

IBQ: SCALE 5, AFFECTIVE DISTURBANCE

CORRELATION MATRIX

(MAIN STUDY, n = 200)

	12	18	47	59*
12		47	31	30
18	47		39	31
47	31	39		25
59*	30	31	25	

* Additional item on 62 item version

Figures are Pearson product moment correlation coefficients x 100.

FACTOR LOADINGS (ON FIRST UNROTATED PRINCIPAL COMPONENT) AND INTERNAL CONSISTENCY

Item No.	Factor Loadings
12	0.75
18	0.79
47	0.68
59	0.62
Percentage of variance =	50.5
Latent root (λ) =	2.02
Internal consistency (θ) =	0.67

IBQ: SCALE 5, AFFECTIVE DISTURBANCE

	Items 12,18,47,59		
	n	$\bar{X}$	s.d.
W. of Scotland normals	40	0.90	1.15
Backs (total)	196	1.62	1.35
Backs (males)	114	1.47	1.29
Backs (females)	82	1.84	1.41
Backs (GPs)	76	1.54	1.28
Backs (problems)	120	1.68	1.40
Nonbacks (minor)	20	1.15	1.31
Nonbacks (OA)	16	1.63	1.67
Nonbacks (RA)	15	2.38	1.26

SELECTED PAIRED GROUP COMPARISONS

Groups	t	df*	p
Backs (total) vs normals	3.13	234	<.01
Backs (GPs) vs normals	2.63	114	<.01
Backs (problems) vs normals	3.16	158	<.01
Backs (GPs vs problems)	0.70	194	NS
Backs (males vs females)	-2.11	156	<.04
Backs (total) vs nonbacks (OA+RA)	1.42	225	NS
Nonbacks (minor vs OA+RA)	1.44	38	NS
Nonbacks (OA vs RA)	1.36	29	NS

* Where variances significantly differ, a separate variance estimate rather than a pooled variance estimate is used for the t-test.

DEPRESSIVE SYMPTOMS: ORIGINAL 20 ITEMS, ZUNG DEPRESSION INVENTORY

	A Little of the Time	Some of the Time	Good Part of the Time	Most of the Time
1. I feel down-hearted and blue.				
2. Morning is when I feel the best.				
3. I have crying spells or feel like it.				
4. I have trouble sleeping at night.				
5. I eat as much as I used to.				
6. I still enjoy sex.				
7. I notice that I am losing weight.				
8. I have trouble with constipation.				
9. My heart beats faster than usual.				
10. I get tired for no reason.				
11. My mind is as clear as it used to be.				
12. I find it easy to do the things I used to.				
13. I am restless and can't keep still.				
14. I feel hopeful about the future.				
15. I am more irritable than usual.				
16. I find it easy to make decisions.				
17. I feel that I am useful and needed.				
18. My life is pretty full.				
19. I feel that others would be better off if I were dead.				
20. I still enjoy the things I used to do.				

DEPRESSIVE SYMPTOMS: EFFECT OF SCALE ON RELIABILITIES OF INDIVIDUAL ITEMS (n = 20)

