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THE MINNESOTA MULTIPHASIC PERSONALITY INVENTORY-2  
AND LOW BACK PAIN SURGERY OUTCOME

by

David S. Shearer

A dissertation submitted in partial fulfillment  
of the requirements for the degree

of

DOCTOR OF PHILOSOPHY

in

Psychology

Approved:

UTAH STATE UNIVERSITY  
Logan, Utah

2001



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## ABSTRACT

The Minnesota Multiphasic Personality Inventory-2  
and Low Back Pain Surgery Outcome

by

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Utah State University, 2001

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Department: Psychology

Chronic back pain is a serious problem in the U.S. for which about 10% of back pain sufferers will undergo elective surgery. Unfortunately, back surgery is not successful in alleviating back pain in a substantial number of surgery patients. Various psychological and psychosocial variables have a demonstrated relationship to back surgery outcome. The most widely used personality test used to predict back surgery outcome is the Minnesota Multiphasic Personality Inventory (MMPI). Past research has shown that elevations on three MMPI clinical scales (Hs, D, and Hy) are positively correlated with poor back surgery outcome. The current prospective study shows a similar pattern using the MMPI-2 to predict surgery outcome for 60 low back pain patients. It appears that past MMPI research in this area is applicable to the use of MMPI-2. These results also suggest that when MMPI-2 variables are combined with demographic and surgical variables, patients more likely to experience poor surgical outcome can be identified.

There is evidence that elevations of the conversion V profile of the MMPI-2 may prospectively differentiate between successful and nonsuccessful surgery outcomes.

(124 pages)

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I want to express my deep appreciation to my wife, Cheryl Estradié, for her unwavering support and belief in me that helped make the completion of a PhD possible.

David S. Shearer

## CONTENTS

	Page
ABSTRACT .....	iii
ACKNOWLEDGMENTS .....	v
LIST OF TABLES .....	vii
CHAPTER	
I.    PROBLEM STATEMENT .....	1
II.   PREVIOUS WORK--LITERATURE REVIEW .....	5
III.  METHOD .....	30
IV.  RESULTS .....	39
V.   DISCUSSION .....	59
REFERENCES .....	89
APPENDICES .....	98
CURRICULUM VITAE .....	110

## LIST OF TABLES

Table		Page
1	Determining Overall Outcome Rating Using the Stauffer and Coventry Index .....	38
2	Descriptive Statistics for Outcome Measures: Disability Questionnaire and Back Pain Questionnaire .....	41
3	Descriptive Statistics for Outcome Measure: Stauffer and Coventry Index .....	42
4	Pearson Product-Moment Correlation Matrix for Variables Used in Analyses .....	42
5	Item Overlap for Scales Hs, D, and Hy .....	43
6	Analysis of Variance for Regression Models Using Scales Hs, D, and Hy as Predictor Variables and the Disability Questionnaire as an Outcome Measure .....	45
7	Multiple Regression Results for Predicting Outcome Scores Using Scales Hs, D, and Hy .....	46
8	Analysis of Variance for Regression Models Using Scales Hs, D, and Hy as Predictor Variables and the Back Pain Questionnaire as an Outcome Measure .....	47
9	Analysis of Variance for Regression Models Using Demographic Information and Scales Hs, D, and Hy as Predictor Variables and the Disability Questionnaire as an Outcome Measure .....	49
10	Multiple Regression Results for Predicting Outcome Scores Using Psychosocial Variables and Scales Hs, D, and Hy .....	50
11	Analysis of Variance for Regression Models Using Demographic Information and Scales Hs, D, and Hy as Predictor Variables and the Back Pain Questionnaire as an Outcome Measure .....	52
12	Effect Sizes for Multiple Regression Analyses Using Scales Hs, D, and Hy to Predict Surgery Outcome .....	55

Table	Page
13 Effect Sizes for Multiple Regression Analyses Using Psychosocial Variables and Scales Hs, D, and Hy to Predict Surgery Outcome . . . . .	57
14 Proportion of Correct Classifications of Outcome Based on the Discriminant Function for Scales Hs, D, and Hy with Scores on the Stauffer and Coventry Index as the Grouping Variable . . . . .	57
15 Proportion of Correct Classifications of Outcome Based on the Discriminant Function for Scales Hs, D, Hy, Pd, Mf, Pa, Pt, Sc, Ma, and Si with Scores on the Stauffer and Coventry Index as the Grouping Variable . . . . .	58
16 Proportion of Correct Classifications of Outcome Based on the Discriminant Function for Demographic Variables and Scales Hs, D, and Hy with Scores on the Stauffer and Coventry Index as the Grouping Variable . . . . .	58
17 Mean <u>T</u> Scores for MMPI-2 Scales Hs, D, and Hy for the Disability Questionnaire Based on Quartile Data . . . . .	61
18 Mean <u>T</u> Scores for MMPI-2 Scales Hs, D, and Hy for the Back Pain Questionnaire based on Quartile Data . . . . .	62
19 Mean <u>T</u> Scores for MMPI-2 Scales Hs, D, and Hy for the Stauffer and Coventry Index Based on Outcome Category . . . . .	63

## CHAPTER I

### PROBLEM STATEMENT

Chronic back pain is a monumental problem in the United States, costing over \$17 billion annually (Turner, Herron, & Weiner, 1986) and affecting approximately 12 million people (Cavanaugh & Weinstein, 1994). Garofalo and Polatin (1999) stated that low back pain (LBP) is a medical condition that is causing a significant burden on the U.S. health care system. Additionally, a crosscultural study indicated that although respondents from all countries surveyed (U.S., Mexico, Japan, Italy, and New Zealand) reported significant problems related to LBP, the U.S. respondents reported the greatest amount of impairment (Sanders et al., 1992). Estimates for the United States suggest that back pain is implicated in 25% of all disabling occupational injuries and that 40% of all visits to orthopedists and neurosurgeons may be accounted for by patients suffering from back pain (Cavanaugh & Weinstein, 1994). It is estimated that each year approximately 1.25 million people in the United States experience a back injury and that back injuries result in permanent disability for about 65,000 annually (Doxey, Dzioba, Mitson, & Lacroix, 1988). Each day the number of Americans receiving treatment for back pain reaches approximately 7 million (Doxey et al., 1988). A LBP episode occurs for at least 5% of American adults annually, and in 1986, 11.7 million people were impaired and 5.3 million were disabled by LBP (Frymoyer & Cats-Baril, 1987). It is estimated that 60-85% of American adults will experience a LBP episode during their lifetime (Polatin et al., 1989). The reoccurrence rate for LBP is quite large, ranging between 30-70% (Garg & Moore,



1992). Of those suffering from chronic back pain, approximately 10% will undergo elective surgery for their problem (Deyo, Cherkin, Conrad, & Volinn, 1991). It is estimated that 280,000 surgeries for LBP are conducted every year (Taylor, Deyo, Cherkin, & Kreuter, 1994). Of those who undergo a laminectomy/discectomy (surgical procedures for back pain), 10% will be operated on again (Hoffman, Wheeler, & Deyo, 1993), and for those undergoing spinal fusion for back pain, 23% will undergo reoperation (Franklin, Haug, Heyer, McKeefrey, & Picciano, 1994).

Unfortunately, back surgery is not successful in alleviating chronic pain in a substantial number of surgery patients (Herron & Turner, 1984; Sorensen & Mors, 1988; Spengler & Freeman, 1979). In a meta-analysis of spinal fusion studies spanning from 1966 to 1991, it was found that satisfactory outcomes were obtained for an average of 68% of patients ranging from 16-95% (Turner et al., 1992). Based on a literature review, Hoffman et al. (1993) found a mean success rate of 67% for laminectomy and discectomy surgeries for back pain. Poor back surgery outcomes can result in disability, continued or increased back pain, additional surgery, costly rehabilitation, emotional problems, and malpractice suits. In addition to the great cost in human terms, there are financial considerations as well. Back pain is the leading cause of disability and production losses in America (Loeser, Bigos, Fordyce, & Violinn, 1990) and is estimated to result in up to \$50 million in total costs annually (Frymoyer, 1993). Block (1999) estimates that correctly identifying patients who will have a failed surgery (laminectomy/discectomy) would result in an annual saving of \$1 billion.

Due to the potentially serious problems associated with unsatisfactory outcome, it

is essential that patient selection before surgery identify those most likely to experience positive results. In this regard, various psychological variables have a demonstrated relationship to back surgery outcomes and psychologists are often asked to preoperatively evaluate candidates for elective back surgery to assist in the determination of the likelihood of a good result.

Psychological recommendations are typically based, in part, upon information obtained through an objective personality test. The most widely used objective test for this purpose is the Minnesota Multiphasic Personality Inventory (MMPI; Hathaway & McKinley, 1943). Evidence in the literature suggests that the Hypochondriasis (Hs), Depression (D), and Hysteria (Hy) scales of the MMPI are most predictive of back surgery outcome. However, a new version of the MMPI, the MMPI-2 (Butcher, Dahlstrom, Graham, Tellegen, & Kramer, 1989), has been developed that has a more recent and representative normative sample. The first and second versions of the MMPI are quite similar, but there have been changes to the content of the original instrument.

Practicing clinicians are using the MMPI-2 in large numbers and it has essentially replaced the original MMPI. It has been suggested that past research on the MMPI may be applicable to the MMPI-2 (Graham, 1993). The work of Riley and associates (Riley, Robinson, Geisser, & Wittmer, 1993; Riley, Robinson, Geisser, Wittmer, & Smith, 1995) provides evidence that back surgery findings based on the MMPI may, indeed, be applicable when using the MMPI-2. However, some research has suggested that there are important differences in clinical interpretation depending on whether the MMPI-2 or

MMPI is used (Dahlstrom, 1992; Edwards, Morrison, & Weissman, 1993; Goldman, Cooke, & Dahlstrom, 1995; Humphrey & Dahlstrom, 1995).

There continues to be a need for a more reliable and accurate procedure for identifying patients more or less likely to benefit from back surgery. In addition, there is little research available that addresses low back surgery outcome prediction using the MMPI-2. The purpose of this study is to determine the utility of scales Hs, D, and Hy of the MMPI-2 in predicting low back surgery outcome.

## CHAPTER II

### PREVIOUS WORK--LITERATURE REVIEW

#### The Minnesota Multiphasic Personality Inventory

The Minnesota Multiphasic Personality Inventory (MMPI) has been the most widely used psychological test in the United States and other countries around the world (Graham, 1993). It was developed by Hathaway and McKinley in 1943 to facilitate psychodiagnosis by psychologists and psychiatrists. The test consists of 566 true/false statements that were empirically determined to differentiate between groups of subjects on a variety of psychological constructs. A convenience sample was used to develop the normative data for the inventory (visitors to the University Hospitals in Minneapolis). Raw scores are transformed into T scores with a mean of 50 and a standard deviation of 10. Typically, scores at least one and one half standard deviations above (and in some cases below) the mean are considered clinically significant. There are 10 clinical scales and four validity scales. In addition, there are numerous subscales and supplementary scales that will not be discussed here.

A second form of the MMPI, the MMPI-2 (Butcher et al., 1989), was developed to restandardize the test. The resulting test is very similar to the first version; however, some items have been removed, some rewritten, and others added. Specifically, some of the MMPI content led to concerns about archaic language, sexist language, dated references, objectionable content (e.g., sexual behavior, religiosity, and bowel function), poor grammar, and difficult idioms (Graham, 1993). Additionally, there was an interest in

broadening the content to assess drug-taking, suicide, and treatment-related behavior. On the basic validity and clinical scales 13 items were deleted and 88 were changed (Graham, 1993). The test was renormed on a contemporary and more representative national sample, although there is an overrepresentation of those with higher education.

The four validity scales assess the test-takers' approach to answering the questions on the inventory. The Cannot Say (?) Scale is an index of the number of items left blank. Protocols with more than 10 items left blank are considered to have questionable validity because such omissions can result in the lowering of the clinical scales (Graham, 1993). The L Scale (L) identifies deliberate attempts to avoid answering items honestly. Elevations of the F Scale (F) can suggest a tendency to exaggerate psychological problems and distress. Moderate elevations of the F Scale may indicate authentic psychological distress. The K Scale (K) measures the test-takers' level of psychological defensiveness. Extreme elevations on L, F, or K can invalidate a protocol.

The 10 clinical scales are labeled with terms that are, in some cases, no longer representative of current psychological nomenclature. They are as follows: Scale 1, Hypochondriasis (Hs); Scale 2, Depression (D); Scale 3, Hysteria (Hy); Scale 4, Psychopathic Deviate (Pd); Scale 5, Masculinity-Femininity (Mf); Scale 6, Paranoia (Pa); Scale 7, Psychasthenia (Pt); Scale 8, Schizophrenia (Sc); Scale 9, Hypomania (Ma); Scale 0, Social Introversion (Si). This study is focused on the first three scales, Hs, D, and Hy, because research evidence on the original MMPI has consistently suggested that of all the clinical scales, these are most related to back surgery outcome. Scale 1 (Hs) consists of 33 items that address nonspecific and vague problems with bodily function. Persons who

are truly experiencing physical problems will typically score moderately high on this scale, but extreme elevations are usually reflective of persons with dramatic or abnormal somatic concerns. Scale 2 (D) consists of 60 items assessing symptoms of depression. Scale 3 (Hy) consists of 60 items that assess both specific somatic complaints and denial of emotional or psychological problems. Elevation on all three scales is sometimes referred to as the "neurotic triad," suggestive of an anxiety disorder, depressive disorder, or somatoform disorder. In profiles of this type there are often somatic complaints with identifiable secondary gains related to the symptoms. A slightly different profile is the "conversion valley" in which there is an elevation on Scales 1 and 3, while Scale 2 is lower relative to the other two scales. Such a profile may be found among individuals showing conversion symptoms; that is, expressing psychological problems in terms of specific somatic problems. They may react to stress and avoid responsibility by developing physical symptoms. Further, these persons may lack insight into their problems and may rely excessively on denial and repression. They may also avoid psychological explanations of their problems and insist that their problems are purely physical.

#### Comparability of MMPI and MMPI-2 T Scores and Configurations

There are several important issues regarding the comparability of the MMPI and MMPI-2. As Ben-Porath and Graham (1991) have noted, we should expect differences in MMPI and MMPI-2 scores because if there were no differences there would be little justification in having developed a second version. Graham (2000) has summarized some of the more important issues of comparability. Given the same raw score, MMPI-2 T-

scores on the basic clinical scales tend, on average, to be five T score points lower than on the MMPI. However, Graham noted that specific scales may vary by up to 10-15 T score points, and in some cases the MMPI produces higher T scores than the MMPI-2.

Therefore, one cannot simply assume that a given MMPI-2 profile would result in an MMPI profile that is elevated five T score points across the clinical scales. Often, MMPI-2 and MMPI profiles are interpreted based on the elevation of one, two, or three clinical scales (called high-, two-, and three-point code types). If the differences between individual MMPI and MMPI-2 clinical scales were consistent, this would not pose a problem. However, the variability between scales on the two measures can potentially result in different code types for the same individual. Some studies have been conducted that explore the relationship between the code types on the MMPI and MMPI-2 for the same individuals. In one study, Ben-Porath and Butcher (1989) found that 58.7% of males and females produced the same high-point code type on the MMPI and MMPI-2, whereas only 35.9% of males and 30.9% of females produced the same two- point codes. Chojnacki and Walsh (1992) found similar results for high- and two-point code types and reported that 42.4% of male participants and 25.0% of female participants in their study produced the same three-point code types on both versions of the test.

Graham (2000) has criticized other researchers for not addressing the issue of definition when comparing MMPI and MMPI-2 code types. Graham stated that definition refers to the difference between the lowest score in a code type and the next highest scale. Typically, five T-score points is considered adequate definition (Graham, 2000). When code point definition was taken into account, it was found that congruence between

MMPI and MMPI-2 high-, two-, and three-point code types improved as the amount of definition increased (Graham, Timbrook, Ben-Porath, & Butcher, 1991).

In sum, it can be concluded that the comparability of MMPI and MMPI-2 profiles for back surgery patients may vary widely depending on definition for high-, two-, or three-point code types. This suggests that past research conclusions based on the MMPI may not be consistent with current conclusions based on the MMPI-2.

### Rationale for Presurgical Psychological Assessment

In the arena of predictions for surgical outcomes for back pain, a wide array of variables has been examined. These presurgical factors include demographic, psychological, psychosocial, biological, and compensation-related variables. Some factors found to be related to poorer surgery outcome are lower socioeconomic status, less education, being older, being female, poor English proficiency, smoking, drug and alcohol use, use of pain medications prior to treatment, higher levels of pain reporting prior to surgery, longer periods of unemployment prior to surgery, obtaining legal representation for compensation, starting full-time work before graduating high school, longer periods of disability prior to surgery, presence of sciatica, and multiple previous back operations (e.g., Bernard, 1993; Debarard, 1997; Doxey et al., 1988; Dzioba & Doxey, 1984; Franklin et al., 1994; Herron, Turner, Ersek, & Weiner, 1992; Oostdam & Duivenvoorden, 1983; Polatin et al., 1989; Schofferman, Anderson, Hines, Smith, & White, 1992; Thorvaldsen & Sorensen, 1990; Wilfling, Klonoff, & Kokan, 1973).

