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Empirically Derived Pain-Patient MMPI Subgroups: Prediction of Treatment Outcome

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Fifty-seven male chronic pain patients admitted to an inpatient multimodal pain treatment program at a Midwestern Veterans Administration hospital completed the MMPI, Profile of Mood States (POMS), Tennessee Self-Concept Scale (TSCS), Rathus Assertiveness Schedule (RAS), activity diaries, and an extensive pain questionnaire. All patients were assessed both before and after treatment, and most also were assessed 2–5 months prior to treatment. No significant changes occurred during the baseline period, but significant improvements were evident at posttreatment on most variables: MMPI, POMS, TSCS, RAS, pain severity, sexual functioning, and activity diaries. MMPI subgroup membership, based on a hierarchical cluster analysis in a larger sample, was not predictive of differential treatment outcome. Possible reasons for comparable treatment gains among these subgroups, which previously have been shown to differ on many psychological and behavioral factors, are discussed.

KEY WORDS: pain; MMPI; treatment outcome; cluster analysis.

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INTRODUCTION

The Minnesota Multiphasic Personality Inventory (MMPI) is commonly used to assess personality characteristics of chronic pain patients. Too frequently investigators have reported only the mean MMPI profile of their samples, implying that chronic pain patients are a homogeneous group with elevations on scales measuring Hypochondriasis, Depression, and Hysteria (Sternbach *et al.,* 1973). Early attempts to distinguish meaningful subgroups based on personality characteristics (e.g., Sternbach, 1974) were useful in facilitating the understanding and treatment of pain patients but still limited since the derivation of subgroups was based on untested clinical conceptualization of which personality characteristics were most relevant to pain.

In the first empirical separation of low back-pain patients, Bradley *et al.* (1978) used a hierarchical clustering procedure to identify three male and four female homogeneous MMPI profile subgroups. These subgroups later were replicated in samples of patients with more diverse pain problems (Armentrout *et al.,* 1982; Prokop *et al.,* 1980). Armentrout *et al.* (1982) additionally demonstrated differences among subgroups on a variety of other psychological and behavioral variables including pain severity, physical activity restriction, depression, sleep disruption, sexual activity, medication use, and relationship dysfunction. Bradley and Van der Heide (1984) also identified MMPI subgroup differences in affective disturbance and disruption of daily activities in a sample of back-pain patients. Bradley *et al.* (1978), Bradley and Van der Heide (1984), and Armentrout *et al.* (1982) all have speculated that MMPI subgroups may reflect different behavioral attributes with important treatment implications.

McGill *et al.* (1983), after again replicating the MMPI subgroups in a sample of LBP patients, compared subgroups on measures of treatment outcome. Although they found no differential response to their multimodal pain treatment program, they did not report the overall efficacy of treatment. This leaves open the possibility that failure to find subgroup differences in their study is an artifact of a treatment with limited overall efficacy. Thus, it remains to be shown whether differential outcome occurs for subgroups receiving treatment of documented efficacy.

The present study first established the efficacy of a multidisciplinary pain treatment program and subsequently evaluated differential treatment outcome among empirically derived MMPI subgroups.

METHOD

Subjects

Subjects were 57 consecutive male chronic pain patients admitted to an inpatient multidisciplinary pain clinic at a Midwestern Veterans Ad-

ministration hospital. The age of the patients was 48.8 years (SD = 8.6) and the mean years of education was 10.5 (SD = 3.2). Most patients were married (91%). The vast majority was unemployed (95%) and receiving disability compensation (87%). Over half the patients reported LBP (53%), 17% reported headaches, and the rest had a variety of other pain complaints. The duration of pain averaged 14.2 years (SD = 11.3), and the mean number of prior surgeries for pain was 3.5 (SD = 5.8). All patients were evaluated by a neurosurgeon prior to admission to rule out the immediate need for surgery or other biomedical treatments.

Assessment

At the time of admission to the pain clinic, all patients completed a test battery consisting of the MMPI, Profile of Mood States (POMS; McNair *et al.*, 1971), Tennessee Self-Concept Scale (TSCS; Fitts, 1965), Rathus Assertiveness Schedule (RAS; Rathus, 1973), and a Pain Appraisal Inventory. The latter measure was constructed by the second author and can be obtained upon request. It contains items from the McGill Pain Questionnaire (Melzack, 1975) as well as questions regarding behavioral and psychological sequelae of pain problems. With the exception of demographic information, all measures were administered again to all patients following treatment.

