Psychological Assessment
1999, Vol. 11, No. 3, 381-385

1040-3590/99/$3.00

Utility of Selected MMPI-2 Scales in the Outcome Prediction for Patients With Chronic Back Pain

Alexander A. Vendrig
Rug AdviesCentra Nederland

Jan J. L. Derksen and Hubert R. de Mey
Department of Clinical Psychology and Personality, University of Nijmegen

The predictive utility of selected scales from the Minnesota Multiphasic Personality Inventory–2 (MMPI-2; J. N. Butcher, W. G. Dahlstrom, J. R. Graham, A. Tellegen, & B. Kaemmer, 1989) was examined in relation to a number of physical and psychosocial measures of treatment outcome in patients reporting chronic back pain. MMPI-2 scales assessing manifestations of emotional distress were considered: anxiety (Scale 7 [*Pt*]: Anxiety [*ANX*] and Obsessiveness [*OBS*]), depression (Scale 2 [*D*]: Depression [*DEP*]), and somatic discomfort (Scale 1 [*Hs*]: Lassitude-Malaise [*Hy3*], Somatic Complaints [*Hy4*], and Health Concerns [*HEA*]). The outcome results at 6-month follow-up for 120 patients who participated in a 4-week outpatient multimodal treatment program were examined. Results showed several of the selected scales to be predictive of less improvement, depending on the outcome measures used.

A vast amount of research has been conducted with the Minnesota Multiphasic Personality Inventory (MMPI; Hathaway & McKinley, 1951) to predict outcome after surgical or medical treatment and multidisciplinary treatment of patients with chronic pain (Keller & Butcher, 1991; Love & Peck, 1987; Rouse, Sullivan, & Taylor, 1997; Snyder, 1990; Vendrig, in press). More specifically, elevations on Scale 1 have been found to predict poorer outcome from surgical or medical treatment in a number of studies (Akerlind, Hornquist, & Bjurulf, 1992; Vendrig, in press). Studies concerned with the predictive utility of the MMPI for multidisciplinary treatment programs have typically focused on the identification of particular subgroups or cluster types (Keller & Butcher, 1991). The merit of this approach has been questioned, however, as unique profiles (i.e., other than the well-known MMPI code types) have not yet been generated (Keller & Butcher, 1991).

The successor of the MMPI, the MMPI-2 (Butcher, Dahlstrom, Graham, Tellegen, & Kaemmer, 1991), continues to be frequently used for the psychological assessment of patients with chronic pain. There is an ongoing need for research on the MMPI-2 with specific populations and treatment settings. Clinicians find it particularly useful to know more about the ability of individual MMPI-2 scales to predict treatment outcome. In one study with the MMPI-2, the Negative Treatment Indicators content scale (*TRT*) and component scales (*TRT1* and *TRT2*) for men with chronic pain were found to (modestly) predict treatment outcome, depending on the outcome measures used (Clark, 1996).

Alexander A. Vendrig, Rug AdviesCentra Nederland, Zeist, The Netherlands; Jan J. L. Derksen and Hubert R. de Mey, Department of Clinical Psychology and Personality, University of Nijmegen, Nijmegen, The Netherlands.

Correspondence concerning this article should be addressed to Alexander A. Vendrig, Rug AdviesCentra Nederland, Utrechtseweg 92, 3702 AD Zeist, The Netherlands. Electronic mail may be sent to vendrig@rac-zeist.nl.

The purpose of this study was to examine the utility of the MMPI-2 clinical and content scales related to emotional distress in predicting outcome of multimodal treatment of patients with chronic back pain. Some typical emotional concomitants of chronic pain are depression (e.g., Fishbain, Cutler, Rosomoff, & Rosomoff, 1997), anxiety (e.g., Amundsen, Norton, & Allerdings, 1997), and somatic discomfort (e.g., McCracken, Samantha, & Janeck, 1998). In the current study, MMPI-2 scales measuring these features were considered particularly relevant: depression (Scale 2 [*D*]: Depression [*DEP*]); anxiety (Scale 7 [*Pt*]: Anxiety [*ANX*] and Obsessiveness [*OBS*]); somatic discomfort (Scale 1 [*Hs*]: Lassitude-Malaise [*Hy3*], Somatic Complaints [*Hy4*], and Health Concerns [*HEA*]). We selected the Harris–Lingoes subscales *Hy3* and *Hy4* rather than Scale 3 because the latter covers more than just somatic discomfort (Prokop, 1986; Vendrig, de Mey, Derksen, & van Akkerveeken, 1998). Treatment outcome was determined at 6-month follow-up and was defined along the multiple dimensions of pain, disability, trunk muscle performance, return to work, medical consumption, and pain medication.