Individual Items	ZUNG (4 pt)				ZD				HIB			
	K	NVAR	NTS	p	K	NVAR	NTS	p	K	NVAR	NTS	p
Z 01	.59	.024	3.86	<.001	.69	.054	2.94	<.01	1.00	.053	-	< .001
Z 02	.40	.025	2.52	<.05	-.09	.099	-0.27	NA	0.86	.056	3.61	< .001
Z 03	.78	.033	4.31	<.001	.76	.062	3.06	<.01	0.88	.055	3.78	< .001
Z 04	.62	.020	4.37	<.001	.40	.058	1.66	NS	1.00	.053	-	< .001
Z 05	.47	.022	3.11	<.01	.45	.055	1.93	NS	0.38	.068	1.45	NS
Z 06	.76	.022	5.04	<.001	1.00	.053	-	<.001	1.00	.056	-	< .001
Z 07	.42	.050	1.88	NS	0.38	.068	1.45	NS	0.77	.061	3.12	< .01
Z 08	.77	.029	4.52	<.001	.87	.055	3.71	<.001	1.00	.053	-	< .001
Z 09	.39	.079	1.37	NS	.48	.057	1.99	<.05	1.00	.053	-	< .001
Z 10	.47	.026	2.94	<.01	.68	.054	2.92	<.01	1.00	.053	-	< .001
Z 11	.32	.031	1.79	NS	.54	.064	2.12	<.05	.47	.064	1.84	NS
Z 12	.52	.023	3.46	<.001	.57	.056	2.39	<.05	.55	.053	2.39	< .05
Z 13	.34	.024	2.20	<.05	.43	.071	1.62	NS	.73	.064	2.90	< .01
Z 14	.44	.028	2.66	<.01	.42	.072	1.58	NS	.05	.053	0.22	NS
Z 15	.35	.025	2.17	<.05	.58	.060	2.39	<.05	.90	.054	3.84	< .001

Individual Items	ZUNG (4 pt)				ZD				HIB			
	K	NVAR	NTS	p	K	NVAR	NTS	p	K	NVAR	NTS	p
Z 16	.18	.024	1.18	NS	.45	.055	1.93	NS	.83	.057	3.45	.001
Z 17	.70	.031	3.96	.001	.88	.058	3.66	.001	.88	.058	3.66	.001
Z 18	.59	.030	3.37	.001	.58	.085	1.97	.05	.58	.081	2.03	.05
Z 19	.61	.037	3.19	.01	.60	.059	2.45	.05	1.00	-	-	.001
Z 20	.51	.030	2.96	.01	.55	.053	2.39	.05	0.88	.055	3.78	.001

K = Kappa coefficient
NTS = Null test statistic
p = Significance level

ZUNG (4 pt) - Original Zung Depression Inventory
ZD - 4 point scale dichotomised post hoc.
HIB - Dichotomised version

DEPRESSIVE SYMPTOMS: INCIDENCE OF INDIVIDUAL ITEMS

		BACKS				NONBACKS		
	Total	Males	Females	GPs	Problems	Minor	OA	RA
n	200	117	83	79	121	20	16	16
Z 01	16.8	10.9	25.0	12.0	20.0	10.5	6.2	25.0
Z 02	25.8	21.1	32.1	20.0	29.6	26.3	25.0	6.2
Z 03	32.5	16.4	54.3	25.3	37.1	21.1	31.2	50.0
Z 04	56.5	54.5	59.3	41.3	66.4	15.8	81.2	62.5
GAR 1	5.2	5.5	4.9	5.3	5.2	10.5	0	18.7
Z 05	69.1	74.5	61.7	76.0	64.7	84.2	56.2	66.7
Z 06	75.0	82.4	64.5	88.7	66.4	94.7	73.3	42.9
Z 07	17.3	17.3	17.3	10.7	21.6	10.5	20.0	25.0
Z 08	19.4	10.0	32.1	17.3	20.7	5.3	18.7	31.2
Z 09	6.3	2.7	11.1	6.7	6.0	5.3	12.5	0
Z 10	30.9	25.5	38.3	21.3	37.1	15.8	25.0	43.7
Z 11	83.8	86.4	80.2	85.3	82.8	89.5	81.2	93.7
GAR 2	49.7	52.7	45.7	40.0	56.0	26.3	56.2	50.0
Z 12	15.2	12.7	18.5	22.7	10.3	47.4	12.5	6.2
Z 13	51.3	55.5	45.7	48.0	53.4	31.6	43.7	25.0
Z 14	84.8	84.5	85.2	80.0	87.9	89.5	87.5	75.0
Z 15	48.4	45.0	53.1	36.0	56.5	15.8	25.0	37.5

		BACKS				NONBACKS		
	Total	Males	Females	GPs	Problems	Minor	OA	RA
Z 16	71.7	72.7	70.4	72.0	71.6	89.5	75.0	81.2
GAR 3	9.9	6.4	14.8	9.3	10.3	10.5	18.7	0
Z 17	94.2	98.2	88.9	93.3	94.8	94.7	93.7	81.2
Z 18	81.6	86.4	75.0	86.7	78.3	94.7	68.7	62.5
Z 19	2.6	1.8	3.7	1.3	3.4	0	0	20
Z 20	61.6	67.0	54.3	78.7	50.4	73.7	56.2	25.0

Z 01 to Z 20 are original Zung Depression Inventory items (dichotomised).

