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Musculoskeletal Status and Disability of MMPI Profile Subgroups Among Patients With Low Back Pain

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The Minnesota Multiphasic Personality Inventory (MMPI) profiles of 205 male and 157 female patients with acute and chronic low back pain (LBP) were studied for replicable homogeneous subgroups using three cluster-analysis procedures. Two normal and three clinically elevated profile subgroups were identified. The two normal subgroups were characterized by relatively normal musculoskeletal condition and were least disabled, but they differed somewhat from each other in duration of pain, presence of physical abnormalities, and daily functioning. The third subgroup had the following characteristics: an elevated neurotic triad, greatest duration of symptoms, most abnormal physical findings, greatest limitation of motion, most pain complaints during physical examination, and the fewest number of intact functional activities. The fourth subgroup, with an elevated neurotic triad plus subclinical elevations on other scales, had somewhat less musculoskeletal impairment but had extensive work disability, financial compensation, and previous surgeries. The fifth and most pathologic profile subgroup surprisingly consisted largely of acute-pain patients whose musculoskeletal condition and daily functioning were similar to those of the normal subgroups. Patients in the three abnormal MMPI subgroups were exposed to more LBP physical-risk factors in the workplace. Implications for psychological treatment with these different profile types are discussed.

Key words: chronic low back pain (LBP), Minnesota Multiphasic Personality Inventory (MMPI) profiles, cluster analysis

A recent advance for the interpretation of the Minnesota Multiphasic Personality Inventory (MMPI) with pain patients is the identification of homo-

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geneous profile subtypes using multivariate cluster analysis (Lorr, 1983). The advantage of being able to interpret several common MMPI profile types instead of only the normal or elevated "neurotic triad" types, is that the MMPI could be employed with greater specificity for diagnosis and treatment recommendations.

To date, eight cluster-analytic studies of MMPI profiles in pain patients have been reported (Armentrout, Moore, Parker, Hewett, & Feltz, 1982; Bernstein & Garbin, 1983; Bradley, Prokop, Margolis, & Gentry, 1978; Bradley & Van der Heide, 1984; McCreary, 1985; McGill, Lawlis, Selby, Mooney, & McCoy, 1983; Prokop, Bradley, Margolis, & Gentry, 1980; Snyder & Power, 1981). The participants in all these investigations were exclusively or primarily chronic-pain patients who had no demonstrable organic basis for their pain. Although chronic-pain patients are more likely to require psychological assessment, subgroups among the chronic patients may not generalize to other pain patients. There is good reason to believe that chronic-pain patients are quite different from acute-pain patients. The psychological stresses stemming from the pain, disability, and medical treatments in the acute phase of low back pain are probably quite different from those of the chronic, long-term phase (Keefe & Brown, 1982). Indeed, patients in the chronic phase of pain disorders have been shown to be less well-adjusted psychologically than patients having pain of shorter duration (Beals & Hickman, 1972; Garron & Leavitt, 1983; Sternbach, Wolf, Murphy, & Akeson, 1973). There also is good reason to believe that patients without clear-cut physical findings differ psychologically from patients having an identifiable organic disorder. Many previous studies have shown that patients without a definite physiologic basis for their pain have more pathological profiles than do other patients (cf. Rosen, Frymoyer, & Clements, 1980). It is possible that patients without diagnostic physical findings may have psychophysiologic pain disorders, may be experiencing greater stress, and may possess more maladaptive behavioral traits. On the other hand, the inability of the physician to give a definite, physical explanation for pain can be quite distressing for many patients. It can be argued that if this ambiguity was removed by a definite medical diagnosis for their pain and disability, such patients might not exhibit psychological symptoms as intensely. One purpose of our study was to sample pain patients representing a broad range of these important low-back-pain (LBP) variables—chronicity and medical diagnosis—and to see whether a cluster analysis of such a population would yield the same MMPI subgroups as found in previous studies.

An additional concern was that, in order for the subgroups derived by cluster analysis to be useful for diagnosis and treatment design, it would be necessary to determine the pain and disability correlates of the different subgroups (Blashfield, 1980; Bradley & Van der Heide, 1984; Chignell & Stacey, 1981). Several cluster-analytic studies have already reported differences among

MMPI profile subgroups on various patient characteristics. Profile subgroups have been related to pain experience (Armentrout et al., 1982; Bradley & Van der Heide, 1984; McCreary, 1985; McGill et al., 1983; Snyder & Power, 1981), medical utilization (Bradley & Van der Heide, 1984; McGill et al., 1983; Snyder & Power, 1981), illness behavior (Armentrout et al., 1982; McGill et al., 1983; Snyder & Power, 1981), psychological distress and somatization (Armentrout et al., 1982; Bradley & Van der Heide, 1984), and range of motion (McGill et al., 1983). Probably because these studies included mostly chronic, intractable-pain patients, the expected differences between MMPI subgroups on these variable sometimes failed to emerge. However, the general trend in these four studies has been a positive relationship among elevation of the MMPI, self-reported pain, and disabling effects on activities. Almost no attention has been given to important musculoskeletal dimensions on which LBP patients vary, such as the degree of physical abnormality, physical performance, and diagnosis. If musculoskeletal and disability status were related to profile subtype, it would be possible to describe these subtypes in terms of both behavioral and physical characteristics and, possibly, to make more specific recommendations for intervention. Therefore, a purpose of our study was to add such musculoskeletal measures to the usual methods of self-rating of pain and disability and to determine the relationship of profile type to a full complement of pain correlates.

