



# THE MINNESOTA MULTIPHASIC PERSONALITY INVENTORY AND CHRONIC PAIN: A CONCEPTUAL ANALYSIS OF A LONG-STANDING BUT COMPLICATED RELATIONSHIP

Alexander A. Vendrig

Rug AdviesCentra Nederland

**ABSTRACT.** *The Minnesota Multiphasic Personality Disorder (MMPI) and its successor, the MMPI-2, have a long-standing tradition in the assessment of patients with chronic pain. With the introduction of more narrowly defined and factor-analyzed pain inventories, however, the utility of the MMPI-2 for pain assessment has been brought into question. In this review, the relevant literature is carefully scrutinized from a conceptual and historical perspective. It is concluded that many of the (recent) criticisms are largely ungrounded. Rather than the test itself being at fault or of little utility in the field of pain assessment, it has simply been applied inappropriately (i.e., for determination of pain etiology or underlying personality structure “explaining” the chronic pain). In conclusion, it is suggested that the application of the MMPI-2 in the assessment of patients with chronic pain should correspond more closely to the original aims and psychometric properties of the tool—that is, for screening and the generation of hypotheses regarding comorbid psychopathology and personality features having the potential to complicate the treatment process. Guidelines for clinical interpretation of MMPI-2 profiles with regard to chronic pain are provided. © 2000 Elsevier Science Ltd.*

**KEY WORDS.** Chronic pain, MMPI-2, Assessment, Personality.

THE MINNESOTA MULTIPHASIC Personality Inventory (MMPI) is clearly the most widely used and studied self-report measure of psychopathology and personality. Consideration of a few figures illustrates this. Since its introduction at the end of the 1940s, more than 12,000 articles and books have been published on the MMPI and

---

Correspondence should be addressed to Dr. Alexander A. Vendrig, Rug AdviesCentra Nederland, Utrechtseweg 92, 3702 AD Zeist, The Netherlands. E-mail: vendrig@rac-zeist.nl

the MMPI-2 (Butcher, 1990); more than 26,000 American psychologists make use of the MMPI-2 (Butcher, 1995); and the MMPI-2 is used in more than 60 countries (Butcher, 1996). The MMPI and its successor, the MMPI-2, are also widely and frequently used in the assessment of patients with chronic pain.

In order to update the item pool and in light of weak psychometric properties, the original MMPI was revised in the 1980s. This revision resulted in the publication of the MMPI-2 in 1989 (Butcher, Dahlstrom, Graham, Tellegen, & Kaemmer, 1989). Among the major changes were the elimination or replacement of outdated items, the formulation of new norms based on a larger and more representative sample, and the use of uniform rather than linear *T*-scores. One important priority on the part of the revision committee was that the MMPI and MMPI-2 remain comparable in order to preserve the wealth of research already conducted with the MMPI. The continuity between the MMPI and MMPI-2 has indeed been established (e.g., Ben-Porath & Butcher, 1989; Graham, Timbrook, Ben-Porath, & Butcher, 1991). In the context of the present review, this means that those conclusions regarding the clinical application of the MMPI are also relevant for the clinical application of the MMPI-2.

With the exception of a few scales, both the MMPI and MMPI-2 possess sufficient test-retest reliability and internal stability (Graham, 1993). The validity of the MMPI and MMPI-2 is nevertheless complicated as it pertains to a number of issues of definition (i.e., construct, content, concurrent, discriminant, and predictive validity), methodological issues, and conceptual/interpretative issues. Declaring that the MMPI-2 is well-validated is thus premature, and the present review can be regarded as a discussion of the validity of the MMPI-2 within a single field of clinical application, namely, chronic pain.

This is not the first review on the application of the MMPI in the field of chronic pain. In fact, three reviews have appeared to date (Keller & Butcher, 1991; Love & Peck, 1987; Snyder, 1990). Thus, why another review? In addition to the fact that the existing reviews appear to be somewhat out of date, they all take a rather strict approach to the accumulation of empirical facts on the MMPI without placing it in its broader historical context or discussing the conceptual difficulties afflicting MMPI research in the field of chronic pain. The application of the MMPI with chronic pain patients raises such sensitive and difficult questions as: What are the merits of assessing psychopathology in this patient population, and how should the MMPI-2 be situated with respect to cognitive/behavioral models of pain?

Since the 1980s, the MMPI has increasingly been criticized. Many clinicians have replaced the MMPI with more narrowly focused questionnaires based more or less directly on a variety of pain constructs. Nevertheless, these developments and the criticisms made of the MMPI have been largely ignored in the aforementioned reviews. Moreover, the reviewers unanimously conclude that the research findings with regard to the utility of the MMPI in the field of pain assessment are inconclusive without clarifying this conclusion any further. Other criticisms of the MMPI are simply not well-grounded, and all too often the validity and utility of the application of the MMPI-2 in the field of chronic pain is brought into question on the basis of conclusions based on now out-of-date concepts of pain. Such conclusions have, in other words, taken on a reality of their own.

The aim of the present review is thus to evaluate the clinical utility of the MMPI-2 in the field of pain assessment. In light of the above observations, moreover, the changing nature of the clinical practices and concepts utilized within this field will be carefully taken into consideration in order to correctly evaluate the scientific status of the

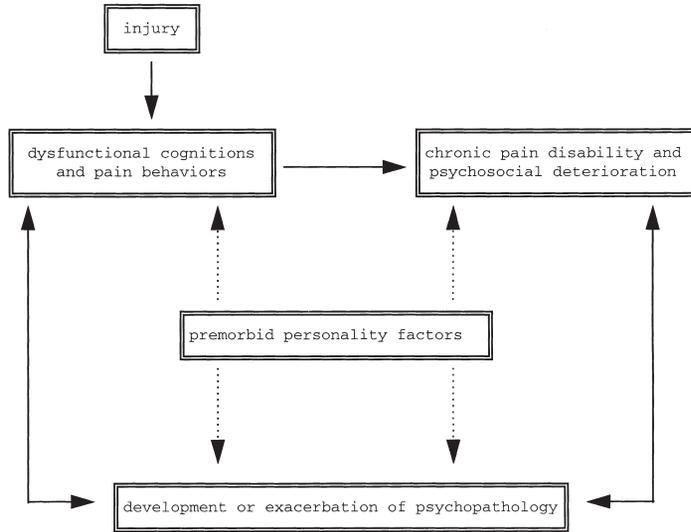
MMPI-2. First, a conceptual model of how the relationship between psychopathology/personality and chronic pain is currently conceived will be presented. Just how the various MMPI studies fit into this model will then be considered throughout the review. Second, the earlier MMPI studies utilizing the concept of psychogenic pain will be evaluated in considerable detail. Third, studies addressing the so-called conversion-V, which has dominated MMPI research with chronic pain patients, will be discussed. Fourth, studies that have factor or cluster analyzed MMPI/MMPI-2 results for chronic pain patients will be considered in line with increasing recognition of the heterogeneity of this population. Fifth, those studies addressing the utility of the MMPI/MMPI-2 for the prediction of treatment outcome will be evaluated. Treatment outcome is considered in terms of different end points along the trajectory from acute pain to chronic pain. Finally, the clinical implications of this review and some possible guidelines for clinicians assessing patients with chronic pain will be put forth.

### **PSYCHOPATHOLOGY/PERSONALITY AND CHRONIC PAIN: A MODEL**

There are different pathways whereby psychological factors can influence chronic pain. The number of psychological factors (e.g., catastrophizing, pain behavior, beliefs, etc.) contributing to chronic pain is almost endless. The MMPI-2 assesses only one group of psychological factors likely to be associated with chronic pain: psychopathology and personality. And, indeed, psychopathology is one of the most important concomitants of chronic pain (Gatchel, 1996).

To assess the utility of the MMPI-2 in the assessment of patients with chronic pain, it is important to have some consensus on the manner in which psychopathology and personality factors contribute to chronic pain. The conceptualization of the relationship in the present review is largely based on Gatchel (1996); the model shown in Figure 1 is a modified version of Gatchel's (1991) conceptual model of the transition from acute to chronic pain. For empirical support of this model, the reader is referred to Gatchel (1996).

Essential to this model is the assumption that patients bring certain predisposing personality/psychological characteristics with them, and that these characteristics can differ from one patient to the next and also be exacerbated by the stress of attempting to cope with chronic pain (Gatchel, 1996). Many difficult personalities may be relatively "dormant" and only elicited by the stress of a more chronic pain experience and/or the disability that dominates the lives of such patients. Psychological problems may thus play a role in the development or exacerbation of chronic pain (but not in the causation of acute pain). It is assumed that a pain problem can persist when acute pain is followed by such dysfunctional reactions as fear-avoidance behavior (kinesiophobia) or catastrophizing. Psychopathology (e.g., an anxiety disorder) and personality factors (e.g., a tendency to somatize) can contribute to such reactions. Conceptually, individuals with difficult personalities and thereby reduced coping skills can be viewed as having decreased resilience and adaptability (Millon, 1981). As a result of the suffering and psychosocial deterioration (e.g., loss of work) associated with what has become chronic pain, psychological problems may either arise or be exacerbated in particular individuals. For example, a person who has always "compensated" for feelings of inferiority through working extra hard and pursuit of a career at all costs may encounter depression and interpersonal problems as a result of the work loss. In keeping with Gatchel (1996), it is hypothesized that the form that the psychological



**FIGURE 1. Conceptual model of the relationship between psychopathology/personality and chronic pain.**

problems may take primarily depends on the premorbid personality/psychological characteristics of the individual and the current socioeconomic/environmental conditions. It is important to emphasize that the relationship between psychopathology/personality and chronic pain depicted in Figure 1 is nonspecific. In the next section, we will see that a preexisting “chronic pain personality” was assumed in earlier models of chronic pain.

In the present review, it is assumed that chronic pain-related distress and pain behaviors should always be evaluated in the context of psychopathology and personality. Conceptually, psychopathology/personality should not be regarded as an exclusive to cognitive/behavioral models of pain but, rather, as the context accompanying such factors. Pain behaviors may have different functions for different types of personality, which means that treatment can be made more effective when tailored to the differences that exist between individuals. More specifically, the treatment of chronic pain in a passive-aggressive personality may demand a different approach than the treatment of chronic pain in a dependent personality. In other words, as a broad screening instrument for psychopathology and personality, the MMPI-2 clearly has a role to play in the assessment of patients with chronic pain.

### EARLY RESEARCH: DETERMINING THE ETIOLOGY OF PAIN

Research on the MMPI with chronic pain patients dates back to the early 1950s. Hundreds of publications have appeared in the decades since then. Chronic pain and alcohol dependency/abuse have received by far the most attention, and the results have been generalized to a number of different clinical groups (Klump & Butcher, 1997). Although the term “chronic pain” will be used in this article, it should be mentioned that most of the studies under consideration examined chronic back pain patients.

In order to understand the theoretical underpinnings of early MMPI research on chronic pain, the then-dominant model of medicine or the so-called disease model must be understood. Physical symptoms were regarded as either the result of organic or psychogenic pathological processes. Following this logic, the pain of people showing no evidence of physical abnormalities or response to medical/surgical treatment were regarded as “psychogenic.” The relevant psychogenic conditions in this context were: hypochondriasis, hysteria, and depression (Engel, 1959).