GAR 1 to GAR 3 are the three items added in Cooke's modification of the scale (see text) (also dichotomised).

DEPRESSIVE SYMPTOMS: FREQUENCIES OF TOTAL SCORE IN CLINICAL GROUPS (20 ITEM VERSION) PERCENTAGES

		BACKS				NONBACKS		
	Total	Males	Females	GPs	Problems	Minor	OA	RA
Score 1 n	194	109	79	76	121	20	16	16
0	1.6	1.8	1.3	1.4	1.8	5.3	0	0
1	4.3	3.7	5.2	5.5	3.5	26.3	0	0
2	7.5	8.3	6.5	13.7	3.5	10.5	6.2	0
3	12.4	15.6	7.8	23.3	5.3	21.1	12.5	6.2
4	12.9	15.6	9.1	11.0	14.2	15.8	18.7	6.2
5	9.7	9.2	10.4	8.2	10.6	5.3	6.2	12.5
6	11.3	13.8	7.8	12.3	10.6	5.3	12.5	6.2
7	11.3	12.8	9.1	8.2	13.3	0	12.5	37.5
8	5.9	4.6	7.8	0	9.7	0	18.7	0
9	5.4	3.7	7.8	4.1	6.2	0	6.2	6.2
10	7.5	4.6	11.7	5.5	8.8	5.3	0	12.5
11	1.1	0.9	1.3	1.4	0.9	0	0	6.2
12	3.2	1.8	5.2	1.4	4.4	5.3	0	0
13	1.6	0.9	2.6	0	2.7	0	0	0
14	2.2	2.8	1.3	1.4	2.7	0	0	0
15	1.1	0	2.6	1.4	0.9	0	0	0
16	0.5	0	1.3	0	0.9	0	0	0
17	0	0	0	0	0	0	6.2	6.2
18	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0
20	0.5	0	1.3	1.4	0	0	0	0

DEPRESSIVE SYMPTOMS: FREQUENCIES OF TOTAL SCORE IN CLINICAL GROUPS (23 ITEM VERSION)

PERCENTAGES

	BACKS					NONBACKS		
	Total	Males	Females	GPs	Problems	Minor	OA	RA
Score 1 n	194	115	79	76	121	20	16	16
0	1.1	1.8	0	1.4	0.9	0	0	0
1	4.8	3.7	6.5	5.5	4.4	31.6	0	0
2	4.8	4.6	5.2	8.2	2.7	10.5	6.2	0
3	10.2	12.8	6.5	17.8	5.3	10.5	6.2	6.2
4	13.4	16.5	9.1	21.9	8.0	15.8	25.0	0
5	9.1	8.3	10.4	4.1	12.4	15.8	0	12.5
6	11.3	14.7	6.5	12.3	10.6	0	6.2	6.2
7	8.6	10.1	6.5	5.5	10.6	5.3	18.7	31.2
8	6.5	5.5	7.8	4.1	8.0	0	6.2	12.5
9	8.1	8.3	7.8	4.1	10.6	0	12.5	0
10	4.8	2.8	7.8	2.7	6.2	0	12.5	12.5
11	6.5	4.6	9.1	5.5	7.1	0	0	6.2
12	2.2	0.9	3.9	2.7	1.8	5.3	0	0
13	1.1	0.9	1.3	0	1.8	0	0	6.2
14	3.2	1.8	5.2	0	5.3	5.3	0	0
15	0.5	0.9	0	0	0.9	0	0	0
16	2.7	1.8	3.9	2.7	2.7	0	0	0
17	0.5	0	1.3	0	0.9	0	0	0
18	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	6.2	6.2
20	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0
23	0.5	0	1.3	1.4	0	0	0	0