Specifically, a number of studies have demonstrated that positive low back surgery outcomes are inversely related to age at time of operation (Doxey et al., 1988; Franklin et



al., 1994; Hasenbring, Marienfeld, Kuhlendahl, & Soyka, 1994; Watkins, O'Brien, Dragelis, & Jones, 1986). Gender also appears to be related to back surgery outcome; however, findings are not uniform in this respect. Overall, it appears that there may be a higher likelihood for poor surgical outcome for women in comparison to men (e.g., Dzioba & Doxey, 1984; Sorensen, Mors, & Skovlund, 1987; Watkins et al., 1986). Some studies, however, have not found gender to be related to back surgery outcome (Kuperman, Osmon, Golden, & Blume, 1979; Oostdam & Duivenvoorden, 1983; Uomoto, Turner, & Herron, 1988). There is evidence that those who are married tend to have better surgical results and recover from medical traumas better than those who are not married (Lynch, 1977; Verbrugge, 1979). Some researchers have shown that back pain disability is more common for those with lower levels of education (Frymoyer, 1993; Frymoyer & Cats-Baril, 1987; Lacroix et al., 1990). In addition, some have found that lower level of education is related to poorer lumbar surgical outcome (Junge, Dvorak, & Ahrens, 1995). The occurrence of previous back operations has also been implicated as a predictor of poorer back surgery outcomes (Franklin et al., 1994; Wilfling, Klonoff, & Kokan, 1973). Finally, duration of current back pain attack has been used successfully to predict first lumbar discectomy outcome (Sorensen et al., 1987).

Psychological and psychosocial variables have received significant attention. It is recognized that an association between lumbar spine surgery outcome and presurgery psychological variables exists (Spengler, Ouellette, Battie, & Zeh, 1990) and experienced surgeons have noted greater success rates for back surgery in psychologically healthy individuals versus psychologically unhealthy patients (Schofferman et al., 1992). Herron

and Pheasant (1982) noted that many surgeons are using psychological evaluation for LBP patients. Waddell and associates have affirmed the importance of psychosocial factors in reviews of failed spinal surgery (Waddell, McCulloch, Kummel, & Venner, 1980). It has been concluded that only one half of the total disability caused by chronic LBP is associated with objective physical impairment, while the remaining variance is accounted for, in part, by psychological variables (Waddell, Main, Morris, DiPaola, & Gray, 1984). Not surprisingly, psychological testing is used in some cases as an adjunct to other diagnostic techniques in the evaluation of patients for elective back surgery (Herron et al., 1992). It has been suggested that initial selection of patients for lumbar spine surgery that includes psychological testing may reduce the occurrence of unsuccessful outcomes (Spengler, Freeman, Westbrook, & Miller, 1980).

#### The MMPI, Back Pain, and Surgical Outcome

Psychological testing for back pain patients has focused primarily on factors involving personality and pathology characteristics. The Minnesota Multiphasic Personality Inventory (MMPI; Hathaway & McKinley, 1943) has been the instrument most utilized to examine the association between psychological functioning and back surgery outcome (Doxey et al., 1988; Long, 1981).

Several studies have conducted a retrospective examination of the relationship between the MMPI and back surgery outcome. Interpretation of the results of retrospective studies must be approached with caution because there is evidence that MMPI scale scores may be different postoperatively than preoperatively (Herron & Pheasant, 1982; Watkins et al., 1986). A retrospective design is one in which a previous

surgery outcome is predicted by later MMPI scale scores. Wilfling et al. (1973) found that in 27 male patients undergoing spinal fusion, elevations on the Hs and D Scales were related to poorer surgery outcome. Also, patients who had previous back operations had higher elevations on Scales Hs, D, and Hy and poorer outcomes than singly operated patients. The finding that the Hs Scale is predictive of poorer outcome is consistent with the retrospective findings of Long (1981) for 44 low back surgery patients based on patient report of pain status and activity level between 6 and 18 months following surgery. Higher elevations on the Hs, D, and Hy Scales were found in a retrospective study of 27 patients with a history of failed traditional surgical methods (Spengler et al., 1980). Spengler et al. recommend reconsidering surgery for patients with an Hy Scale score greater than two standard deviations above the mean ( $T > 70$ ) for whom only minimal objective findings of back problems exist. However, these conclusions are questionable because the authors appear to have mistakenly transposed Scale Hy for Hs (Spengler et al., 1980, Figure 1, p. 359).

Fortunately, a number of prospective studies have also examined the relationship between the MMPI and back surgery outcome. Prospective designs provide a stronger foundation for making inferences about the predictive relationship between two variables than retrospective designs. A prospective design is one in which a surgery outcome is predicted by MMPI scale scores obtained prior to surgery. The remaining studies discussed in this section are all prospective in design. Wiltse and Rocchio (1975) reported that lower elevations on Hs and Hy ( $T < 54$ ) were predictive of success in chymopapain injection therapy for 130 patients. Outcome in this study was determined by surgeon

rating, and it is interesting to note that physician's preoperative evaluation of patients as having a greater psychogenic component to their pain was positively correlated with poorer outcome. Pheasant, Gilbert, Goldfarb, and Herron (1979) suggested that chemonucleolysis treatment results are difficult to interpret because research has demonstrated that this treatment has been found to be no better than placebo in a number of studies. The results are, however, similar to other findings in the literature. For example, Blumetti and Modesti (1976) found that elevations on the Hs and Hy Scales predicted poorer outcome in 42 low back surgery patients, 40 of whom had undergone previous back surgery.

Doxey et al. (1988) reported that for 74 patients undergoing lumbar surgery there was a correlation between preoperative elevations on the Hs Scale and less positive orthopedic outcome as determined by an orthopedic surgeon independent of the operating physician or patient ratings. In this study rehabilitation outcome (vs. surgical outcome) was determined by whether the patients returned to work. The authors found that only increasing age and lack of English proficiency predicted rehabilitation outcome in this group. The obvious relationships between dominant language proficiency, advancing age, and employability may have influenced this finding. Dzioba and Doxey (1984) found that poorer outcome for four different types of back surgeries in 77 patients was predicted by the Hs Scale when combined with orthopedic assessment.

Oostdam, Duivenvoorden, and Pondaag (1981) reported that higher elevations on scales Hs, D, and Hy were related to poorer outcome for 100 low back surgery patients, but recommended the use of only scales D and Hy because they were better predictors for

their sample of patients. Interestingly, in their prospective study they found that patients with both satisfactory and less satisfactory outcomes displayed a "conversion V" pattern on the MMPI. However, this profile was more elevated for the less satisfactory outcome patients. Outcome was determined by combining patients' subjective ratings of improvement, utilization of medical care postoperatively, and the presence of back pain. In a later study of 162 patients, Oostdam and Duivenvoorden (1983) found a relationship between poor low back surgery outcome and scales Hs and Hy, but not D. Outcome was determined jointly by physician and patient ratings.

Gentry (1982) studied 35 patients who had elevated MMPI profiles during hospitalization for elective back surgery. Each of these patients had an elevation on at least one clinical scale above a T-score of 70. The frequency of elevated scores for this sample of back surgery patients included Hs (85.7%), Hy (74.3%), D (42.9%), and Pd (22.9%). It was found that 7 (20%) of these patients underwent surgery for a second time within 18 months of their first surgery, indicating a failure of the first operation.

Kuperman et al. (1979) reported that poorer disc surgery outcome was related to elevations on scales Hs, D, and Hy for 31 patients. The operating neurosurgeon provided ratings of outcome based on an interview with the patient that took patient-reported level of pain and employment status into consideration. This is consistent with the Wilfling et al. (1973) findings that elevations on these scales were higher for multiply operated patients who did less well than those undergoing their first operation. Turner and Leiding (1985) found similar results for lumbosacral fusion as did another study of lumbar laminectomy for disc herniation, but not for a decompressive lumbar laminectomy for

spinal stenosis (Herron, Turner, Clancy, & Weiner, 1986). As the authors of the later study note, successful use of the MMPI to predict back surgery outcome may depend on spinal diagnosis. Further research is needed to clarify this point

In another prospective study Sorensen (1992) reported that 57 patients having undergone lumbar discectomy with elevations on scales Hs and Hy had poorer results at a 5-year follow-up, whereas those with an elevation on scale D had poorer outcomes only at a 6-month follow-up. Outcome over the 5 years was determined based on patient report and physical exams. Pheasant et al. (1979) found that elevations on scales Hs and Hy were associated with less positive surgical outcome for 103 patients seen over a 10-year period. In addition, they noted that elevations on scales Hs, D, and Hy when the score on D was significantly lower than the other two scales (conversion V) were related to poorer surgical outcomes for patients having undergone multiple low back operations previously.

Pheasant et al. (1979) cautioned against the use of the MMPI as a single predictor because they did not find strong predictive value in the MMPI scales. They suggested the use of the MMPI only with concurrent use of other data for patient surgery selection. At least one study has not demonstrated a relationship between the MMPI scales and surgery outcome (Waring, Weisz, & Bailey, 1976). The Waring et al. study was a prospective examination of 34 consecutive patients admitted to a general hospital. The mean age of the patients in this study was 40.4 years, and 14 patients were women. The surgeon rated organic and functional-emotional outcome for each patient 6-months postsurgery. Although Waring et al. did not find a statistically significant relationship between outcome and MMPI scales, they did note that the average profile for patients having poor

functional outcomes was the conversion V profile. Possible reasons for the discrepancy between these findings and that of others include the effect of small sample size on statistical significance testing and the fact that outcome was rated by surgeons not patients. Nevertheless, Watkins et al. (1986) suggested that preoperative MMPIs for patient surgery selection should not be used because the MMPI is not a reliable predictor of success for back surgery. However, Sorensen (1992) suggested that, given past research findings, it is reasonable to conclude that there is a relationship between scales Hs, D, and Hy and lumbar discectomy surgery outcome. Further, Sorensen noted that the majority of studies in the area of surgical outcome and personality using the MMPI have found a correlation with the Hs Scale and to a lesser extent the Hy Scale. Oostdam and Duivenvoorden (1983) stated that preoperative psychological evaluations, including personality testing, are clearly relevant when used with other data in making decisions regarding surgery for LBP.

Some studies have found a relationship between the MMPI validity scales and surgical outcome. Jamison, Ferrer-Brechner, Brechner, and McCreary (1976) reported that treatment outcome for patients representing a variety of chronic pain complaints with a history of failed treatment could be discriminated by higher scores on the K Scale. However, it is unclear what percentage of these patients had low back pain and how many were treated with surgical intervention versus other methods. Similarly, Uomoto et al. (1988) found that less satisfactory surgery results for 129 patients undergoing lumbar laminectomy were related to higher scores on both the K and L validity scales (in addition to the Hs Scale); however, the classification of patients into outcome categories using



these scales was close to base rate predictions and may be, therefore, of limited utility.

Outcome was determined using a rating scale comprised of back and leg pain relief, return to work status, use of analgesics, and amount of restriction of physical activities.

In summary, given that back pain, even in the absence of objective findings, is experienced as debilitating by patients, it is reasonable to employ psychometrics as an adjunct to other information in making treatment decisions (Elkins & Barrett, 1984). There is some research evidence that questions the utility and strength of using MMPI scales to predict surgery outcome; however, given the current state of research on personality and surgery outcome for back pain, it appears that several MMPI scales are of importance. To date the Hs, Hy and D Scales, in that order, are the best objective personality predictors of surgery outcome.

#### MMPI Subscales and Equations Incorporating MMPI Scales

Several other scales, developed from existing MMPI items, have been used to identify different categories of back pain patients and to predict back surgery outcome (Hanvik, 1951; Little & Fisher, 1958; Pichot et al., 1973; Sorensen & Mors, 1988). In addition, some researchers have used MMPI scales to develop multiple regression equations to predict surgery outcome (Smith & Duerksen, 1979) and others have used MMPI scales in conjunction with other variables for the same purpose (Dzioba & Doxey, 1984; Oostdam & Duivenvoorden, 1983; Sorensen et al., 1987).

Hanvik (1951) developed the Low Back (LB) Scale comprised of 26 MMPI items and reported 80% accuracy in differentiating functional from organic back pain. Later



empirical research with the LB Scale demonstrated that it is little better than chance at differentiating these two categories of back pain (Tsushima & Towne, 1979). Wilfling et al. (1973) found that the LB Scale did not differentiate between poor, fair, or good outcomes for spinal fusion patients in a retrospective study. Similarly, Pichot et al. (1973) developed a 63-item MMPI scale called the Dorsal (DOR) Scale to differentiate functional from organic back pain groups, but reported only 57% accuracy. When they combined this with the LB Scale they improved the hit rate to 80%. Later empirical research, however, demonstrated that the DOR Scale has problems similar to the LB Scale (Elkins & Barrett, 1984; Towne & Tsushima, 1978). Towne and Tsushima (1978) found that neither the LB Scale nor the DOR Scale differentiated between low back patients and psychiatric and gastrointestinal patients. They concluded that the LB and DOR Scales measure emotional characteristics that are common to patients with functional back pain, psychological problems and functional gastrointestinal conditions. Apparently, the LB and DOR Scales do not measure patient features that are unique to low back pain patients and are, therefore, not useful in identifying such persons.

Little and Fisher (1958) developed the Admission of Symptoms (Ad) Scale that is a subscale of the Hy MMPI Scale. The Ad Scale is thought to measure the degree to which the patient engages in somatization of symptoms. Sorensen (1992) found that elevations on the Ad Scale correlated with good surgery outcome for 24 of 57 patients undergoing lumbar discectomy for the first time. Patients rated their own outcome across 5 years at four different assessment periods. An overall estimate of outcome was made based on these ratings. Sorensen and Mors (1988) created the S.M. Scale that is

comprised of 30 MMPI items. They reported predicting poor outcome correctly in 89% of first lumbar discectomies. Outcome was based on patients' ratings of the "health status" of their back, level of pain, and occupational status. Of the scales reviewed, the Ad and S.M. seem to be most promising; however, research on their utility in back surgery outcome is sparse. It is also important to consider the fact that a Danish version of the MMPI was used in both studies (Sorensen & Mors, 1988; Sorensen, 1992), and the generalizability of these results to use with English-speaking patients needs to be established.

Smith and Duerksen (1979) developed a Pain Assessment Index (PAI) to predict surgery outcome for chronic pain, including back pain. The PAI is a weighted multiple linear regression equation using five MMPI scales: Hs, D, Hy, Pt, and Ma. These authors reported an 83% correct prediction rate of surgery outcome using the PAI with six different kinds of surgery for pain. Turner et al. (1986), however, suggested caution in the use of the PAI to select candidates for back surgery because they found that the PAI did not correctly classify one fifth of the patients they studied undergoing lumbar laminectomy and discectomy. Dhanens and Jarrett (1983) found the PAI to correlate with several nonsurgical outcomes in chronic pain patients including follow-through with treatment recommendations, subjective pain relief, and return to work.

Several researchers have combined MMPI scales with other variables to predict outcome. Sorensen et al. (1987) used the Ad Scale in conjunction with duration of attack and whether the patient was employed at time of surgery to come up with an 86% correct classification of surgery outcome for 57 lumbar discectomy patients; this predictive

formula was named the Psychological and Social Strain (PASS) index. Again, there is a paucity of available research to confirm these findings and, although it is not stated, it appears that a Danish version of the MMPI was used.

Dzioba and Doxey (1984) used the Hs Scale with four other variables to predict lumbar surgery for industrial accidents. They combined the Hs Scale with measures of English proficiency, a nonorganic signs test, back versus leg pain, and pain drawings to predict orthopedic outcome correctly for 81% of the patients in their study. Finally, Oostdam and Duivenvoorden (1983) combined a test of somatic complaints with the Hs and Hy MMPI Scales to predict surgical outcome for LBP in 80% of the patients studied.

The use of single, composite MMPI scales designed to measure surgery outcome and the use of MMPI scales in conjunction with other predictive variables both seem to be promising areas of investigation. Currently, there is not enough research available to determine the reliability of these measures to use them confidently for presurgery prediction.

#### Comparisons of the MMPI with Other Measures

Some researchers have compared the efficacy of the MMPI to predict surgical or treatment outcome for back pain patients with other psychological measures. Smith and Duerksen (1979) compared the utility of the MMPI to the Rorschach personality test and Street Gestalt Completion Test (SGCT) and found that neither the Rorschach nor SGCT had adequate predictive properties for patients having surgery for chronic pain. Uomoto et al. (1988) compared the MMPI to the Millon Clinical Multiaxial Inventory (MCMI;

Millon, 1983). Although both measures predicted lumbar laminectomy outcome moderately, they recommend using the MMPI over the MCMI because there was less variability in the MMPI and because only three scales on the MMPI (with age and compensation status) were needed for reasonable prediction. In a comparison of the MMPI with the Millon Behavioral Health Inventory (MBHI; Millon, Green, & Meagher, 1979) to predict lumbar laminectomy outcome, it was found that the MMPI had predictive power and the MBHI did not (Herron et al., 1992). Kinney, Gatchel, and Mayer (1991) compared the MMPI to the Symptom Checklist-90-Revised (SCL-90R; Derogatis, 1983) for screening LBP patients for a functional restoration treatment program. Kinney et al. (1991) concluded that the SCL-90R was a good instrument for assessing general psychological distress, but the MMPI was better if greater detail about the patient was needed.

Uniformly in these comparison studies the MMPI stands out as the instrument of choice, at least in relation to the instruments chosen for comparison. While a less lengthy alternative to the MMPI would be desirable, it continues to be the best objective psychological predictor of surgical outcome.

#### The MMPI-2, Low Back Pain, and Surgery Outcome

The development of the second version of the MMPI, the MMPI-2 (Butcher et al., 1989), raises an important question: Are past research findings using the MMPI applicable to the current use of the MMPI-2? A descriptive study of chronic LPB patients using the MMPI-2 (Riley et al., 1993) supported a four-cluster solution described earlier

by Costello, Hulse, Schoenfeld, and Ramamurthy (1987). Costello et al. (1987) identified four MMPI typologies of chronic pain sufferers (denoted by the acronym PAIN) by combining the findings of 10 previous studies. They identified the following four MMPI types: (a) Type P (Pathology) involving an elevation in all or nearly all of the clinical scales; (b) Type A (Upside-down V) consisting of a "conversion V" profile (elevations on scales Hs and Hy, and a lower D scale relative to Hs and Hy); (c) Type I (Infirm) involving the classic "neurotic triad" with elevations on scales Hy, D, and Hs; and (d) Type N (Normal) reflecting a "normal" profile with no scale elevated above a T-score of 70. Earlier findings by Rappaport, McAnulty, Waggoner, and Brantley (1987) are reflective of the conclusions reached by Costello et al. (1987). In a study of Australian chronic pain patients, researchers identified three MMPI profile clusters that included one cluster described as being within "normal" limits (no significant clinical elevations), another cluster that was characterized by elevations on Hs, D, and Hy, and a final cluster characterized by elevations of most clinical scales (Strassberg, Tilley, Bristone, & Oei, 1992). A similar study of chronic pain patients also found clusters like those described by Strassberg and associates (Armentrout, Moore, Parker, Hewett, & Feltz, 1982).