In addition to all patients completing assessment batteries at admission and posttreatment, 32 of the 57 patients were initially evaluated at a time when no pain-clinic beds were immediately available. These 32 patients were placed on a waiting list for a period ranging from 2 to 5 months prior to admission, at which time they again were administered the assessment battery. Therefore, for 32 patients data were collected at baseline (2–5 months pretreatment), admission, and posttreatment, whereas data were collected only at admission and posttreatment for the remaining 25 patients.

All patients maintained Activity Diaries reflecting the time spent standing or walking, sitting, reclining, and sleeping for the entire period of hospitalization. Diaries were openly monitored regularly by nursing staff to elicit reliable patient self-reports and to verify the accuracy of patients' activity records.

Treatment

Patients typically remained in the treatment program approximately 6 weeks, with occasional minor variations dictated by particular patient needs. Treatment was based on cognitive-behavioral principles and included physical therapy; occupational therapy; training in cognitive pain management techniques; relaxation training; exercise in a heated pool; gradual withdrawal of pain medications, masked in a pain cocktail and given on a time-contingent schedule; individual, marital, and group psychotherapy; and training of

spouses in operant techniques to reinforce healthy behaviors and extinguish pain behaviors. All staff also were trained in the use of behavioral principles for altering pain behaviors.

Analyses

Sampling Bias. To rule out any sampling bias resulting from some patients being admitted to the hospital immediately while others were placed on a waiting list following the initial evaluation, these two groups were compared on all demographic and dependent variables at admission. Chi-square analyses and *t* tests were used in the comparisons.

Treatment Outcome. To determine the stability of dependent measures during the waiting-list period, comparisons were made between scores obtained at baseline and those obtained at admission. To determine changes resulting from treatment, comparisons, were made between scores obtained at admission and those obtained at posttreatment. Multivariate paired *t* tests using Hotellings T^2 (Nie *et al.*, 1975) were performed on the following dependent variables across both time periods: (1) MMPI (13 scales), (2) POMS (6 scales), (3) sexual functioning (monthly frequency, percentage of normal desire, and percentage of normal ability), (4) pain severity (now, at its worst, and at its least), and (5) sleep dysfunction (percentage of time experiencing problems of falling asleep, needing medication to sleep, being awakened by pain, and needing remedication to return to sleep). Individual paired *t* tests also were performed on the following dependent variables: (1) RAS, (2) TSCS Total *P* Score, (3) hours per week walking, (4) hours per week sitting, (5) hours per week reclining, and (6) hours per week sleeping. The latter four variables were not assessed prior to admission; thus, stability during the waiting list period could not be determined.

Treatment Outcome × *Subgroup.* To determine the extent to which MMPI subgroups benefited differentially from treatment, analyses of covariance (ANCOVA; Nie *et al.*, 1975) were performed on the subgroup means of all dependent variables at posttreatment using admission scores as covariates. Multivariate analyses of covariance were not performed prior to these univariate analyses since the number of subjects in subgroups was inadequate for multivariate analyses.

RESULTS

Sampling Bias. There were no differences between the 32 patients placed on the waiting list and the 25 who were not required to wait on any of the demographic or dependent variables assessed at admission.

Table I. Changes in MMPI Scale Scores During Waiting-List and Treatment Periods

MMPI scale	Pre- and post-waiting-list period means (N = 32)			Pre- and post-treatment period means (N = 54)		
	Baseline	Admission	t	Admission	Posttreatment	t
L	52.4	54.0	−1.25	53.4	51.4	1.76
F	57.0	61.7	−1.41	63.0	56.0	2.52*
K	53.0	54.2	−.77	52.7	53.9	−1.06
Hypochondriasis (*Hs*)	89.1	90.1	−.57	87.4	82.6	3.29**
Depression (*D*)	80.8	82.6	−.94	81.9	74.5	3.46**
Hysteria (*Hy*)	78.6	80.9	−1.17	79.0	74.7	4.31***
Psychopathic deviate (*Pd*)	61.4	63.9	−.99	65.9	61.8	2.45*
Masculinity-femininity (*Mf*)	57.1	57.3	−.11	57.3	54.6	2.48*
Paranoia (*Pa*)	55.7	58.8	−1.41	60.3	55.8	2.40*
Psychasthenia (*Pt*)	68.8	71.3	−1.55	70.3	63.5	3.79***
Schizophrenia (*Sc*)	69.0	73.9	−1.98	72.5	63.5	3.69***
Mania (*Ma*)	55.0	57.6	−1.75	59.3	59.3	.03
Social Introversion (*Si*)	57.8	57.1	.61	57.5	55.1	1.99