METHOD

Participants

In a LBP clinic of the Department of Orthopaedics at the University of Vermont, we enrolled 362 outpatients into this study over a 2-year period. The racial/ethnic makeup of the study population was essentially all White; there were 1 Black, 1 Asian, and 2 Hispanic patients. There were 205 and 157 female patients. There was no significant difference in age between males (M = 37.7 years, SD = 11.4 years, range = 16 to 67 years) and females (M = 36.1 years, SD = 11.8 years, range = 14 to 74 years).

Two measures of LBP duration were obtained: (a) length of time since the first episode of LBP and (b) duration of the current pain episode. The distributions of time since onset of first and current pain episodes were highly skewed toward episodes of shorter duration, so the central tendencies are best represented by the median rather than the mean. Median length of time since onset of the first episode of pain was 4 years, 2 months (range = 1 week to 37 years). Median length of time since onset of the current episode of pain was 4 months (range = 1 week to 10 years). Using a cutoff point of 6 months to separate acute from chronic cases, 62% of the sample had a current pain

duration of 6 months or less. The onset of the first-ever episode of pain was within the last 6 months for 19% of the patients. The most common history of these patients typically included several episodes of mild-to-moderate LBP over a period of years prior to the current, usually acute, episode.

Physician Ratings

Diagnosis. Based on a physical examination, outside medical reports, and objective test findings (e.g., radiographs and electromyographs), a diagnosis was assigned from one of four categories (see Pope, Wilder, Stokes, & Frymoyer, 1979, for full description):

1. Structural abnormalities exclusive of systemic diseases affecting the spine, including spondylolisthesis, extreme scoliosis, segmental instability, facet disease, ankylosing spondylitis, and fractures.
2. Disc disease including herniated disc and/or spinal stenosis.
3. Previous surgery, that is, a history of one or more lumbar spinal operations with residual symptoms and no other specific disease.
4. Specific etiology not confirmed, including LBP attributable to musculoskeletal strain or LBP symptoms inconsistent with typical disease patterns.

No reliability check on these diagnoses was taken.

Appropriateness of disability. Patients were classified by the orthopedic surgeon during their clinic visit as *appropriately disabled* or *excessively disabled.* This rating was a subjective judgment of whether the patient reported undue pain and disability. It was not a rating of the presence of "hard findings" or organicity but rather a rating of the patient's degree of disability relative to the physical findings. Because excessive disability and evidence of physical disease were not mutually exclusive, it was possible, for example, for a participant to have definite disc disease and still be classified as excessively disabled on the basis of magnified pain symptoms, prolonged absence from work, avoidance of most activities of daily living, dependence on analgesics, or lack of active participation in the back-care program. Magnified pain symptoms referred to intense pain associated with activity that should not strain the back or pain that was unresponsive to narcotics. Inappropriate avoidance of activity referred to gross avoidance of activity past a normal period of rest, especially avoidance of activities that should not strain the back. The intrarater reliability for this classification was 92% on a subsample of 20%. This was tested at least several months after all the participants were evaluated and as long as 2 years later. Another precaution taken to reduce the possibility of recall influencing the reliability was that the orthopedist classified the cases with all the identifying information removed.

Physical Examination

In addition to an orthopedist's examination, patients were given a standardized physical examination by a physical therapist which was based on an examination procedure described in detail elsewhere (Keim & Kirkaldy-Willis, 1980). This examination proceeded in a systematic manner to assess the trunk, hips, and legs along the following dimensions: active and passive range of motion, active and resistive muscle strength, pain during motion, cardiovascular status, and neurologic status including straight-leg raising and reflex testing. In total, the physical examination included 71 ratings by the physical therapist, which were then combined for data analysis into three measures of biomechanical and clinical significance:

1. *Structural and neurologic abnormalities* was the total count of abnormal ratings out of 14 for posture, range-of-motion for the lumbar spine, trunk strength, gait, leg strength, reflexes, leg measurements, hip range-of-motion, nerve root tests, passive mobility tests, chest expansion, and Trendelenburg sign. This was considered a relatively "pure" measure of physical abnormalities.
2. *Spinal motion* was the number of limited spinal motions for 12 movements involving flexion, extension, lateral bending, and trunk rotation. Though limited spinal motion is often associated with back disorders, the range of spinal motion can also be a matter of how willingly the patient tolerates discomfort. Patients who are pain sensitive will often restrict their motion to avoid pain even though they are physically capable of greater movement. In a previous study, for example, we reported that range of spinal motion was associated with hypochondriasis on the MMPI (Pope, Rosen, Wilder, & Frymoyer, 1980). Accordingly, we conceptualized this variable as measuring both physical abnormality and pain behavior.
3. *Pain during movement* was the number of times that the patient reported pain out of 47 tests of movement or strength. This variable was considered primarily a measure of pain behavior.[1]

LBP Questionnaire

Participants completed a questionnaire designed to measure degree of pain, disability, and adjustment to low back disease. Intensity of pain was assessed using a 5-point numerical rating scale ranging from *no pain* (1) to *excruciating pain* (5). For a measure of functional impairment, patients endorsed activities that significantly increased their LBP; the 12 activites were sitting,

[1]A complete list of the ratings comprising each variable is available on request from the authors.

walking, lifting, bending, twisting, walking upstairs, carrying, making a bed, stooping over a sink, riding in a car, doing prescribed low back exercises, and performing recreational exercise. They were asked whether they had to engage in or were exposed to various risk factors for LBP on the job, including frequent or prolonged sitting, twisting, medium-weight lifting, heavy-weight lifting, and vibration from equipment. In regard to work, patients indicated (a) whether their back was injured on the job, (b) their current employment status, and (c) any wage replacement compensation that they received including vocational rehabilitation, public assistance, Social Security disability, unemployment compensation, workman's compensation, or veteran's disability pension. Finally several questions were included which related to the participants' perceptions of their illness and medical care.

MMPI and Cluster Analysis

Participants were administered the standard MMPI. A cluster analysis was then performed using the 3 validity and 10 clinical scales. Previous investigators (e.g., Bradley et al., 1978) have used only a single clustering procedure, but there is some debate over which of several cluster-analytic procedures should be used with behavioral data. Each algorithmic method has its own merits and the clustering solutions sometimes differ (Blashfield & Morey, 1980; Lorr, 1983; Lorr & Suziedelis, 1982). In addition, a solution derived from one cluster analysis needs to be shown to be reliable or replicable using either another cohort or another cluster procedure. If only one clustering procedure is used with a single cohort, there is a greater likelihood of deriving an unreliable set of subgroups. To maximize reliability of the clustering solution for this cohort and to incorporate the advantages of several algorithmic techniques we followed Blashfield's (1980) recommendations that more than one cluster-analytic procedure be used if only one cohort is available. Two hierarchical clustering procedures of the Biomedical Data Program statistical software package (Dixon, 1981) were used, *cluster analysis of cases* and *cluster analysis of variables,* along with one divisive method, the *K-means* program. Cluster analysis of cases uses Euclidean distance as a similarity measure, which when forming subgroups would tend to accentuate similarities in profile elevation. Cluster analysis of variables uses product-moment correlation for a similarity measure, which would accentuate profile configuration similarities. By emphasizing profile configurations, the analysis-of-variables method avoids creating clusters that differ only on a general sickness–health continuum as a result of differences in profile elevation. The data matrix was transposed to apply this program for cluster analysis of cases. The K-means clustering-of-cases method partitions the cases into user-specified numbers of clusters; successive runs of two to eight clusters were made. MMPI profile

subgroups were developed from these three clustering procedures by selecting those profile types that consistently appeared across procedures and were therefore most reliable. The general configurations of these profile types were then used as starting centroids for a second K-means partitioning of cases to finalize subgroup membership. In partitioning all cases into a final cluster, subgroup sizes were maintained at a reasonable level although risking a slight dilution of pure subtypes (see Edelbrock, 1979, for discussion of 100% coverage of cases). The final subgroups were highly concordant with the intermediate solutions, particularly with the clusters found in the solution emphasizing profile shape rather than elevation. Cluster analyses were performed to identify homogeneous MMPI profile subgroups with the male and female samples separately and for the total sample. (See Grubman, 1984, for a complete description of the cluster-analytic procedure used.)

RESULTS

MMPI Subgroups

The same basic MMPI configurations were found for the male, female, and total samples. Further, subgroup membership for those in the male and female subgroups did not change significantly when subgroups for the total sample were derived. There was sufficient similarity between the clustering solutions to conduct the descriptive analyses with subgroups of the total sample instead of separate analyses for male and female subgroups. The subgroups for the total sample are shown in Table 1.

Subgroup 1. These patients had mild elevations on the Psychopathic Deviate (Pd), Masculinity–Femininity (Mf), and Hypomania (Ma) scales and somewhat lower scores on Depression (D) and Social Introversion (Si) compared with Subgroup 2. (See Figure 1 for a graphic representation of the total-sample subgroups.) They were not psychologically distressed and they may have exhibited some behavioral tendencies well suited for adapting to low back disease including being active, energetic, ambitious, outgoing, and assertive (Graham, 1977).