The fact that Riley et al. (1993) identified very similar profiles for low back pain patients suggests that past MMPI research may apply to the use of the MMPI-2 in the area of chronic pain. Recently, the same researchers conducted an investigation of back surgery outcome for low back pain patients using the MMPI-2. They identified the following four homogenous profile subgroups: a Depressed-pathological profile characterized by elevations on most clinical scales; a neurotic Triad profile characterized

by elevations on Hs, D, and Hy; a within normal limits (WNL) profile characterized by no scale elevations in the clinical range; and a V-type profile characterized by a "conversion V" profile (Riley et al., 1995). This is reflective of the four MMPI typologies identified earlier by Costello et al. (1987). Riley et al. (1995) reported that the Triad and WNL profiles were significantly related to reports of greater satisfaction with improvement following surgery than those in the other two groups. Patients with the Triad profile subjectively rated surgical outcome more favorably than did those in the V-type or Depressed-pathological groups. Interestingly, virtually all earlier studies using the MMPI associated the Triad profile with poorer outcomes. Replication of Riley and associates' (1995) finding is needed to clarify this difference.

#### Conclusions Regarding the Use of the MMPI in Back Surgery Prediction

Several conclusions might be reached by reviewing past and current research in this area. First, the MMPI (and tentatively the MMPI-2) appears to be of moderate utility when used to predict back surgery outcome. Second, in order of predictive utility the individual scales most highly correlated with back surgery outcome are scales Hs, Hy, and D. The consensus appears to be that when all three scales are clinically elevated, when Hs and Hy are clinically elevated relative to scale D, or when Hs or Hy are elevated alone, poorer outcomes are expected. However, the use of the MMPI has not become routine in general clinical practice (Schofferman et al., 1992) despite acceptance that psychosocial factors influence response to surgery (Herron et al., 1992).

Presurgical psychological evaluations would seem to be a useful source of information for surgeons making the often difficult decision about which patients might benefit from back surgery. As noted earlier, there is a broad variety of other presurgical variables that are correlated with outcome including demographic, psychosocial, biological, and compensation-related variables. Therefore, a good presurgical psychological evaluation will include information from a number of sources, only one of which is the MMPI or MMPI-2. As Herron and Pheasant (1982) have warned, the use of the MMPI alone for selection or rejection of back surgery candidates is inappropriate.

Graham (1993) has suggested that much of the past research on the MMPI will be directly applicable to interpretation of MMPI-2 results. At this time there is not enough available evidence to support this hypothesis in the area of psychological prediction of back surgery outcome. The purpose of this study is to determine the utility of the Hy, D, and Hs scales of the MMPI-2 in predicting low back surgery outcome. The results of the current study will provide information regarding the importance of the MMPI-2 in low back surgery outcome prediction. Further, the results will shed light on the applicability of past research using the MMPI to current interpretations of the MMPI-2 in back surgery outcome prediction.

### Research Questions and Hypotheses

#### Question #1

What combination of Scales 1, 2, and 3 of the MMPI-2 best predict low back surgery outcome in this sample of patients? It is hypothesized that elevations on all three

scales will be positively correlated with poorer surgical outcomes. Additionally, it is hypothesized that elevations on Scales 1 and 3, relative to scale 2 (conversion V profile), will also be positively correlated with poorer outcomes.

#### Question #1a

When added to the predictive equation do additional clinical scales improve the predictive strength of the equation? It is hypothesized that additional clinical scales will not significantly improve the prediction of surgery outcome over that found for Scales 1, 2, and 3.

#### Question #2

Will the addition of Scales 1, 2, and 3 improve prediction of outcome beyond that found using basic demographic and medical status variables alone (age, gender, education level, marital status, number of previous surgeries, and months in pain prior to surgery)? It is hypothesized that the addition of Scales 1, 2, and 3 to a regression equation composed of demographic and medical status variables will statistically significantly improve prediction of outcome at each of the follow-up periods.

#### Question #2a

What combination of self-reported demographic and medical status variables and Scales 1, 2, and 3 best predicts surgery outcome? No specific hypothesis is made regarding this question.



### Question #3

Are the results of this study using the MMPI-2 to predict low back surgery outcome consistent with previous research using the MMPI? It is hypothesized that the results of this study will be consistent with previous research using the MMPI.

### Question #4

Are these results clinically significant? In other words, is the predictive ability of the MMPI-2 of sufficient magnitude to influence clinical practice? It is hypothesized that the results of this study will be of clinical significance in informing clinical practice.

## Analyses

### Question #1

Stepwise multiple regression was used to determine what combination of Scales 1, 2, and 3 of the MMPI-2 best predicts low back surgery outcome in this sample for Back Pain Questionnaire total score and Disability Questionnaire total score. The three predictor variables were entered simultaneously. Separate stepwise multiple regression analyses were conducted for each of the three postsurgery outcome collection periods; 3 months, 9 months, and 12 months.

Discriminant analysis was used to determine what combination of Scales 1, 2, and 3 of the MMPI-2 best predicts low back surgery outcome in this sample for the Stauffer and Coventry Index outcome rating. The three predictor variables were entered simultaneously. Separate discriminant analyses were conducted for each of the three postsurgery outcome collection periods. Predicted outcome was compared with actual

outcome to determine the proportion of correct classifications based on the discriminant function(s) derived in this analysis.

#### Question #1a

The degree to which the remaining seven clinical scales of the MMPI-2 contribute relevant and unique variance to the dependent variable was determined. After the first three predictor variables had been entered into the equation (Scales 1, 2, and 3) these remaining 7 variables were added to the discriminant analysis and each of the stepwise multiple regression analyses.

#### Question #2

Stepwise multiple regression was used to determine if Scales 1, 2, and 3 improve prediction of low back surgery outcome beyond that found using demographic and medical status variables alone, and what combination of demographic and medical status variables and Scales 1, 2, and 3 of the MMPI-2 best predict outcome in this sample. The outcome variables used in these analyses are the Back Pain Questionnaire total score and Disability Questionnaire total score. The predictor variables were entered in three separate blocks in the following order: Block (1)--age, gender, marital status, and education; Block (2)--previous number of surgeries and number of months in pain prior to surgery; and Block (3)--Scales 1, 2, and 3. In each block the variables were entered simultaneously.

The variables were entered in blocks so that the amount of variance that each block of variables added to the prediction equation could be determined. The choice to

enter MMPI-2 variables after demographic and medical status variables was made to determine to what degree, if any, MMPI-2 variables improved prediction beyond that made using simple demographic and medical variables. Given the simplicity of gathering these variables, there is no reason to administer the lengthy and potentially costly MMPI-2 if the MMPI-2 does not significantly improve the predictive equation. On the other hand, if the MMPI-2 does significantly improve prediction made when using demographic and simple medical variables, then it demonstrates evidence in favor of the continued use of the MMPI-2 in back surgery outcome prediction. Separate stepwise multiple regression analyses were conducted for each of the three postsurgery outcome collection periods: 3 months, 9 months, and 12 months.

Discriminant analyses were used to examine these questions for the Stauffer Coventry Index outcome variable. Again, the predictor variables were entered in three separate blocks in the following order: Block (1)--age, gender, marital status, and education; Block (2)--previous number of surgeries and number of months in pain prior to surgery; and Block (3)--Scales 1, 2, and 3. In each block the variables were entered simultaneously. Separate discriminant analyses were conducted for each of the three postsurgery outcome collection periods. Predicted outcome was compared with actual outcome to determine the proportion of correct classifications based on the discriminant function(s) derived in this analysis.

### Question #3

The results of the analyses for research Questions 1 and 1a were subjected to

qualitative examination to determine if the results are representative of previous finding in this area using the MMPI.

#### Question #4

To determine the clinical significance of multiple regression results the amount of variance in the dependent variable(s) accounted for by the independent variable(s) was evaluated using Cohen's classification system (Cohen, 1992). To determine the clinical significance of the discriminant analyses conducted for the Stauffer and Coventry Index, the percentage of cases correctly classified was used.

## CHAPTER III

### METHOD

#### Participants

Sixty LBP patients awaiting surgery at either a major university hospital or a community hospital in the western U.S. were recruited to participate in the study. The decision to provide surgery was unrelated to participation in this study and was made according to general surgical practice. All participants completed institutional review board-approved informed consent forms prior to participation and were paid \$100 upon completion of the presurgical questionnaires. The individuals in the study ranged in age from 19 to 81 years ( $M = 45.98$ ;  $SD = 13.53$ ) and 53% were female. Ninety percent were Caucasian, 3% were American Indian, 3% were Hispanic, and 3% did not report ethnicity. Sixty-two percent of participants were married, 20% divorced, 12% single, 3% married but separated, and 3% did not report marital status or were widowed. Participants' highest level of completed formal education ranged from "some high school" to a "master's degree," with 71% having between a high school degree and a 2-year college degree. Of the 60 original participants, 5 did not undergo surgery.

#### Three-Month Follow-Up

Fifty-five of the participants (100% of those receiving surgery) were contacted for outcome assessment at 3-months postsurgery. The individuals ranged in age from 19 to 78 years ( $M = 45.25$ ;  $SD = 13.22$ ) and 51% were female. Eighty-nine percent were Caucasian, 3.5% were American Indian, 3.5% were Hispanic, and 3.5% did not report

ethnicity. Sixty-four percent of participants were married, 20% divorced, 11% single, 2% married but separated, and 4% did not report marital status or were widowed.

Participants' highest level of completed formal education ranged from "some high school" to a "master's degree," with 69% having between a high school degree and a 2-year college degree.

#### Nine-Month Follow-Up

Forty-eight of the participants (87% of those receiving surgery) could be contacted for outcome assessment at 9-months postsurgery. The individuals ranged in age from 19 to 78 years ( $M = 45.27$ ;  $SD = 12.72$ ), and 50% were female. Ninety-two percent were Caucasian, 4% were Hispanic, and 4% did not report ethnicity. Sixty-nine percent of participants were married, 19% divorced, 8% single, and 4% did not report marital status or were widowed. Participants' highest level of completed formal education ranged from "some high school" to a "master's degree," with 69% having between a high school degree and a 2-year college degree.

#### One-Year Follow-Up

Forty-two of the participants (76% of those receiving surgery) could be contacted for outcome assessment at one-year postsurgery. The individuals ranged in age from 19 to 78 years ( $M = 46.02$ ;  $SD = 12.95$ ), and 55% were female. Ninety-one percent were Caucasian, 5% were Hispanic, and 5% did not report ethnicity. Sixty-seven percent of participants were married, 19% divorced, 7% single, 2% married but separated, and 5% did not report marital status or were widowed. Participants' highest level of completed

formal education ranged from "some high school" to a "master's degree," with 69% having between a high school degree and a 2-year college degree.

### Drop-Outs

Overall, there were 19 participants who were not available for follow-up for at least one of the three follow-up intervals. Of these, 5 were not contacted because they did not have surgery. These 19 participants ranged in age from 28 to 81 years ( $M = 45.42$ ;  $SD = 14.89$ ), and 53% were female. Ninety percent were Caucasian and 3% were Asian American. Forty-seven percent of participants were married, 21% divorced, 21% single, and 11% married but separated. Participants' highest level of completed formal education ranged from "high school graduate" to a "master's degree," with 68% having between a high school degree and a 2-year college degree. There was no significant difference between dropouts and other participants on demographic variables.

The reasons for attrition across outcome collection points included not undergoing surgery ( $N = 5$ ), disconnected telephone number with no forwarding number ( $N = 4$ ), lack of response to telephone or mail contact ( $N = 8$ ), extended vacation ( $N = 1$ ), and undergoing another back surgery ( $N = 2$ ). Of the two individuals undergoing another back surgery prior to completion of the study one was eligible for follow-up at both 3- and 9-months postsurgery and the other was eligible for follow-up at only the 3-month postsurgery date.

### Procedures

Participants were invited to participate by their physicians in the study prior to

surgery. Upon agreement to participate those in the university hospital setting were contacted by the researcher (DS) and a time was arranged to administer the MMPI-2, background questionnaire, and two additional questionnaires. For participants in the community hospital setting, arrangements for the presurgical administration of these items was coordinated by each surgeon's executive secretary. All participants reviewed and signed an informed consent statement at the time of the initial testing. This was followed by the administration of the presurgical questionnaires and the MMPI-2. Administration of these instruments occurred in private rooms, without distractions, at each respective hospital. Participants accompanied by relatives or friends were instructed to complete all items without assistance. They were also informed that they would be contacted by phone at 3, 9, and 12 months following surgery for administration of outcome measures.

Outcome measures include the Stauffer and Coventry Index (Stauffer & Coventry, 1972), the Back Pain Questionnaire (Million, Hall, Haavik Nilsen, Baker, & Jayson, 1982) and the Disability Questionnaire (Roland & Morris, 1983). A reminder sheet with researcher telephone numbers and names was provided to all participants so that changes in addresses or telephone numbers could be readily communicated to the researchers. All information was maintained in confidence and stored according to numerical codes, not patient names.

Upon completion of the presurgical testing, each patient was paid \$100 for their participation in the study. The amount and decision to pay participants was based on the results of a pilot study conducted by the principal investigator of the grant supporting this research (Masters, 1996). Masters found that without payment the volunteer rate was quite low and that paying them \$50 resulted in only a slight improvement and therefore



created the possibility of a relatively select sample. It was hoped that paying \$100 would result in a more representative and consecutive sample of patients. Because patients were asked to complete questionnaires and an inventory (requiring about 2 hours) during a time when they were likely to be in great pain, it was prudent to provide monetary compensation. In addition, they were called upon to respond to a brief survey (that included each of the outcome measures) three times in the year following surgery (Appendix A). Frequent and long-term outcome measurements are necessary following low back surgery because recovery may occur over an extended period of time (Nachmenson & LaRocca, 1987). Therefore, participation in this study was an inconvenience and participants deserved reasonable compensation.

### Measures

The independent variables are the Hy, D, and Hs Scales of the MMPI-2 (Butcher et al., 1989). Outcome measures include the Stauffer and Coventry Index total score, the Back Pain Questionnaire total score (Million et al., 1982), and the Disability Questionnaire total score (Roland & Morris, 1983). All measures in this study are self-report. These measures do not allow for assessment of "objective" physical states as could be done with MRI or X-ray; however, the focus of the present study is on those dimensions of outcome that may be most important to the patient; that is, level of pain, return to work status, and functional disability. The views of other researchers are consistent with this approach to outcome assessment (Kaplan, 1990; Million et al., 1982; Riley et al., 1995). Kaplan (1990) has stated that the most important medical outcomes are behavioral, that is, life

expectancy and quality of life. Quality of life is certainly influenced by pain and disability. Patients are likely to be more concerned about behavioral outcomes than physiological outcomes. In fact, most patients subjectively assess their outcome in terms of behavioral function, such as their ability to engage in activities they enjoy, sleep well, and be meaningfully employed. Physiological outcomes such as imaging studies (e.g., MRI, CAT scan) may demonstrate that a given surgery is a "success" objectively; however, if the patient continues to be significantly limited in activities of daily living, the patient is unlikely to agree that the outcome is a "success."

#### Demographic and Background Questionnaire

Participants were asked to provide their age, gender, marital status, occupation, ethnic status, level of education, length of time experiencing back pain, number of previous back surgeries, smoking habits, current level of stress, and perceived level of emotional support from others (Appendix B).

Some of the information gathered in the demographic questionnaire was collected for other research supported by the same grant and was not used in the current study (occupation, current stress, and social support). The smoking habits' information was not used in the final analyses because the question was phrased poorly. Patients are directed by their physicians to not smoke tobacco prior to the surgery, therefore, when asked "Do you smoke?" all respondents said "no." The question "Do you smoke?" was asked before questions gathering information about previous smoking habits. Apparently, after responding "no" to the smoking question most patients skipped the questions regarding

previous smoking habits. As a result, information obtained from patients on smoking habits were often inaccurate and/or incomplete.

### MMPI-2

The MMPI-2 (Butcher et al., 1989) is a revision of the MMPI (Hathaway & McKinley, 1943) used for the purpose of assessing personality and psychopathology. The MMPI-2 consists of 567 true-false items. As described earlier for the MMPI, the MMPI-2 yields the same four validity scales and ten clinical scales with essentially the same purpose. Three new validity scales (Fb, VRIN, TRIN) were developed for the MMPI-2. Subscales and supplementary scales may also be derived. For the purpose of this study only data on the four original validity and 10 clinical scales was collected. These are the same scales used routinely in past research as discussed earlier. As presented earlier, the norms for the MMPI-2 are based on a relatively diverse sample of U.S. citizens, and data have been reported to substantiate the test's reliability and validity (Butcher et al., 1989; Graham, 1993).

### Back Pain Questionnaire

The Back Pain Questionnaire was developed to measure effectiveness of intervention with back pain patients (Million et al., 1982). The Back Pain Questionnaire consists of 15 questions that require patients to rate their current level of pain, circumstances that influence symptoms of pain, and the effect of these problems on life style. A visual analogue anchored by extreme answers to each question (e.g., no pain--intolerable pain, complete relief--no relief, no stiffness-- intolerable stiffness) was used in

the original instrument; however, for purposes of this study this method was adapted to a 7-point Likert scale to accommodate phone interviews (Appendix C). The anchor points remained the same as those used in the original analogue scale. The ratings on all items are combined to produce a global subjective index of back pain. A test/retest reliability of .96 is reported by the authors in an article that won the 1981 Volvo Award in Clinical Science, a prestigious award made annually in the area of spinal treatment.