DEPRESSIVE SYMPTOMS: FREQUENCIES OF TOTAL SCORE IN CLINICAL GROUPS (20 ITEM VERSION)

CUMULATIVE PERCENTAGES

		BACKS					NONBACKS		
		Total	Males	Females	GPs	Problems	Minor	OA	RA
Score	n	194	109	79	76	121	20	16	16
0		1.6	1.8	1.3	1.4	1.8	5.3	0	0
1		5.9	5.5	6.5	6.8	5.3	31.6	0	0
2		13.4	13.8	13.0	20.5	8.8	42.1	6.2	0
3		25.8	29.4	20.8	43.8	14.2	63.2	18.7	6.2
4		38.7	45.0	29.9	54.8	28.3	78.9	37.5	12.5
5		48.4	54.1	40.3	63.0	38.9	84.2	43.7	25.0
6		59.7	67.9	48.1	75.3	49.6	89.5	56.2	31.2
7		71.0	80.7	57.1	83.6	62.8	89.5	68.7	68.7
8		76.9	85.3	64.9	83.6	72.6	89.5	87.5	68.7
9		82.3	89.0	72.7	87.7	78.8	89.5	93.7	75.0
10		89.8	93.6	84.4	93.2	87.6	94.7	93.7	87.5
11		90.9	94.5	85.7	94.5	88.5	94.7	93.7	93.7
12		94.1	96.3	90.9	95.9	92.9	100	93.7	93.7
13		95.7	97.2	93.5	95.9	95.6	100	93.7	93.7
14		97.8	100	94.8	97.3	98.2	100	93.7	93.7
15		98.9	100	97.4	98.6	99.1	100	93.7	93.7
16		99.5	100	98.7	98.6	100	100	93.7	93.7
17		99.5	100	98.7	98.6	100	100	100	100
18		99.5	100	98.7	98.6	100	100	100	100
19		99.5	100	98.7	98.6	100	100	100	100
20		100	100	100	100	100	100	100	100

DEPRESSIVE SYMPTOMS: FREQUENCIES OF TOTAL SCORE IN CLINICAL GROUPS (23 ITEM VERSION)

CUMULATIVE PERCENTAGES

	BACKS					NONBACKS		
	Total	Males	Females	GPs	Problems	Minor	OA	RA
Score 1 n	194	115	79	76	121	20	16	16
0	1.1	1.8	0	1.4	0.9	0	0	0
1	5.9	5.5	6.5	6.8	5.3	31.6	0	0
2	10.8	10.1	11.7	15.1	8.0	42.1	6.2	0
3	21.0	22.9	18.2	32.9	13.3	52.6	12.5	6.2
4	34.4	39.4	27.3	54.8	21.2	68.4	37.5	6.2
5	43.5	47.7	37.7	58.9	33.6	84.2	37.5	18.7
6	54.8	62.4	44.2	71.2	44.2	84.2	43.7	25.0
7	63.4	72.5	50.6	76.7	54.9	89.5	62.5	56.2
8	69.9	78.0	58.4	80.8	62.8	89.5	68.7	68.7
9	78.0	86.2	66.2	84.9	73.5	89.5	81.2	68.7
10	82.8	89.0	74.0	87.7	79.6	89.5	93.7	81.2
11	89.2	93.6	83.1	93.2	86.7	89.5	93.7	87.5
12	91.4	94.5	87.0	95.9	88.5	94.7	93.7	87.5
13	92.5	95.4	88.3	95.9	90.3	94.7	93.7	93.7
14	95.7	97.2	93.5	95.9	95.6	100	93.7	93.7
15	96.2	98.2	93.5	95.9	96.5	100	93.7	93.7
16	98.9	100	97.4	98.6	99.1	100	93.7	93.7
17	99.5	100	98.7	98.6	100	100	93.7	93.7
18	99.5	100	98.7	98.6	100	100	93.7	93.7
19	99.5	100	98.7	98.6	100	100	100	100
20	99.5	100	98.7	98.6	100	100	100	100
21	99.5	100	98.7	98.6	100	100	100	100
22	99.5	100	98.7	98.6	100	100	100	100
23	100	100	100	100	100	100	100	100