The MMPI was quickly used to diagnose the vast (and increasing) number of pain sufferers with pain that appeared to be of a “psychogenic” origin. Hanvik (1951) was the first to compare the MMPI profiles of chronic back pain patients either with or without definite physical origins. His results showed those patients (30 males) without any evidence of physical abnormalities to score higher on nearly all of the clinical scales with the most pronounced differences found on Scales 1 (Hypochondriasis) and 3 (Hysteria). This configuration of elevated scores on Scales 1 and 3 was previously characterized by Gough (1946) as the “Conversion or Depressive Valley,” and the results of Hanvik (1951) seemed to be promising for differentiating between “organic” and “psychogenic” pain. Not until the 1970s, however, were attempts at replication undertaken.

In several studies, the results of Hanvik (1951) were indeed replicated (Leavitt, 1985; McCreary, Turner, & Dawson, 1977; Turner & McCreary, 1978). In some of these studies, it was nevertheless warned that the MMPI should be most carefully applied for the diagnosis of psychogenic pain because of considerable overlap (about 25% to 30%) between the categories of pain etiology.

One group of investigators sought a solution to the problem of overlap between organic and psychogenic patients by formulating a third category of “mixed” patients. Such patients were asserted to possess some definite physical abnormality, but with a notable higher degree of disability than could reasonably be expected. The results of research along these lines showed both “mixed” as well as “psychogenic” patients to have significantly greater scale elevations, with the greatest elevations again occurring on Scales 1 and 3 (Calsyn, Louks, & Freeman, 1976; Freeman, Calsyn, & Louks, 1976; Louks, Freeman, & Calsyn, 1978). Other studies failed, however, to demonstrate either directly or indirectly a significant difference between the “organic” and “psychogenic” categories of pain (Fordyce, Brena, Holcomb, De Lateur, & Loeser, 1978; Sternbach, Wolf, Murphy, & Akesson, 1973b).

### ***Back Pain Scales***

An alternative to the differentiation between “organic” and “psychogenic” pain using the clinical scales of the MMPI was to use specially designed “back pain scales.” These scales were developed to aid in the psychological diagnosis of chronic back pain patients. Two such scales were the Low Back scale (LB) (Hanvik, 1951) and the Dorsal scale (DOR) (Pichot et al., 1972). The latter group of authors entitled their scale “dorsal” because all of the patients they studied had midback or “dorsal” pain. In attempts to evaluate the utility of these scales in the differentiation of “psychogenic” from “organic” pain, it has been found that those patients diagnosed as “psychogenic” tend to obtain higher scores on the LB and DOR scales than “organic” patients, although the correct classification rates appear to be far below what is now considered clinically acceptable (the rates of correct classification varied between 50% and 75%) (Calsyn et al., 1976; Freeman et al., 1976; Pichot et al., 1972; Tsushima & Towne, 1979).

Endeavors were also made to cross-validate the LB and DOR scales. Towne and Tsushima (1978) compared the scores of functional back pain patients with those of patients suffering from gastrointestinal complaints on the LB and DOR scales, and failed to establish important differences. According to the authors:

The failure of the LB and DOR scales to differentiate low back pain patients from GI [gastrointestinal] and psychiatric patients implied that patients with an organic back condition who have other psychosomatic or psychiatric symptoms are likely to be misdiagnosed as having a functional back condition. It appears that the LB and DOR scales do not measure features that are unique to persons with functional back pain, but rather seem to measure emotional characteristics that also can be found in persons with psychoneurotic and functional GI conditions. (p. 90)

Given these disappointing results, Tsushima and Towne (1979) advised against the application of the LB and DOR scales for clinical diagnostic purposes, and the lack of any publication on these scales since the early 1980s shows most researchers agree with this conclusion.

### ***Inadequate Test or Inappropriate Use?***

The primary aim of early MMPI research was to provide empirical data to confirm the characteristics of patients suffering from “psychogenic” pain. The empirical evidence at the time showed this undertaking to be not very successful. An important point of dispute continues to be whether such failure should be attributed to problems inherent to the MMPI or to the conceptual model of medicine being used at the time (i.e., the disease model). Put differently: If the concept being investigated is wrong, then the test being utilized—no matter what its quality—is likely to produce inconsistent results. In short, if we consider the model presented in Figure 1, it becomes obvious that the early MMPI studies in the field of chronic pain clearly have failed (according to our current standards) in regarding the complex interactions between psychopathology/personality and chronic pain.

The introduction of the gate control theory of pain by Melzack and his colleagues (Melzack & Wall, 1965) marked the replacement of the disease model with the biopsychosocial model. It is now acknowledged that pain is a multidimensional phenomenon and the result of a complex interaction between biological, psychological, and social variables (Turk, 1996). In other words, organic and psychological factors are not mutually exclusive factors. In a study by Rosen, Frymoyer, and Clements (1980), such a view is applied in connection with the MMPI. Rosen et al. compared four groups of patients ( $n = 123$ ) in terms of “organic” versus “psychogenic” pain and “appropriate” versus “inappropriate” disability. Those patients with only an “inappropriate” disability were found to have elevated scores on both Scales 1 and 3. However, those patients reporting organic pain and “inappropriate” disability had the highest scores on the Scales 1 and 3 when compared to the other groups.

On the basis of these findings, it was concluded that the early MMPI researchers in chronic pain had followed the wrong track and that the studies in question are simply not relevant for evaluating the potential of the MMPI in the field of pain assessment. According to some philosophies of science (Kuhn, 1962; Lakatos, 1970), the “empirical facts” uncovered prior to the occurrence of a scientific revolution (in this case, the shift from the disease model to the biopsychosocial model of medicine) can take on a

completely different meaning within a new paradigm. Put differently, it is simply incorrect to draw conclusions on the basis of results obtained within a different paradigm. Although this pitfall seems rather obvious, many researchers continue to ignore the different paradigms associated with different studies/facts and thereby draw false conclusions. For example, Main, Wood, Hollis, Spanswick, and Waddell (1992) concluded that the MMPI "has poor discriminatory validity" and cited the study of McCreary et al. (1977) as evidence for this, even though the disease model of pain underlies this study.

It also seems scientifically mistaken to utilize a theoretically neutral questionnaire such as the MMPI-2 to determine the etiology of an illness in isolation from other clinical information. The clinical descriptions derived from the MMPI can be used to formulate possible explanations for an illness but should not be taken as the explanation itself. In another field of clinical application (i.e., the assessment of sexual dysfunction), Leonard and Dorfman (1996) have similarly observed that the MMPI does not identify etiology very well. Many years ago, moreover, Sternbach et al. (1973b) also highlighted the same problem in connection with the diagnosis and explanation of chronic pain:

The MMPI cannot be used to corroborate the physician's suspicion of either organically or functionally based illness. To do so would place the psychologist in the untenable position of diagnosing a physical disorder; a decision for which the psychologist lacks expertise.

### THE POLEMICAL CONVERSION-V

The gate control theory of pain (Melzack & Wall, 1965) had a tremendous impact on pain research, in general, and paved the way for recognition of psychological factors as an essential part of the pain experience, in particular. The changes in clinical and research practice obviously affected MMPI research on chronic pain as well. The primary aim of such research was no longer to determine the etiology of pain but to elucidate those patient characteristics that appear to play an important role in the pain experience. As the mean MMPI profile of chronic pain patients was commonly found to have elevated scores on Scales 1 and 3 relative to Scale 2 (Keller & Butcher, 1991), this profile pattern or the so-called conversion-V profile pattern became an important object of scrutiny. The conversion-V profile derives its name from the V-shape created by Scales 1, 2, and 3 and the presumed tendency in such cases to convert emotional problems into somatic ones. The conversion-V is also one of the most disputed issues in MMPI research with chronic pain.

The conversion-V profile is typically assumed to be the result of channeling emotional problems into somatic concerns. The emotional difficulty is more or less "converted" into a physical problem. Gough (1946) speaks of a "successful neurosis" because the patients are able to avoid the feelings of depression associated with most neuroses. Such explanations for the conversion-V (or the 13-codetype) are also found in the MMPI-2 manuals (e.g., Graham, 1993).

Particular personality characteristics have also been found to be associated with the conversion-V profile pattern. Gentry, Shows, and Thomas (1974) state that such people tend "to interpret problems in living in rational and socially acceptable terms" and tend to be "externally extroverted and sociable and internally self-centered, demanding, and dependent." Graham (1993) states that "the 13/31 individual is likely to con-

tinue functioning but at a reduced level of efficiency . . . They make excessive use of denial, projection, and rationalization, and they blame others for their difficulties . . . They are dependent but are uncomfortable with the dependency and experience conflict because of it." As personality is a rather stable and long-lasting entity, the finding of a distinct pattern of MMPI scores associated with the experience of pain and chronic pain, in particular, suggests that the experience of pain may be the result of a particular personality organization in such cases.

The explanation of the conversion-V profile in terms of personality has been challenged by many. The conversion-V pattern of scores may simply be a reflection of the pain condition rather than the cause of it. Sherman, Camfield, and Arena (1995), for example, asked orthopedic in-patients with organic findings to take the MMPI twice: first as they would have responded when pain-free and second in connection with the current pain. Scales 1 and 3 were indeed significantly elevated when compared to how the subjects would have responded when pain-free, which led to authors to conclude that the finding of a conversion-V pattern of responding is simply not clinically relevant for this group of patients.

Several attempts have been made to further understand the underpinnings to the conversion-V pattern of responding and have, in particular, challenged the earlier-mentioned traditional explanation. For example, a number of investigators have examined the subscales and items associated with Scale 3. Prokop (1986) compared the Harris-Lingoes subscales for patients with chronic back pain to those for normals and found subscale Hy3 (Lassitude-Malaise) to be the most salient discriminator. This finding then led Prokop to conclude that "the conversion-V must be conceptualized as a desire to communicate the presence of physical distress and dysfunctioning." Using a somewhat different design, Ornduff, Brennan, and Barrett (1988) came to the same conclusion. Similarly, McGrath and O'Malley (1986) found the admission of somatic complaints in patients with chronic pain to not be correlated with the denial of psychological difficulties or defensiveness. Watson (1982) performed an item analysis on the K-scale and Scales 1, 2, and 3 from the MMPI in three samples: 144 chronic pain patients; 50,000 medical patients; and over 5,600 college students. The chronic pain patients did not prove to be more defensive, but did endorse more somatic complaints than both the medical patients and the college students. Further item analysis showed distress, dissatisfaction, and somatic preoccupation to be most prominent among the patients with chronic pain.

In a handful of studies, the demographic and medical features associated with the MMPI profiles of chronic pain patients have been examined. When such characteristics as the age of the subject, number of operations, and number of physicians visited increased, a corresponding tendency for the scores on Scales 1 and 3 to also increase was observed (Adams, Heilbronn, Silk, Reider, & Blumer, 1981; Garron & Leavitt, 1983; Leavitt, 1985; Rook, Pesch, & Keeler, 1981; Sherman et al., 1995). These results have generally been taken to suggest that the conversion-V pattern of responding may indicate the "severity" of an illness.