Method

Participants

Participants consisted of 120 consecutive referrals (78 men and 42 women) to the Rug AdviesCentra Nederland (Netherlands Back Advice Center) which is a network of multidisciplinary assessment and intervention centers for chronic spinal disorders. All of the patients had chronic back pain with a duration of at least 3 months. None of the patients participating in the study had a structural pathology of the spine. Moderate degenerative changes of the intervertebral disc were not regarded as structural pathology. The mean age of the participants was 41.3 years (SD = 9.0). The mean duration of the symptoms was 47.6 months (SD = 37.6), with an average absence from work due to back pain of 14.0 months (SD = 8.2). The educational background was distributed as follow: 96 participants (80%) had at least an elementary, high school, or higher (non-university) education; 24 participants (20%) had a university education.

Treatment Overview

Treatment involved a daily 4-week outpatient multimodal program with the aim of restoring a normal pattern of daily functioning, including a complete return to work. Decrease of pain and improvement of pain coping were not the direct aims of the program. The program is based on the functional restoration approach (Hazard et al., 1989; Mayer et al., 1987) and includes many of the principles outlined by Fordyce (1976). The patients participated in groups of about six. The professionals involved in the treatment were a clinical psychologist, physical therapist, occupational therapist, and orthopedic surgeon or neurologist. The professionals worked together closely and consulted daily. All of the clinicians provided group sessions, which included back school (i.e., education on the spine and associated topics), challenging of deep-rooted beliefs about symptoms and disabilities, and education on stress management. The physical training occurred according to operant learning principles ("graded activity") and was aimed at the elimination of inappropriate pain behaviors and the restoration of muscle strength endurance as well as aerobic fitness. Such activities as swimming and squash were also part of the program. The occupational therapist assisted the patient in the process of returning to work. The clinical psychologist provided 12 group sessions in which an eclectic approach was adopted to identify and modify maladaptive behaviors, enhance adequate coping skills, and improve emotional awareness.

Procedure and Measures

During multidisciplinary assessment, each patient completed the MMPI-2 using the computer administration scoring system (Theuns et al., 1994). The possibility to omit items was not activated, which resulted in a cannot-say score of 0 for all participants. The following criteria were applied to determine the validity of the MMPI-2 profiles: *T* score below 80 on the Variable Response Inconsistency scale (VRIN); *T* score below 80 on the True Response Inconsistency scale (TRIN); raw *F* score below 27; and a raw *Fb* score below 23 (Graham, Watts, & Timbrook, 1991). Two participants were excluded due to a VRIN score over 80. The outcome measures were assessed during multidisciplinary assessment, as well, at 6-month follow-up. The other outcome measures (return to work, no pain medication use, and no medical consumption) were obtained at the 6-month follow-up meeting.

The predictor measure was the Flemisch/Dutch version of the MMPI-2 (Derksen, de Mey, Sloore, & Hellenbosch, 1993). The MMPI-2 is a 567 item self-report measure of psychopathology and personality. The validity of the MMPI-2 has been demonstrated in an extensive research base (Graham, 1993). The Flemisch/Dutch version of the MMPI-2 has its own normative data base, which consists of 1,244 people representative of the Dutch society. The Dutch norms of the MMPI-2 correspond well with the United States's norms (de Mey & Derksen, 1995; Sloore, Derksen, de Mey, & Hellenbosch, 1996). The mean test–retest reliability of the selected MMPI-2 scales (*Hs, D, Hy3, Hy4, Pt, ANX, DEP, OBS,* and *HEA*) is 0.83 (range: 0.64–0.89) and the mean internal consistency is 0.78 (range: 0.61–0.86; Graham, 1993).