DEPRESSIVE SYMPTOMS - FACTOR LOADINGS ON FIRST UNROTATED PRINCIPAL COMPONENT AND INTERNAL CONSISTENCY OF SCALES

		23 Item Version (modified Zung) Factor Loading	20 Item Version (Zung) Factor Loading
Z 01	I feel downhearted and sad	.67	.66
Z 02	Morning is when I feel best	-.04	-.04
Z 03	I have crying spells or feel like it	.63	.64
Z 04	I have trouble getting to sleep	.37	.40
GAR 1	I feel that nobody cares	.43	-
Z 05	I eat as much as I used to	-.29	-.32
Z 06	I still enjoy sex	-.57	-.60
Z 07	I notice that I am losing weight	.13	.15
Z 08	I have trouble with constipation	.29	.30
Z 09	My heart beats faster than usual	.38	.35
Z 10	I get tired for no reason	.51	.52
Z 11	My mind is as clear as it used to be	-.42	-.41
GAR 2	I tend to wake up too early	.40	-
Z 12	I find it easy to do the things I used to	-.31	-.34
Z 13	I am restless and can't keep still	.48	.45
Z 14	I feel hopeful about the future	-.42	-.43
Z 15	I am more irritable than usual	.53	.55

		23 Item Version (modified Zung) Factor Loading	20 Item Version (Zung) Factor Loading
Z 16	I find it easy to make decisions	-.35	.33
GAR 3	I feel quite quilty	.42	-
Z 17	I feel that I am useful and needed	-.34	-.33
Z 18	My life is pretty full	-.54	-.56
Z 19	I feel that others would be better off if I were dead	.45	.42
Z 20	I still enjoy the things I used to	-.61	-.63
	Percentage of variance	19.5	20.3
	Latent root (λ)	4.48	4.05
	Internal consistency (θ)	0.81	0.79

DEPRESSIVE SYMPTOMS - COMPARISON OF CLINICAL POPULATIONS ON DICHOTOMIZED ZUNG (20 ITEM) AND REVISED VERSION (23 ITEM)

	20 ITEM			23 ITEM	
	n	$\bar{X}$	s.d.	$\bar{X}$	s.d.
Normals	40	4.02	3.33	4.35	3.58
Backs (total)	186	6.15	3.56	6.77	3.93
Backs (males)	109	5.51	3.05	6.12	3.39
Backs (females)	77	7.03	4.03	7.67	4.43
Backs (GPs)	70	5.16	3.63	5.67	3.98
Backs (problems)	116	6.80	3.38	7.49	3.74
Nonbacks (minor)	20	3.47	3.10	4.00	3.65
Nonbacks (OA)	16	6.31	3.55	7.06	4.07
Nonbacks (RA)	16	7.63	3.32	8.31	3.77

PAIRED GROUP COMPARISONS

	20 ITEM			23 ITEM		
	t	df*	p	t	df*	p
Backs (males vs females)	-3.05	184	<.005	-2.85	184	<.005
Backs (GPs vs problems)	3.10	184	<.005	3.12	184	<.005
Backs (total) vs nonbacks (OA+RA)	1.20	216	NS	1.22	186	NS
Nonbacks (minor) vs nonbacks (OA+RA)	3.73	41	<.001	3.39	40	<.003
Nonbacks (OA vs RA)	1.08	30	NS	0.90	30	NS

* Where variances differ significantly, a separate rather than a pooled estimate of variance is used in the calculation of the t-test.