Subgroup 2. This group exhibited a normal-range profile with a mild elevation of the neurotic triad and a lack of elevation on the other scales. Although this profile type is closer to the mean on several clinical scales than Subgroup 1, we interpret this profile as perhaps lacking some of the strengths of Subgroup 1. Specifically, these patients may be less active, energetic, ambitious, and outgoing even though they are still within the normal range.

TABLE 1
MMPI T-Score Means and Group Membership by Sex for the Total-Sample LBP Subgroups

	Subgroup				
MMPI Scale	*1*	*2*	*3*	*4*	*5*
L	49.8	50.9	55.7	55.3	45.7
F	55.3	51.5	54.3	62.4	69.3
K	57.3	55.3	60.1	53.0	44.8
Hs	55.1	56.2	74.9	80.1	73.7
D	54.7	57.2	65.7	83.3	67.9
Hy	60.9	59.8	73.2	79.3	70.6
Pd	61.1	52.8	61.5	67.3	73.3
Mf	61.7	48.4	54.4	54.7	60.4
Pa	59.4	52.7	54.8	63.6	72.1
Pt	54.9	51.2	56.0	68.3	70.1
Sc	57.8	50.8	56.9	66.7	75.8
Ma	63.7	50.3	52.7	51.0	73.8
Si	45.7	51.8	50.1	61.7	56.7
Male (*n*)	48	64	49	25	17
Female (*n*)	21	93	26	13	6
Total (*N*)	69	157	75	38	23

Subgroup 3. The third group had significant elevations on the Hypochondriasis (Hs) and Hysteria (Hy) scales, mild elevation on the D scale, and the other scales were within or close to one standard deviation above the mean. This profile is similar to the elevated neurotic triad which is frequently reported for chronic pain patients. These patients are suffering from a mild-to-moderate depression and tend to be preoccupied with unpleasant somatic symptoms, but they are the least psychologically dysfunctional of the three clinically elevated profile types. According to the MMPI, they should not have serious problems in relationships or major coping deficits.

Subgroup 4. The fourth group was characterized by marked elevations on scales D, Hs, and Hy with moderate elevations on Psychasthenia (Pt), Pd, Schizophrenia (Sc), and Paranoia (Pa), and F greater than K. Patients with this MMPI profile are suffering from moderate-to-severe depression, accompanied by other mood disturbances including anger, irritability, and anxiety. They tend to be preoccupied with an unusual degree of somatic distress. In addition, these individuals are likely to be filled with self-doubt, are untrusting and uncomfortable with other people, and perhaps are socially alienated.

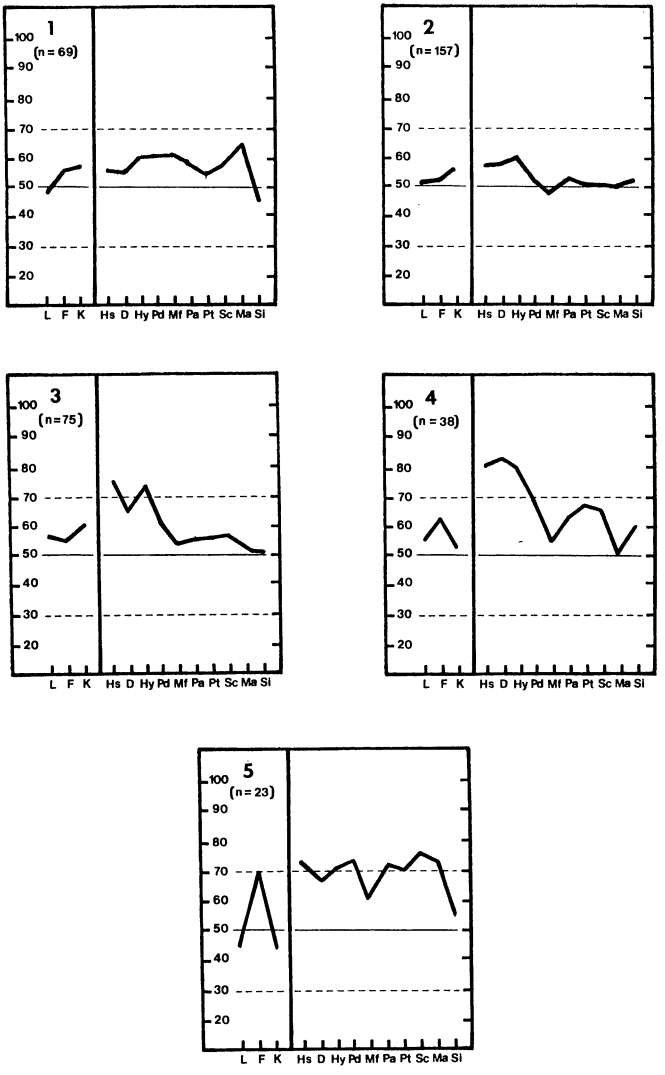

FIGURE 1 MMPI subgroups for the total sample.

