Does Personality at College Entry Predict Number of Reported Pain Conditions at Mid-Life? A Longitudinal Study

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Abstract: **The purpose of this study was to evaluate whether personality traits, as assessed by the Minnesota Multiphasic Personality Inventory (MMPI), at time of college entry can predict the number of reported pain conditions at an approximate 30-year follow-up for 2332 subjects, 1834 men and 498 women, who were administered the MMPI on entry to the University of North Carolina (Chapel Hill) between 1964 and 1966. In 1997, a follow-up was conducted in which subjects were administered a self-report questionnaire regarding whether they had experienced 1 or more chronic pain conditions. Analyses of the relationship between the MMPI clinical scales at college entrance and the report of number of chronic pain conditions at follow-up were conducted. Among male participants, elevations of Scales 1 (Hypochondriasis), 3 (Hysteria), and 5 (Masculinity/Femininity) predicted increases in number of chronic pain conditions at follow-up. For female participants, elevations in Scales 1, 3, and 6 (Paranoia) predicted increases in number of chronic pain conditions at follow-up. The current study suggests that a statistically significant relationship exists between MMPI responses at college entry and reports of chronic pain conditions at mid-life.**

Perspective: ***This study found a small, but significant relationship between elevations on MMPI scales measuring hypochondriasis and hysteria and the report of chronic pain conditions at follow-up. The study is important because it is the first to examine how personality assessed in younger adults relates to the number of chronic pain conditions reported 30 years later.***

Pain clinicians and theorists have long been intrigued by the notion that personality traits might predispose individuals to chronic pain. Some of the earliest clinical reports of patients with persistent pain emphasized the role of personality predispositions and traits in the development of persistent pain.[10] A number of pain theories emerging during the past 30 years, including the gate control theory,[21,22] neuromatrix theory,[20] and Field's theory,[11] have also acknowledged the influences of psychological variables, such as personality, on the pain experience.

From a research perspective, one of the most important and interesting questions is whether personality traits evident before the onset of pain place individuals at risk for developing subsequent pain. Although this question is significant, few prospective investigations have been performed. Instead, most studies of the relationship between personality and pain have examined subjects who already have a chronic pain problem. The usual design of these studies involves (1) recruiting a sample of chronic pain patients from an outpatient clinic or specialized pain management program, (2) assessing personality by using a standardized instrument, such as Minnesota Multiphasic Personality Inventory (MMPI), and (3) performing statistical analyses to examine associations between MMPI scale scores and subjects' responses to measures of pain, psychosocial adjustment, and clinical outcome. Although the results of these studies are varied,[31] many suggest that elevations on hypochondriasis, depression, and hysteria scales of the MMPI are related to higher levels of pain, poorer adjustment to pain, and poorer clinical outcomes after surgical or medical treatment.[17,26,32]

The predictive utility of the MMPI for clinical outcome research has been investigated in numerous populations. Variables from the MMPI have been examined for their relationship to postoperative weight loss among bariatric surgery patients, heart disease and mortality in middle-age, and the future development of schizophrenia among high risk adolescents.[1,7,16] MMPI profiles have also been used to predict success after spine surgery or

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treatment outcome after interdisciplinary pain management rehabilitation among chronic back pain patients.[5,8,18]

The few prospective studies of the utility of MMPI personality scales in predicting the development of pain conditions have included relatively short follow-up assessments of patients who developed pain problems before the study.[30] To our knowledge, only 2 prospective studies have attempted to examine how pre-morbid personality patterns, as assessed by the MMPI, relate to the subsequent development of pain in otherwise healthy populations. The first prospective study, conducted with a sample of 1569 employees at the Boeing Company factory,[4] examined the degree to which MMPI scale scores predicted the report of work-related back injuries over an average of 3 years. After completing the MMPI, healthy, pain-free employees (ages 21 to 67 years) were followed up to 4.25 years. Data analyses showed that employees scoring in the highest quintile on the Hysteria subscale (scale 3) of the MMPI were twice as likely to report painful back injury during the follow-up period than employees in the lowest quintile of scores. Although the results of this study are interesting, the study design is limited by the relatively short and highly variable follow-up period (from 1 day to 4 1/4 years). The second study[14] examined the predictive utility of the MMPI by using a sample of 404 healthy pain-free people, all of whom were age 50 years at the time of initial MMPI administration. All participants completed measures of back pain at ages 60 and 70 years and were given a repeat administration of the MMPI at age 60 years. The results of this study did not support the notion that premorbid elevations on MMPI scales predict reports of low back pain.

The studies by Bigos et al[4] and Hansen et al[14] were both important in that they used a prospective approach to determine whether personality features as assessed by using the MMPI predict the subsequent development of pain. These studies, however, had several limitations. First, both studies focused on one pain condition only, low back pain. This leaves open the question of whether personality might be predictive of other pain conditions. Second, the study by Bigos et al relied on a relatively short follow-up period. As a result, the findings do not address the issue of whether personality predicts the development of pain conditions during a much longer period in the life span. Finally, both studies assessed personality traits in individuals who were at mid-life or older. Thus, they fail to shed light on whether personality traits assessed early in life are predictive of the development of pain during a much longer period of life.

The purpose of the present study was to examine the degree to which personality traits, assessed by the MMPI at the time of entry to college, predicted reports of pain during a 30-year follow-up period. To our knowledge, this study is the first to examine the role of personality in the prediction of the report of chronic pain conditions during such an extended follow up period.