*$P < 0.05$.
**$P < 0.01$.
***$P < 0.001$.

Treatment Outcome. Dependent measures remained stable over the waiting list period. None of the multivariate or individual paired t tests of the summary scores indicated any significant change from baseline to admission. From admission to posttreatment, however, all dependent measures except sleep and time sitting improved significantly. There were significant multivariate improvements in MMPI personality characteristics [$T^2 = 51.75$, $F(13,41) = 3.08$, $P < 0.01$], sexual functioning [$T^2 = 9.94$, $F(3,28) = 3.09$, $P < 0.05$], POMS mood states [$T^2 = 45.80$, $F(6,42) = 6.82$, $P < 0.001$], and pain severity ratings [$T^2 = 13.60$, $F(3, 52) = 4.36$, $P < 0.01$] and significant univariate improvements in TSCS self-concept [$t(53) = -2.80$, $P < 0.01$], RAS assertiveness scores [$t(43) = -4.97$, $P < .001$], time spent walking [an increase; $t(38) = -5.77$, $P < 0.001$], and time spent reclining [a decrease; $t(38) = 4.53$, $P < 0.001$]. Two patients dropped out of treatment and one was transferred to another ward for surgery prior to completion of the program or posttreatment measures.

Table I presents means and paired t tests demonstrating changes in individual MMPI scales from baseline to admission and from admission to posttreatment. As can be seen in Table I there was a consistent, although nonsignificant, exacerbation of dysfunction on MMPI scales from baseline to admission. Following treatment, however, there were significant decreases on scales *F, Hs* (Hypochondriasis), *D* (Depression), *Hy* (Hysteria), *Pd* (Psychopathic-Deviate), *MF* (Masculinity-Femininity), *Pa* (Paranoia), *Pt* (Psychasthenia), and *Sc* (Schizophrenia).

On the POMS, all moods except anger improved significantly from admission to posttreatment (Table II). On the TSCS, there were consistent and significant improvements from admission to posttreatment. Not only was the Total *P* Score (positive self-concept) significantly improved posttreatment, but subscales of Identity, Behavior, Physical Self, and Personal Self also were significantly enhanced (Table III).

Regarding pain severity (Table IV), from admission to posttreatment, pain "right now" decreased significantly, with pain "at its worst" and pain "at its least" also decreasing, although not significantly. Table IV also presents changes in sexual functioning. Despite a significant multivariate difference indicating admission to posttreatment improvements for combined sexual functioning variables, none of the individual sexual functioning variables reached statistically significant improvement at posttreatment.

Admission and posttreatment means for assertiveness (RAS), weekly hours of walking, and weekly hours of reclining also are presented in Table IV. There was a significant improvement in assertion following treatment. Baseline period measures were not available for walking and reclining, but as can be seen from Table IV, there were significant improvements by the end of treatment. Walking increased as reclining decreased.

Table II. Changes in Profile of Mood States During Waiting-List and Treatment Periods

	Pre- and post-waiting-list period mean T score (N = 23)			Pre- and post-treatment period mean T score (N = 48)		
Mood state	Baseline	Admission	t	Admission	Posttreatment	t
Tension	47.1	44.1	2.46*	47.8	43.3	4.38**
Depression	45.2	41.8	2.52*	44.8	40.5	5.30**
Anger	43.4	42.0	1.18	45.1	42.9	2.00
Vigor	50.8	52.0	−.72	50.3	57.2	−4.51**
Fatigue	55.9	53.3	1.35	54.8	48.9	4.55**
Confusion	46.0	44.7	1.04	45.5	41.6	3.75**

*$P < 0.05$.
**$P < 0.001$.