Subgroup 5. A prominent F scale and significant elevations on most of the clinical scales characterized this group. As the least homogeneous subgroup in the clustering solution, these patients were alike in being significantly more psychopathologic than the rest of the study population. Individuals with this profile have traditionally been considered to have longstanding psychopathology and to exhibit mood disturbance, somatic preoccupation,

impairment of relationships, and possibly psychotic symptoms. This is the one subgroup in which somatic preoccupation was likely to be overshadowed by other psychopathologic conditions.

Sex and age differences. Males and females differed significantly in their subgroup membership, $\chi^2(4) = 28.84$, $p < .001$ (see Table 1). Nearly half the male patients (45%) were in one of the three clinically disturbed subgroups (3, 4, or 5) whereas only 28% of the females were in one of these subgroups. An analysis of variance (ANOVA) revealed a significant difference in age among the subgroups, $F(4, 354) = 3.87$, $p < .001$. Patients in Subgroup 4 were significantly older ($M = 40.7$ years) than those in the other subgroups. Those in Subgroups 2 and 3 (Ms = 37.5 years and 37.9 years) were also significantly older than those in Subgroups 1 and 5 (Ms = 33.8 years and 32.6 years).[2]

Pain Variables

The MMPI subgroups were significantly different from each other on nearly all measures of pain and disability including length of time since first pain episode, duration of current pain, orthopedic diagnosis, physical abnormalities, range of motion, pain responses on physical examination, impairment of daily activities, exposure to vibration and heavy lifting in the workplace, financial compensation for pain, employment, emotional impact of illness, previous mental health treatment, and physician rating of disability. Although these differences were statistically significant, it is important to note that some of the differences were of such small magnitude that they may not be dramatically important from a clinical perspective. For example, the subgroups differed from each other on the physical examination measures by a few abnormalities. The subgroups were not significantly different with respect to self-rated pain intensity; exposure to sitting, twisting, and medium-weight lifting in the workplace; and satisfaction with medical care. The means or frequencies for the pain variables and the statistical results can be inspected in Tables 2 and 3 and in Figure 2. Although the magnitude of differences between groups on variables analyzed with the chi square are apparent by inspecting the different percentages, post hoc comparisons with separate two-sample chi squares using the Yates correction were done to identify the strongest differences. To facilitate a comparison of the subgroups across the many variables, results are summarized subgroup by subgroup.

Subgroup 1. This was one of the two youngest subgroups. These patients had the shortest duration of LBP, most being acute cases. They had a

[2]Post hoc analyses for all ANOVAs were performed with the Student Newman-Keuls method.

TABLE 2
Pain, Disability, Work, and Adjustment to Illness for MMPI LBP Subgroups

Variable	Subgroup 1	2	3	4	5	Statistic	df	Post Hoc Comparisons (Subgroups)
Months since first episode of LBP (median)	19.8	37.3	60.6	72.3	37.3	$H = 18.19$***[a]	4	3, 4 > 1, 2, 5[b]
Months duration of current episode of LBP (median)	1.9	4.0	9.8	8.2	5.0	$H = 25.99$***[a]	4	2, 3, 4, 5 > 1; 3, 4 > 2[b]
Pain intensity (1 to 5)	2.1	1.9	2.2	2.3	2.0	$F = 1.38$	4, 205	
Painful activities (0 to 12)[c]	7.2	8.3	10.0	9.1	8.2	$F = 8.31$***	4, 268	2, 3, 4, > 1; 3 > 2, 5[d]
Risk factors on the job (percentage)								
Sitting more than half the time	41.5	39.3	32.2	41.4	35.7	$\chi^2 = 1.37$	4	
Twisting	37.7	41.9	59.3	55.2	50.0	$\chi^2 = 7.48$	4	
Vibration from equipment	7.5	7.7	23.7	20.7	42.9	$\chi^2 = 20.66$***	4	3, 4, 5 > 2; 3, 5 > 1[e]
Lifting 15 to 45 lb	49.1	37.6	59.3	55.2	57.1	$\chi^2 = 9.61$	4	
Lifting more than 45 lb	26.4	20.5	44.1	48.3	50.0	$\chi^2 = 17.57$**	4	3, 4, 5 > 2; 4 > 1[e]
Back was injured while working (percentage)	28.6	23.9	37.9	51.7	53.8	$\chi^2 = 12.54$*	4	3, 4, 5 > 2; 4, 5 > 1[e]
Receiving financial compensation (percentage)	16.7	18.8	37.3	44.8	50.0	$\chi^2 = 18.62$***	4	3, 4, 5 > 1, 2[e]
Currently not working (percentage)	30.0	52.2	57.6	69.0	50.0	$\chi^2 = 13.67$**	4	2, 3, 4 > 1[e]
Not working due to back pain (percentage)	50.0	72.3	82.9	94.4	83.3	$\chi^2 = 11.39$*	4	3, 4, 5 > 1, 2[e]
Weeks not working (median)	21.5	9.0	12.0	75.0	10.0	$H = 6.13$*[a]	4	4 > 1, 2, 3, 5[b]
On sick leave, but still employed (percentage)	87.8	73.3	52.6	39.3	71.4	$\chi^2 = 26.69$***	4	1, 2, 5 > 3, 4[e]
Feel severely handicapped by LBP (percentage)	29.2	36.8	52.5	55.2	35.7	$\chi^2 = 9.59$	4	
Been made miserable by health problems (percentage)	33.3	43.6	62.7	75.9	64.3	$\chi^2 = 20.64$***	4	3, 4, 5 > 1; 3, 4 > 2[e]
Satisfied with medical care for LBP (percentage)	48.9	55.9	39.6	33.3	38.5	$\chi^2 = 6.24$	4	
Had previous mental health treatment (percentage)	13.0	17.1	27.1	51.7	57.1	$\chi^2 = 27.49$***	4	4, 5 > 3 > 1[e]
Disability is excessive to physical findings (orthopedist's rating in percentage)	33.3	28.7	65.0	77.8	53.3	$\chi^2 = 26.11$***	4	3, 4 > 1, 2[e]