EPQ: SCALES, TEST-RETEST RELIABILITIES

(FROM EPQ MANUAL, P 16;
EYSENCK & EYSENCK, 1975)

	n	E	N	P	L
MALES (Total)	136	0.90	0.89	0.83	0.86
Dental students	80	0.89	0.87	0.83	0.90
Polytechnic students	23	0.89	0.92	0.80	0.79
Social workers	16	0.92	0.91	0.79	0.76
University students	17	0.89	0.90	0.76	0.90
FEMALES (Total)	121	0.87	0.80	0.71	0.86
Dental students	31	0.88	0.80	0.80	0.87
Polytechnic students	8	0.96	0.89	0.78	0.87
Social workers	44	0.93	0.86	0.86	0.84
University students	38	0.80	0.74	0.51	0.61

Figures are Pearson product moment correlations.

EPQ: SCALES, INTERNAL CONSISTENCY RELIABILITIES

(ADAPTED FROM EPQ MANUAL, TABLE 3;
EYSENCK & EYSENCK, 1975)

	n	E	N	P	L
MALES					
Normals	500	.85	.84	.74	.81
Prisoners	934	.84	.84	.71	.82
FEMALES					
Normals	500	.84	.85	.68	.79
Prisoners	71	.86	.88	.77	.86

Figures are Pearson product moment correlations.

EPQ: EXTRAVERSION SCALE, COMPARISON OF NORMALS (n = 4306)*, BACK PATIENTS (MAIN STUDY, n = 200) AND NONBACK ORTHOPAEDIC PATIENTS (n = 56)

	n	$\bar{X}$	s.d.
Normals (males)	1707	12.90	4.97
Normals (females)	2599	12.46	4.82
Backs (total)	194	13.14	5.19
Backs (males)	111	13.31	5.20
Backs (females)	83	12.93	5.21
Backs (GPs)	78	13.69	4.77
Backs (problems)	116	12.78	5.45
Nonbacks (minor)	20	12.55	7.14
Nonbacks (OA)	16	8.25	7.12
Nonbacks (RA)	16	11.75	4.63

PAIRED GROUP COMPARISONS

	t	df	p
Backs (males) vs normals (males)	0.84	1816	NS
Backs (females) vs normals (females)	0.87	2680	NS
Backs (males) vs backs (females)	0.50	192	NS
Backs (GPs) vs backs (problems)	1.19	192	NS
Backs (total) vs nonbacks (OA+RA)	1.23	224	NS
Nonbacks (minor) vs nonbacks (OA+RA)	-2.44	38	< .02
Nonbacks (OA) vs nonbacks (RA)	0.23	27	NS

* Constructed for the 20-55 age group from EPQ Manual (Eysenck and Eysenck, 1975).

EPQ - NEUROTICISM SCALE, COMPARISON OF NORMALS* (n = 4306), BACK PATIENTS (MAIN STUDY, n = 200) AND NONBACK ORTHOPAEDIC PATIENTS (n = 56)

	n	$\bar{X}$	s.d.
Normals (males)	1707	9.61	5.14
Normals (females)	2599	12.70	5.15
Backs (total)	194	8.99	5.43
Backs (males)	111	8.06	4.98
Backs (females)	83	10.23	5.80
Backs (GPs)	78	8.89	5.25
Backs (problems)	116	9.06	5.78
Nonbacks (minor)	20	6.55	6.16
Nonbacks (OA)	16	5.19	6.24
Nonbacks (RA)	16	9.93	4.89

PAIRED GROUP COMPARISONS

	t	df	p
Backs (males) vs normals (males)	3.08	1816	< .01
Backs (females) vs normals (females)	4.28	2680	< .01
Backs (males) vs backs (females)	3.57	192	< .01
Backs (GPs) vs backs (problems)	0.21	192	NS
Backs (total) vs nonbacks (OA+RA)	1.40	224	NS
Nonbacks (minor) vs nonbacks (OA+RA)	1.91	47	NS
Nonbacks (OA) vs nonbacks (RA)	0.31	30	NS

* Constructed for the 20-55 age group from EPQ Manual (Eysenck and Eysenck, 1975).