#### Stauffer and Coventry Index

The Stauffer and Coventry Index is the most frequently used low back surgical outcome measure and was developed originally to assess outcomes for anterior interbody lumbar spinal fusion surgeries (Appendix D). The Stauffer and Coventry Index has been used in studies similar to the one completed here (Riley et al., 1995; Turner et al., 1986). Three categories of outcome were measured: pain relief in back and lower extremities, employment status, and restrictions of physical activities. Each of these three categories can result in either a good, fair, or poor status. Pain relief is rated as percentage of pain relief. Employment is rated according to whether the patient has returned to previous work status, less strenuous work, or not returned to work at all. Physical activities are rated based on whether there are minimal, moderate, or severe restrictions of physical activities. The overall outcome rating is determined by the most impaired rating in any category (see Table 1).

#### Disability Questionnaire

The Disability Questionnaire was developed to measure self-report of disability

Table 1

Determining Overall Outcome Rating Using the Stauffer and Coventry Index

Outcome	Percent pain relief postsurgery	Employment postsurgery	Physical activities postsurgery
Good	76-100% pain relief in back and lower extremity	Able to return to accustomed employment	Minimal or no restrictions of physical activities
Fair	26-75% pain relief in back and lower extremity	Able to return to accustomed employment with limitation or returned to lighter work	Moderate restrictions of physical activities
Poor	0-25% pain relief in back and lower extremity	Not able to return to work	Severe restrictions of physical activities

due to back pain (Roland & Morris, 1983). The Disability Questionnaire consists of 25 true-false statements about the patient's current disability status covering a variety of daily living activities such as walking, kneeling/bending, turning over in bed, getting out of a chair, and getting dressed (Appendix E). A total disability score is derived by totaling the number of responses scored in the true directions. All questions are keyed in the direction of disability when the response is "true." The authors report a test-retest reliability coefficient 0.91 for the Disability Questionnaire and provide initial evidence of validity for purpose of determining disability due to back pain. The article in which this instrument appeared won the 1982 Volvo Award in Clinical Science.

## CHAPTER IV

## RESULTS

## Differences Between Study Dropouts and Nondropouts

Independent groups  $t$  tests were performed comparing the mean clinical scale score on scales Hs, D, and Hy for dropouts (participants who were not available for at least one of the three follow-up periods) with that for nondropouts. Results indicate that on the Hs Scale the mean score for dropouts (67.00) was not statistically significantly different from that found for completers (64.95),  $t(58) = .621$ ,  $p < .537$ . Similarly, there was no statistically significant difference on scale Hy for mean dropout score (67.00) compared to the mean nondropout score (63.73),  $t(58) = .890$ ,  $p < .377$ . However, there was a statistically significant difference on Scale D between mean dropout score (63.53) and mean nondropout score (56.66),  $t(58) = 2.43$ ,  $p < .018$ , indicating that those participants who were not available for one or more follow-up periods were more likely to score higher on the D scale. An independent groups  $t$  test was performed comparing the mean age for completers (46.24) and dropouts (45.42). This was found to be statistically nonsignificant,  $t(58) = -2.17$ ,  $p < .829$ . Chi-square tests were applied to the relationship between completer/ dropout status and the four remaining demographic variables under consideration. The results were found to be statistically nonsignificant for all four variables: gender  $\chi^2(1, N = 60) = .006$ ,  $p < .941$ ; marital status  $\chi^2(1, N = 58) = 3.30$ ,  $p < .069$ ; ethnicity  $\chi^2(2, N = 58) = 5.12$ ,  $p < .077$ ; and education  $\chi^2(6, N = 58) = 2.69$ ,

$p < .847$ . Therefore, it is concluded that there were no statistically significant differences between the groups on age, gender, ethnicity, education, and marital status.

## Outcome Measures

### Disability Questionnaire

Descriptive statistics for the Disability Questionnaire were computed for each of the three outcome periods: at 3-months surgery  $N = 55$  ( $M = 9.78$ ,  $SD = 6.45$ ), at 9-months postsurgery  $N = 48$  ( $M = 8.15$ ,  $SD = 7.39$ ), and at 1-year postsurgery  $N = 42$  ( $M = 7.90$ ,  $SD = 7.34$ ; see Table 2).

### Back Pain Questionnaire

Descriptive statistics for the Back Pain Questionnaire were computed for each of the three outcome periods: at 3-months postsurgery  $N = 55$  ( $M = 0.79$ ,  $SD = 0.11$ ), at 9-months postsurgery  $N = 48$  ( $M = 0.03$ ,  $SD = 0.12$ ), and at 1-year postsurgery  $N = 42$  ( $M = 0.28$ ,  $SD = 0.12$ ; see Table 2).

### Stauffer and Coventry Index

Descriptive statistics for the Stauffer and Coventry Index were computed for each of the three outcome periods. Recall that the Stauffer and Coventry Index is categorical in nature and is represented by the lowest of three measures (pain, return to work, physical activity); therefore, the modal category is the most meaningful measure of central tendency. At 3-months postsurgery with  $N = 55$  the modal outcome was fair (12.7% good, 45.5% fair, and 41.8% poor). At 9-months postsurgery with  $N = 48$  the modal

Table 2

Descriptive Statistics for Outcome Measures: Disability Questionnaire and Back PainQuestionnaire

Outcome measure	<u>N</u>	Mean	<u>SD</u>
Disability Questionnaire			
3-month	55	9.78	6.4
9-month	48	8.15	7.39
1-year	42	7.90	7.34
Back Pain Questionnaire			
3-month	55	0.79	0.11
9-month	48	0.03	0.12
1-year	42	0.28	0.12

outcome was fair (20.8% good, 47.9% fair, and 31.3% poor). At 1-year postsurgery with N = 42 the modal outcome was again fair (28.6% good, 52.4% fair, and 19.0% poor; see Table 3).

## Correlational Results

The correlation matrix of variables used in the analyses is presented in Table 4. An inspection of this matrix revealed substantial colinearity between each of the three MMPI-2 predictor variables: Hs, D, and Hy. The correlations between these three variables were all statistically significant; Hs and Hy ( $r^2 = .729$ ,  $p < 0.01$ ), Hs and D ( $r^2 = .378$ ,  $p < 0.01$ ), and Hy and D ( $r^2 = .218$ ,  $p < 0.01$ ). The relationship between these variables was not surprising given that there was significant item overlap in the composition of each of these three scales (see Table 5). Both Hs and Hy targeted somatic problems and shared the





Table 5

Item Overlap for Scales Hs, D, and Hy

Scales	Number of items shared by scales		
	Hs	D	Hy
Hs (32 items)	--	8	19
D (57 items)	8	--	13
Hy (60 items)	19	13	--

greatest number of items, which was reflected in the correlation found in Table 4. Scale D, which was primarily concerned with assessing symptoms of depression, also showed a small to moderate relationship with both scales Hs and Hy. Some relationship between depressive symptoms and somatic complaints was to be expected given that people experiencing/reporting greater somatic problems might be more likely to also be experiencing negative affect. While the colinearity between these variables was not unexpected, it did create difficulty when interpreting the present analyses. The overlap in variance between the three independent variables decreased the amount of unique variance that each predicted in the outcome variables(s) and thus limited their additive predictive ability.

It is also important to note that the associations between the three outcome variables (Disability Questionnaire, Back Pain Questionnaire, and the Stauffer and Coventry Index) ranged from medium to large (see Table 4). This suggested that the outcome instruments were measuring a similar construct in back surgery outcome. The range of correlations found among these outcome variables suggested that while they

measured a related construct they also assessed slightly different aspects of surgery outcome. This provided evidence in favor of using multiple outcome measures when assessing back surgery results.

### Results of Regression and Discriminant Analyses

#### Hypothesis #1

The first hypothesis of this study was that elevations on scales Hs, D, and Hy of the MMPI-2 would be predictive of poorer surgery outcome. It was also speculated that this relationship would be stronger for scales Hs and Hy relative to scale D. Finally, it was thought that the addition of the remaining seven clinical scales of the MMPI-2 to the regression analyses would not statistically significantly improve the predictive equation. Recall that each of the three outcome variables was assessed at three discrete postsurgery times: 3 months, 9 months, and 12 months. Each outcome measure will be considered individually because different outcome measures assess different aspects of surgery outcome.

Disability Questionnaire. Three separate stepwise multiple regression analyses were conducted to examine the predictive utility of scales Hs, D, and Hy in assessing back surgery outcome as measured by the Disability Questionnaire at 3-, 9- and 12-months postsurgery (see Table 6). At 3 months the regression was statistically significant,  $F(1, 53) = 10.06, p < .003$ . Results indicated that only the Hs Scale was predictive of outcome at 3-months postsurgery (Adjusted  $R^2 = .144, p < .003$ ). At 9-months postsurgery the regression was statistically significant,  $F(1, 46) = 8.59, p < .005$ , with the Hs Scale alone

Table 6

Analysis of Variance for Regression Models Using Scales Hs, D, and Hy as Predictor Variables and the Disability Questionnaire as an Outcome Measure

Model	Source	SS	df	MS	F
3-month outcome Hs scale	Regression	368.19	1	368.19	10.06**
	Residual	1939.19	53	36.59	
	Total	2307.38	54		
9-month outcome Hs scale	Regression	404.37	1	404.37	8.59**
	Residual	2165.61	46	47.08	
	Total	2569.98	47		
12-month outcome Hy scale	Regression	428.74	1	428.74	9.64**
	Residual	1778.88	40	44.47	
	Total	2207.62	41		

\*\*  $p < .01$ .

predicting outcome (Adjusted  $R^2 = .139$ ,  $p < .005$ ). In both cases higher scores on the Hs Scale were related to reports of greater disability. At 12-months postsurgery the regression was statistically significant,  $F(1, 40) = 9.64$ ,  $p < .003$ , with higher scores on the Hy scale being predictive of outcome (Adjusted  $R^2 = .174$ ,  $p < .003$ ), such that higher scores on the Hy Scale were related to more disability (see Table 7). The remaining seven MMPI-2 clinical scales were entered in a stepwise fashion into each of the regression analyses after Hs, D, and Hy had been entered. As hypothesized, the addition of the seven remaining MMPI-2 clinical scales did not statistically significantly improve prediction of outcome at 3, 9, or 12 months.

Back Pain Questionnaire. Three separate stepwise multiple regression analyses were conducted to examine the predictive utility of scales Hs, D, and Hy in assessing back

Table 7

Multiple Regression Results for Predicting Outcome Scores Using Scales Hs, D, and Hy

Outcome variable	Pred variables	N	<u>R</u>	<u>R</u> <sup>2</sup>	Adj <u>R</u> <sup>2</sup>	<u>R</u> <sup>2</sup> change	Sig.
DQ1	Hs	55	.399	.160	.144	.160	.003
DQ2	Hs	48	.397	.157	.139	.157	.005
DDQ3	Hy	42	.441	.194	.174	.194	.003
BPQ1	D	55	.304	.092	.075	.092	.024
BPQ2	Hs	48	.347	.120	.101	.120	.016
BPQ3	Hs	42	.334	.112	.090	.112	.030

surgery outcome as measured by the Back Pain Questionnaire at 3-, 9-, and 12-months postsurgery (see Table 8). At 3-months postsurgery the regression was statistically significant,  $F(1, 53) = 5.39$ ,  $p < .024$ . Results indicated that only the D Scale was predictive of outcome at 3 months (Adjusted  $R^2 = .075$ ,  $p < .024$ ) such that higher scores on the D Scale were related to more self-reported back pain. At 9-months postsurgery the regression was statistically significant,  $F(1, 46) = 6.28$ ,  $p < .016$ . Higher scores on the Hs Scale were predictive of poorer outcome at 9-months postsurgery (Adjusted  $R^2 = .101$ ,  $p < .016$ ). At 12-months postsurgery the regression was statistically significant,  $F(1, 40) = 5.04$ ,  $p < .030$ . Higher scores on the Hs Scale again predicted more back pain (Adjusted  $R^2 = .090$ ,  $p < .030$ ). The remaining seven MMPI-2 clinical scales were entered in a stepwise fashion into each of the regression analyses after Hs, D, and Hy had been entered. Again, the addition of the seven remaining MMPI-2 clinical scales did not

Table 8

Analysis of Variance for Regression Models Using Scales Hs, D, and Hy as Predictor Variables and the Back Pain Questionnaire as an Outcome Measure

Model	Source	SS	df	MS	F
3-month outcome D scale	Regression	589.95	1	589.95	5.39*
	Residual	5796.93	53	109.38	
	Total	6386.88	54		
9-month outcome Hs scale	Regression	826.23	1	826.23	6.28*
	Residual	6048.23	46	131.483	
	Total	6874.46	47		
12-month outcome Hs scale	Regression	616.99	1	616.99	5.04
	Residual	4900.90	40	122.52	
	Total	5517.89	41		

\*  $p < .05$ .

statistically significantly improve prediction of outcome at 3, 9, or 12 months.

Stauffer and Coventry Index. Three separate discriminant analyses were conducted to examine the predictive utility of scales Hs, D, and Hy in assessing back surgery outcome as measured by the Stauffer and Coventry Index at 3-, 9-, and 12-months postsurgery. None of the functions emerged as statistically significant predictors of outcome at any of the three assessment points. At 3 months only 40% of the grouped cases were correctly classified as good, fair, or poor outcomes. At 9 months 35% were correctly classified, and at 12 months 50% of cases were correctly classified. An additional analysis of the remaining seven clinical variables was, therefore, not conducted.

Hypothesis #2

It was hypothesized that the addition of scales Hs, D, and Hy to a regression

equation composed of demographic and medical status variables would statistically significantly improve prediction of outcome at each of the follow-up periods.

Disability Questionnaire. Three separate stepwise multiple regression analyses were conducted to examine the predictive utility of adding scales Hs, D, and Hy to a regression equation composed of demographic and medical status variables in assessing back surgery outcome as measured by the Disability Questionnaire at 3-, 9- and 12-months postsurgery (see Table 9). Each regression equation was conducted by forcing the stepwise entry of three blocks of variables in the following order: Block (1)--age, gender, education level, and marital status; Block (2)--number of previous surgeries and number of months of pain prior to surgery; and Block (3)--scales Hs, D, and Hy. Entering the variables in these blocks allowed for an assessment of the amount of predictive variance added by predictors in each successive block. The order of entry for the blocks was selected to place demographic variables first, surgery related variables second, and MMPI-2 variables last.

At 3-months postsurgery the overall regression model was statistically significant,  $F(2, 50) = 15.07, p < .000$ . The number of previous surgeries and the Hs Scale emerged as significant predictors of outcome (Adjusted  $R^2 = .351, p < .000$ ). An examination of the  $R^2$  change shows that after number of previous surgeries is entered into the model the Hs Scale contributed less than half of total variance accounted for by the predictive equation ( $R^2$  change = .128; see Table 10). Therefore, at the 3-month follow-up higher numbers of previous back surgeries and higher scores on the Hs scale predicted poorer outcome on the Disability Questionnaire. At 9-months postsurgery the overall regression

Table 9

Analysis of Variance for Regression Models Using Demographic Information and ScalesHs, D, and Hy as Predictor Variables and the Disability Questionnaire as an OutcomeMeasure

Model	Source	SS	df	MS	F
3-month outcome Prev, Hs	Regression	817.42	2	408.71	15.07**
	Residual	1355.79	50	27.12	
	Total	2173.21	52		
9-month outcome Mos, Prev, Hs	Regression	780.43	3	260.14	6.78**
	Residual	1610.55	42	38.35	
	Total	2390.98	45		
12-month outcome Gen, Prev, Hy	Regression	886.24	3	295.41	8.41**
	Residual	1264.54	36	35.13	
	Total	2150.78	39		

\*\*  $p < .01$ .

model was statistically significant,  $F(3, 42) = 6.78$ ,  $p < .001$ , with the number of months of pain prior to surgery, number of previous surgeries, and the Hs Scale predicting outcome (Adjusted  $R^2 = .278$ ,  $p < .001$ ) such that more months of pain, more surgeries, and higher Hs scores were related to more disability as reported on the Disability Questionnaire. An examination of the  $R^2$  change demonstrates that after months of pain was entered into the model, the number of previous surgeries contributed significantly to the prediction equation ( $R^2$  change = .100). After the first two variables had been accounted for, number of previous surgeries and months in pain, the Hs Scale provided a strong contribution to the prediction of outcome ( $R^2$  change = .129). At 12-months postsurgery the overall regression model was statistically significant,  $F(3, 36) = 8.41$ ,  $p < .000$ , with patient



Table 10

Multiple Regression Results for Predicting Outcome Scores Using Psychosocial Variables and Scales Hs, D, and Hy

Outcome variable	Pred variables	N	R	R <sup>2</sup>	Adj R <sup>2</sup>	R <sup>2</sup> change	Sig.
DQ1	# Prev surg	52	.498	.248	.233	.248	.000
	# Prev surg, Hs	52	.613	.376	.351	.128	.000
DQ2	Mos in pain	46	.312	.097	.077	.097	.035
	Mos in pain, # pev surg	46	.445	.198	.160	.100	.009
	Mos in pain, # prev surg, Hs	46	.517	.326	.278	.129	.001
DDQ3	Gender	40	.351	.123	.100	.123	.027
	Gender, # prev surg	40	.536	.288	.249	.165	.002
	Gender, # prev surg, Hy	40	.642	.412	.363	.124	.000
BPQ1	Marital stat	53	.395	.156	.140	.156	.003
	Marital stat, # prev surg	53	.635	.403	.379	.247	.000
	Marital stat, # prev surg, D	53	.674	.455	.421	.052	.000
BPQ2	# Prev sur	46	.313	.098	.077	.098	.034
	# Prev surg, mos in pain	46	.429	.184	.146	.086	.013
	# Prev surg, mos in pain, Hs	46	.531	.282	.230	.098	.003
BPQ3	Gender	40	.359	.129	.106	.129	.023
	Gender, age	40	.478	.229	.187	.100	.008

gender, number of previous surgeries, and the Hy Scale emerging as predictors of outcome ( $R^2 = .363$ ,  $p < .000$ ). After gender was entered into the model, number of previous surgeries contributed significant variance to the outcome variable ( $R^2$  change = .165). Finally, when entered after gender and number of previous surgeries, the Hy scale contributed significantly to the overall variance in the outcome variable ( $R^2$  change = .124). At 12-months postsurgery being female, more previous surgeries, and a higher score on the Hy Scale predicted more disability.