Elevations on Scales 1 or 3 have also been found to be associated with behavioral characteristics such as a reduced spinal mobility (Pope, Rosen, Wilder, & Frymoyer, 1980; Vendrig, de Mey, Derksen, & van Akkerveeken, 1998); illness behavior according to the Waddell behavioral signs (Maruta et al., 1997; Vendrig et al., 1998; Waddell, McCulloch, Kummel, & Venner, 1980); and reduced activity levels (Fordyce et al., 1978). In still other research, elevations on Scales 1 and 3 have been found to be correlated with psychological characteristics such as tension and inhibition (Leavitt &

Garron, 1982) and “trait anxiety” and “trait anger suppression” (Kinder, Curtiss, & Kalichman, 1986), and “somatic distress” (Main, 1983; Main et al., 1992).

The effect of compensation and litigation on patients’ responses to the MMPI have also been examined, and it appeared that the MMPI scores of those patients seeking compensation and/or litigation are elevated, and most elevated on Scales 1 and 3 when compared to those of patients not seeking such compensation or litigation (Beals & Hickman, 1972; Leavitt, Garron, McNeill, & Whisler, 1982; Pollack & Grainey, 1984; Sternbach, Wolf, Murphy, & Akeson, 1973a). Unfortunately, recent studies concerning the effect of compensation/litigation on MMPI results are lacking.

In sum, the studies reviewed so far provide little support for the traditional interpretation (personality hypothesis) of the conversion-V pattern of responding in connection with chronic pain patients in terms of the 13/31 code-type. Research has failed to provide evidence for the hysteria-related personality traits sometimes assumed to be associated with the 13/31 code-type (and caution is therefore warranted with respect to interpreting the 13/31 individual along these lines). It appears, rather, that a conversion-V pattern of responding in patients with chronic pain must largely be attributed to the endorsement of stress-related somatic complaints. Closer inspection of the items constituting Scales 1 and 3 along with the results of some of the studies reviewed above suggest that the elevations on Scales 1 and 3 are certainly indicative of tension, emotional constraint, and general “somatic distress.” In fact, studies show the experience of multiple somatic complaints to be one of the most salient manifestations of emotional distress in cases of chronic pain (e.g., Novy, Nelson, Berry, & Averill, 1995; Williams & Richardson, 1993). There is ample research showing that tension and bodily distress can prolong a chronic pain state (for review, the reader is referred to Turk, 1996). It is therefore possible to argue that such tension and distress are not causing the pain directly but simply exacerbate or complicate the pain, when present, and thereby hinder the natural resolution of the pain situation, or stated otherwise, guarantee the pain to persist (Turk, 1996). In terms of Figure 1, a conversion-V pattern of responding could be regarded as a somatoform stress-reaction influencing, in a reciprocal manner, dysfunctional pain coping (catastrophizing, kinesiophobia) and psychosocial deterioration.

This line of reasoning is in keeping with the earlier pain-fear hypothesis put forth by Caldwell and Chase (1977) to explain the 13/31 code-type. In their words: “It is reasonable to presume that Scales 1 and 3 catch individual variations as regards pain-fear as well as the disposition toward anxiety and negative expectations with regard to physical functional capacity and freedom from pain in the future.”

## FACTOR ANALYSIS

Factor analysis is currently the method of choice for the construction of psychological tests. The MMPI, however, was developed before factor analysis was generally available and thus based on criterion analyses. In criterion-keyed test construction, a pool of items is administered to different groups and then those items that discriminate one group from the other are selected for inclusion. The main problem with this method lies in the fact that the groups may differ on more than one variable, which can make the psychological significance of the scales unclear at times or even empty. It also makes theorizing on the basis of scales derived in such a manner dubious at best. In other words, the MMPI-2 does not seem to be very useful for increasing our knowl-

edge of the psychological factors involved in pain, as we simply do not know what we are measuring at times. Once again, however, it should not be concluded that the MMPI-2 is therefore of absolutely no value in the clinical assessment of patients with chronic pain (a question to which I will return).

Some attempts have been made to factor analyze the MMPI-2 scale scores for patients with chronic pain. The scale, as opposed to item scores, have typically been analyzed (as an analysis of the 567 item scores would require more than 1,000 patients). It should be noted that the factor analysis of such scale scores reveals only higher order information, and that it is nevertheless interesting to consider the results of such an analysis as they can show us which of the MMPI-2 scales represent similar dimensions and which of the scales represent dissimilar dimensions. External validation with chronic pain patients can also clarify how these dimensions relate to the pain being suffered by these individuals. Three such attempts have been made over the years. The first attempt (Schmidt & Wallace, 1982) will not be discussed here because some of the elementary assumptions required for factor analysis were not met in that study.

In other work, Deardorff, Chino, and Scott (1993) and Vendrig et al. (1998) factor analyzed the basic MMPI-2 scales and the Harris-Lingoes subscales from Scales 2 (Depression) and 3 (Hysteria). In both studies, almost identical factor structures were revealed. Four factors emerged and could be labeled: "Psychological Disturbances: (Scales: Pd, Pa, Pt, Sc, D1, D4, D5); "Extroversion-Introversion" (K, Hy2, Hy1, -Si); "Passivity" (D2, -Ma); and "Somatic Complaints" (Hs, Hy4, D3, Hy3) (Vendrig et al., 1998). The latter group of authors also correlated these factors with a number of clinical variables relevant to pain. The measures of pain behavior were found to be clearly associated with the factor "Somatic Complaints." The latter study also showed the dimensions of psychological distress and somatic distress to be quite distinct and independently related to the measures of pain behavior. Somatic indications of distress appeared to bear a much more direct relationship to pain than "purely" psychological indications of distress.

## PROFILE ANALYSIS

With the development and refinement of a psychological approach to chronic pain in the 1980s, researchers became increasingly aware of the heterogeneity of the chronic pain population. In fact, current research on chronic pain is still dominated by the identification of subtypes in order to customize treatment. The most prominent research in this area is the work of Turk, who developed the Multidimensional Pain Inventory (MPI; Kerns, Turk, & Rudy, 1985) for the classification of patients in terms of a number of behavioral and psychosocial variables.

As early as 1974, Sternbach described four representative MMPI profiles for chronic pain patients: "Hypochondriasis", "Reactive depression", "Somatization reaction", and "Manipulative reaction." Little can be said about the validity of these subtypes as Sternbach did not correlate them with data external to the test. This is understandable in light of the purpose of this research, which was to verify the assumption that replicable subgroups of chronic pain patients demonstrate unique pain behaviors, can thus be distinguished, and can thus be investigated for more tailored treatment.

Basically two approaches have been adopted in the study of MMPI subtypes. The one approach can be characterized as "clinical" as the subgroups are established on the basis of similar code-types (for example, the 13/31 code-type). The other ap-

proach originated with Bradley (Bradley, Prokop, Margolis, & Gentry, 1978) and can be characterized as “empirical” or “statistical” because the technique of cluster analysis is usually applied to empirically identify the different subgroups. The difference between cluster analysis and factor analysis is that the first attempts to summarize *patients* with similar characteristics, whereas factor analysis summarizes *variables* with similar characteristics.

Keller and Butcher (1991) published an overview of those studies in which it is attempted to discern MMPI profile subtypes, and the reader is referred to this overview for more detailed information. Keller and Butcher (1991) did not discuss the methodological and conceptual problems associated with the preceding profile analyses, however, so explicit attention will be paid to these issues in the following sections of the present review.

### **External Validity of Subgroups**

As already mentioned, the assumption underlying the initial examination of subgroups was that each subgroup might be associated with a unique set of pain-related behaviors and thus concomitant treatment options. Replication of the established subtypes from study to study or documentation of the internal consistency of the subtypes provides initial evidence for the validity of the subtypes.

Evidence of the replicability of the clusters derived for chronic pain patients using the MMPI was provided by Costello, Hulsey, Schoenfeld, and Ramamurthy (1987) after performing a meta-cluster analysis of nine previously published studies reporting a total of 54 profile types. A four-cluster solution was found to best characterize the different profile types, and the four subtypes were labeled as “P-A-I-N.” Type P is the most psychopathological subtype as nearly all of the scales are elevated (with an estimated rate of occurrence within the population or base rate of 15%). Type A is defined as the conversion-V pattern (with an estimated base rate of 20%). Type I has elevated scores on Scales 1, 2, and 3 of the MMPI (with an estimated base-rate of 30%). And type N profiles are “within-normal-limits” (with an estimated base-rate of 25%).

It is of interest to know whether the P-A-I-N typology has been replicated with the MMPI-2. Two such attempts have been made with varying success. Keller and Butcher (1991) failed to replicate the four-cluster solution while Riley, Robinson, Geisser, and Wittmer (1993) clearly replicated the four-cluster solution. The failure of Keller and Butcher (1991) to replicate this underlying structure may be the result of a less than representative sample: between 60% and 70% of their original sample was lost. Greater replication is therefore needed to draw more definite conclusions.

The establishment of significant, consistent, and discriminatory relationships between extra-test data and the identified subgroups constitutes a second source of evidence for the validity of the derived patient subtypes. MMPI subgroups (basically the P-A-I-N subtypes) have been examined in conjunction with various clinical variables including the number of prior surgeries, pain intensity, depression, pain coping strategies, illness behavior, and overt pain behavior. Multivariate analyses of variance have indeed shown the different subtypes to significantly differ with regard to the extra-test correlates (e.g., Armentrout, Moore, Parker, Hewett, & Feltz, 1982; Bradley & Van der Heide, 1984; McGill, Lawlis, Selby, Mooney, & McCoy, 1983; Rosen, Grubman, Bevins, & Frymoyer, 1987; Swimmer, Robinson, & Geisser, 1992). However, post hoc comparisons showed the differences between the different subtypes with regard to the external variables to be largely due to the normal subtype (N) differing significantly from

the three clinical subtypes (P-A-I). Significant differences were generally not observed between the three clinical subtypes themselves. This finding refutes the assumption that each subtype stands for a unique constellation of pain-related behaviors. The subtypes derived from the MMPI will also, therefore, not be particularly useful in the planning of pain management programs as there is no direct relationship between the subtypes and more specific pain behavior profiles. Concluding that the MMPI is therefore of little or no value in the field of pain assessment is also mistaken, however. In keeping with our arguments regarding the use of the MMPI to determine pain etiology, it can be argued that the MMPI item pool is made up of largely psychiatric items and that it is therefore rather unlikely that subgroups established on the basis of such items will directly and consistently relate to categorizations of patients in terms of simple physically based pain behaviors. Such an approach is comparable to evaluating the nuances of color in a coral reef on the basis of a black and white picture. With regard to pain assessment, more consistent and useful results may have been found with the selection of more relevant extra-test data. One can think of such clinical variables as angry interactions with others, the anger components of pain, vulnerability, type of resistance demonstrated during group therapy, assertiveness, etc. And such clinical information is without any doubt relevant for the effective clinical management of patients. An alternative conclusion is that the inclusion of psychiatric measures in the assessment of pain is simply irrelevant—an issue to which we will return at the end of this review.

## OUTCOME PREDICTION

A frequently examined application of the MMPI in the field of chronic pain is for the prediction of treatment outcome. The investigators in this area are less interested in understanding the “nature” of the observed MMPI profile patterns than in knowing which elements are clinically relevant for the prediction of treatment outcome. In still other studies, the capacity of the MMPI to predict the development of chronic pain has also been examined. Gatchel, Polatin, and Mayer (1995) distinguish three types of outcome predictors. Primary or preinjury predictors identify the percentage of an injured population likely to develop a back pain incident. Secondary or prechronicity predictors identify those patients with an acute back pain incident that is likely to develop into a chronic condition. Finally, tertiary or chronic outcome predictors identify treatment success and/or failure in the chronic pain population. The apparent utility of the MMPI for each type of prediction will be considered in the following.