Note. The sample sizes for the dependent variables differed slightly.

[a]Kruskal–Wallis one-way ANOVA.

[b]Mann–Whitney U test.

[c]Sitting, walking, lifting, bending, twisting, walking up stairs, carrying, making a bed, stooping over a sink, riding in a car, prescribed exercises, recreational exercise.

[d]Newman–Keuls comparison.

[e]Two-sample chi square with Yates correction.

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

TABLE 3
Physical Examination for MMPI Subgroups

Variable	Subgroup 1	2	3	4	5	F	df
Structural/neurologic abnormalities	5.1	6.1	6.7	6.4	6.1	2.58*[a]	4, 217
Number of impaired spinal motions	2.5	3.6	5.7	3.9	3.9	4.17**[b]	4, 214
Number of pain reports during movement	7.6	9.3	11.7	11.4	9.1	2.46*[c]	4, 217

Note. See text for explanation of measures.
[a]Subgroups 2, 3, 4, 5 > Subgroup 1.
[b]Subgroup 3 > Subgroups 1, 2.
[c]Subgroups 3, 4 > Subgroup 1.
$*p < .05$. $**p < .01$.

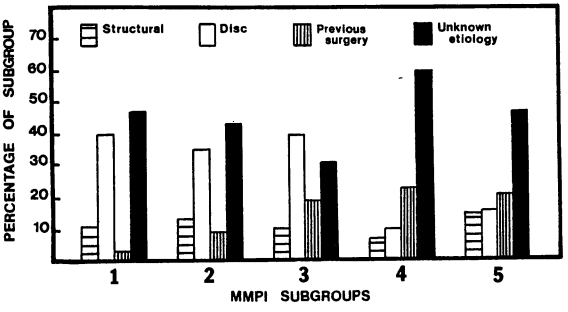

FIGURE 2 Distribution of diagnostic categories across MMPI subgroups, $\chi^2(12) = 26.54, p < .01$.

high rate of disc disease and LBP of unknown etiology and were the least likely to have had previous surgery. On physical examination, they showed the fewest neurologic and structural abnormalities. They were the most flexible in their range of motion and they were least likely to report pain during movement. Similarly, they reported the fewest number of activities at home that were hampered by pain. With respect to work, this subgroup was one of the two subgroups with little exposure to occupational risk factors for low back injury, a low rate of injury on the job, and a low rate of financial compensation. Further, these patients were more likely than others to be working at the time of the evaluation. Those who were not working were more likely than patients in other subgroups to be on sick leave and still employed, rather than having lost their jobs. The orthopedist's independent opinion of these patients indicated that this was one of the two subgroups least likely to exhibit an excessive degree of disability. Finally, they were reasonably satisfied with their professional health-care experiences, least likely to feel handi-

capped or distressed by their illness, and least likely to have had previous mental health treatment.