The outcome measures included the pain Visual Analogue scale (VAS), the Quebec Back Pain Disability scale (QBPDS; Kopec et al., 1995), and trunk muscle performance (Maximal Isometric Strength Extension; MISE). The pain VAS assesses the intensity of the pain experienced by the patient along a 10-cm horizontal line with two endpoints. The VAS score can vary from 0 (*no pain*) to 100 (*the worst pain ever experienced*). The patient is asked to estimate the current level of pain. VAS has been found to serve as a valid and reliable measure of the sensory–intensity dimension of pain perception (Duncan, Bushnell, & Lavigne, 1989; Ohnhaus & Adler, 1975). The QBPDS assesses self-reported disability due to back pain symptoms. The Dutch translated and validated version of the QBPDS was used (Schoppink, van Tulder, Koes, Beurkens, & de Bie, 1996). The QBPDS was constructed using a conceptual approach to disability assessment and the empirical methods of item development, analysis, and selection. The test–retest reliability and Cronbach's alpha for the Dutch adaptation of the QBPDS are 0.90 and 0.95, respectively (Schoppink et al., 1996). The QBPDS correlates .80 with the Roland Disability in Activities of Daily Living scale (Roland & Morris, 1983) and .80 with the Oswestry Low Back Pain Disability scale (Fairbank, Couper, Davies, & O'Brian, 1980; Kopec et al., 1995; Schoppink et al., 1996). Trunk muscle performance (MISE) was assessed with the Isostation B200 (Isotechnologies, Inc., Hillsborough, NC). The Isostation B200 is a triaxial dynamometer that measures isometric and dynamic trunk muscle performance (angular position, angular velocity, and torque). The reliability of the Isostation B200 has been demonstrated in many studies (Newton & Waddell, 1993). Undergoing an Isostation test requires action by the participant, and it can thus be regarded as a test of the participant's behavior. Pain behavior, anticipation of fear of pain due to physical activity, and self-efficacy beliefs regarding one's physical capabilities have been shown to affect trunk muscle performance, in particular in extension (Beimborn & Morrissey, 1988; Cooke, Menard, Beach, Locke, & Hirsch, 1992; Estlander, Vanharanta, Moneta, & Kaivanto, 1994; Menard, Cooke, Locke, Beach, & Butler, 1994).

At 6-month follow-up, it was also documented by means of a clinical interview whether the patient had achieved the following goals of normal (i.e., pain independent) daily functioning or not: (a) complete return to work (i.e., pre-illness level of work demand), (b) no medical or paramedical treatment during the past 6 months, and (c) no use of any pain medication during the past 6 months to reduce back pain symptoms. For each of these three outcome criteria a dichotomous score was assigned (goal achieved vs. not achieved). With regard to pain medication, it may be relevant to note that this refers to any drug used to influence the pain (e.g., narcotic analgesics, muscle relaxants, NSAIDs, or antidepressive medication). Return to work was reliably documented by the occupational therapist, who was involved in the work reintegration process of the patient. On the other hand, Criteria 2 and 3 were based only on self-report, and some underreporting cannot, therefore, be excluded.

Results

All patients attended the 6-month follow-up meeting. Thus, there was no attrition of patients. The means and standard deviations for the selected MMPI-2 scales are presented in Table 1. The pattern of the means is similar to that reported for most chronic pain populations. The highest mean score was on *Hs* followed by *D* and *Pt* (e.g., Keller & Butcher, 1991). The mean score for *Hs* (66.1) is somewhat lower than what is usually reported in the literature. This is most likely due to the outpatient setting and the heterogeneous nature of our sample with regard to the severity of the complaints.

The means and standard deviations for preprogram, follow-up, and treatment-related change are presented in Table 2. Treatment-

Table 1
Means and Standard Deviations for the Selected MMPI-2 Scales

Variables	*M*	*SD*	Range
Anxiety			
Psychasthenia (*Pt*)	56.8	9.2	32–85
Anxiety (*ANX*)	52.4	9.6	35–76
Obsessiveness (*OBS*)	50.0	8.0	33–74
Depression			
Depression (*D*)	57.5	11.4	37–90
Depression (*DEP*)	52.8	8.7	35–82
Somatic Discomfort			
Hypochondriasis (*Hs*)	66.1	11.3	42–100
Lassitude–Malaise (*Hy3*)	60.7	10.0	37–92
Somatic Complaints (*Hy4*)	60.0	11.2	37–87
Health Concerns (*HEA*)	60.1	10.9	37–83

Table 2
Means and Standard Deviations for Outcome Measures at Preprogram, Follow-up, and Reliable Change

Outcome measure	Preprogram		Follow-up		Reliable change	
	M	*SD*	*M*	*SD*	*M*	*SD*
Pain intensity (VAS)	46.3	21.0	25.7	25.8	1.6	2.4
Disability (QBPDS)	32.5	13.5	14.4	13.5	2.7	2.2
Trunk muscle performance (MISE)	92.2	44.8	158.3	46.7	5.5	2.9