### ***Primary Outcome Prediction***

In the 1970s and 1980s, it was increasingly recognized that an injury model alone cannot explain what is commonly referred to as an “industrial back problem.” Vallfors (1985) found the majority of people filing back-injury claims to be incapable of describing a specific incident or injury. For this reason, investigators became interested in the risk factors associated with the report of back problems. Research showed psychosocial factors to be stronger predictors than physical measures (e.g., Troup, Foreman, Baxter, & Brown, 1987). In this context, Bigos et al. (1991) conducted a prospective study of 3,020 aircraft employees at a Boeing factory in western Washington to identify the risk factors for report of acute back pain at work. The premorbid data

included individual physical, psychosocial, and workplace factors. The psychosocial factors included the MMPI, among other measures. The results of univariate analyses showed significant predictive power for Scale 3 (Hysteria), Scale 4 (Psychopathic Deviate), and Scale 8 (Schizophrenia). In the multivariate model, Scale 3 was selected together with job/task enjoyment and a history of back pain.

The significance of Scale 3 (Hysteria) for the prediction of back injury report stimulated Fordyce, Bigos, Battié, and Fisher (1992) to take a closer look at the items and subscales constituting Scale 3. They found the greatest contribution from Hy3 (Lassitude-Malaise). Hy1 (Denial of Social Anxiety) made the next largest contribution. Hy2 (Need for Affection) made only a slight contribution after the inclusion of Hy1 (Denial of Social Anxiety). Hy4 (Somatic Complaints) and Hy5 (Inhibition of Aggression) were not selected. The nonsignificance of Hy4 (Somatic Complaints) reinforces the questionable relationship between the report of back injury and actual bodily distress. It appears, rather, that the unhappiness and feelings of general malaise expressed by Hy3 may be responsible for the absenteeism related to back pain. It is possible that those people with Hy3 elevations are more prepared to give up working than those without such elevations. To date, 75% of the working-aged population reports back symptoms when surveyed each year, but only 2% to 5% are disabled because of back pain. The same type of argument may hold for Hy1 (Denial of Social Anxiety); those people with elevated Hy1 scores may be more inclined to neglect their (employment) duties when confronted with back pain than those without such elevated scores. While the results of these two studies have increased our understanding of the psychosocial factors involved in absenteeism related to back pain, the predictive power of the MMPI scales is simply not great enough for individual screening.

The relationship between the MMPI and the report of back pain has also been examined prospectively within the general population (Hanssen, Biering-Sorensen, & Schroll, 1995). In the context of a general health survey aimed at the identification of cardiovascular risk factors, participants completed a shortened Danish version of the MMPI (386 items composing 13 basic scales) at the ages of 50 and 60 years. Back pain data were collected in interviews at the ages of 60 and 70. The authors found the MMPI scores at age 50 to be no different for those who did and those who did not report back pain between the ages of 60 and 70 years, provided no back pain was reported between the ages of 50 and 60 years. However, those people reporting back pain between the ages of 50 and 60 showed significantly higher MMPI profiles than those reporting no back pain in the same period. The authors thus conclude that the experience of back pain may change the MMPI results and not the other way around. The results of this study should nevertheless be interpreted with caution due to major methodological problems, including high drop-out rates; the older age of the population not being representative of the back pain population; simply asking "Have you experienced back pain in the past 10 years?" to assess the occurrence of back pain; and the type of statistical contrasts applied to the groups (Vendrig, 1996).

### ***Secondary Outcome Prediction***

A relatively recent interest concerns the prediction of outcome in people with acute back pain. Put differently, which of the people with acute or subacute back pain develop chronic pain complaints? In two recent studies, Gatchel and coworkers used the MMPI in conjunction with other psychological tests to predict outcome (Gatchel, Polatin, & Kinney, 1995; Gatchel, Polatin, & Mayer, 1995). A cohort of 324 patients

within 6 weeks of the onset of acute back pain was evaluated and then interviewed 6 months later to evaluate return-to-work status. The results showed those patients not back at work after 6 months due to the original injury to have significantly higher scores than those back at work on Scale 3 of the MMPI. Unfortunately, the subscales of Scale 3 were not considered in these two studies. According to Gatchel, the individuals with high Scale 3 scores are more likely to develop and passively accept a chronic disability because of a general "malaise" with regard to their condition. In a study by Lacroix et al. (1990), 100 workers' compensation patients were assessed 3 to 6 months after their first back injury and reassessed at a mean of 13.7 months postinjury when their work status was also determined. Once again, MMPI Scales 1 and 3 negatively correlated with return-to-work status.

### ***Tertiary Outcome Prediction Using Individual MMPI Scales***

The poor treatment response of patients with chronic pain has inspired attempts to identify those MMPI variables that can predict individual responses to therapy. The usual procedure is to compare the pretreatment MMPI data for successfully and unsuccessfully treated patients. The studies in this realm have examined both the individual MMPI scales and MMPI profiles. The studies concerned with the individual MMPI scales will be considered here, and the studies concerned with MMPI profiles will be considered in the next section.

One of the most frequently studied treatments examined in MMPI outcome prediction research is surgical treatment. Wilfling, Klonoff, and Kokan (1973) were the first to study the MMPI in connection with the outcome of surgical treatment for back pain. Subjects were 26 male subjects who had undergone lumbar intervertebral fusion(s) for relief of back pain 2 to 9 years prior to study. The pretreatment MMPI results for three groups of patients were compared: patients with a poor, fair, or good treatment outcome. The results showed patients with a fair or poor treatment outcome to score significantly higher than the patients with a good outcome on MMPI scales 1 (Hypochondriasis), 2 (Depression), 3 (Hysteria), and the Ego-strength (Es) scale.

In an elaboration of the summary provided by Akerlind, Hornquist, and Bjurulf (1992), a summary of those studies examining the MMPI in connection with the prediction of surgical outcome is presented in Table 1. As can be seen, the most frequent result is obtained for Scale 1 (Hypochondriasis) and, to a lesser degree, for Scale 3 (Hysteria).

Somatic distress and a preoccupation with one's body may explain the poor response of individuals scoring high on MMPI Scale 1. Surgical and conservative treatment addresses only one component of the pain problem. Such factors as somatic distress and a bodily preoccupation, moreover, may actually prompt pain behavior and tension (or exacerbate the presence of such) and thereby hinder successful recovery from chronic pain in a more or less self-perpetuating process. It must be emphasized that Scale 1 should not be understood as a measure of some "hypochondriacal" personality trait. To date, several studies have shown elevations on Scale 1 to decrease after successful (simple) treatments, which contradicts an interpretation of Scale 1 in terms of personality (Barnes, Gatchel, Mayer, & Barnett, 1990; Gatchel, Mayer, Capra, Diamond, & Barnett, 1986; Naliboff, McCreary, McArthur, Cohen, & Gottlieb, 1988; Sternbach & Timmermans, 1975; Watkins, O'Brien, Draugelis, & Jones, 1986). According to Fordyce (1976), people with high Scale 1 scores may be predisposed to complain of

TABLE 1. Summary of Studies Addressing Utility of the MMPI to Predict Surgical Treatment Success

| Author(s)                                    | Sample<br>N | Mean Age (Yr.)<br>(Range or SD) | Follow-up               | Outcome<br>Measure(s) | Significant MMPI scales |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
|--|-------------|---------------------------------|-------------------------|-----------------------|-------------------------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
|  |             |                                 |                         |                       | L                       | F | K | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |   |   |   |   |   |
| Blumetti & Modesti (1976)                    | 81          |                                 | 6 m.                    | Rating                | -                       | - | - | * | - | * | - | - | - | - | - | - | - | - | - | - |   |
| Chapman & Brena (1982)                       | 67          | 43 (10.2)                       | 1 d.                    | Pain                  | *                       | - | * | - | * | - | * | - | - | - | - | - | - | - | - | - |   |
| Dzioba & Doxey (1984)                        | 77          |                                 | 1 yr.                   | Rating                | -                       | - | - | * | - | - | - | - | - | - | - | - | - | - | - | - |   |
|  |             |                                 |                         | Work status           | -                       | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |   |
| Herron & Pheasant (1982)                     | 69          | 45 (20-65)                      | 1-11 yr.<br>(M = 5 yr.) | Rating                | -                       | - | - | * | - | * | - | - | - | - | - | - | - | - | - | - |   |
| Herron & Turner (1985)                       | 106         | 41 (16-69)                      | 1-4 yr.<br>(M = 18 m.)  | Rating                |                         |   |   | * |   | * |   |   |   |   |   |   |   |   |   |   |   |
| Herron, Turner, Clancy, & Weiner (1986)      | 106         | 41 (16-69)                      | 1-5 yr.<br>(M = 18 m.)  | Rating                | -                       | - | - | * | - | * | - | * | - | * | - | * | - | * | - | * | - |
| Herron, Turner, & Weiner (1986)              | 129         | 46 (16-82)                      | 1-4 yr.<br>(M = 18 m.)  | Rating                | -                       | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Long (1981)                                  | 44          |                                 | 6-18 m.                 | Rating                | -                       | - | - | * | - | * | - | - | - | - | - | - | - | - | - | - | - |
| Oostdam, Duivenvoorden, & Pondaag (1981)     | 113         | 40 (40.2)                       | 6 m.                    | Rating                | -                       | - | - | * | - | * | - | * | - | * | - | * | - | * | - | * | - |
| Pheasant, Gilbert, Gildfarb, & Herron (1979) | 103         | 40 (20-55)                      | 6-12 m.                 | Rating                | -                       | - | - | * | - | * | - | * | - | * | - | * | - | * | - | * | - |
| Sorensen & Mors (1988)                       | 57          |                                 | 6 m.                    | Pain, work status     |                         |   |   | * |   | * |   | * |   | * |   | * |   | * |   | * |   |
| Turner, Herron, & Weiner (1986)              | 106         | 40.6 (11.5)                     | 1-4 yr.<br>(M = 18 m.)  | Rating                |                         |   |   | * |   | * |   | * |   | * |   | * |   | * |   | * |   |
| Uomoto, Turner, & Herron (1988)              | 129         | 46 (16-82)                      | 1-4 yr.<br>(M = 18 m.)  | Pain, functioning     | *                       | - | * | - | * | - | * | - | * | - | * | - | * | - | * | - | * |
| Waring, Weisz, & Bailey (1976)               | 34          | 40 (24-68)                      | 6 m.                    | Rating                | -                       | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Watkins, O'Brien, Draugelis, & Jones (1986)  | 42          | 42 (1.4)                        | 2 yr.                   | Pain, work status     | -                       | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Wilfling, Klonooff, & Kokan (1973)           | 26          |                                 | 2-9 yr.                 | Rating                | -                       | - | - | * | - | * | - | * | - | * | - | * | - | * | - | * | - |
| Wiltse & Rocchio (1975)                      | 130         | 43                              | 1 yr.                   | Work status           | -                       | - | - | * | - | * | - | * | - | * | - | * | - | * | - | * | - |

\* = significant finding; - = non-significant finding; blanks = not assessed; Rating = rating of the success of the operation (e.g., poor, fair, good); d. = days; m. = months; yr. = years.

pain and bodily distress and thereby have an increased “risk” of pain behaviors being reinforced by not only the family but also the health care system (p. 139).