Back Pain Questionnaire. Again, three separate stepwise multiple regression analyses were conducted to examine the predictive utility of adding scales Hs, D, and Hy

to a regression equation composed of demographic and medical status variables in assessing back surgery outcome as measured by the Back Pain Questionnaire at 3-, 9-, and 12-months postsurgery (see Table 11). The same forced entry model in the above analyses using three separate blocks was utilized. The same variables were entered in the same order as in the above analyses.

At 3-months postsurgery the overall regression model was statistically significant,  $F(3, 49) = 13.62, p < .000$ , with marital status, number of previous surgeries, and the D Scale emerging as predictors of outcome (Adjusted  $R^2 = .421, p < .000$ ) such that not being married, having more previous surgeries, and a higher score on the D Scale were related to more back pain. In this case after marital status had been entered into the model, number of previous surgeries accounted for a significant amount of variance ( $R^2$  change = .247). After both marital status and number of previous surgeries had been accounted for in the equation, the D Scale accounted for a modest amount of variance in the outcome measure ( $R^2$  change = .052). At 9-months postsurgery the overall regression model was statistically significant,  $F(3, 42) = 5.49, p < .003$ , with number of previous surgeries, months of pain prior to surgery, and the Hs Scale predicting outcome (Adjusted  $R^2 = .230, p < .003$ ). In this case more surgeries, more months of pain, and a higher score on the Hs Scale predicted more back pain. When months in pain was added to the regression following number of previous surgeries, it accounted for a modest amount of variance (Adjusted  $R^2 = .086, p < .039$ ). When the Hs Scale was added to the regression equation following number of previous surgeries and months in pain, it also contributed a modest amount of variance to the overall equation (Adjusted  $R^2 = .098, p < .021$ ). At

Table 11

Analysis of Variance for Regression Models Using Demographic Information and ScalesHs, D, and Hy as Predictor Variables and the Back Pain Questionnaire as an OutcomeMeasure

Model	Source	SS	df	MS	F
3-month outcome Marital, prev, D	Regression	2600.61	3	866.87	13.62**
	Residual	3118.87	49	63.65	
	Total	5719.48	52		
9-month outcome Prev, mos, Hs	Regression	1727.921	3	575.97	5.49**
	Residual	4403.99	42	104.86	
	Total	6131.91	45		
12-month outcome Gen, age	Regression	1198.78	2	599.39	5.49**
	Residual	4040.54	37	109.20	
	Total	5239.32	39		

\*\*  $p < .01$ .

12-months postsurgery the overall regression model was statistically significant,  $F(2, 37) = 5.48$ ,  $p < .008$ , with patient gender and age predicting outcome (Adjusted  $R^2 = .187$ ,  $p < .008$ ) such that being female and increasing age were predictive of more back pain. After gender was accounted for in the regression equation, age contributed significantly to the overall model ( $R^2$  change = .100).

Stauffer and Coventry Index. Three separate discriminant analyses were conducted to examine the predictive utility of adding scales Hs, D, and Hy to demographic and medical status variables in assessing back surgery outcome as measured by the Stauffer and Coventry Index at 3-, 9-, and 12-months postsurgery. The demographic and medical status variables included age, gender, education level, marital status, number of months of pain prior to surgery, and number of previous surgeries. The results indicated

that none of the functions statistically significantly classified outcome at any of the three follow-up periods. At 3 months 60% of the grouped cases were correctly classified as good, fair, or poor outcomes. At 9 months 54% were correctly classified, and at 12 months 65% of cases were correctly classified.

### Hypothesis #3

It was hypothesized that the results of this study would be consistent with previous research using the MMPI. In the literature review section of the present study it was concluded that previous research indicated that elevation on scales Hs, D, and Hy were most consistently found to be related to poorer surgical outcomes for chronic low back pain. In the present study only these three (Hs, D, and Hy) out of the 10 clinical scales on the MMPI-2 were found to be correlated with outcome as measured by the Disability Questionnaire and the Back Pain Questionnaire. No clinical scales on the MMPI-2 predicted outcome as measured by the Stauffer and Coventry Index. Also, similar to previous findings is that the Hs Scale was the scale most often related to outcome, followed by the Hy and D Scales.

### Hypothesis #4

It was hypothesized that the results of this study would be of clinical significance in informing surgical practice. To determine clinical significance the amount of variance in the dependent variable(s) accounted for by the independent variable(s) was evaluated using Cohen's effect size classification system for each of the multiple regression results (Cohen, 1992). An effect size (ES) is a statistic that represents the *magnitude* of a result

unrelated to sample size or the scale of measurement used. Therefore, utilizing effect size indexes in addition to traditional significance testing is useful when attempting to determine the degree of "real life" or clinical importance of a result.

To calculate an effect size for multiple regression results, the following formula is used:  $f^2 = \frac{R^2}{1 - R^2}$ . The effect size indexes for a small, medium, or large  $f^2$  are, respectively, .02, .15, and .35 (Cohen, 1992). The results for each outcome variable were considered in light of their clinical significance as determined by effect size index scores.

Discriminant analysis classifies participants into groups based on several measures; in this case MMPI-2 scales and demographic variables. To determine the clinical significance of the discriminant analyses conducted for the Stauffer and Coventry Index, the percentage of cases correctly classified was used.

Disability Questionnaire. The results for predicting outcome using scales Hs, D, and Hy were identical to the results obtained using all 10 clinical scales; therefore, both results will be considered together (see Table 12). At 3- and 9-months postsurgery the Hs Scale predicted outcome in the regression analyses. The ES for outcome at 3 months was in the medium range ( $f^2 = .190$ ), and at 9 months was also in the medium range ( $f^2 = .185$ ). At 12-months postsurgery the Hy Scale predicted outcome in the regression equation and represents a medium-large ES ( $f^2 = .241$ ).

When demographic and medical status variables were considered with scales Hs, D, and Hy the composition of the regression analysis results varied across outcome assessment times (see Table 10). At 3-months postsurgery the number of previous

Table 12

Effect Sizes for Multiple Regression Analyses Using Scales Hs, D, and Hy to PredictSurgery Outcome

Outcome variable	Predictive variables	$R^2$	$ES$	
DQ1	Hs	.160	.190	medium
DQ2	Hs	.157	.186	medium
DQ3	Hy	.194	.241	medium-large
BPQ1	D	.092	.101	small-medium
BPQ2	Hs	.120	.136	medium
BPQ3	Hs	.112	.126	medium

surgeries and the Hs Scale predicted outcome as measured by the Disability Questionnaire and produced a large ES ( $f^2 = .603$ ). At 9- months postsurgery, months of pain prior to surgery, number of previous surgeries, and the Hs Scale predicted outcome and produced a large ES ( $f^2 = .484$ ). Finally, at the 12-months follow-up, gender, number of previous surgeries, and the Hy Scale were predictive of outcome and resulted in a large ES ( $f^2 = .701$ ). In sum, the effect sizes for the  $R^2$  obtained in multiple regression analyses using the Disability Questionnaire as an outcome measure ranged from medium to large.

Back Pain Questionnaire. Once again, the results for predicting outcome using scales Hs, D, and Hy were identical to the results obtained using all 10 clinical scales; therefore, both results will be considered together (see Table 12). At 3-months postsurgery the multiple regression analysis showed that the D Scale alone predicted outcome on the Back Pain Questionnaire and demonstrated a small-medium ES ( $f^2 =$

.101). At 9- and 12-months postsurgery the multiple regression analyses demonstrated that only the Hs scale predicted outcome and both effect sizes were in the medium range ( $f^2 = .136$  and  $f^2 = .126$ , respectively).

With demographic and medical status variables considered in conjunction with the Hs, D, and Hy Scales, the predictive variables differed across the three outcome assessment points (see Table 13). At 3-months postsurgery, months of pain prior to surgery, number of previous surgeries, and the D Scale predicted outcome and produced a very large ES ( $f^2 = .835$ ). At the 9-month follow-up, number of previous surgeries, months of pain prior to surgery, and the Hs Scale predicted outcome and also demonstrated a respectably large ES ( $f^2 = .393$ ). At 12-months postsurgery, gender and age predicted outcome and demonstrated a medium-large ES ( $f^2 = .297$ ). Thus, when the Back Pain Questionnaire was used as the outcome measure, the effect sizes ranged from small-medium to large.

Stauffer and Coventry Index. As noted earlier none of the discriminant analyses yielded statistically significant functions for predicting outcome based on MMPI-2 or demographic variables. Discriminant analysis provided data on the percentage of cases that were correctly classified by the derived function regardless of statistical significance. The MMPI-2 variables Hs, D, and Hy correctly classified 40, 35, and 50% of cases into good, fair, and poor outcomes, respectively (see Table 14). When all 10 MMPI-2 clinical scales were used, they correctly classified 55, 48, and 76% of cases into good, fair, and poor outcomes, respectively (see Table 15). Finally, when scales Hs, D, and Hy were added to demographic variables, they correctly classified 60, 54, and 65% of cases into

Table 13

Effect Sizes for Multiple Regression Analyses Using Psychosocial Variables and Scales Hs, D, and Hy to Predict Surgery Outcome

Outcome variable	Predictive variables	$R^2$	<u>ES</u>
DQ1	# Previous surgeries, Hs	.376	.603 large
DQ2	Mos in pain, # prev surg, Hs	.326	.484 large
DQ3	Gender, # prev surg, Hy	.412	.701 large
BPQ1	Marital stat, # prev surg, D	.455	.835 large
BPQ2	E Prev surg, mos pain, Hs	.282	.393 large
BPQ3	Gender, age	.229	.297 medium-large

Table 14

Proportion of Correct Classifications of Outcome Based on the Discriminant Function for Scales Hs, D, and Hy with Scores on the Stauffer Coventry Index as the Grouping Variable

Outcome period	Function standardized canonical coefficients			% Original cases correctly classified
	Hs	D	Hy	
3-months	.494	.428	.248	40.0
9-months	.611	.786	-.437	35.4
12-months	1.52	-.214	-.572	50.0



Table 15

Proportion of Correct Classifications of Outcome Based on the Discriminant Function for Scales Hs, D, Hy, Pd, Mf, Pa, Pt, Sc, Ma, and Si with Scores on the Stauffer and Coventry Index as the Grouping Variable

Outcome period	Function standardized canonical coefficients										% Original cases correctly classified
	Hs	D	Hy	Pd	Mf	Pa	Pt	Sc	Ma	Si	
3-months	.452	.473	.151	-.181	.058	.238	-1.673	1.066	.050	.766	54.5
9-months	.483	-.171	.258	-.413	.123	.134	-.500	.201	-.392	.977	47.9
12-months	.689	.453	-.463	.002	.273	-.459	-.632	1.134	-.164	-.372	76.2

Table 16

Proportion of Correct Classifications of Outcome Based on the Discriminant Function for Demographic Variables and Scales Hs, D, and Hy with Scores on the Stauffer and Coventry Index as the Grouping Variable

Outcome period	Function standardized canonical coefficients									% Original cases correctly classified
	Age	Educ	Mar	Gen	Prev	Mos	Hs	D	Hy	
3-months	.539	-.330	-.378	-.005	.602	.244	-.225	.383	.438	60.4
9-months	.483	.003	-.427	-.301	.669	.384	.191	.505	-.493	54.3
12-months	.425	-.046	-.416	-.290	.654	.034	.293	.242	.099	65.0

good, fair, and poor outcomes, respectively (see Table 16). An examination of these classification rates clearly suggests that they are not high enough to adequately inform clinical decision making. Even a classification rate at one year of 76% using all 10 MMPI-2 clinical scales would leave 25% of patients incorrectly classified.

## CHAPTER V

### DISCUSSION

#### Hypotheses

##### Hypothesis #1

The first hypothesis of this study was that elevations on scales Hs, D, and Hy of the MMPI-2 would be predictive of poorer surgery outcome. This hypothesis was supported for the Back Pain Questionnaire and the Disability Questionnaire outcome measures. However, for the Stauffer and Coventry Index the hypothesis was not supported. Interestingly, for the Back Pain Questionnaire and Disability Questionnaire only one of the three MMPI-2 scales entered into the analyses was predictive of outcome at each of the data collection periods. The Hs Scale alone predicted outcome on the Disability Questionnaire measure at 3 and 9 months and also predicted outcome on the Back Pain Questionnaire at 9 and 12 months. The Hy Scale predicted outcome at 12 months on the Disability Questionnaire and the D Scale predicted outcome at 3 months on the Back Pain Questionnaire. The substantial colinearity between each of these variables (Hs, D, Hy) may have made it less likely that more than one of these variables would predict outcome when considered together in the multiple regression analyses.

As mentioned above none of the MMPI-2 scales predicted outcome as measured by the Stauffer and Coventry Index. The Stauffer and Coventry Index outcome data are ordinal by nature and limited variability may have made finding a relationship difficult (if one exists for these data) between the MMPI-2 scales and the Stauffer and Coventry

Index. A qualitative analysis of the Stauffer and Coventry Index data showed a trend very similar to that found for the Disability Questionnaire and Back Pain Questionnaire. This will be discussed at greater length in a qualitative examination of the data.

It was also predicted that the relationship between the MMPI-2 scales and outcome would be stronger for the Hs and Hy Scales relative to the D Scale. The results of this study provided evidence in favor of this hypothesis. The Hs Scale predicted outcome in four separate instances and the Hy and D Scales predicted outcome in one instance each. The strongest relationship found between MMPI-2 variables and outcome was for the Hy Scale predicting Disability Questionnaire scores at the 12-month follow-up ( $R = .441$ ). The Hs Scale predicted outcome at two time periods each for the Disability Questionnaire and Back Pain Questionnaire with correlation coefficients ranging from .334 to .399. Finally, the D Scale demonstrated the weakest statistically significant coefficient ( $R = .304$ ). As predicted, the D Scale had the weakest relationship to outcome of the three variables investigated.

The Hs, D, and Hy Scales are 3 of 10 clinical scales in the MMPI-2. It was speculated that the remaining 7 clinical scales would not statistically significantly improve prediction of outcome when added to the first 3 scales (Hs, D, and Hy). This hypothesis was supported when it was shown that none of the 7 scales provided statistically significant information to the prediction when added to the first 3 scales. This is consistent with much of the previous research using the MMPI (e.g., Blumetti & Modesti, 1976; Kuperman et al., 1979; Oostdam et al., 1981; Sorensen, 1992; Wiltse & Rocchio, 1975).

A qualitative examination of means for scales Hs, D, and Hy was conducted by dividing the data for the Disability Questionnaire and Back Pain Questionnaire at each collection time into three groups based on quartile data (see Tables 17 and 18). Thus, for these outcome variables, at each collection time, the distribution of scores was separated into the highest 25%, lowest 25%, and middle 50%. The highest 25% of scores represented the poorest outcomes, the lowest 25% of scores represented the best outcomes, and the middle 50% represented those patients having a fair outcome. A mean for each of the three MMPI-2 scales examined was calculated for patients

Table 17

Mean T Scores for MMPI-2 Scales Hs, D, and Hy for the Disability Questionnaire Based on Quartile Data

Quartiles	Mean DQ	Mean T scores			N
		HS	D	Hy	
3-month outcome					
Good (lowest 25%)	4.00	61	56	61	17
Fair (middle 50%)	10.00	65	58	62	14
Poor (highest 25%)	15.00	69	64	69	24
9-month outcome					
Good (lowest 25%)	1.00	59	54	57	14
Fair (middle 50%)	7.00	65	58	64	22
Poor (highest 25%)	15.50	71	63	70	12
12-month outcome					
Good (lowest 25%)	0.75	55	52	53	10
Fair (middle 50%)	7.00	67	57	65	22
Poor (highest 25%)	15.25	69	59	71	10

Table 18

Mean T Scores for MMPI-2 Scales Hs, D, and Hy for the Back Pain Questionnaire Based on Quartile Data

Quartiles	Mean BPQ <sup>a</sup>	Mean <u>T</u> scores			<u>N</u>
		HS	D	Hy	
3-month outcome					
Good (lowest 25%)	91.76	62	54	59	14
Fair (middle 50%)	101.26	65	59	65	27
Poor (highest 25%)	111.10	67	64	66	14
9-month outcome					
Good (lowest 25%)	90.25	59	53	57	12
Fair (middle 50%)	96.84	64	59	63	24
Poor (highest 25%)	110.97	71	61	70	12
12-month outcome					
Good (lowest 25%)	89.10	61	52	59	10
Fair (middle 50%)	98.68	64	57	64	22
Poor (highest 25%)	110.78	70	60	67	10

<sup>a</sup> Mean BPQ scores were transformed by adding 100 points to mean to eliminate negative numbers.

falling within each of the categories. The Stauffer and Coventry Index scores were divided into good, fair, and poor by simply using the total score (see Table 19). Therefore a total score of 1 = good, 2 = fair, and 3 = poor.