Table III. Changes in Tennessee Self-Concept Scales During Waiting-List and Treatment Periods

	Pre- and post-waiting-list period means (N = 31)			Pre- and post-treatment period means (N = 54)		
TSCS scale	Baseline	Admission	t	Admission	Posttreatment	t
Total P Score (summary)	323.9	324.2	−.07	322.4	331.1	−2.80**
Self-Criticism	34.4	32.0	2.64*	32.6	32.8	−.37
Identity	116.1	117.2	−.62	115.5	118.6	−2.36*
Self-Satisfaction	100.2	99.5	.52	100.6	103.2	−1.09
Behavior	107.6	107.0	.39	106.0	109.3	−2.78**
Physical Self	55.3	54.9	.47	55.0	59.0	−4.13***
Moral-Ethical Self	68.9	68.6	.22	68.3	69.6	−1.59
Personal Self	64.4	64.1	.20	63.7	66.0	−2.51*
Family Self	69.8	70.2	−.29	69.6	70.2	−.80
Social Self	65.6	66.0	−.40	65.5	66.2	−.96

*$P < 0.05$.
**$P < 0.01$.
***$P < 0.001$.

Table IV. Changes in Mean Pain Severity, Sexual Functioning, Assertiveness (RAS), Walking, and Reclining During Waiting-List and Treatment Periods

Variable	Pre- and post-waiting-list period means			Pre- and post-treatment period means		
	Baseline	Admission	*t*	Admission	Posttreatment	*t*
Pain severity (1–5)						
Now	2.7	2.6	0.42	2.5	2.0	3.37**
At worst	4.4	4.4	−0.24	4.4	4.1	1.86
At least	1.9	2.0	−0.39	1.8	1.6	1.68
Sexual function						
Monthly sex frequency	3.2	2.8	0.68	3.0	4.9	−1.96
% normal desire	61.4	61.6	−0.05	58.9	70.1	−1.96
% normal ability	61.6	58.1	0.60	53.0	64.3	−1.75
Assertiveness (RAS)	100.0	98.2	0.41	103.5	114.1	−4.97***
Walking (hours/week)	—	—	—	24.8[a]	34.6[b]	−5.77***
Reclining (hours/week)	—	—	—	79.6[a]	69.7[b]	4.53***

[a]Week 1.
[b]Week 5.
*$P < 0.05$.
**$P < 0.01$.
***$P < 0.001$.

Table V. MMPI *T*-Score Means (*K* Corrected) and Univariate *F* Ratios[a] of Subgroups

MMPI scale	Cluster assignment A ($N = 7$)	B ($N = 29$)	C ($N = 18$)	*F*
L	47.57	54.50	53.72	1.887
F	51.00	55.28	79.67	12.898****
K	50.14	56.19	48.17	5.994**
Hypochondriasis	64.00	92.03	90.56	15.108****
Depression	55.29	79.53	97.89	36.667****
Hysteria	63.71	82.03	81.83	11.376****
Psychopathic Deviate	53.86	62.94	73.89	9.996***
Masculinity–Femininity	56.29	54.69	61.61	3.688*
Paranoia	48.29	54.84	73.39	20.008****
Psychoasthenia	48.14	66.94	84.61	47.784****
Schizophrenia	46.57	66.09	93.44	37.229****
Hypomania	59.86	55.16	65.33	4.846*
Social Introversion	48.43	54.78	64.83	10.345***

[a]df = 2/54.
*$P < 0.05$.
**$P < 0.01$.
***$P < 0.001$.
****$P < 0.0001$.

Treatment Outcome × *Subgroup.* Using a least-squares differences procedure, patients were assigned, on the basis of admission MMPI profiles, to the closest of the MMPI clusters reported by Armentrout *et al.* (1982). Most of these patients actually had been included in the Armentrout *et al.* original cluster analysis of 240 patients. MMPI profile means of the resulting three subgroups are presented in Table V along with univariate *F* ratios of between-cluster comparisons. These MMPI subgroups are clearly similar to those reported by Bradley *et al.* (1978).