A flaw in almost all studies of response to surgical treatment is a failure to report and analyze the positive hit rates or cases in which the response to surgical treatment was accurately predicted. Without some index of the sensitivity and specificity of the MMPI for the prediction of the outcome of surgical treatment, it is difficult to evaluate the clinical utility of the MMPI for this purpose. More detailed and refined research is needed. To date, however, the MMPI-2 appears to be a suitable tool for the assessment of patients undergoing back surgery. High Scale 1 patients may need additional behavioral support following surgery.

Individual MMPI scales have also been considered in connection with treatment other than surgical intervention. However, the number of such studies in this area is limited. McCreary, Turner, and Dawson (1979) found some evidence suggesting that elevated scores on Scales 1 and 3 are associated with a poor response to conservative treatment. Roberts and Reinhardt (1980) evaluated the MMPI for outcome prediction after an operant inpatient treatment program ( $N = 26$ ). The follow-up ranged from 1 to 8 years. Unsuccessfully treated patients were found to have higher scores on the Paranoia (Pa) scale and lower scores on the Ego-strength (Es) scale already at baseline. Keefe, Block, Williams, and Surwit (1981) evaluated the responses of 52 chronic back pain patients to a comprehensive behavioral treatment program emphasizing relaxation procedures. The MMPI scores of the patients in the best ( $N = 15$ ) and worst ( $N = 10$ ) groups were compared. No significant differences were found. In a recent study, Vendrig (1999) evaluated the ability of the MMPI-2 to predict return to work (determined 6 months after outpatient participation in a four-week, multimodal, chronic back pain treatment program ( $N = 143$ ). Scale 1 and Hy3 (Lassitude-Malaise) were found to be significant predictors of return of work.

### ***Tertiary Outcome Prediction Using MMPI Profile Subtypes***

In Table 2, the results of studies examining the utility of personality profile subtypes derived from the MMPI are summarized. All of the studies made use of the original MMPI with the exception of the study by Riley, Robinson, Geisser, Wittmer, and Smith (1995). Only those studies with the entire sample consisting of chronic pain patients were considered. The samples largely consisted of patients with ongoing back pain. Additional inclusion criteria were a minimal follow-up period of 6 months and the use of well-defined code types ( $T > 69$ ) in studies with clinically-derived subgroups. Of the 12 initial studies, 8 were included in the end (see Table 2). These eight studies were then examined for the presence of significant outcome differences in the areas of pain intensity, disability, depression, and return to work, which are the dimensions most frequently used to assess the outcomes of treatment for chronic pain (Turk, Rudy, & Sorkin, 1993).

The methodological quality of the studies under consideration was generally poor. No study could be qualified as methodologically “sound.” Among the most significant methodological flaws were: no multiple outcome measures (to cover the four key domains of treatment outcome in chronic pain); no description of the inclusion and exclusion criteria; no clear description of treatment components; no description of dropouts; no intention-to-treat analysis; no description of attrition rates; no report or description of the removal of invalid MMPI profiles (as established by the MMPI validity scales); and no covariance analyses for possible baseline differences. This last meth-

**TABLE 2. Summary of Studies Examining MMPI Subtypes and Treatment Outcome**

| Authors  | Sample<br><i>N</i> | Mean age<br>( <i>SD</i> ) | Mean Length<br>of Pain<br>( <i>SD</i> ) | Illness   | Treatment             | Treatment<br>Duration | Follow-up<br>Period         | Outcome Domain |           |           |
|--|--------------------|---------------------------|---|-----------|-----------------------|-----------------------|-----------------------------|----------------|-----------|-----------|
|  |                    |                           |   |           |                       |                       |                             | Pain           | Disab.    | RTW       |
| <b>Clinically-derived subgroups</b>                    |                    |                           |   |           |                       |                       |                             |                |           |           |
| Chapman & Pemberton<br>(1994)                          | 122                |                           | 7 yr.                                   | Back pain | Multidisc.<br>program | 2 wk                  | 6-66 m.<br><i>M</i> = 36 m. | sig.           |           | <i>ns</i> |
| McCreary, Naliboff, &<br>Cohen (1989)                  | 271                | 45 yr.                    | 3 yr.                                   | Back pain | Pain clinic           |                       | 6-12 m.                     | sig.           | <i>ns</i> |           |
| Trief & Yuan (1983)                                    | 132                |                           | 4 yr.                                   | Back pain | Rehab.<br>program     | 6 wk.                 | 8-12 m.                     |                | <i>ns</i> | sig.      |
| <b>Empirically-derived subgroups</b>                   |                    |                           |   |           |                       |                       |                             |                |           |           |
| Riley, Robinson, Geisser,<br>Wittmer, & Smith (1995)   | 201                | 41 yr.<br>(8.2)           | 28.2 m.<br>(24.5)                       | Back pain | Surgery and<br>rehab. | 5 d.                  | > 6 m.                      | <i>ns</i>      | sig.      | sig.      |
| McCreary, Naliboff, &<br>Cohen (1989)                  | 271                | 45 yr.                    | 3 yr.                                   | Back pain | Pain clinic           | 6 wk.                 | 6-12 m.                     | sig.           | <i>ns</i> |           |
| Guck, Meilman, Skultety, &<br>Poloni (1988)            | 635                | 43 yr.                    | 64.7 m.                                 | Mixed     | Multidisc.<br>program | 4 wk.                 | 1-5 yr.                     | <i>ns</i>      | <i>ns</i> | <i>ns</i> |
| McCreary (1985)  | 401                | 45 yr.                    | 3 yr.                                   | Back pain | Pain clinic           |                       | 6-12 m.                     | sig.           |           |           |
| Bombardier, Divine, Jordan,<br>Brooks, & Neelon (1993) | 263                | 45 yr.                    | 6.5 yr.<br>(14)                         | Mixed     | Multidisc.<br>program | 2 wk.                 | 6 m.                        | sig.           | sig.      |           |

sig. = significant; *ns* = nonsignificant; RTW = Return-to-Work; d. = days; wk. = weeks; m. = months; yr. = years; multidisc. = multidiscipline.

odological concern is particularly important as isolated outcome scores versus pre-treatment to follow-up difference scores can yield quite different results. Put differently: Controlling for baseline differences is of central importance when potentially different responses to intervention are at issue.

An equal number of “positive” results (i.e., significant overall differences across MMPI subtypes) and “negative” results (i.e., no significant overall differences across MMPI subtypes) were found (see Table 2). The results were quite comparable for the two different methods of cluster derivation (clinical versus empirical). Taken together, the results summarized in Table 2 are not very impressive and suggest that the utility of the MMPI (and most likely the MMPI-2 as well) for the prediction of treatment outcome in connection with pain management may be limited. Definite conclusions cannot as yet be drawn. Additional research is clearly needed in this direction, and such investigation should certainly take the aforementioned methodological concerns into consideration along with a few other issues.

The first issue pertains to whether the subgroups should be derived on the basis of code-type or cluster analysis. Both methods have specific advantages and disadvantages. An important advantage of the cluster analysis method may be the identification of new and rather “unexpected” profile configurations that do not resemble any of the well-known code types. The literature to date, however, tend to support just the opposite. In keeping with Keller and Butcher (1991), it is therefore concluded that the popular cluster analysis provides little or no information that is not already available from code-type studies. In other words, when the code-type rules are well-defined, which means that both particular elevations and configurations are taken into account, cluster analysis adds very little.

A related issue is the clear conflict between actual subgroup homogeneity and classification demands. In cluster analyses, each and every case must be assigned to a cluster type, which produces an automatic classification rate of 100%. As a consequence, however, rather dissimilar profiles may be placed within the same cluster type at times. This makes replication very complicated, if not impossible (Henrichs, 1987), and suggests that conventional code types should again be preferred for the establishment of patient subtypes.

A final issue pertains to the fact that the studies in Table 2 utilized more or less the same design. That is, the responses of the established subgroups to more or less the same general treatment protocol were investigated. The question is whether significant differences between the various subgroups can or should be expected under more broad treatment conditions. Cognitive-behavioral treatment programs typically contain multiple treatment components; this means that some elements are most likely to work with some patients and other elements most likely to work with other patients. A better approach is to explicitly examine the interaction of the various subgroups with the different components of the treatment protocol or, better yet, completely different treatment protocols. Such an approach is far more likely to yield the information necessary to customize pain treatment. Unfortunately, such a Treatment  $\times$  Subgroup design has only a small empirical basis to date. To my knowledge, the only other study adhering to such a design is that by Turk, Rudy, Kubinski, Zaki, and Greco (1996) in which patients with temporomandibular disorders were classified on the Multidimensional Pain Inventory (MPI) and then randomly assigned to two different treatment protocols.

### ***Conclusions Concerning Prediction of Outcome***

Some general conclusions can now be drawn regarding the use of the MMPI to predict the outcome of (chronic) back pain. Outcome was regarded as different end-

points in the development and treatment of (chronic) pain. An interesting observation is that the significance of certain MMPI scales clearly depends on the type of outcome (i.e., primary, secondary, or tertiary outcome). That is, empirical support was found for Scale 3 as both a primary and secondary predictor of outcome, and for Scale 1 as a tertiary predictor of outcome with regard to surgical treatment in particular. However, inconclusive results were found for the utility of the MMPI in predicting treatment outcome following participation in multidisciplinary chronic pain programs. Love and Peck (1987) also concluded that pain management programs appear to be less sensitive to MMPI scale elevations than some forms of medical treatment. Although empirical support was found for the significance of Scale 1 in the prediction of outcome following surgery, the actual suitability of the MMPI-2 for the initial screening of surgical patients nevertheless remains questionable. To date, the type of information tapped by Scale 1 (i.e., somatization) can also be obtained using much shorter inventories such as the Distress and Risk Assessment Method (DRAM; Main et al., 1992) or the Illness Behavior Questionnaire (IBQ; Pilowsky & Spence, 1994).

With regard to the use of the MMPI-2 to predict outcome following participation in multidisciplinary pain programs, there appears to be no clear relationship between particular MMPI-2 scales or combinations of scales and outcome. A general finding was that people with within-normal-limits profiles showed a better treatment outcome than people with elevated profiles, regardless of the particular type of profile. This observation supports Gatchel's (1996) assumption that the relationships between personality/psychological problems and pain are largely nonspecific. For example, Gatchel, Polatin, and Kinney (1995) found any Axis II personality disorder in general and no specific type of disorder to predict chronicity. For these reasons and in light of the fact that chronic pain patients tend to show more disturbed than within-normal-limits profiles, the MMPI-2 does not appear to be very suited for the (simple) screening of candidates for chronic pain treatment programs.

## CONCLUSIONS

The present exploration of the literature on chronic pain and the MMPI has shown the relationship of the MMPI and its successor the MMPI-2 to the study of chronic pain to be a long standing but complicated one. Some authors have argued that the MMPI-2 does not have a place in the assessment of patients with chronic pain and that the inventory "should after more than half a century be gracefully retired" (Kline, 1993).

The position taken in the present review is that many of the criticisms of the MMPI-2 are simply the product of not taking the historical context of the relevant research into consideration. Stated more strongly, several of the applications of the MMPI in pain assessment research have simply been inaccurate, which means that the inventory is not the problem but its application is. For example, it is frequently stated that the MMPI is of little use because it does not discriminate between "organic" and "psychogenic" pain patients (Main et al., 1992). In fact, however, the MMPI was never intended to determine the etiology of pain or, for that matter, the etiology of any psychopathological condition. Viewed from this perspective, then, it is not surprising that the MMPI shows some definite shortcomings.