Note. VAS = Visual Analogue scale; QBPDS = Quebec Back Pain Disability scale; MISE = Maximal Isometric Strength Extension.

related change was operationalized using the reliable change (RC) index originally developed by Jacobson, Folette, and Revenstorf (1984) to assess the clinical significance of treatment outcome findings. RC is obtained by computing the difference between pre- and posttreatment scores and then dividing this difference by a standard error measure that includes not only the standard deviation of the measure, but also its reliability coefficient. Individual RCs that exceed 1.96 are unlikely to occur ($p < .05$) unless an actual change occurs in scores between pre- and posttreatment testing. Inspection of the mean RCs of outcome measures shows the program to be generally quite effective (see Table 2).

The utility of the selected MMPI-2 scales as predictors of posttreatment improvement was examined by calculating partial correlations. For each dependent measure, a pretreatment to follow-up difference score was calculated. A positive change score indicates improvement. Age, education, pain duration, and pretreatment pain medication were first examined as potential confounds of posttreatment improvement. Because pretreatment medication was not found to be related to any outcome measure, it was excluded from further analysis. Age, education, pain duration, and the outcome variables measured pre-program were then used as control variables. The alpha was set at .006 (.05/9) after Bonferroni correction for the application of nine concurrent statistical tests.

The partial correlations are presented in Table 3. Several MMPI-2 scales were found to be significant predictors of posttreatment improvement for VAS and QBPDS. That is, greater elevations on the MMPI-2 scales predicted less improvement in these outcome measures even after possible preprogram differences in the outcome measures were controlled for. However, none of the MMPI-2 scales was able to predict posttreatment improvement regarding trunk muscle performance (MISE).

Next, the capacity of the selected MMPI-2 scales to predict outcome in terms of the attainment of normal (i.e., pain independent) functioning was evaluated. The percentage of participants achieving "normal" functioning was as follows: complete return to work (87%); no use of pain medication during the last 6 months (82%); and no medical or paramedical treatment during the last 6 months (93%). Partial correlations were calculated between the selected MMPI-2 scales and three categorial outcome variables. Age, education, and pain duration were used as control variables. The results are shown in Table 4. None of the MMPI-2 scales was found to be a significant ($p < .006$) predictor of the categorial outcomes.

Discussion

The results of the current study partially support the original hypothesis, which suggests that certain MMPI-2 scales (especially those involving emotional distress) could have predictive value concerning outcome after multimodal chronic pain treatment. Several of the selected scales predicted less improvement concerning subjectively experienced pain (VAS) and self-reported disability (QBPDS). However, physical outcome (trunk muscle performance) was not predicted by any of the selected scales. Therefore, emotional distress may be less important for the prediction of this aspect of treatment outcome. The greatest improvement following

Table 3
Partial Correlations Between the Selected MMPI-2 Scales and Posttreatment Improvement

Outcome variable	Scale								
	Anxiety			Depression		Somatic Discomfort			
	Pt	*ANX*	*OBS*	*D*	*DEP*	*Hs*	*Hy3*	*Hy4*	*HEA*
Pain intensity (VAS)	−.25*	−.21	−.30**	−.25*	−.24	−.27*	−.32**	−.21	−.24
Disability (QBPDS)	−.18	−.15	−.27*	−.27*	−.20	−.27*	−.27*	−.28*	−.23
Trunk muscle performance (MISE)[a]	−.03	−.01	−.03	−.05	.01	.11	−.02	.11	.10

Note. Correlations were controlled for age, education, pain duration, and preprogram measurement of outcome variable. VAS = Visual Analogue scale; QBPDS = Quebec Back Pain Disability scale; MISE = Maximal Isometric Strength Extensic; *Pt* = Psychasthenia; *ANX* = Anxiety; *OBS* = Obsessiveness; *D* = Depression; *DEP* = Depression; *Hs* = Hypochondriasis; *Hy3* = Lassitude-Malaise; *Hy4* = Somatic Complaints; *HEA* = Health Concerns.
[a] Controlled for sex.
* $p < .006$. ** $p < .001$.