An examination of this data shows exactly the same pattern for patients in the good, fair, and poor outcome categories for every outcome measure (BPQ, DQ, SCI) at every collection time (3, 9, 12 months). The pattern was typified by higher scores on scales Hs and Hy relative to the score on scale D, a profile pattern typically referred to as "conversion V." This suggested that for this population of back pain patients there was a

Table 19

Mean T Scores for MMPI-2 Scales Hs, D, and Hy for the Stauffer and Coventry IndexBased on Outcome Category

Quartiles	SCI outcome score	Mean <u>T</u> scores				<u>N</u>
		HS	D	Hy		
3-month outcome						
Good	1	60	54	59	7	
Fair	2	63	58	62	25	
Poor	3	68	61	66	23	
9-month outcome						
Good	1	62	54	62	10	
Fair	2	64	58	63	23	
Poor	3	67	61	65	15	
12-month outcome						
Good	1	59	53	58	12	
Fair	2	67	57	65	22	
Poor	3	66	60	69	8	

typical pattern that emerged regardless of outcome category. Examining each outcome variable (BPQ, DQ, SCI) at each outcome time (3, 9, 12 months) resulted in nine sets of scores divided into good, fair, and poor outcome. Eight of these sets of scores followed a similar pattern. In this pattern those in the good outcome category had the lowest scores on each variable (Hs, D, Hy), those in the poor outcome category had the highest score on each variable, and those in the fair outcome category had scores on each variable that fell between that found for the good and poor group at that collection time. Recall that these groups were derived by examining the scores obtained on each of the outcome variables

without regard to scores on the MMPI-2 scales. This is exactly the pattern we expected to see if higher scores on scales Hs, D, and Hy predicted poorer outcome for elective back surgery. While the data for the Stauffer and Coventry Index did not reach statistical significance, the qualitative examination of the data showed that the trend in the Stauffer and Coventry Index data closely matched that found for both the Back Pain Questionnaire and the Disability Questionnaire. What does this mean? It suggested that for this group of back surgery patients the typical pattern was characterized by a conversion V profile. Therefore, it was not the presence of a conversion V profile alone that suggested poorer outcome, rather it was higher conversion V profiles. This was strikingly similar to the findings of Oostdam et al. (1981), who found that back surgery patients in their sample demonstrated a conversion V profile regardless of whether or not they were in the satisfactory or unsatisfactory outcome groups. They found that it was the relative elevation of the conversion V profile that delineated satisfactory from unsatisfactory outcome such that higher elevations were related to poorer outcome.

In sum, the quantitative and qualitative analyses provided evidence that scales Hs, D, and Hy were, indeed, related to surgery outcome. In fact, they were the only clinical scales on the MMPI-2 that were related to outcome for this sample of back pain patients. While the Hy Scale showed the strongest relationship to back surgery, outcome the Hs Scale was the one most frequently related to outcome. The D Scale, as predicted, was found to have a significant but weaker relationship to outcome in this sample of patients. The problem of colinearity among the predictor variables may have limited the ability to find statistical significance for more than one variable at each outcome time. However, it

should be noted that in the qualitative examination of data the Hs and Hy mean scale scores for each category (good, fair, poor) at each outcome time (3, 9, and 12 months) for each outcome variable (BPQ, DQ, SCI) never differed from each other more than 2 T-score points (see Tables 17, 18, and 19). Due to the nature of this qualitative examination, no conclusions can be drawn; however, it was certainly suggestive of previous MMPI research that found Hs and Hy to be the best predictors of outcome (Sorensen, 1992).

### Hypothesis #2

As discussed in the literature review there was evidence that select demographic and medical status variables have a demonstrated relationship to elective back surgery outcome for chronic low back pain. The second hypothesis predicted that the addition of scales Hs, D, and Hy to a regression equation composed of demographic and medical status variables would statistically significantly improve prediction of outcome. This is important because if MMPI-2 variables do not improve upon the prediction generated using demographic and medical status variables, then the use of the MMPI-2 is not warranted. Demographic and medical status data are much easier and less expensive to gather than administering the 567 items of the MMPI-2.

Neither demographic and medical status nor MMPI-2 variables were statistically significantly related for outcome as measured by the Stauffer and Coventry Index at any of the follow-up times. However, MMPI-2 variables were found to improve prediction in five out of six multiple regression analyses in which demographic and medical status variables were statistically significantly related to surgery outcome (as measured by the



Back Pain Questionnaire and Disability Questionnaire). Therefore, support was found for the use of the MMPI-2 in addition to demographic and medical status variables.

As found in the analyses examining only MMPI-2 scales and outcome, just one of the three MMPI-2 scales examined was found to be statistically significant in five of the six analyses. Of the multiple regression equations that demonstrated a relationship between demographic and medical status variables and outcome, only the 12-month follow-up on the Back Pain Questionnaire regression equation was found not to be improved by an MMPI-2 scale. In this case being female and older predicted greater self-reported back pain.

On the Disability Questionnaire at 3 months, higher number of previous surgeries and higher scores on the Hs scale predicted more self-reported disability. At 9-months postsurgery, more pain, higher number of previous surgeries, and a higher score on the Hs Scale were related to more disability. At 12 months being female, higher number of previous surgeries, and a higher score on the Hy Scale were associated with greater disability as reflected in Disability Questionnaire scores.

On the Back Pain Questionnaire subjective back pain is predicted at each follow-up time by a unique set of variables. At 3 months not being married, higher number of previous surgeries, and a higher score on the D Scale predicted more back pain. At 9 months higher number of previous surgeries, more months in pain prior to surgery, and a higher score on the Hs Scale predicted higher back pain scores. Finally, at 12 months being female and older predicted greater self-reported back pain.

The demographic variables entered into the regression equations (age, gender, marital status, and education level) have all been shown to be related to back surgery outcome in past studies (e.g., Hasenbring et al., 1994; Dzioba & Doxey, 1984; Frymoyer, 1992; Lynch, 1977). Interestingly, the demographic variables listed above played a relatively minor role in prediction of outcome with the exception of the 12-months follow-up using the Back Pain Questionnaire. At 12-months postsurgery being female and older predicted poorer outcome on the Back Pain Questionnaire. There were six predictive equations generated using multiple regression at 3, 9, and 12 months on the Disability Questionnaire and Back Pain Questionnaire. Of these six equations age and marital status were predictive in one equation each, gender was predictive in two separate equations, and educational level was not predictive at any point.

These demographic variables played less of a role in prediction than might be expected based on previous research findings. The relationship between advancing age and poorer outcomes may be related to the slower recovery time and other physical limitations associated with older populations. Literature on social support has shown that being married is positively related to better outcomes from surgery and medical trauma (e.g., Lynch, 1977). However, two previous low back surgery studies did not find a relationship between being married and outcome (Sorensen et al., 1987; Wilfling et al., 1973). In the current study marital status played a relatively minor role in predicting outcome at only one follow-up point when combined with medical status and MMPI-2 variables. As noted previously, education did not predict outcome at any point or measure in this study. Past research has indicated a relationship between lower levels of education and poorer

outcome (e.g., Frymoyer, 1992; Frymoyer & Cats-Baril, 1987). Some have hypothesized that this link stems from a correlation between less education and more physically demanding jobs. The failure of educational level to predict outcome in the current study is reflective of the smaller relative role that demographic variables played overall in predicting back surgery outcome for this sample of patients.

The findings on the relationship between gender and rehabilitation or surgery for low back pain are mixed. There is evidence that being female predicts poorer outcome (e.g., Dzioba & Doxey, 1984; Frymoyer & Cats-Baril, 1987; Sorenson et al., 1987; Watkins et al., 1986). However, other studies exploring the relationship between back surgery outcome and gender did not find gender to be a predictor of outcome (Boos, Marchesi, & Aebi, 1992; Kuperman et al., 1979; Oostdam & Duivenvoorden, 1983; Uomoto et al., 1988). In the present study being female was predictive of poorer outcome at 12-months postsurgery on both the Disability Questionnaire and Back Pain Questionnaire. One possible interpretation of these results is that women are less likely to benefit from back surgery for chronic low back pain than men. However, it is also possible that women are culturally more willing to admit physical problems than men. If this is the case, then self-report measures of back pain and disability may bias prediction of outcome against women. The mixed nature of past research on gender and outcome, the possibility of cultural variables mediating outcome for women, and the potential for women to be unfairly denied surgery indicate that great caution should be used in predicting outcome based on gender. More research is needed before gender becomes a viable factor in predicting back surgery outcome.

The two medical status variables explored in this study were number of months in pain prior to surgery and number of previous surgeries. In the present study number of months in pain prior to surgery was predictive of outcome at 9-months postsurgery on both the Disability Questionnaire and the Back Pain Questionnaire. Sorensen et al. (1987) combined duration of pain with employment status and an MMPI scale to correctly classify 86% of patients' outcomes following low back surgery. Waddell et al. (1984) found duration of pain to be related to a magnification of illness behavior in chronic low back pain patients. It may be that the longer a person has been experiencing pain, the more serious or intractable the pain. Longer periods of pain prior to surgery might allow for the development of more entrenched pain behaviors that would be reflected in self-report measures.

The most consistent predictor of low back surgery outcome in the present study was number of previous back surgeries. In a review of the fusion surgery outcome literature, DeBarard (1997) identified this variable as one of the most promising predictor variables of low back surgery outcome. Re-operation is a marker for serious spinal problems and failure of previous back surgeries. Based on the current results it is recommended that patients who have had a previous back surgery be carefully evaluated for potential outcome prior to making the decision to conduct surgery.

Interestingly, the number of previous surgeries variable added statistical significance to the prediction in the five analyses that included an MMPI-2 scale in the equation. Only for the 12-months follow-up on the Back Pain Questionnaire where only sex and age predicted outcome did number of previous surgeries and MMPI-2 variables

not add statistical significance to the prediction. As found by Franklin et al. (1994) in an examination of long-term outcome in fusion surgery, the number of previous surgeries is a meaningful predictor variable for disability in low back surgery patients.

One observation about these data is that the constellation of variables that predict outcome at each follow-up time are different for each measure. In other words, the specific combination of predictor variables is different at each follow-up period with only one exception. At 9-months postsurgery the same three independent variables predict outcome on both the Disability Questionnaire and Back Pain Questionnaire: months of pain prior to surgery, number of previous surgeries, and the Hs Scale. Essentially, there is no one set of variables that best predicts outcome at every follow-up for the Back Pain Questionnaire or for the Disability Questionnaire. This variability in results suggested that back pain and disability were fluid constructs that were related to different patient variables at different time periods following recovery. This is important because measures of outcome at one time period following surgery may not predict similar outcomes at a later date. These differences suggested that although back pain and disability are related concepts in back surgery outcome, they are different enough to be predicted by slightly different combinations of demographic and medical status and personality variables. One concern based on these results was that when outcome data from low back surgery patients was collected at diverse times and pooled, postsurgery, the results would be misleading. For example, if the predictive measures used in such a study are most related to outcome at a given time period, then the results will vary depending on when the majority of data was collected.

Finally, the results found in this study suggest that demographic and medical status variables such as those found to be significant here should be considered in conjunction with MMPI-2 variables when making a determination about the likely outcome of elective back surgery for chronic low back pain. Such a finding is supported by Pheasant et al. (1979), who stated that the MMPI-2 should be used in conjunction with other variables in making such determinations. In conclusion, the MMPI-2 variables (Hs, D, Hy) make a significant and varied contribution to prediction when considered with demographic and medical status variables.

### Hypothesis #3

It was hypothesized that the results of this study would be consistent with previous research using the MMPI. Research on the MMPI has shown that elevations in the Hs, D, and Hy Scales are most related to poorer surgical outcomes for chronic low back pain. In the present study only these 3 of the 10 clinical scales of the MMPI-2 were found to be related to outcome. As was noted in the literature review, several studies have found relationships between one or more of the three validity scales (L, F, and K) and some of the other seven clinical variables (e.g., Gentry, 1982; Jamison et al., 1976; Uomoto et al., 1988). For the most part, however, these relationships tend to wash out when the literature base is considered en masse. The results of the current investigation provide strong evidence that elevations in the Hs, D, and Hy Scales are in fact those most related to poorer surgical outcome.

There are several important implications of these results. Because these results are similar to those found in previous research it provides some evidence that the findings in

this study are not merely spurious. Most importantly, there is very little research available investigating the relationship between back surgery outcome and the MMPI-2 for chronic pain patients. The present results provide strong confirmation that much of the previous research using the MMPI to explore the relationship between psychological variables and back surgery outcome for chronic low back pain patients is applicable to the MMPI-2. Therefore, clinicians and others using the MMPI-2 to assist in decision making for low back surgery patients can have more confidence in conclusions based on the bulk of existing literature. Interestingly, Riley et al. (1995) reported that profiles characterized by similar elevations on scales Hs, D, and Hy (Neurotic Triad profile) of the MMPI-2 were significantly related to reports of greater satisfaction with improvement following surgery. They also found that profiles demonstrating higher scores on scales Hs and Hy relative to D (conversion V profile) were related to poorer outcomes following surgery. Riley's findings regarding the conversion V profile are similar to those found here. In a qualitative examination of the means for the patients in the present study it was found that Hs and Hy were higher relative to scale D in virtually all outcome conditions (good, fair, poor). However, the present study also suggested that elevations on each of the three scales were related to poorer outcome depending on the timing of the follow-up measure. Riley et al. used a cluster analysis to exam their data, which may explain the difference in results. Also, it may be that Riley et al. collected data at different time periods following surgery and simply pooled the results. As can be seen in the present study, such pooling of outcomes resulted in a loss of more fine grained information. Both Riley and the current study showed evidence for a relationship between the conversion V profile and



poorer outcome; however, future research should continue to investigate the degree to which Triad and conversion V profiles differentially predict outcome.

#### Hypothesis #4

The concept of clinical significance has been addressed in a number of literature bases and has been alternately referred to as ecological validity, cultural validity, clinical importance, applied importance, and qualitative change (Foster & Mash, 1999). The existence of a varied nomenclature highlights both the importance of the concept as well as the difficulty in defining what is meant by "clinical significance." Clinical significance has been defined in a number of ways. Kazdin (1999) defines it as "...whether the intervention makes a real difference in everyday life to the clients..." (p. 81). The social validation approach considers clinical significance to be a multidimensional construct that can be separated into the acceptability and importance of treatment and outcome to the patient (Foster & Mash, 1999). Some have defined it as a statistically reliable change that places patients in a range of functioning that is not distinguishable from that of well-functioning persons (Jacobsen, Roberts, Berns, & McGlinchey, 1999). Still others approach the concept from a "quality of life" perspective (Gladis, Gosch, Dishuk, & Critis-Christoph, 1999). Kazdin (1999) argued that a change in negative symptoms (such as psychological distress) may be less important to patients than their level of impairment in interpersonal interactions, role expectations, and restrictions in important activities. Clinical significance of a result can be assessed by either the patients themselves or by someone else who is impacted by the outcome or who is especially qualified to evaluate outcome. For example, Foster and Mash (1999) suggested that significant others (e.g.,



spouses, parents) and other "consumers" of the patient's behavior (e.g., teacher, employer) may also be reasonable judges of the clinical significance of an outcome.

In the present study an attempt was made to evaluate the clinical significance of results by using varied measures of outcome that address issues of importance to the patients in their daily lives (e.g., physical disability, pain, return to work, activity level). In other words, is the patient returning to "normal" functioning in major areas of life activities. To evaluate these subjective patient reports, Cohen's (1992) effect size statistics were used to measure the degree of change in a way that would not be affected by sample size or scale of measure. This approach took advantage of both subjective patient report on quality of life functioning and statistical analyses.

It was predicted that the results of this study would be of clinical significance in informing applied practice. Effect sizes (ES) were used to determine the magnitude of each significant multiple regression result unrelated to sample size or scale of measure. To determine the clinical significance of the discriminant analyses conducted for the Stauffer and Coventry Index, the percentage of cases correctly classified was used. This hypothesis is of particular importance in this study because a primary purpose was to inform current practice in psychology and surgery. Cohen's (1992) classification system was used to exam this hypothesis relative to multiple regression results. Recall that multiple regression effect size indexes for a small, medium, or large are respectively .02, .15, and .35.

On the Disability Questionnaire the Hs Scale predicted outcome at 1 and 9 months with effect sizes in the medium range (.190 and .185, respectively). The Hy Scale predicted outcome with an effect size in the medium to large range (.241) on the Disability

Questionnaire. On the Back Pain Questionnaire the D Scale predicted outcome at 3 months with a small to medium effect size (.101). The Hs Scale predicted outcome on the Back Pain Questionnaire at 9 and 12 months with effect sizes in the medium range (.136 and .126, respectively). With the exception of the D Scale these effect sizes demonstrate a moderate level of clinical utility for the MMPI-2 scales in predicting outcome. The smaller effect size for the D Scale is reflective of findings in previous research showing the D Scale to have less strength in prediction. As mentioned earlier the results for the addition of the seven other clinical scales to Hs, D, and Hy were no different than the results for Hs, D, and Hy alone. Therefore, a discussion of those results would be redundant.

The use of demographic and medical status variables in conjunction with Hs, D, and Hy Scales demonstrated significantly larger effect sizes. The effect sizes ranged from medium-large to very large. Based on Cohen's classification system the effect sizes found for the demographic and medical status/ MMPI-2 scales combined are quite noteworthy. For the Disability Questionnaire at 1-month postsurgery, number of previous surgeries and the Hs Scale resulted in a very large effect size (.603). At 9 months on the Disability Questionnaire, the effect size was .484 based on months of pain prior to surgery, number of previous surgeries, and the Hs Scale. At 12 months on the Disability Questionnaire, gender, number of previous surgeries, and the Hy Scale resulted in a very large effect size (.701).

On the Back Pain Questionnaire at 1-month postsurgery, the largest effect size was calculated (.835) based on three predictor variables: marital status, number of previous

surgeries, and the D Scale. At 9 months the number of previous surgeries, months of pain prior to surgery, and the Hs Scale predicted outcome on the Back Pain Questionnaire and resulted in a large effect size (.393). Finally, the Back Pain Questionnaire at 12 months was predicted by gender and age reflecting the least impressive effect size that was in the medium to large range (.297). These effect sizes demonstrate that the magnitude of the relationship between outcome and predictor variables comprised of demographic, medical status, and MMPI-2 variables was very significant for the Disability Questionnaire and Back Pain Questionnaire.

Such a result indicates that the combination of demographic and medical status variables and the three MMPI-2 scales (Hs, D, and Hy) were very powerful predictors of outcome. The fact that different combinations of these variables predict outcome at different follow-up times for different outcome variables suggests that postsurgical outcome across time is a varied construct. More research is needed to determine which specific variables are the best combined predictors of outcome at which outcome periods. In the meantime it is apparent that for this sample of patients the addition of MMPI-2 variables to basic demographic and medical status variables is a meaningful and important contribution to prediction.