As a putative indicator of particular "personality structures," the MMPI and MMPI-2 have also provided the breeding ground for considerable speculation and numerous

unproductive research efforts. To illustrate, the literature on the conversion-V demonstrated that there is virtually no evidence for a hysterical personality style underlying this pattern of responding. This does not, however, make this profile pattern completely irrelevant for patients with chronic pain. In fact, a number of important clinical variables have been found to be clearly associated with this pattern of responding on the MMPI. In retrospect, thus, the presumption of a direct relationship between personality "structure" and pain appears to be mistaken. As early as 1952, Alexander (1952) argued that personality constitutes the background for the formation of symptoms and that the assumption of a direct relationship between personality and symptoms is simply untenable. As with the etiology of any disorders, it must be recalled that the MMPI was never designed to assess "personality structure." The MMPI is intended to screen for psychopathology and personality styles. Such an endeavor is clearly possible and legitimate as there is ample evidence of significant overlap/interaction (see Figure 1) between psychopathology and chronic pain conditions (e.g., Gatchel, 1996; Polatin, Kinney, Gatchel, Lillo, & Mayer, 1993).

It appears that investigators have tried too much to delineate the general characteristics of chronic pain patients on the MMPI-2. And, as has been outlined before, efforts have therefore been made to understand these characteristics in terms of behaviors/dysfunctions associated with pain. It cannot be stressed enough that such an approach has created a totally false impression of the application of the MMPI-2 with chronic pain patients. Again, the most effective application of the MMPI-2 is the determination of the psychological makeup of individual patients. And it is hard to study these for the "average" pain patient.

The value of the MMPI-2 in pain assessment has often been doubted because the tool was not specifically developed for chronic pain patients. In light of the aforementioned, however, the opposite may in fact be argued: The MMPI-2 should not be evaluated in such terms because the instrument was not designed to assess pain variables. Narrowly defined and factor analyzed pain inventories will naturally yield higher correlations than the MMPI-2 with constructs and behaviors related to pain. Nevertheless, it is of clinical interest to investigate the extent to and manner in which psychopathology relates to the impairment and/or disabilities of patients with chronic pain. To illustrate, significant and consistent associations have been found between the "dysfunctional" and "interpersonally distressed" subtypes on the Multidimensional Pain Inventory (MPI) and elevations on the MMPI-2 (Etscheidt, Steger, & Braverman, 1995).

The MMPI-2 has also been criticized for the overlap between the scales and therefore a lack of unidimensional constructs. The reality of clinical disorders, however, is that they do overlap. Neither the clinical interpretation of the information generated by the MMPI-2 nor research based on this information are problematic as long as the primary purpose is the screening for and specification of hypotheses regarding comorbid psychopathology. Evaluation in terms of unidimensional constructs and overly simple behaviors, moreover, can falsely color our perceptions of the utility of the MMPI-2 in the area of pain assessment.

Concerning future research, it seems to be more fruitful to study the MMPI-2 in terms of moderator of treatment instead of "rigid" predictors of treatment outcome. That is, under which circumstances and how must psychopathology/personality be dealt with to raise the effectiveness of treatment? More careful attention to our underlying assumptions and more thoughtful research designs can presumably reduce an additional 50 years of research to a few worthy studies.

### ***Guidelines for Clinical Interpretation of MMPI Profiles with Regard to Chronic Pain***

The considerable overlap and interaction between psychopathology and chronic pain conditions have been noted by many (e.g., Gatchel, 1996; Polatin et al., 1993). In Figure 1, however, it is shown that no simple cause-effect relationship exists between the two. It can be assumed, rather, that “dormant” psychological problems may express themselves in response to the stress of chronic pain and disability and thereby further aggravate or complicate the chronic pain problem. The assumption underlying the present review is that the management of patients with chronic pain can be made more effective by recognizing and understanding their psychological distress and weaknesses. For this reason, the MMPI-2—as a broad measure of psychopathology and personality—certainly has a role to play in the assessment of patients with chronic pain. Certain applications of the MMPI-2 with chronic pain patients have not received empirical support and cannot therefore be recommended while other applications have received some empirical support and can, thus, be recommended. It should be emphasized that the uses of the MMPI-2 that we recommend are based on the aforementioned assumption regarding the relevance of assessing psychopathology/personality in this patient population and have yet to be directly supported by empirical data.

### ***Discouraged Uses of the MMPI-2 with Chronic Pain Patients***

To start with, the use of the MMPI-2 to identify psychogenic pain appears to be a poor application simply because the concept of psychogenic pain is outdated. It is now generally accepted that pain is a multidimensional phenomenon and the result of a complex interaction between biological, psychological, and social factors (Turk, 1996). And, indeed, most of the earlier MMPI studies clearly failed to distinguish “psychogenic” from “organic” pain.

Second, the use of the MMPI-2 to decide whether a patient should or should not be admitted to a multidisciplinary chronic pain program must be discouraged. Of course, patients presenting a profile suggestive of a severe thought disorder, for example, should not be automatically admitted to such a treatment program. Otherwise, the body of evidence showing certain MMPI-2 scales or profile patterns to be associated with a poor treatment outcome is still weak. There is strong empirical evidence for the utility of the MMPI-2 for the prediction of outcome following surgical intervention (see Table 1), but use of the MMPI-2 for this purpose is still not recommended as the MMPI-2 has little more utility than much shorter inventories also aimed at the assessment of somatization (only MMPI-2 Scale 1 was predictive of treatment outcome following surgical intervention).

Third, the MMPI-2 is also not recommended as an initial screening instrument for general psychological adjustment in relationship to chronic pain. The MMPI-2 was not developed for this purpose and is, in fact, rather cumbersome when compared to more specific tests, including the Multidimensional Pain Inventory (MPI; Kerns et al., 1985) and the Distress and Risk Assessment Method (DRAM; Main et al., 1992).

### ***Recommended Uses of the MMPI-2 with Chronic Pain Patients***

First, and perhaps most importantly, the MMPI-2 may be used to determine the existence of psychological problems comorbid with the chronic pain. Such problems may then merit clinical attention in their own right. Chronic pain treatments are usually

brief and of a fixed length. It is very important that patients benefit to some extent from treatment as failed treatment experiences can lead to further demoralization. For this reason, the clinician should be aware of any comorbid psychopathology prior to the initiation of treatment. When a severely depressed patient is, for example, given antidepressant medication in the preprogram stage, the accessibility of the patient may change and thereby the chances of successful treatment enhanced. The MMPI-2 may be extremely useful for this purpose as other measures of pain-related psychological functioning lack the framework for assessment of general psychopathology/personality.

Second, the MMPI-2 can be used for reassessment. The model presented in Figure 1 suggests that psychological distress may decrease when the chronic pain problem is diminished. Nevertheless, clinical experience shows that residual psychopathology may persist (or even increase) in some patients despite improved functioning. Post-treatment assessment with the MMPI-2 may therefore be helpful for pinpointing the precise psychological maladjustment and identifying the type of psychological treatment that may be needed. McMahon, Gatchel, Polatin, and Mayer (1997), for example, found patients with a history of childhood abuse to have more disturbed pretreatment MMPI profiles, lower work retention rates, and a higher frequency of postrehabilitation operations for the same area of injury than patients without a history of childhood abuse. In a series of case studies, Vendrig (1999) showed comparison of the pre- and postprogram MMPI-2 profiles of patients treated in a 4-week chronic pain program to provide greater insight into psychological dysfunctioning and thereby the treatment possibilities for a patient.

Third, the information yielded by a MMPI-2 profile can help the clinician build some rapport with the patient and thereby enhance the level of motivation. The MMPI-2 validity scales are very helpful in this context as they assess the extent to which the individual has an open or closed outlook on his or her emotional condition (Graham, 1993). Moreover, the exact nature of the patient's outlook (i.e., shyness, extroversion, high personal standards, etc.) can be detected using the MMPI-2. Similarly, the motivational stage in which the patient finds him/herself is increasingly recognized as important (Jensen, 1996). To avoid patient resistance, the clinician should avoid discussion of psychological problems in a too-early stage. The MMPI-2 can be used to assess how prepared the patient is to face problems other than pain. In this light, Finn (1996) has presented some guidelines for how to use a patient's MMPI-2 results to match the clinical approach to the characteristics of the patient.

Fourth, the MMPI-2 can be used to detect psychological problems not discussed in the clinical interview. Patients may simply not report all relevant information in the clinical interview. It is not uncommon for a patient to not report substance abuse, for example. Many of the MMPI-2 scales nevertheless address such a problem. The patient should always be provided with feedback on his or her MMPI-2 results, which means that the clinician can also inform the patient about such problem areas.

Finally, it is suggested that the MMPI-2 results of a patient can be evaluated with regard to current theories of chronic pain. Diagnostic labels standing on their own should be avoided. In other words, the clinician should outline the manner in which psychopathology or certain aspects of personality can relate to pain behaviors and particular environmental circumstances. Along these lines, Fordyce (1976) has outlined how MMPI results can be related to particular operant behaviors. For example, chronic pain may yield rich reinforcement from the environment in the sense of "time out" from severe psychological problems. Conversely, a high Scale 0 score (So-

cial introversion) suggests that attention and social interaction may not be effective reinforcers for this particular patient (Fordyce, 1976). It should be emphasized that such clinical hypotheses must be further tested in empirical research. The MMPI-2 appears, in any case, to be relevant for pain assessment.