Subgroup 2. This was the largest group, containing nearly one half of the study population and mostly average-age females. Like Subgroup 1, the majority were acute cases, with the second shortest duration of pain. They had mostly disc disease and back pain of unknown etiology. The rate of previous surgery was second lowest. On physical examination, they showed somewhat more abnormal findings than the other normal-profile subgroup (Subgroup 1) but fewer abnormalities than two of the clinically disturbed profile types. They exhibited few pain responses during motion tests, and had an average range of motion. Relatively few of their activities were hampered by pain. With respect to work, these patients were like those in Subgroup 1 in that they were unlikely to be exposed to occupational risk factors, to be injured on the job, or to be getting financial compensation. They had an average number of unemployment episodes but these tended to be of short duration. Furthermore, they were likely to retain their jobs. The orthopedist considered the disability of this subgroup, like Subgroup 1, to be appropriate given the degree of physical pathology. Most patients were satisfied with their medical care, but compared with Subgroup 1 they were somewhat more likely to feel handicapped or distressed by their illness. Few of these subjects had previous mental health treatment.

Subgroup 3. More subjects exhibited this profile than either of the two other clinically elevated profiles. They were of average age for the study sample, about the same as Subgroup 2 for example, yet their current pain episode was the longest lasting found among all the subgroups and they had the second longest overall history of LBP. The rate of disc disease for this subgroup was about the same as for the two normal subgroups, but higher than for the groups with the other pathologic profiles. More of these patients had undergone surgery, compared with the normal-profile patients. Interestingly, these patients had the lowest rate of unknown etiology for back pain, but their physical examinations indicated they had the most abnormal neurologic and structural findings, most limitation of spinal movement, and most frequent reports of pain during motion tests. In addition, these patients reported the greatest number of activities being affected by pain. In the workplace, there was a higher prevalence of biomechanical risk factors for low-back injury than there was for the psychologically normal subgroups and about the same risk exposure as for the other clinically disturbed subgroups. The subjects were more likely to blame their injury on work activities and to be receiving financial assistance than normals, though less so than the more pathologic profile types. The number of patients not working at the time of the evaluation was approximately average for the study population and about the same as for Subgroups 2 and 5. The duration of vocational disability was relatively short, but they were more likely than normals to become

unemployed. Overall, the sick role of these patients, who had the poorest physical capacity, was not as intense as for Subgroup 4, which was not as orthopedically impaired, but they exhibited more psychopathology. The orthopedist, more often than not, thought the disability of these patients was beyond what would be expected from the physical findings; the excessive disability rate was much higher than in the normal subgroups. Finally, these patients were more likely to be distressed by their illness/disability and to be dissatisfied with health-care services, and they were more likely than the normals to have had previous mental health treatment.

Subgroup 4. These were the oldest patients, with the longest history of LBP and second longest current episode of pain. Very few of them had disc disease; most had pain of unknown etiology. Compared with other subgroups, more of these patients had had previous surgery. On physical examination, these patients had a high number of abnormal findings. Their range of spinal motion was fair, but they frequently complained of pain during the movement tests. In addition, they reported that most activities were hampered by pain. With respect to work, they were likely to be exposed to LBP risk factors, to blame their back pain on work activities, and to be receiving financial compensation. The degree of work disability was severe; they had the highest rate of not working, the longest period off work, and the lowest likelihood of retaining their jobs. More often than for any other subgroup, the orthopedist considered the disabilities of these patients to be in excess of their objective physical limitations. Although these patients were less impaired orthopedically than those in Subgroup 3, their level of pain behavior and disability were more extreme. Finally, these patients were the most distressed by their illness, most dissatisfied with health-care providers, and second most likely to have had previous mental health treatment.

Subgroup 5. In contrast to their severe psychological impairment, these patients did not have severe physical impairments or disabilities. They were largely young, acute patients with a short history of LBP. This subgroup had a high rate of previous surgery and back pain of unknown etiology. On physical examination, these patients appeared most similar to the Subgroup 2 patients. They had an average number of physical abnormalities and limitations of motion and few complaints of pain during movement. Of the clinically disturbed groups, they reported the fewest number of activities hampered by pain and were relatively unlikely to feel handicapped by their condition. The high rate of financial compensation in this subgroup was surprising and seemed unwarranted considering that these patients had average physical and functional incapacity; it may be these patients were being supported on the basis of psychosocial rather than musculoskeletal disabilities. In regard to work, they had an average rate of not working, though their un-

employed periods were of short duration, and they were more likely than patients in the other clinically disturbed groups to retain their jobs. The orthopedist considered the disability in this subgroup to be excessive more often than for those with normal profiles but less likely so than for the other clinically disturbed groups. Finally, these patients were about as distressed by their illness and dissatisfied with health care as the other patients with clinically elevated MMPIs. Significantly, they had the highest rate of previous mental health intervention.