When using the Stauffer and Coventry Index as an outcome assessment tool, the predictive measures did not suggest clinical utility. Classification rates derived from discriminant analyses ranged from 35-76%. We can conclude that using MMPI-2 scales and/or the demographic variables examined in this study are not of practical use in predicting outcome as measured by the Stauffer and Coventry Index.

## Implications

### Use of the MMPI-2 in Back Surgery Prediction

One of the most important questions to be addressed in this study is the following: Is the use of the MMPI-2 in low back surgery outcome prediction warranted? The answer is "yes" with some qualifications. The fact that scales Hs, D, and Hy predicted outcome in this study as hypothesized is important. The hypothesis was derived based on multiple years of previous research that utilized the MMPI. The MMPI has been the objective instrument of choice for psychologists and others attempting to make predictions regarding surgery outcome for LBP patients. Now, the results of the present study and those of Riley et al. (1995) indicate that use of the MMPI-2 for this same purpose is supported. As of yet, no better objective test has been found for this purpose. The correlations between LBP surgery outcome and the MMPI and MMPI-2 are fairly reliable; however, the correlations range in size from small to medium. Therefore, the qualification that should be considered when using the MMPI-2 for this purpose is that it should be used in conjunction with other predictors of outcome.

In the present study it was shown that the MMPI-2 variables used in conjunction with demographic (age, gender, and marital status) and physical (months in pain prior to surgery and number of previous surgeries) variables provide strong predictors of outcome at multiple time periods following surgery. Demographic and physical variables are easy to assess through simple self-report. Based on the results in this study it is concluded that both MMPI-2 results and demographic/physical variables should be taken into

consideration when making predictions about back surgery outcome for chronic LBP patients.

A qualitative examination of the data for the entire sample of back pain patients in this study indicates that the conversion V profile is the most descriptive. As noted in previous research the conversion V profile is related to poorer outcomes; however, in the present study it appears that the likelihood of poor outcomes increases as the elevation of the conversion V increases. Oostdam et al. (1981) also noted the same phenomena in their prospective study. Although they did not find a statistically significant relationship between outcome and MMPI scales, Waring et al. (1976) did note that the average profile for patients having poorer functional outcomes in their study was the conversion V profile. Pheasant et al. (1979) also found the conversion V profile to be predictive of poorer outcomes for multiply operated LBP patients. Finally, Riley et al. (1995) found the conversion V profile predicted poorer outcome when using the MMPI-2. This evidence suggests that particular attention should be paid to patients with conversion V profiles when they are significantly elevated. Further research will be needed to determine the cutoffs differentiating significant from nonsignificant elevations on the conversion V.

Another important question relates to when surgeons should refer a prospective elective back surgery patient to a psychologist for evaluation. Presumably not all patients undergoing elective back surgery would benefit from psychological evaluation. Good clinical practice would dictate referrals from experienced physicians in three circumstances. First, when the surgeon cannot determine an organic origin for the pain. Second, when the surgeon suspects that emotional/psychological/social variables are

influencing the patient's perception of pain and ability to cope with the pain. And finally, when there is a substantial psychiatric history for the patient, regardless of the current presentation.

### The Relationship Between Personality and Back Surgery Outcome

Upon initial consideration many lay persons (and some professionals) would not anticipate a link between personality and surgery outcome for chronic pain. However, the most influential theory of pain perception, the Gate Control Theory (Melzack & Wall, 1965), hypothesizes a relationship between psychological factors and pain perception. This theory is of such importance that a brief review is warranted.

The premise behind the Gate Control Theory is the existence of a neural gating mechanism that can be opened or closed to different degrees that affects the number of pain signals reaching the brain (Melzack & Wall, 1965, 1982). This "gate" is thought to be located in the gray matter that runs along the length of the spinal cord in the *substantia gelatinosa* of the dorsal horns. When a noxious stimulus occurs, impulses are sent via small diameter pain fibers (A-delta and C fibers) to the substantia gelatinosa. When the impulses from these pain fibers arrive in the gating mechanism (in the substantia gelatinosa), they activate transmission cells, or T cells. T cells send impulses to the brain and when they reach a critical level the person experiences pain. The greater the intensity of impulses sent to the brain from the T cells, the greater the degree of pain experienced.

Melzack and Wall (1965, 1982) also proposed that a central control trigger in the nervous system mediates incoming pain impulses by influencing the gating mechanism.

They suggested that descending efferent fibers from the brain are responsible for this process. The gate can be selectively opened or closed in the same time frame for different stimuli; therefore, they concluded that signals from the brain that close the gate must be sent before the pain perception system is activated. This would require impulses from extremely fast fibers. They suggested that the dorsal column-medial lemniscus system and/or the dorsolateral path are the systems responsible for this central control trigger mechanism. Further, they stated that the gating mechanism can be set and reset indefinitely.

Three factors are thought to influence the amount that the gating mechanism is opened or closed (Melzack & Wall, 1965). First, the greater the amount of activity in the pain fibers the more open the gate will be. In other words, noxious stimuli of greater intensity will cause an increase in pain fiber activity that result in an increase in T cell impulses to the brain. Second, the amount of activity in peripheral (A-beta) fibers will influence the degree to which the gate is open. The activation of these peripheral fibers has a closing effect on the gating mechanism that would then reduce the impulses sent to the brain from the T cells, thereby decreasing the intensity of perceived pain. This process would account for the reduction in pain experienced when rubbing an area near an injury or causing mild irritation in a completely different area. Thirdly, and most importantly for the present discussion, messages sent from the brain by efferent pathways can influence the degree to which the gate is open or closed.

The Gate Control Theory (Melzack & Wall, 1965) proposes a physiological mechanism whereby psychological factors can increase or decrease the intensity of



perceived pain. Research has demonstrated that several psychological factors are related to the opening and closing of the gating mechanism in the Gate Control Theory of pain perception (Turk, Meichenbaum, & Genest, 1983). Variables thought to open the gate and increase the perception of pain intensity include: anxiety or worry, tension, depression, focusing on the pain, and boredom. Conversely, Turk et al. reported conditions that can close the gate include the following: positive emotions like happiness and optimism, relaxation, and involvement and interest in life activities.

Combinations of elevations on scales Hs, D, and Hy of the MMPI are clearly related to some of the psychological variables found to open the gating mechanism. These scales measure depression, anxiety, abnormal somatic complaints, somatoform disorders, classic "conversion" symptoms, and the tendency to develop physical symptoms in response to stress. Therefore, it is not surprising that patients who have personality profiles that have some combination of elevations on scales Hs, D, and Hy are less likely to report satisfactory pain reduction following surgery. In other words, by virtue of their psychological dispositions these patients may be more likely to increase the flow of signals from the T cells to the brain, signaling greater pain. In contrast, patients not exhibiting these psychological problems are more likely to report satisfaction with pain reduction following surgery.

From a purely psychopathological standpoint the relationship between elevations on the Hs, D, and Hy MMPI-2 scales and postsurgical pain complaints is not surprising. High scale responders on the Hs scale are often described as unhappy, complaining, having excessive bodily concern, and having a significant psychological component to their



medical condition. High scale D responders are often described as depressed, pessimistic, having physical complaints, and dreading the future. High scale Hy responders respond to stress by developing physical symptoms, desire a great deal of attention from others, view themselves as having medical problems, and are resistant to psychological interpretations (Graham, 1993). Elevations on all of these scales have in common the tendency to focus on somatic complaints such as pain. High scores on scales Hs and Hy are not likely to accept a psychological explanation or treatment for their pain. Physical complaints may or may not be a component of a high D Scale responder; therefore, the relative weakness of the correlation between scale D and surgery outcome (as compared to scales Hs and Hy) makes intuitive sense. In addition to the Gate Control Theory and psychopathological explanations of the relationship between personality and back surgery outcome, social issues may also shed some light on the connection.

In our society there continues to be prejudice against persons who acknowledge mental health issues. They are often seen as "crazy" or undesirable in social contexts. There is a much greater social acceptance of medical problems, perhaps because medical problems have the appearance of being outside of one's control whereas mental illnesses are perceived as a personal weakness. Whatever the mechanism, social pressure to be "mentally healthy" may influence some people experiencing depression, anxiety, or loneliness to attempt to resolve these problems by seeking medical rather than psychological assistance. The tendency to express psychological problems in somatic form can be exacerbated and extended by the potential secondary gains of attention, compensation, and administration of prescription pain killers. If some of these

psychological problems could be resolved in psychotherapy, these patients may become better candidates for elective surgery. Therefore, the identification of patients with emotional problems early in the process of evaluation for surgery may help some patients improve their chances of a good surgical outcome.

The relationship between personality and back surgery outcome is best described by a model that integrates biological, psychological, and social perspective. The biological components as described in the Gate Control Theory, the psychopathological components as tapped by the MMPI-2, and the social influence of culture are probably best considered together when attempting to understand the complexities of the chronic back pain patient. A biopsychosocial model is an appropriate way of conceptualizing these patients because it lends itself to an interdisciplinary approach to patient care, an approach that is inherent in use of psychologists in predicting back surgery outcome.

#### Future Directions for Research

Continued research on the MMPI-2 and surgery outcome for chronic LBP patients is needed. The evidence suggests that the MMPI-2 will predict outcome with similar reliability to the MMPI. The most promising line of research appears to be in the area of combining MMPI-2 scales with demographic and physical variables to predict outcome. Additionally, more research is needed to determine which outcome measures best tap the aspects of outcome that are most related to behavioral functioning.

Investigation into the use of the conversion V profile of pain patients may be useful. More information is needed to determine what elevations of the conversion V

profiles are most related to good, fair and poor surgical outcomes. It may turn out that the D Scale is most useful when used in conjunction with the Hs and Hy Scale, rather than as a single predictor. Such research might fruitfully examine the findings of Riley et al. (1995) that indicate better outcomes for Triad profiles (elevations on all three scales) as compared to conversion V profiles. Does outcome improve as D increases in value relative to Hs and Hy?

Predictions based on psychological data combined with surgical judgement should be compared to surgical judgment alone. How much better (or worse) is prediction of outcome when psychological evaluation is used? Longer term follow-ups are needed to determine the longevity of predictions made with psychological data. Follow-up data should be gathered at specified time periods post surgery rather than pooled across different time periods.

Intervention studies examining the utility of providing psychotherapy for surgical candidates with emotional problems should be conducted to determine if outcomes can be improved for these patients. There is evidence that cognitive behavioral therapy can improve functional ability and lessen health care use in chronic pain patients (Jensen, Turner, & Romano, 1994) and result in decreases in self-reported pain (Keefe, Salley, & Lefebvre, 1992). Finally, the results of the current study need to be replicated.

### Limitations

Some limitations of the current study should be noted. Increased sample size would have increased the statistical power in the analyses. Of particular importance is the

attrition that occurred across data collection times. At 3 months 55 patients were available for response, at 9 months 48 patients, and at 12 months 42 patients. In addition to lost statistical power there is always the danger that this attrition was systematic in some way that influenced the results of the study. Comparison of dropouts to nondropouts in this study revealed that dropouts tended to have significantly higher scores on the D Scale. This scale is a relatively homogenous measure and this difference suggests that those who dropped out were experiencing more subjective depressive symptoms than those who did not. This is concerning because this loss of data may have artificially suppressed the D Scale scores obtained in data collection. This finding makes intuitive sense because people who are more depressed may be more disabled and less likely to be motivated to respond to a telephone interview. On demographic variables, however, there were no significant differences found between dropouts and nondropouts.

The problem of colinearity was discussed in the results section and, as mentioned, the overlap in variance between the three independent variables decreases the amount of unique variance that each predicts in the outcome variable(s). Not finding any statistically significant relationship between the Stauffer and Coventry Index (a categorical variable) and presurgical variables may be the result of limited variance in the outcome variable. In fact, a simple examination of mean scores on the MMPI-2 for each of the categories in the Stauffer and Coventry Index shows a trend very similar to that found for the Back Pain Questionnaire and the Disability Questionnaire outcome measures showing poorer outcomes for persons reporting greater pain and more work and activity disability. One of the problems encountered with the Stauffer Coventry model centers on how the final score

is derived. Essentially, the lowest category scored (good, fair, poor) out of all three measures (pain, physical activities, and return to work) determines the overall category. For example, patients may indicate that they have 100% pain relief, are as physically active as they were prior to surgery, but are employed in less strenuous work than before surgery. In this case a patient's outcome is "fair." Another example would be patients who indicate that they have had only about 27% pain relief, are moderately restricted in their physical activities, and are employed in less strenuous work than before surgery. These patients would also be determined to have a "fair" outcome. As can be seen there can be a great deal of variance that is not represented in the Stauffer and Coventry Index for two patients who receive the same final score.

While every effort was made to obtain a continuous sample of patients from each of the two hospitals participating in the study, this ideal was not fully obtained. Few opportunities were missed to invite patients to participate and a small number of these patients chose not to be in the study. Again, if there was some systematic reason for refusal to participate, especially one related to personality factors, this would result in an important loss of information in the final analyses.

Outcome data were gathered by phone by the experimenter. It is possible that patients may have felt some desire to report better or worse outcomes to the experimenter. It was stated that the experimenter was an independent researcher not associated with the hospital or surgeons; however, the patients may have felt some pressure to report better outcomes because they had formed an association between the experimenter and the hospital. Alternatively, it is possible that some patients chose to

exaggerate problems following surgery in hopes of gaining physician attention. Overall, the study design sought to manage these potential problems by investigating a relatively large sample of patients so that individual differences would be balanced across participants, using standardized measures, and following a script during the telephone follow-up interviews (see Appendix A). Additionally, only one experimenter made virtually every follow-up call and, therefore, problems with experimenter effects on patient report were kept constant.

A possible criticism of the study is that the participants in the experiment represented a number of different diagnoses and underwent a number of different back surgeries (e.g. fusion, discectomy, laminectomy) and, therefore, the results are not generalizable to specific diagnoses and treatments. This is a reasonable criticism and overgeneralization of the results should be avoided. However, in this study we were only interested in generalizing to patients undergoing voluntary surgery for chronic low back pain.

The fact that the data were collected from patients in one geographic location and that no more than three physicians provided surgery may limit the generalizability of the study. It should be noted, however, that each surgeon had a substantial history of back surgery experience and all were employed by major hospitals. In sum, we can have some confidence that these results should be applicable to back surgery patients within the United States, but caution should be exercised in applying these results to specific diagnostic groups.

Another concern that might be raised is that physician ratings were not used in determining outcome. It might be argued that physician ratings of surgery outcome are important because surgeons can provide objective information about the success of the surgery in physical terms. This information was not gathered in this study because subjective patient ratings of outcome are believed to have the greatest relationship to patient activities following surgery (e.g. continued pain complaints, medication use, return to work, engagement in physical activities, utilization of medical services). In fact, one might argue that a patient who reports a poor outcome will behave in accordance with this report regardless of whether the surgeon proclaims the surgery an objective success.

Finally, this study is correlational by nature. Therefore, no statements about causation can be made. It can be stated that there is a relationship between personality as measured by the MMPI-2 and outcome for back surgery in this sample of patients. It is certainly reasonable to suggest that there may an interactive relationship between personality and chronic back pain such that pain influences responses on the MMPI-2 and that personality influences pain perception. In fact, the current model of pain perception posits that personality and affect have a strong influence of how much pain is experienced by a patient (Melzack & Wall, 1965).



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APPENDICES

## Appendix A: Telephone Outcome Survey

Hello Mr./Ms. \_\_\_\_\_ my name is \_\_\_\_\_ and I'm calling for the low back surgery research team to conduct the follow-up survey to you surgery. It will take us about 10 minutes, is this a good time? (If yes proceed, if no ask when can call back).

Remember to answer as honestly as possible and I remind you that your answers will be kept confidential. Neither your surgeon or any other doctors will see your answers. Do you have any questions?

1. Since your surgery, how much pain relief have you experienced in your back and lower extremities? Please provide a percent rating from 0 to 100.
2. With regard to your employment after surgery, which of the following best describes your status after surgery?

1 = Return to previous work status following surgery

2 = Return to less strenuous work following surgery

3 = No return to work following surgery

3. With regard to your physical activities after surgery, which of the following best describes your status after surgery?

1 = Minimal or no restrictions of physical activities

2 = Moderate restrictions of physical activities

3 = Severe restrictions of physical activities

4. How would you rate your surgical outcome?

Good

Fair

Poor

5. Please rate how much you have improved following surgery on a scale from 0 to 10 where 0 represents no improvement and 10 represents improvement to preinjury level.
6. Please rate your level of satisfaction with the results of your treatment on a scale from 0 to 10 where 0 represents totally unsatisfied and 10 represents completely satisfied.
7. What is your current level of pain on a scale from 0 to 10 where 0 represents no pain and 10 represents the worst pain imaginable?

## Appendix B: Demographic and Background Questionnaire

Name: \_\_\_\_\_ SS# \_\_\_\_\_

Address: \_\_\_\_\_

Street Address

\_\_\_\_\_ City

\_\_\_\_\_ State

\_\_\_\_\_ Zip

Phone :

Home: \_\_\_\_\_

Work: \_\_\_\_\_

Today's Date: \_\_\_\_\_

Date Surgery Scheduled: \_\_\_\_\_

Age: \_\_\_\_\_

Gender: (circle one) *M* *F*

Marital Status: (circle one) Single Married Divorced Married but Separated

Ethnic Status: (circle one)

1. White
2. African-American
3. American Indian
4. Asian-American
5. Hispanic-American
6. Other: Specify \_\_\_\_\_

Occupation: \_\_\_\_\_

Please indicate your highest level of completed formal education: (circle one)

- |                         |                         |
|-------------------------|-------------------------|
| 1. some high school     | 5. 4 year degree        |
| 2. high school graduate | 6. some graduate school |
| 3. some college         | 7. masters degree       |
| 4. 2 year degree        | 8. doctoral degree      |

How long have you been experiencing back pain?