## REFERENCES

- Adams, K. M., Heilbronn, M., Silk, S. D., Reider, E., & Blumer, D. P. (1981). Use of the MMPI with patients who report chronic pain. *Psychological Reports, 48*, 855–866.
- Akerlind, L., 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.
- Alexander, F. (1952). *Psychosomatic medicine: Its principles and application*. London: Allan and Unwin.
- Armentrout, D. P., Moore, J. E., Parker, J. C., Hewett, J. E., & Feltz, C. (1982). Pain-patient subgroups: The psychological dimensions of pain. *Journal of Behavioral Medicine, 5*, 201–211.
- Barnes, D., Gatchel, R. J., Mayer, T. G., & Barnett, J. (1990). Changes in MMPI profile levels of chronic low back pain patients following successful treatment. *Journal of Spinal Disorders, 3*, 353–355.
- Beals, R. K., & Hickman, N. W. (1972). Industrial injuries of the back and extremities: Comprehensive evaluation, an aid in prognosis and management: A study of 180 patients. *Journal of Bone and Joint Surgery, 54*, 1593–1611.
- Ben-Porath, Y. S., & Butcher, J. N. (1989). The comparability of the MMPI and MMPI-2 scales and profiles. *Psychological Assessment, 1*, 345–347.
- Bigos, S. J., Battié, M. C., Spengler, D. M., Fisher, L. D., Fordyce, W. E., Hansson, T. H., Nachemson, A. L., & Wortley, M. D. (1991). A prospective study of work perceptions and psychosocial factors affecting the report of back injury. *Spine, 16*, 1–6.
- Blumetti, A. E., & Modesti, L. M. (1976). Psychological predictors of success or failure of surgical intervention for intractable back pain. In J. J. Bonica & D. G. Albe-Fessard (Eds.), *Advances in pain research and therapy* (pp. 323–325). New York: Raven Press.
- Bombardier, C. H., Divine, G. W., Jordan, J. S., Brooks, W. B., & Neelon, F. A. (1993). Minnesota Multiphasic Personality Inventory (MMPI) cluster groups among chronically ill patients: Relationship to illness adjustment and treatment outcome. *Journal of Behavioral Medicine, 16*, 467–484.
- Bradley, L. A., Prokop, C. K., Margolis, R., & Gentry, W. D. (1978). Multivariate analyses of the MMPI profiles of low back pain patients. *Journal of Behavioral Medicine, 1*, 253–272.
- Bradley, L. A., & Van der Heide, L. H. (1984). Pain-related correlates of MMPI profile subgroups among back pain patients. *Health Psychology, 3*, 157–174.
- Butcher, J. N. (1990). *MMPI-2 in psychological treatment*. Oxford, England: Oxford University Press.
- Butcher, J. N. (1995). Letter to MMPI'ers. *News and Profiles, 6*, 1.
- Butcher, J. N. (1996). *International adaptations of the MMPI: Research and clinical applications*. Minneapolis, MN: University of Minnesota Press.
- Butcher, J. N., Dahlstrom, W. G., Graham, J. R., Tellegen, A., & Kaemmer, B. (1989). *MMPI-2: An administrative and interpretive guide*. Minneapolis, MN: University of Minnesota Press.
- Caldwell, L. A., & Chase, C. (1977). Diagnosing and treatment of personality factors in chronic low back pain. *Clinical Orthopedics and Related Research, 129*, 141–149.
- Calsyn, D. A., Louks, J., & Freeman, C. W. (1976). The use of the MMPI with chronic low back pain patients with a mixed diagnosis. *Journal of Clinical Psychology, 32*, 532–536.
- Chapman, S. L., & Brena, S. F. (1982). Learned helplessness and responses to nerve blocks in chronic low back pain patients. *Pain, 14*, 355–364.
- Chapman, S. L., & Pemberton, J. S. (1994). Prediction of treatment outcome from clinically derived MMPI clusters in rehabilitation for chronic low back pain. *Clinical Journal of Pain, 10*, 267–276.
- Costello, R. M., Hulsey, T. L., Schoenfeld, L. S., & Ramamurthy, S. (1987). P-A-I-N: A four-cluster MMPI typology for chronic pain. *Pain, 30*, 199–209.
- Deardorff, W. W., Chino, A. F., & Scott, D. W. (1993). Characteristics of chronic pain patients: Factor analysis of the MMPI-2. *Pain, 54*, 153–158.
- Dzioba, R. B., & Doxey, N. C. (1984). A prospective investigation into the orthopaedic and psychological predictors of outcome of first lumbar surgery following industrial injury. *Spine, 9*, 614–623.
- Engel, G. L. (1959). 'Psychogenic' pain and the pain-prone patient. *American Journal of Medicine, 26*, 899–918.
- Etscheidt, M., Steger, H., & Braverman, B. (1995). Multidimensional Pain Inventory profile classification and psychopathology. *Journal of Clinical Psychology, 51*, 29–36.

- Finn, S. E. (1996). *Using the MMPI-2 as a therapeutic intervention*. Minneapolis, MN: University of Minnesota Press.
- Fordyce, W. E. (1976). *Behavioral methods for chronic pain and illness*. St. Louis, MO: C.V. Mosby.
- Fordyce, W. E., Brena, S. F., Holcomb, R. J., De Lateur, B. J., & Loeser, J. D. (1978). Relationship of patient semantic pain descriptions to physician diagnostic judgments, activity level measures and MMPI. *Pain, 5*, 293–303.
- Fordyce, W. E., Bigos, S. J., Battié, M. C., & Fisher, L. D. (1992). MMPI Scale 3 as a predictor of back injury reports: What does it tell us? *Clinical Journal of Pain, 8*, 222–226.
- Freeman, C. W., Calsyn, D. A., & Louks, J. L. (1976). The use of the Minnesota Multiphasic Personality Inventory with low back pain patients. *Journal of Clinical Psychology, 32*, 294–298.
- Garron, D. C., & Leavitt, F. (1983). Chronic low back pain and depression. *Journal of Clinical Psychology, 39*, 486–493.
- Gatchel, R. J. (1991). Early development of physical and mental deconditioning in painful spinal disorders. In T. G. Mayer, V. Mooney, & R. J. Gatchel (Eds.), *Contemporary conservative care for painful spinal disorders* (pp. 64–81). Philadelphia: Lea & Febiger.
- Gatchel, R. J. (1996). Psychological disorders and chronic pain. In R. J. Gatchel, & D. C. Turk (Eds.), *Psychological approaches to pain management: A practitioner's handbook* (pp. 33–52). New York: The Guilford Press.
- Gatchel, R. J., Mayer, T. G., Capra, P., Diamond, P., & Barnett, J. (1986). Quantification of lumbar functioning. Part 6: The use of psychological measures in guiding physical functional restoration. *Spine, 11*, 36–42.
- Gatchel, R. J., Polatin, P. B., & Kinney, R. K. (1995). Predicting outcome of chronic back pain using clinical predictors of psychopathology: A prospective analysis. *Health Psychology, 14*, 415–420.
- Gatchel, R. J., Polatin, P. B., & Mayer, T. G. (1995). The dominant role of psychosocial risk factors in the development of chronic low back pain disability. *Spine, 20*, 2702–2709.
- Gentry, W. D., Shows, W. D., & Thomas, M. (1974). Chronic low back pain: A psychological profile. *Psychosomatics, 15*, 174–177.
- Graham, J. R. (1993). *MMPI-2. Assessing personality and psychopathology*. Oxford, England: Oxford University Press.
- Graham, J. R., Timbrook, R. E., Ben-Porath, Y. S., & Butcher, J. N. (1991). Code-type congruence between MMPI and MMPI-2: Separating fact from artifact. *Journal of Personality Assessment, 57*, 205–215.
- Gough, H. E. (1946). Diagnostic patterns on the Minnesota Multiphasic Personality Inventory. *Journal of Clinical Psychology, 2*, 23–37.
- Guck, T. P., Meilman, P. W., Skultety, F. M., & Poloni, L. D. (1988). Pain-patient Minnesota Multiphasic Personality Inventory (MMPI) subgroups: Evaluation of long-term treatment outcome. *Journal of Behavioral Medicine, 11*, 159–169.
- Hanssen, F. R., Biering-Sorensen, F. B., & Schroll, M. S. (1995). Minnesota Multiphasic Personality Inventory profiles in persons with or without low back pain: A 20-year follow-up study. *Spine, 20*, 2716–2720.
- Hanvik, L. J. (1951). MMPI profiles in patients with low-back pain. *Journal of Consulting Psychology, 15*, 350–353.
- Henrichs, T. F. (1987). MMPI profiles of chronic pain patients: Some methodological considerations that concern clusters and descriptors. *Journal of Clinical Psychology, 43*, 650–660.
- Herron, L. D., & Pheasant, H. C. (1982). Changes in MMPI profiles after low-back surgery. *Spine, 7*, 591–597.
- Herron, L. D., & Turner, J. (1985). Patient selection for lumbar laminectomy and discectomy with revised objective rating system. *Clinical Orthopedics and Related Research, 199*, 145–152.
- Herron, L. D., Turner, J., Clancy, S., & Weiner, P. (1986). The differential utility of the Minnesota Multiphasic Personality Inventory: A predictor of outcome in lumbar laminectomy for disc herniation versus spinal stenosis. *Spine, 11*, 847–850.
- Herron, L. D., Turner, J., & Weiner, P. (1986). A comparison of the Millon Clinical Multiaxial Inventory and the Minnesota Multiphasic Personality Inventory as predictors of successful treatment by lumbar laminectomy. *Clinical Orthopedics and Related Sciences, 203*, 232–238.
- Jensen, M. P. (1996). Enhancing motivation to change in pain treatment. In R. J. Gatchel & D. C. Turk (Eds.), *Psychological approaches to pain management: A practitioner's handbook*. New York: The Guilford Press.
- Keefe, F. J., Block, A. R., Williams, R. B., & Surwit, R. S. (1981). Behavioral treatment of chronic low back pain: Clinical outcome and individual differences in pain relief. *Pain, 11*, 221–231.
- Keller, L. S., & Butcher, N. J. (1991). *Assessment of chronic pain patients with the MMPI-2*. Minneapolis, MN: University of Minnesota Press.
- Kerns, R. D., Turk, D. C., & Rudy, T. E. (1985). The West Haven-Yale Multidimensional Pain Inventory (WHYMPI). *Pain, 23*, 345–356.