Table 4
Partial Correlations Between the Selected MMPI-2 Scales and Categorial Outcome

	Scale								
	Anxiety			Depression		Somatic Discomfort			
Outcome variable	*Pt*	*ANX*	*OBS*	*D*	*DEP*	*Hs*	*Hy3*	*Hy4*	*HEA*
Complete return to work	.08	.05	.04	.03	.10	.18	.23	−.09	.16
No use of pain medication	.11	.08	.15	.07	.11	.16	.21	.03	.06
No (para)medical treatment	−.05	−.13	.08	−.11	−.11	.07	.02	.09	−.01

Note. Correlations were controlled for age, education, and pain duration. *Pt* = Psychasthenia; *ANX* = Anxiety; *OBS* = Obsessiveness; *D* = Depression; *DEP* = Depression; *Hs* = Hypochondriasis; *Hy3* = Lassitude-Malaise; *Hy4* = Somatic Complaints; *HEA* = Health Concerns.

treatment was linked to trunk muscle performance (see Table 2). This suggests that many patients improve on this variable regardless of the severity of their emotional distress. It should nevertheless be acknowledged that our program was daily, highly structured, and followed clear operant-behavioral principles. In other words, the program more or less prohibited emotional distress from interfering with the physical training. Emotional distress may play more of a role during a less-structured and less-aggressive treatment program.

A possible explanation for these findings may be that the interrelations among physical functioning, subjective disability, and emotional distress may change as a result of treatment. In untreated groups of people with chronic back pain, physical functioning, subjective disability, and emotional distress are interrelated (e.g., Linton, 1985; Pope, Rosen, Wilder, & Frymoyer, 1980; McQuade, Turner, & Buchner, 1988; Vendrig et al., 1998). However, after function-oriented treatment, physical functioning may become "disconnected" from the variables emotional distress and subjective disability. Again, this observation is not surprising because patients learn in function-oriented treatments to perform activities despite their pain and experienced distress. Thus, in light of such a treatment-related disconnection between emotional distress and physical functioning, the selected MMPI-2 scales will logically fail to predict outcome linked to trunk muscle functioning.

The selected MMPI-2 scales failed to predict the categorial outcomes (i.e., complete return to work, no use of pain medication, and no medical or paramedical treatment during the 6-month follow-up period). Several reasons may account for the obtained nonsignificant results in the prediction of these outcomes. First, the categorial outcomes had a rather skewed distribution. With such high percentages falling into the "success" category (87%, 82%, and 93%, respectively), it was difficult for any of the MMPI-2 scales to be significantly related to these outcomes. Second, there was a relatively long delay between MMPI-2 testing and the determination of the categorial outcomes. Prediction of such specific (and skewed) outcomes more than 7 months after administration of a single psychological inventory may be too much to expect. Third, many, and probably also more important, factors other than emotional distress are involved in the process of returning to work (e.g., support at work, financial compensation, etc.). Moreover, most of the participants in our study (87%) resumed their work completely, whereas many of them probably had high levels of emotional distress prior to treatment. Also in the prediction of the outcomes "no pain medication" and "no medical or paramedical treatment," many factors other than emotional distress are probably involved.

In summary, the results of this study partially support the utility of selected MMPI-2 scales for the prediction of treatment outcome in cases of chronic pain. The utility of the selected scales clearly depends on the outcome measures used. Some caution is nevertheless warranted as the percentage of variance explained by the relevant MMPI-2 scales was generally low (the significant correlations varied between .25 and .32). The following considerations may also explain the relatively small contribution of the selected MMPI-2 scales to the prediction of treatment outcome. First, it is important to recognize that chronic pain programs generally produce a considerable reduction in the degree of emotional distress and thereby impede the prediction of treatment outcome on the basis of emotional distress. Simply put, emotional distress is clearly not a stable trait remaining unaffected by the treatment process. Second, it must be emphasized that our chronic pain population was rather heterogeneous in terms of pain severity and global dysfunction and is therefore not representative of the larger chronic pain population as a whole. Given that the intent of the study is to identify MMPI-2 scales that may be of value in predicting treatment outcome, this is a major limitation of the present study. Third, our patient sample was, on average, also not very emotionally disturbed. The power of emotional distress to predict treatment outcome was thus quite limited within the present study. In future research, it will therefore be interesting to examine the predictive utility of selected MMPI-2 scales within a "differential treatment framework" (Finn & Tonsager, 1997). More specifically, the influence of emotional distress on various outcome measures (i.e., pain, disability, return to work) for different types of treatment (i.e., simple physical training vs. more comprehensive treatment, including psychological treatment) may provide further insight into the prediction of outcome after chronic pain treatment. On the basis of such research, the match between emotional factors and type of treatment regimen can be optimized. Further research is needed to compare the current findings with other treatment settings and outcome measures.