DISCUSSION

The results of this study give further support to the idea that several MMPI subgroups exist within the population of patients suffering from musculoskeletal pain syndromes. Besides differing in their degree of psychopathology, the MMPI subgroups were also distinguished by their pain history, medical diagnosis, physical capacity, disability, and psychological adjustment to illness. Though generally consistent with other cluster analyses of pain patients, our study differed, notably from most in that we found two normal-range clusters. Most normal patients were seen in our study because we had a more representative and acute sample of pain patients, as opposed to the usual chronic, intractable population. Thirty-seven percent of our participants fell into the clinically disturbed profile groups whereas 50% to 75% of participants in other studies exhibited clinically elevated profiles. Our clustering solution corresponds fairly well with other reports, but these solutions would still have to be further validated with other samples to insure generalizability.

The association between pain correlates and profile subtype in this study and others was in good agreement. We used a broader range of pain variables, including more traditional medical methods of evaluating disability and physical status, yet the association of these variables with MMPI profile types was similar to that obtained by other studies using different measures. The fact that the other two studies reporting two normal-range profiles (Bradley & Van der Heide, 1984; McCreary, 1985) also found these groups distinguishable by pain correlates supports our finding that acute-pain patients may differ in their ability to deal with LBP. With one exception (Subgroup 5), more severe psychopathology was associated with worse low-back outcome. There are three studies now (our study; Bradley & Van der Heide, 1984; McGill et al., 1983) that have found such a group of patients with severe psychopathology (our Subgroup 5) who are psychologically impaired but not as disabled or somatically preoccupied as other individuals with clinically elevated profiles. The need for treatment of the serious psychological disorders in such patients would seem to be a priority over focusing on pain

behavior or illness-related stress. The nature of Subgroup 5 in this and other studies is inconsistent with the general assumption that the more severe the psychopathology, the poorer the prognosis for LBP.

In the current study, subgroup membership was confounded by several important dependent variables. This made some findings in the study ambiguous and worth studying further. For example, older age, long history of LBP, severe disability, and psychopathology were patient characteristics that tended to be associated with one another. One view of this is that these patients have had much time for disability to develop. This, in conjunction with the mounting stress of a chronic LBP condition, could have caused psychopathology. An alternative explanation is that the psychopathology could have preexisted the LBP, somehow predisposing younger patients to impaired functioning later in life. Although we did not find an exact correspondence among these variables (e.g., there were some chronic patients in each of the normal MMPI subgroups), age and duration of disability appear to be salient characteristics when patients are clustered by their psychological adjustment. A prospective study of acute patients begun prior to the time when significant disability develops could reveal the directionality of this relationship.

Another confounded relationship is the association of occupational risk factors, disability, and psychopathology. Those in Subgroups 1 and 2 appeared to work in jobs less physically demanding and therefore may have risked little additional injury by resuming their work activities. Individuals in Subgroups 3 and 4 more often had heavy-lifting requirements and exposure to vibrating equipment on the job, so that they may have suffered more severe injuries at the beginning or more reinjury when they returned to work. Their higher rate of work disability could therefore have been due to the necessity of leaving work for which they were no longer physically capable. In effect, the psychopathology of Subgroups 3 and 4 may have been caused in part by their losing work capacity and facing financial losses. If individuals in Subgroups 1 and 2 had been exposed to the same degree of occupational risk factors, they too might have deteriorated psychologically. Of course, there remains an alternative view that patients who are poorly adjusted psychologically are more likely to select or persist with risk-laden jobs. Although there is not an exact correspondence among these variables (e.g., Subgroup 5 patients were exposed to physical risk factors, yet they were relatively nondisabled), occupational risk factors and work disability are also salient characteristics when patients are clustered by their psychological adjustment. A prospective study in which LBP patients of similar occupations would be reevaluated over time could help determine whether psychological variables predict low back outcomes within specific populations of workers.

Although speculative, we offer the following treatment recommendations for the different subgroups. Because Subgroups 1 and 2 represent the

healthiest patients from both psychological and physical perspectives, no focused psychological intervention for these patients seems necessary. These patients should respond satisfactorily to ordinary education and reassurance from their physician or other health-care providers. Patients of Subgroup 3, who are distressed by their physical condition and exhibit moderate physical disability, may be appropriate for psychological intervention that focuses on facilitating coping with the stresses of illness and disability and controlling subjective pain and pain behavior. Patients in Subgroup 4 should receive psychological intervention geared toward reducing their illness behavior *and* reducing depression and interpersonal skill deficits that may be promoting the sick role. In addition, there should be some emphasis on vocational rehabilitation, as they are quite impaired in this respect. Behavioral interventions for illness behavior and pain control are not indicated for Subgroup 5, because these patients do not exhibit the typical chronic pain syndrome. Instead, treatment of these individuals could include psychotherapy or pharmacotherapy for their psychological disorders.

Finally, it should be noted that, as is characteristic of cluster solutions for the MMPI, the subgroups here essentially lined up on an elevation continuum and are not necessarily "natural" groupings of patients. Although heterogeneity of the groups has been stressed in the descriptions, the subgroups may basically represent different *levels* of pathology rather than categorically different forms.

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