- Kinder, B. N., Curtiss, G., & Kalichman, S. (1986). Anxiety and anger as predictors of MMPI elevations in chronic pain patients. *Journal of Personality Assessment*, *50*, 651–661.
- Kline, P. (1993). *Personality: The psychometric view*. London: Routledge.
- Clump, K., & Butcher, J. N. (1997). Psychological tests in treatment planning. In J. N. Butcher (Ed.), *Personality assessment in managed health care: Using the MMPI-2 in treatment planning* (pp. 93–130). Oxford, England: Oxford University Press.
- Kuhn, T. (1962). *The structure of scientific revolutions*. Chicago: The University of Chicago Press.
- Lacroix, J. M., Powell, J., Lloyd, G. J., Doxey, N. C., Mitson, G. L., & Aldam, C. F. (1990). Low-back pain: Factors of value in predicting outcome. *Spine*, *15*, 495–499.
- Lakatos, I. (1970). Falsification and the methodology of scientific research programmes. In I. Lakatos & A. Musgrave (Eds.), *Criticism and the growth of knowledge* (pp. 22–63). London: Cambridge University Press.
- Leavitt, F. (1985). The value of the MMPI conversion 'V' in the assessment of psychogenic pain. *Journal of Psychosomatic Research*, *29*, 125–131.
- Leavitt, F., & Garron, D. C. (1982). Rorschach and pain characteristics of patients with low back pain and "Conversion V" MMPI profiles. *Journal of Personality Assessment*, *46*, 18–25.
- Leavitt, F., & Garron, D. C., McNeill, T. W., & Whisler, W. W. (1982). Organic status, psychological disturbance and pain report characteristics in low back pain patients on compensation. *Spine*, *7*, 398–402.
- Leonard, S., & Dorfman, W. (1996). The role of the Minnesota Multiphasic Personality Inventory in the assessment of sexual dysfunctions: A review. *Clinical Psychology Review*, *16*, 317–335.
- Long, C. J. (1981). The relationship between surgical outcome and MMPI profiles in chronic pain patients. *Journal of Clinical Psychology*, *37*, 744–749.
- Louks, J. L., Freeman, C. W., & Calsyn, D. A. (1978). Personality organization as an aspect of back pain in a medical setting. *Journal of Personality Assessment*, *42*, 152–158.
- Love, A. W., & Peck, C. L. (1987). The MMPI and psychological factors in chronic low back pain: A review. *Pain*, *28*, 1–12.
- Main, C. J. (1983). The Modified Somatic Perception Questionnaire (MSPQ). *Journal of Psychosomatic Research*, *27*, 503–514.
- Main, C. J., Wood, P. L., Hollis, S., Spanswick, C., & Waddell, G. (1992). The distress and risk assessment method: A simple patient classification to identify distress and evaluate the risk of poor outcome. *Spine*, *17*, 42–52.
- Maruta, T., Goldman, S., Chan, C. W., Ilstrup, D. M., Kunselman, A. R., & Colligan, R. C. (1997). Waddell's nonorganic signs and Minnesota Multiphasic Personality Inventory profiles in patients with low back pain. *Spine*, *22*, 72–75.
- McCreary, C. (1985). Empirically derived MMPI profile clusters and characteristics of low back pain patients. *Journal of Consulting and Clinical Psychology*, *53*, 558–560.
- McCreary, C., Naliboff, B., & Cohen, M. (1989). A comparison of clinically and empirically derived MMPI subgroups in low back pain patients. *Journal of Clinical Psychology*, *45*, 560–570.
- McCreary, C., Turner, J., & Dawson, E. (1977). Differences between functional and organic low back pain patients. *Pain*, *4*, 73–78.
- McCreary, C., Turner, J., & Dawson, E. (1979). The MMPI as a predictor of response to conservative treatment for low back pain. *Journal of Clinical Psychology*, *35*, 278–284.
- McGill, J. C., Lawlis, G. F., Selby, D., Mooney, V., & McCoy, C. E. (1983). The relationship of Minnesota Multiphasic Personality Inventory (MMPI) profile clusters to pain behaviors. *Journal of Behavioral Medicine*, *6*, 77–92.
- McGrath, R. E., & O'Malley, W. B. (1986). The assessment of denial and physical complaints: The validity of the Hy scale and associated MMPI signs. *Journal of Clinical Psychology*, *42*, 754–760.
- McMahon, M. J., Gatchel, R. J., Polatin, P. B., & Mayer, T. G. (1997). Early childhood abuse in chronic spinal disorder patients: A major barrier to treatment success. *Spine*, *22*, 2408–2415.
- Melzack, R., & Wall, P. D. (1965). Pain mechanisms: A new theory. *Science*, *50*, 971–979.
- Millon, T. (1981). The nature of personality. In T. Millon (Ed.), *Disorders of personality* (pp. 3–23). New York: John Wiley & Sons.
- Naliboff, B. D., McCreary, C. P., McArthur, D. L., Cohen, M. J., & Gottlieb, H. J. (1988). MMPI changes following behavioral treatment of chronic low back pain. *Pain*, *35*, 271–277.
- Norton, J. C. (1990). Compensation and litigation in disabled pain patients. In Miller, T. W. (Ed.), *Chronic pain: Clinical issues in health care management* (pp. 110–148). Madison, CT: International University Press.
- Novy, D. M., Nelson, D. V., Berry, L., & Averill, P. M. (1995). What does the Beck Depression Inventory measure in chronic pain? A reappraisal. *Pain*, *61*, 261–270.
- Oostdam, E. M., Duivenvoorden, H. J., & Pondaag, W. (1981). Predictive value of some psychological tests on the outcome of surgical intervention in low back pain patients. *Journal of Psychosomatic Research*, *25*, 227–235.

- Ornduff, S. R., Brennan, A. F., & Barrett, C. L. (1988). The Minnesota Multiphasic Personality Inventory (MMPI) hysteria (hy) scale: Scoring bodily concern and psychological denial subscales in chronic pain patients. *Journal of Behavioral Medicine, 11*, 131–146.
- Pheasant, H. C., Gilbert, D., Gildfarb, J., & Herron, L. (1979). The MMPI as a predictor of outcome in low-back surgery. *Spine, 4*, 78–84.
- Pichot, P., Perse, J., Lekeous, M. O., Dureau, J. L., Perez, C. I., & Rychewaert, A. (1972). La personalite des subjects presentant des douleurs dorsales fonctionnelles valeur de l'inventaire multiphasique de personalite du minnesota. *Revue de Psychologie Appliquee, 22*, 145–172.
- Pilowsky, I., & Spence, N. (1994). *Manual for the Illness Behavior Questionnaire (IBQ)* (3rd ed.). Adelaide, Australia: University of Adelaide.
- Polatin, P. B., Kinney, R. K., Gatchel, R. J., Lillo, E., & Mayer, T. G. (1993). Psychiatric illness and chronic low-back pain: The mind and the spine—which goes first? *Spine, 18*, 66–71.
- Pollack, D. R., & Grainey, T. F. (1984). A comparison of MMPI profiles for state and private disability insurance applicants. *Journal of Personality Assessment, 48*, 121–125.
- 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*, 173–177.
- 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.
- Riley, J. L., Robinson, M. E., Geisser, M. E., & Wittmer, V. T. (1993). Multivariate cluster analysis of the MMPI-2 in chronic low-back pain patients. *Clinical Journal of Pain, 9*, 248–252.
- Riley, J. L., Robinson, M. E., Geisser, M. E., & Wittmer, V. T., & Smith, A. G. (1995). Relationship between MMPI-2 cluster profiles and surgical outcome in low-back pain patients. *Journal of Spinal Disorders, 8*, 213–219.
- Roberts, A. H., & Reinhardt, L. (1980). The behavioral management of chronic pain: Long-term follow-up with comparison groups. *Pain, 8*, 151–162.
- Rook, J. C., Pesch, R. N., & Keeler, E. C. (1981). Chronic pain and the questionable use of the Minnesota Multiphasic Personality Inventory. *Archives of Physical Rehabilitation Medicine, 62*, 373–376.
- Rosen, J. C., Frymoyer, J. W., & Clements, J. H. (1980). A further look at the validity of the MMPI with low back patients. *Journal of Clinical Psychology, 36*, 994–1000.
- Rosen, J. C., Grubman, J. A., Bevins, T., & Frymoyer, J. W. (1987). Musculoskeletal status and disability of MMPI profile subgroups among patients with low back pain. *Health Psychology, 6*, 581–598.
- Schmidt, J. P., & Wallace, R. W. (1982). Factor analysis of the MMPI profiles of low back pain patients. *Journal of Personality Assessment, 46*, 366–369.
- Sherman, R. A., Camfield, M. R., & Arena, J. G. (1995). The effect of presence or absence of low back pain on the MMPI's conversion V. *Military Psychology, 7*, 29–38.
- 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 University Press.
- Sorensen, L. V., & Mors, O. (1988). Presentation of a new MMPI scale to predict outcome after first lumbar discectomy. *Pain, 34*, 191–194.
- Sternbach, R. A. (1974). *Pain patients: Traits and treatment*. New York: Academic Press.
- Sternbach, R. A., & Timmermans, G. (1975). Personality changes associated with reduction of pain. *Pain, 1*, 177–181.
- Sternbach, R. A., Wolf, S. R., Murphy, R. W., & Akeson, W. H. (1973a). Aspects of chronic low back pain. *Psychosomatics, 14*, 52–56.
- Sternbach, R. A., Wolf, S. R., Murphy, R. W., Akeson, W. H. (1973b). Traits of pain patients: The low back 'loser.' *Psychosomatics, 14*, 226–229.
- Swimmer, G. I., Robinson, M. E., & Geisser, M. E. (1992). Relationship of MMPI cluster type, pain coping strategy, and treatment outcome. *Clinical Journal of Pain, 8*, 131–137.
- Towne, W. S., & Tsushima, W. T. (1978). The use of the low back and dorsal scales in the identification of functional low back patients. *Journal of Clinical Psychology, 34*, 88–91.
- Trief, P. M., & Yuan, H. A. (1983). The use of the MMPI in a chronic back pain rehabilitation program. *Journal of Clinical Psychology, 39*, 46–53.
- Troup, J. D., Foreman, T. K., Baxter, C. E., & Brown, D. (1987). The perception of back pain and the role of psychophysical tests of lifting capacity. *Spine, 12*, 645–657.
- Tsushima, W. T., & Towne, W. S. (1979). Clinical limitations of the low back scale. *Journal of Clinical Psychology, 35*, 306–308.
- Turk, D. C. (1996). Biopsychosocial perspective on chronic pain. In R. J. Gatchel & D. C. Turk (Eds.), *Psychological approaches to pain management: A practitioner's handbook* (pp. 3–32). New York: The Guilford Press.

- Turk, D. C., Rudy, T. E., Kubinski, J. A., Zaki, H. S., & Greco, C. M. (1996). Dysfunctional patients with temporomandibular disorders: Evaluating the efficacy of a tailored treatment protocol. *Journal of Consulting and Clinical Psychology, 64*, 139–146.
- Turk, D. C., Rudy, T. E., & Sorkin, B. (1993). Neglected topics in chronic pain treatment outcome studies: Determination of success. *Pain, 53*, 3–16.
- Turner, J. A., Herron, L., & Weiner, P. (1986). Utility of the MMPI pain index in predicting outcome after lumbar surgery. *Journal of Clinical Psychology, 42*, 764–769.
- Turner, J. A., & McCreary, C. (1978). Short forms of the MMPI with back pain patients. *Journal of Consulting and Clinical Psychology, 46*, 354–355.
- Uomoto, J. M., Turner, J. A., & Herron, L. D. (1988). Use of the MMPI and MCMI in predicting outcome of lumbar laminectomy. *Journal of Clinical Psychology, 44*, 191–197.
- Vallfors, B. (1985). Acute, subacute and chronic low back pain: Clinical symptoms, absenteeism and working environment. *Scandinavian Journal of Rehabilitation Medicine Supplement 11*, 1–98.
- Vendrig, A. A. (1996). Comment on 'Minnesota Multiphasic Personality Inventory profiles in persons with and without low back pain: A 20-year follow-up study'. *Spine, 21*, 1939–1940.
- Vendrig, A. A. (1999). Prognostic factors and treatment-related changes associated with return to work in the multimodal treatment of chronic back pain. *Journal of Behavioral Medicine, 22*, 217–232.
- Vendrig, A. A., de Mey, H. R., Derksen, J. J. L., & van Akkerveeken, P. F. (1998). Assessment of chronic back pain patient characteristics using factor analysis of the MMPI-2: Which dimensions are actually assessed? *Pain, 76*, 179–188.
- Waddell, G., McCulloch, J. A., Kummel, E., & Venner, R. M. (1980). Nonorganic physical signs in low-back pain. *Spine, 5*, 117–125.
- Waring, E. M., Weisz, G. M., & Bailey, S. I. (1976). Predictive factors in the treatment of low back pain by surgical intervention. In J. J. Bonica & D. G. Albe-Fessard (Eds.), *Advances in pain research and therapy* (pp. 939–942). New York: Raven Press.
- Watkins, R. G., O'Brien, J. P., Draugelis, R., & Jones, D. (1986). Comparisons of preoperative and postoperative MMPI data in chronic back patients. *Spine, 11*, 385–390.
- Watson, D. (1982). Neurotic tendencies among chronic pain patients: An MMPI item analysis. *Pain, 14*, 365–385.
- Wilfling, F. J., Klonoff, H., & Kokan, P. (1973). Psychological, demographic and orthopedic factors associated with prediction of outcome of spinal fusion. *Clinical Orthopedics and Related Research, 90*, 153–160.
- Williams, A. C., & Richardson, P. H. (1993). What does the BDI measure in chronic pain? *Pain, 55*, 259–266.
- Wiltse, L. L., & Rocchio, P. D. (1975). Preoperative psychological tests as predictors of success of chemonucleolysis in the treatment of the low-back syndrome. *Journal of Bone and Joint Surgery, 57*, 478–483.