References

Akerlind, I., Hornquist, J. O., & Bjurulf, P. (1992). Psychological factors in the long-term prognosis of chronic low back pain patients. *Journal of Clinical Psychology, 48,* 596–605.

Amundsen, J. G., Norton, G. R., & Allerdings, M. D. (1997). Fear and avoidance in dysfunctional chronic back pain patients. *Pain, 69,* 231–236.

Beimborn, D. S., & Morrissey, M. C. (1988). A review of the literature related to trunk muscle performance. *Spine, 13,* 655–660.

Butcher, J. N., Dahlstrom, W. G., Graham, J. R., Tellegen, A., & Kaem-

mer, B. (1989). *Minnesota Multiphasic Personality Inventory (MMPI-2): Manual for administration and scoring.* Minneapolis: University of Minnesota Press.

Clark, M. E. (1996). MMPI-2 negative treatment indicators content and content component scales: Clinical correlates and outcome prediction for men with chronic pain. *Psychological Assessment, 8,* 32–38.

Cooke, C., Menard, M. R., Beach, G. N., Locke, S. R., & Hirsch, G. H. (1992). Serial lumbar dynamometry in low back pain. *Spine, 17,* 653–662.

Derksen, J. L., Mey, H. R. de, Sloore, H., & Hellenbosch, G. (1993). *MMPI-2: Handleiding bij afname, scoring en interpretatie.* [Manual for administration, scoring, and interpretation]. Nijmegen, the Netherlands: PEN Tests Publisher.

Duncan, G. H., Bushnell, M. C., & Lavigne, G. J. (1989). Comparison of verbal and visual analogue scales for measuring the intensity and unpleasantness of experimental pain. *Pain, 37,* 295–303.

Estlander, A. M., Vanharanta, H., Moneta, G. B., & Kaivanto, K. (1994). Anthropometric variables, self-efficacy beliefs, and pain and disability ratings on the isokinetic performance of low back pain patients. *Spine, 19,* 941–947.

Fairbank, J. C., Couper, J., Davies, J. B., & O'Brian, J. P. (1980). The Oswestry low back pain disability questionnaire. *Physiotherapy, 66,* 271–273.

Finn, S. E., & Tonsager, M. E. (1997). Information-gathering and therapeutic models of assessment: Complementary paradigms. *Psychological Assessment, 9,* 374–385.

Fishbain, D. A., Cutler, R., Rosomoff, H. L., & Rosomoff, R. S. (1997). Chronic pain-associated depression: Antecedent or consequence of chronic pain? A review. *Clinical Journal of Pain, 13,* 116–137.

Fordyce, W. E. (1976). *Behavioral methods for chronic pain and illness.* St. Louis, MO: CV Mosby.

Graham, J. R. (1993). *MMPI-2: Assessing personality and psychopathology.* New York: Oxford University Press.

Graham, J. R., Watts, D., & Timbrook, R. E. (1991). Detecting fake-good and fake-bad MMPI-2 profiles. *Journal of Personality Assessment, 57,* 264–277.

Hathaway, S., & McKinley, J. (1951). *The Minnesota Multiphasic Personality Inventory manual.* New York: Psychological Corporation.

Hazard, R., Fenwick, J., Kalisch, S. M., Redmond, J., Reeves, V., Reid, S., & Frymoyer, J. W. (1989). Functional restoration with behavioral support: A one-year prospective study of patients with chronic low back pain. *Spine, 14,* 157–161.

Jacobson, N. S., Folette, W. C., & Revenstorf, D. (1984). Psychotherapy outcome research: Methods for reporting variability and evaluating clinical significance. *Behavior Therapy, 15,* 336–352.

Keller, L. S., & Butcher, J. N. (1991). *Assessment of chronic back pain patients with the MMPI-2.* Minneapolis: University of Minnesota Press.

Kopec, J. A., Esdaile, J. M., Abrahamowicz, M., Abenhaim, L., Wood-Dauphinee, S., Lamping, D. L., & Williams, J. I. (1995). The Quebec Back Pain Disability Scale, Measurements properties. *Spine, 20,* 341–352.