\_\_\_\_\_ years \_\_\_\_\_ months

Have you had previous surgery for back pain? (circle one) Yes No

If yes, how many surgeries and what are the dates for each:

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Do you smoke? (circle one) Yes No

If yes, when did you begin smoking: \_\_\_\_\_ How many packs of cigarettes  
do you currently smoke per day? \_\_\_\_\_  
Mo/Yr

If you have smoked in the past please indicate:

When you began: \_\_\_\_\_

When you quit: \_\_\_\_\_

How many packs smoked per day:

Use the following scale to indicate the degree of stress you are currently experiencing:  
(circle one)

1            2  
Little or No  
Stress

3

4

5

6

7

Very High Level  
of Stress

Please indicate the number of persons in each category below that you feel are currently available to offer significant emotional support before, during and after your back surgery:

		How adequate is this support (circle one for each category)						
		Not at all Adequate						Totally Adequate
# Family Members:	_____	1	2	3	4	5	6	7
# Friends:	_____	1	2	3	4	5	6	7
# Co-Workers:	_____	1	2	3	4	5	6	7
# Others:	_____	1	2	3	4	5	6	7

## Appendix C: Back Pain Questionnaire

1. Do you have any pain in the back? (Yes/No)  
How severe is it on a scale ranging from 0 to 7 where 0 equals no pain and 7 equals intolerable pain?
2. Do you have any pain in the night? (Yes/No)  
How severe is it on a scale ranging from 0 to 7 where 0 equals no pain and 7 equals intolerable pain?
3. If activity give you pain, how much activity does it take to give you backache?  
Please rate on a 0 to 7 scale where 0 equals a great deal and 7 equals almost none.
4. Do you get relief from pain killers? (Yes/No)  
Please rate on a 0 to 7 scale where 0 equals complete relief and 7 equals no relief.
5. Do you have any stiffness in the back? (Yes/No)  
Please rate on a 0 to 7 scale where 0 equals no stiffness and 7 equals intolerable stiffness.
6. Does you back pain interfere with your freedom to walk? (Yes/No)  
Please rate on a 0 to 7 scale where 0 equals complete freedom to walk and 7 equals completely unable to walk because of pain.
7. Do you have discomfort when walking? (Yes/No)  
Please rate on a 0 to 7 scale where 0 equals none at all and 7 equals intolerable.
8. Does your pain interfere with your ability to stand still? (Yes/No)

Please rate on a 0 to 7 scale where 0 equals able to stand still for a long time, that is an hour; and 7 equals not able to stand still at all.

9. Does your pain prevent you from turning and twisting? (Yes/No)

Please rate on a 0 to 7 scale where 0 equals complete freedom to twist and 7 equals completely incapable of twisting.

10. Does your back pain allow you to sit on an upright hard chair? (Yes/No)

Please rate on a 0 to 7 scale where 0 equals complete freedom to sit on a hard chair and 7 equals so much pain that I cannot sit on such a chair at all.

11. Does your back pain prevent you from sitting in a soft chair? (Yes/No)

Please rate on a 0 to 7 scale where 0 equals complete comfort and 7 equals such discomfort that I cannot sit in a soft chair at all.

12. Do you have back pain when lying down in bed? (Yes/No)

Please rate on a 0 to 7 scale where 0 equals complete comfort and 7 equals none at all.

13. What is your overall handicap in your complete life-style because of back pain?

Please rate on a 0 to 7 scale where 0 equals completely free to perform any task and 7 equals totally handicapped.

14. To what extent does your pain interfere with your work?

Please rate on a 0 to 7 scale where 0 equals no interference at all and 7 equals totally incapable of work.



15. To what extent does your work have to be modified so that you are able to do your job?

Please rate on a 0 to 7 scale where 0 equals no adjustment to work and 7 equals so much adjustment that you have had to change your job.

## Appendix D: Stauffer and Coventry Index

1. Since your surgery, how much pain relief have you experienced in your back and lower extremities? Please provide a percent rating from 0 to 100.
2. With regard to your employment after surgery, which of the following best describes your status after surgery?
  - 1 = Return to previous work status following surgery
  - 2 = Return to less strenuous work following surgery
  - 3 = No return to work following surgery
3. With regard to your physical activities after surgery, which of the following best describes your status after surgery?
  - 1 = Minimal or no restrictions of physical activities
  - 2 = Moderate restrictions of physical activities
  - 3 = Severe restrictions of physical activities

## Appendix E: Disability Questionnaire

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

This list contains some sentences that people have used to describe themselves when they have back pain. When you read them, you may find that some stand out because they describe you today. As you read the list, think of yourself today. When you read a sentence that describes you today, put a check next to it. If the sentence does not describe you, then leave the space blank and go on to the next one. Remember, only check the sentence if you are sure that it describes you today.

1. I stay at home most of the time because of my back.
2. I change positions frequently to try and get my back comfortable.
3. I walk more slowly than usual because of my back.
4. Because of my back, I am not doing any of the jobs that I usually do around the house.
5. Because of my back, I use a handrail to get upstairs.
6. Because of my back, I lie down to rest more often.
7. Because of my back, I have to hold on to something to get out of an easy chair.
8. Because of my back, I try to get other people to do things for me.
9. I get dressed more slowly than usual because of my back.
10. I only stand up for short periods of time because of my back.
11. Because of my back, I try not to bend or kneel down.

12. I find it difficult to get out of a chair because of my back.
13. My back is painful almost all the time.
14. I find it difficult to turn over in bed because of my back.
15. My appetite is not very good because of my back pain.
16. I have trouble putting on my socks (or stockings) because of the pain in my back.
17. I only walk short distances because of my back pain.
18. I sleep less well because of my back.
19. Because of my back pain, I get dressed with help from someone else.
20. I sit down for most of the day because of my back.
21. I avoid heavy jobs around the house because of my back.
22. Because of my back pain, I am more irritable and bad tempered with people than usual.
23. Because of my back, I go up stairs more slowly than usual.
24. I stay in bed most of the time because of my back.

## CURRICULUM VITAE

David Shearer  
(September 2000)

## EDUCATION

- Ph.D. Utah State University, Logan, Utah. (Expected August 2000)  
Combined Clinical/Counseling/School Psychology Program  
Full APA Accreditation  
Major Professor: Kevin S. Masters, Ph.D.  
Specialization: Behavioral Medicine, Child/School Psychology  
Dissertation: The MMPI-2 and Low-Back Pain Surgery Outcome
- M.S. Utah State University, Logan, Utah, June, 1998.  
Major: School Psychology  
Full NASP Accreditation  
Major Professor: Gretchen A. Gimpel, Ph.D.  
Certified School Psychologist, K - 12, State of Utah
- M.S. University of Idaho, Moscow, Idaho, May 1995.  
Major: Clinical Psychology  
Major Professor: David Christian, Ph.D.  
Thesis: Personality and Academic Risk Status in University Students
- B.A. University of California - Santa Barbara. August 1990.  
Major: Psychology GPA: 3.93

## CLINICAL EXPERIENCE

- 1997 - Present Psychometrician, Cher King, PhD, Private Practice, Ogden, Utah.  
Responsibilities include psychological testing, diagnosis and report writing for adolescents in youth corrections; and psychological testing, observation, diagnosis and evaluation for child custody evaluations.  
Hours: 140. Supervisor: Cher King, PhD

- 1998 - 1999 Therapist, Psychology Community Clinic, Utah State University Practicum. Provide individual, couple, family and child therapy; generalized anxiety, depression, pain disorders, personalty disorders, phobias, anger management, and crisis intervention. Conduct diagnostic evaluations and responsible for case management.  
Hours: 450. Supervisors: Kevin Masters, PhD, Scott Blickenstaff, PhD
- Summer 1998 Pain Management Therapist, Pain Management Center, University of Utah Practicum. Responsibilities included psychological evaluation and diagnosis of pain patients in a multidisciplinary setting, behavioral treatment of pain disorders, and report writing.  
Hours 100. Supervisor: Bruce D. Etringer, PhD
- 1997 - 1998 Psychological Assistant, Clinical Services, Center for Persons with Disabilities, Utah State University. Responsibilities included: psychological assessment, diagnosis and treatment planning for children and adolescents with mental disorders in including pervasive developmental disorders, mood disorders, anxiety disorders, mental retardation, behavior disorders, and learning disabilities. Psychological report writing, supervision and training of graduate students, behavioral consultation with schools, and psychotherapy were provided in a multidisciplinary setting.  
Hours 600. Supervisor: Phyllis Cole, PhD
- 1997 - 1998 Therapist, Student Counseling Center, Utah State University Practicum. Provided individual therapy; anxiety, depression, personality disorders, relationship problems. Conducted intake evaluations and responsible for case management.  
Hours: 300. Supervisors: David Bush, PhD, Gwena Coulliard, PhD
- 1996 -1998 Therapist, Child Evaluation and Treatment Center, Logan, Utah. Responsibilities included treatment of psychological disorders in children, adolescents, adults and families. Psychological evaluation and report writing for children and adolescents.  
Hours: 200. Supervisor: Steven Gentry, PhD
- 1996 - 1997 School Psychology Practicum Student, Ogden City Schools. Psychological and psychoeducational evaluation of preschool and elementary students for classification and placement purposes. Responsibilities included development and implementation of behavioral modification

interventions, report writing, and teacher consultation.  
Hours: 300. Supervisor: Cher King, PhD

- 1995 - 1997 Psychometrician/Mental Health Specialist, Community Family Partnership, Center for Persons with Disabilities, Utah State University. Responsibilities included: psychological assessment  
  
(Battelle, WISC-III, WPPSI-R, Vineland Adaptive Behavior Scales, SCL-90-R, MMPI-2), individual, couple, family and child therapy.  
  
Hours: 1200. Supervisors: Michelle-Ann Robinson, PhD, Pat Truhn, PhD
- 1994 - 1995 Therapist, Student Counseling Center, University of Idaho Practicum.  
  
Provided individual and group therapy; anxiety, depression, relationship problems. Conducted diagnostic evaluations and responsible for case management.  
Hours: 300. Supervisors: Martha Kitzrow, PhD, Debra Goldstein, PhD
- 1994 Therapist, Psychology Clinic, University of Idaho Practicum. Provided adult individual therapy and case management; personality disorders, anger management, depression.  
Hours: 150 Supervisors: David Christian, PhD, Laurie Wilson, PhD
- 1993 - 1994 Psychometrician/Therapist, Neuropsychology Clinic, Psychology Department, University of Idaho Practicum. Administration, scoring and interpretation of Halstead-Reitan Neuropsychological Battery under the supervision of a licensed clinical psychologist. Provided individual, couple and court-mandated therapy.  
Hours: 100. Supervisors: Robert Gregory, PhD, Laurie Wilson, PhD
- 1993 Mental Health Worker, North Coast Rehabilitation Hospital, Santa Rosa, California. Responsibilities included structure management in a psychiatric out-patient hospital, co-facilitation of group psychotherapy, and development and management of transportation services.  
Hours: 500. Supervisor: Vicki Flarherty, PhD

- 1991 - 1993 Counselor, Family Life Center Residential Treatment Program, Petaluma, California. Senior shift counselor in a residential treatment program for severely emotionally disturbed adolescents. Responsibilities included treatment planning and implementation, structure management, group facilitation and staff training. Hours: 3800. Supervisor: Craig Goishi, PhD

#### TEACHING EXPERIENCE

- 1998 - 2000 Graduate Teaching Assistant, Introduction to Psychology 1010, Utah State University. Responsibilities include lecture preparation and delivery, test construction and administration, student consultation and maintenance of course grades. Supervisor: Mark Nafziger, PhD
- 1994 Graduate Teaching Assistant, Group Facilitation, Psychology 499/502, University of Idaho. Co-taught a combined graduate/undergraduate group facilitation skills class with a psychology department faculty member. Responsibilities included curriculum development, teaching, grading and student consultation. Supervisor: David Christian, PhD
- 1994 Graduate Teaching Assistant, Psychology of Learning, Psychology 390, University of Idaho. Responsibilities included lecture preparation and delivery, test construction and administration, student consultation and maintenance of course grades. Supervisor: Justin Hollands, PhD
- 1989 - 1990 Instructor, Communication and Counseling Skills Class, New Directions in Counseling, Santa Barbara, California. Co-taught an adult communication and counseling skills class. Topics covered included basic therapeutic communication skills, active listening, techniques for self-understanding and the formation and maintenance of the therapeutic relationship. Supervisor: Barbara Reiner, MA, MFCC

#### RESEARCH EXPERIENCE

- 1996 - 1999 Research Assistant, Utah State University, A research grant to study the relationship between the MMPI-2 and surgical outcome in low-back



patients. Responsibilities include literature reviews, participant recruitment, instrument administration, data collection, supervision of research assistants, and assisting with analysis and interpretation.  
Supervisor: Kevin S. Masters, PhD

- 1997 Research Assistant, Utah Lumbar Fusion Outcome Study, A state-wide survey of lumbar fusion outcome for patients receiving compensation from the Workers Compensation Fund of Utah. Responsibilities included assisting in the development of survey materials and conducting telephone surveys with patients. Supervisor: Kevin S. Masters, PhD
- 1995 *Master's Thesis*, University of Idaho, Shearer, D. S. Personality and academic risk status in university students. Assessment of personality variables associated with college students academically at-risk to drop out of college or experience low achievement. Supervision of undergraduate research assistants was provided. The resulting data was used to inform the content of an intervention program designed for at-risk freshmen at the University of Idaho.  
Thesis Chair: David Christian, PhD
- 1994-1995 Research Assistant, University of Idaho, Assisted in the continued development, refinement, and expansion of a cognitive-behavioral program designed to increase achievement in college students. Responsibilities included data collection, program delivery, and assisting in the analysis and interpretation of results. Supervisor: David Christian, PhD

#### OTHER EXPERIENCE

- 1993 - 1995 *Academic Advisor*, College of Letters and Science, University of Idaho. Responsible for undergraduate academic advising, career/major advising, work with academically at-risk students, campus resource referrals, consultation with departmental faculty and delivery of freshman orientation presentations. Supervisor: Dene Thomas, PhD

#### ORGANIZATIONAL ACTIVITIES

Graduate Student Representative, University of Idaho Psychology Department Tenure Advisory Committee, 1994-1995.

Graduate Student Representative, Utah State University, 1997-1998.

Student Affiliate, American Psychological Association

Student Member, California Psychological Association

Student Member, Western Psychological Association

Member, Toastmasters International Club #8663. Offices: Secretary and Treasurer, 1993 - 1995.

## HONORS

Highest Honors, University of California - Santa Barbara, August 1990.

Dean's Honor List, University of California - Santa Barbara, 1988 - 1990.

Highest Honors, Santa Rosa Junior College, May 1988.

## ABSTRACT PUBLICATIONS

Masters, K. S., & Shearer, D. S. (1997). Aerobic exercise under competitive conditions mitigates positive emotional response among type A individuals. Medicine and Science in Sports and Exercise, 29 (Suppl. 5), 122.

Masters, K. S., Shearer, D. S., Ogles, B. M., & Schleusener, R. L. (1998). Pre-surgical MMPI-2 cluster profiles in low-back pain patients. Annals of Behavioral Medicine, 20, (Supplement), S139.

## PUBLICATIONS

Stewart, K., & Shearer, D. S. (1999). The impact of parenting style on elementary school student behaviors. Presented at the 1999 annual National Association of School Psychologists Conference, Las Vegas, Nevada.

Shearer, D. S., & Stewart, K. (1998). The relationship between Attention Deficit/Hyperactivity Disorder, the TOVA and the ADDES: Implications for diagnosis. Presented at the 1998 annual Virginia Beach Conference, Virginia Beach, Virginia.

Masters, K. S., Shearer, D. S., & Ogles B. M. (1998). MMPI-2 cluster profiles predict low back surgery outcomes. Presented at the August, 1998 annual American Psychological Association Conference, Chicago, Illinois.

Masters, K. S., Shearer, D. S., & Ogles, B. M. (1998). Presurgical MMPI-2 cluster profiles in low-back pain patients. Presented at the March, 1998 annual Society of Behavioral Medicine Conference, New Orleans, Louisiana.

Stewart, K., & Shearer, D. S. (1998). Internalizing symptoms in school-aged children: Stability, recognition and measurement. Presented at the February, 1998 annual Utah Association of School Psychologists Conference, Salt Lake City, Utah.

Masters, K. S., Ives, D. E., & Shearer, D. S. (1997). Religious orientation differentially impacts guilt and hostility. Presented at the April, 1997 annual Western Psychological Association Conference, Seattle, Washington.

Masters, K. S., Ives, D. E., & Shearer, D. S. (1997). Religious orientation as a predictor of Type A hostility. Presented at the August, 1997 annual American Psychological Association Conference, Chicago, Illinois.

Masters, K. S., & Shearer, D. S. (1997). Aerobic exercise under competitive conditions mitigates positive emotional response among Type A individuals. Presented at the May, 1997 annual American College of Sports Medicine Conference, Denver, Colorado.

Shearer, D. S., & Merrell, K. W. (1997). Characteristics of antisocial behavior in school age children and adolescents: Implications for the treatment of "controversial" students. Presented at the February, 1997 annual Utah Association of School Psychologists Conference, Salt Lake City, Utah.

Christian, D., & Shearer, D. S. (1995, April). Motivating academically at-risk undergraduates: A preliminary trial of the CHANGES program. Presented at the annual Rocky Mountain Psychological Association Conference, Boulder, Colorado.

#### INVITED PRESENTATIONS

Shearer, D. S. (1994, Fall). Academically at-risk college students and personality. Presentation given at the University of Idaho Advisory Council meeting at the invitation of the University of Idaho College of Letters and Science.

Shearer, D. S. (1996, 1997, 1998 Spring). Treatment alternatives for the management of anger and violent behavior in male populations. Presentation for a Men's Issues section of a transcultural assessment course, Utah State University.