EPQ - PSYCHOTICISM SCALE, COMPARISON OF NORMALS* (n = 4306), BACK PATIENTS (MAIN STUDY, n = 200) AND NONBACK ORTHOPAEDIC PATIENTS (n = 56)

	n	$\bar{X}$	s.d.
Normals (males)	1707	3.56	2.94
Normals (females)	2599	2.55	2.28
Backs (total)	194	2.21	2.58
Backs (males)	111	2.43	2.88
Backs (females)	83	1.92	2.10
Backs (GPs)	78	2.09	1.91
Backs (problems)	116	2.29	2.95
Nonbacks (minor)	20	2.75	3.43
Nonbacks (OA)	16	0.81	0.98
Nonbacks (RA)	16	1.19	1.60

PAIRED GROUP COMPARISONS

	t	df	p
Backs (males) vs normals (males)	4.69	1816	< .01
Backs (females) vs normals (females)	2.48	2680	< .05
Backs (males) vs backs (females)	1.36	192	NS
Backs (GPs) vs backs (problems)	0.53	192	NS
Backs (total) vs nonbacks (OA+RA)	0.76	224	NS
Nonbacks (minor) vs nonbacks (OA+RA)	-1.15	42	NS
Nonbacks (OA) vs nonbacks (RA)	-0.88	30	NS

* Constructed for the 20-55 age group from the EPQ Manual (Eysenck and Eysenck, 1975).

EPQ - LIE SCALE, COMPARISON OF NORMALS* (n = 4306), BACK PATIENTS (MAIN STUDY, n = 200) AND NONBACK ORTHOPAEDIC PATIENTS (n = 56)

	n	$\bar{X}$	s.d.
Normals (males)	1707	7.06	4.03
Normals (females)	2599	8.38	3.97
Backs (total)	194	9.27	4.62
Backs (males)	111	8.37	4.48
Backs (females)	83	10.47	4.55
Backs (GPs)	78	8.32	4.01
Backs (problems)	116	9.91	4.90
Nonbacks (minor)	20	7.75	4.79
Nonbacks (OA)	16	6.63	6.64
Nonbacks (RA)	16	11.81	5.47

PAIRED GROUP COMPARISONS

	t	df	p
Backs (males) vs normals (males)	3.29	1816	<.01
Backs (females) vs normals (females)	4.70	2680	<.01
Backs (males) vs backs (females)	3.19	192	<.01
Backs (GPs) vs backs (problems)	2.37	192	<.05
Backs (total) vs nonbacks (OA+RA)	2.73	224	<.01
Nonbacks (minor) vs nonbacks (OA+RA)	1.70	48	NS
Nonbacks (OA) vs nonbacks (RA)	2.33	28	<.05

* Constructed for the 20-55 age group from the EPQ Manual (Eysenck and Eysenck, 1975).

THEORETICAL MODEL: FINAL LIST OF VARIABLES WITH DISABILITY AS DEPENDENT VARIABLE

VARIABLE	CODE	CLASS
Sex	SEX	D
Major Problem	MAJPROB	OPC
Lumbar flexion	FLEXCMS	OPC
Straight leg raising (left)	SLRLEFT	OPC
Straight leg raising (right)	SLRRIGHT	OPC
Root compression	ROOTCOMP	OPC
Previous surgery	PREVSURG	OPC
Time pattern	TIMEPATT	OPC
Depressive symptoms	COOKE1	MOOD
- Interaction with sex	SEXCOOKE	MOOD
Somatic concern	MSPQ	MOOD
- Interaction with sex	SEXMSPQ	MOOD
Inappropriate signs	SIGNSTOT	ILLNESS BEHAVIOUR
Inappropriate symptoms	SYMPTTOT	ILLNESS BEHAVIOUR

D Demographic

OPC Objective physical characteristics