Linton, S. J. (1985). The relationship between activity and chronic pain. *Pain, 21,* 289–294.

Love, A. W., & Peck, C. L. (1987). The MMPI and psychological factors in chronic low back pain: A review. *Pain, 28,* 1–12.

Mayer, T., Gatchel, R. J., Mayer, H., Kishino, N., Keeley, J., & Mooney, V. (1987). A prospective two-year study of functional restoration in industrial low back injury: An objective assessment procedure. *JAMA: Journal of the American Medical Association, 258,* 1763–1767.

McCracken, L. M., Samantha, D. F., & Janeck, A. S. (1998). Pain-related anxiety predicts non-specific physical complaints in persons with chronic pain. *Behaviour Research and Therapy, 36,* 621–630.

McQuade, K. J., Turner, J. A., & Buchner, D. M. (1988). Physical fitness and chronic low back pain. *Clinical Orthopedics and Related Research, 233,* 198–204.

Menard, M. R., Cooke, C., Locke, S. R., Beach, G. N., & Butler, T. B. (1994). Pattern of performance in workers with low back pain during a comprehensive motor evaluation. *Spine, 19,* 1359–1366.

Mey, H. R. de, & Derksen, J. (1995). Het nieuwe uniform van de MMPI-2: Omtrent *T*-scores [The MMPI-2's new uniform: About *T*-scores.] *Gedrag & Gezondheid, 23,* 179–184.

Newton, M., & Waddell, G. (1993). Trunk strength testing with isomachines: Part 1: Review of a decade of scientific evidence. *Spine, 18,* 801–811.

Ohnhaus, E. E., & Adler, R. (1975). Methodological problems in the assessment of pain: A comparison between the verbal rating scale and the visual analogue scale. *Pain, 1,* 379–384.

Pope, M. H., Rosen, J. C., Wilder, D. G., & Frymoyer, J. W. (1980). The relation between biomechanical and psychological factors in patients with low-back pain. *Spine, 5,* 173–178.

Prokop, C. K. (1986). Hysteria scale elevations in low back pain patients: A risk factor for misdiagnosis? *Journal of Consulting and Clinical Psychology, 54,* 558–562.

Roland, M., & Morris, R. (1983). A study of the natural history of low back pain. Part I: Development of a reliable and sensitive measure of disability in low back pain. *Spine, 8,* 141–144.

Rouse, S. V., Sullivan, J., & Taylor, J. (1997). Treatment-oriented MMPI/MMPI-2 studies. In J. N. Butcher (Ed.), *Personality Assessment in Managed Health Care: Using the MMPI-2 in Treatment Planning* (pp. 173–199). New York: Oxford University Press.

Schoppink, L. E., Tulder, M. W. van, Koes, B. W., Beurkens, S. A., & Bie, R. A. de (1996). Reliability and validity of the Dutch adaptation of the Quebec Back Pain Disability Scale. *Physical Therapy, 76,* 268–275.

Sloore, H., Derksen, J., Mey, H. R. de, & Hellenbosch, G. (1996). The Flemisch/Dutch version of the MMPI-2: Developments and adaptation of the inventory for Belgium and The Netherlands. In J. Butcher (Ed.), *International adaptations of the MMPI-2, A handbook of research and clinical application.* Minneapolis: University of Minnesota Press.

Snyder, D. K. (1990). Assessing chronic pain with the Minnesota Multiphasic Personality Inventory (MMPI). In T. W. Miller (Ed.), *Chronic pain: Clinical issues in health care management* (pp. 215–257). Madison, CT: International Universities Press.

Theuns, P., Mey, H. R. de, Schaeks, H. M., Bögels, Th. J., Roverts, J. E., & Derksen, J. J. (1994). *MMPI-2: Computerprogramma voor afname en scoring. Ver. 2.01* [Computer program for administration and scoring]. Nijmegen, the Netherlands: PEN Tests Publisher.

Vendrig, A. A. (in press). The Minnesota Multiphasic Personality Inventory and chronic pain: A conceptual analysis of a long standing but complicated relationship. *Clinical Psychology Review.*

Vendrig, A. A., Mey, H. R. de, Derksen, J. J., & Akkerveeken, P. F. van (1998). Assessment of chronic back pain patient characteristics using factor analysis of the MMPI-2: Which dimensions are actually assessed? *Pain, 76,* 179–188.

Received November 16, 1998
Revision received March 3, 1999
Accepted March 29, 1999 ■