Analyses of covariance of subgroup posttreatment dependent variable means were then performed using admission values as covariates. Variables on which ANCOVAs were performed included the 8 clinical MMPI scales (*Hs, D, Hy, Pd, Pa, Pt, Sc,* and *Ma*), 6 POMS scales, 10 TSCS scales, 3 pain severity ratings, 3 sexual functioning variables, 4 sleep/medication variables, the assertiveness score, and 4 Activity Diary variables (walking, reclining, sitting, and sleeping). Of these 39 ANCOVAs, only 2 (ratings of physical ability for sex and pain severity at its least) indicated differential treatment-related changes for MMPI subgroups. As 2 of 39 significant differences would be expected purely on the basis of chance, we must conclude that MMPI subgroups did not respond differentially to treatment in this study.

DISCUSSION

The present study found no differential responses to multimodal pain treatment among relatively homogeneous MMPI subgroups. These results are consistent with those found by McGill *et al.* (1983) in their LBP treatment program. McGill *et al.*, however, did not present data on overall treatment efficacy. Since overall treatment efficacy was clearly demonstrated in the present study, failure to find differential treatment benefit among MMPI subgroups cannot be an artifact of a weak treatment effect.

The present study by and large employed different measures of treatment outcome than did McGill *et al.*, who measured narcotic medication consumption, range of motion, hours out of bed, and a pain estimate with an ischemic pain test as a reference point. Despite these differences, both studies yielded results suggesting that MMPI subgroups respond similarly to multimodal pain treatment programs. These results, therefore, represent both an extension and a replication of the research of McGill *et al.*

Both Bradley *et al.* (1978) and McGill *et al.* (1983) have speculated on the treatment implications of membership in different MMPI subgroups. Individual treatment components may indeed be differentially beneficial for MMPI subgroups, but multicomponent programs may obscure these differences. Similar to McGill *et al.* (1983), the present treatment program was a multicomponent package. In both studies, the failure to find subgroup differences in response to treatment may have resulted from various patients benefiting from different components of the program. It is also possible, despite clear initial psychological and behavioral differences among MMPI subgroups, that all patients benefited to a comparable extent from the same one or more treatment components. Future studies might productively evaluate the differential effects of narrowly focused interventions among subgroups. Not only is it important for pain researchers to determine which patients benefit from particular treatment components, it is similarly important to determine if one or more treatment components are effective for all patients.

Although MMPI profile subgroups may be associated with treatment-relevant behavioral attributes, the nature of this relationship may vary across different types of pain. In addition to a heterogeneous treatment package, this study utilized a heterogeneous sample of patients with regard to their pain complaints. It is possible that this patient heterogeneity contributed to the failure to find differential treatment effects among MMPI subgroups. Subsequent research might compare subgroup responses to treatment in a patient sample with homogeneous pain complaints (e.g, LBP).

Whereas the treatment program of McGill *et al.* lasted only 2 weeks, the treatment program in this study lasted an average of 6 weeks. This more

intensive treatment program may have more reliably produced positive changes in patients than the shorter program of McGill *et al.*, thus making subgroup differences on outcome measures more difficult to observe. On the other hand, a treatment program that is too brief to produce substantial benefits in a significant proportion of patients may similarly fail to identify MMPI subgroup differences in treatment outcome.

While the present study documented immediate posttreatment changes, maintenance of these effects over follow-up remains to be established and investigated for differential courses of rehabilitation among subgroups. Initial treatment gains may be comparable among subgroups, but subgroup characteristics may differentially affect the maintenance of treatment gains.

To examine overall treatment efficacy, the present study employed subjects as their own controls in a single group outcome design. The stability of measures during the baseline period and the consistent and significant improvements following treatment suggest that improvements are due to treatment and not to repeated measurements or simple passage of time. Since to date there have been no experimentally controlled outcome evaluations of inpatient pain treatment programs, this study, although also lacking a control group, provides further documentation of the efficacy of inpatient multimodal chronic pain treatment by using a within-subject control single group outcome design. Without a placebo control, however, effects of factors such as expectation and attention cannot be ruled out.

The significant MMPI improvements noted for the entire patient sample following treatment included changes not only on scales reflecting somatization, but also on most other clinical scales and the *F* scale. This finding may reflect a generalized improvement in psychological functioning following treatment and may be related to the comprehensive nature of this treatment program. Less comprehensive treatment might produce more focal changes on the MMPI as well as differential treatment outcome for MMPI subgroups.

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