Methods

Participants

In 1987, individuals were invited to participate in a longitudinal study examining behavioral risk factors for coronary artery disease if they had taken the MMPI when they were admitted to the University of North Carolina in Chapel Hill between 1964 and 1966. All students gave written permission at that time for their MMPI responses to be used for research purposes. In 1986, all students who had completed the MMPI were invited to participate in the UNC-Alumni Heart Study investigating the role of personality as a predictor of health and disease in later life. Approximately 4985 students enrolled in the longitudinal project. Seven waves of data have now been collected in this longitudinal project. In 1997, as part of this larger longitudinal study that was approved by the Institutional Review Board at Duke Medical Center, individuals completed a brief questionnaire assessing chronic pain conditions.

An archival data analysis was conducted on those individuals who had completed both the MMPI and the subsequent pain assessments (n = 2332). Within this group, there were 1834 men (78.6%) and 498 (21.4%) women. The participants were predominantly white (99.6%) with an average age of 50.7 years (standard deviation, 2.1) in 1997. At college entrance, health records indicated that of the 4985 students, 5 were hypertensive and none were diagnosed with chronic pain conditions. No participants were excluded for invalid MMPI data. Additional information on the cohort and study procedures can be found elsewhere.[27-29]

Materials

Students completed the MMPI,[15] a 566-item true/false self-report instrument, as part of their entrance process to UNC in Chapel Hill in 1964 to 1966 (T1). This first version of the MMPI was developed by using an empirical keying approach devised to differentiate various personality styles/traits. The MMPI includes 3 validity scales and 10 clinical scales. The validity scales assess the degree to which participants attempt to present themselves in an overly favorable light, whether participants approach the test-taking task in a manner different from that intended by the test developers, and the degree to which participants respond defensively to items. The 10 clinical scales assess similarity between the responder and preexisting personality groups. These were labeled Hypochondriasis (Scale 1), Depression (Scale 2), Hysteria (Scale 3), Psychopathic Deviate (Scale 4), Masculinity-Femininity (Scale 5), Paranoia (Scale 6), Psychasthenia (Scale 7), Schizophrenia (Scale 8), Hypomania (Scale 9), and Social Introversion (Scale 10).

The report of chronic pain conditions was assessed by self-report mailed survey questionnaire in 1997. Participants were specifically asked to respond yes or no to the following question: "Have you ever had a problem with any of following chronic pain conditions: chronic headache pain, chronic back pain, chronic facial pain, or other

Table 1. Mean MMPI T-Scale Scores for All Participants and for Men and Women

Scale Name	All Participants Mean (SD)	Women (n = 498) Mean (SD)	Men (n = 1834) Mean SD
Lie	46.12 (5.53)	46.49 (5.59)	46.01 (5.51)
Frequency	52.46 (6.02)	52.13 (5.86)	52.55 (6.06)
Defensiveness	54.63 (7.56)	54.43 (7.27)	54.68 (7.64)
Hypochondriasis	51.60 (7.96)	50.34 (7.61)	51.94 (8.02)
Depression	53.35 (11.23)	52.46 (10.74)	53.59 (11.35)
Hysteria	56.58 (7.69)	55.36 (8.50)	56.91 (7.357)
Psychopathic deviance	57.56 (9.75)	55.77 (9.66)	58.05 (9.721)
Masculinity-Femininity	58.57 (12.31)	44.69 (8.88)	62.33 (10.24)
Paranoia	55.28 (8.27)	56.96 (8.76)	54.83 (8.071)
Psychasthenia	58.66 (10.37)	57.07 (9.82)	59.09 (10.48)
Schizophrenia	58.06 (10.04)	57.25 (9.02)	58.29 (10.29)
Mania	58.82 (10.23)	57.51 (10.24)	59.18 (10.20)
Isolation	50.74 (9.98)	53.71 (10.87)	49.94 (9.57)

NOTE: T-score values above 65 are interpreted as clinically significant.

Abbreviations: MMPI, Minnesota Multiphasic Personality Inventory; SD, standard deviation.

chronic pain condition?" On the basis of the number of yes responses to this question, we computed the total number of chronic pain conditions reported by each participant.

Results

Table 1 displays the mean MMPI scale scores obtained at college entry for the entire sample of men and women. As can be seen, all mean scores fell in the normal range (T-scores less than 65 considered nonclinical range); however, considerable variability was noted, with some participants scoring much higher than others. To investigate how these variations in scale scores related to the subsequent report of pain conditions, a series of analyses were conducted. From the available sample, 2045 individuals completed the chronic pain conditions item on the questionnaire data collected in middle adulthood. Among these participants, approximately 57.8% reported no chronic pain conditions, 32.5% reported 1 chronic pain condition, 7.9% reported 2 chronic pain conditions, 1.4% reported 3 chronic pain conditions, and 0.3% reported 4 chronic pain conditions.

The first set of analyses investigated gender differences on the original MMPI data for the 3 validity and 10 clinical scales. *T* tests showed no gender differences on the validity scales; however, there were statistically significant gender differences on all 10 clinical scales. These mean values for men and women of these 10 clinical scales are displayed in Table 1, and the results of the *t* tests comparing gender differences are presented in Table 2.

The second set of analyses investigated the relationship between the MMPI clinical scales at college entrance and the report of number of chronic pain conditions at mid-life. Because of the gender differences in the MMPI data noted above, correlational analyses between the MMPI clinical scales and number of pain conditions reported were conducted separately for men and women. The results of the correlational analyses conducted for men in the study sample (n = 1834) showed that scores on 3 clinical scales of the MMPI obtained at college entry predicted the number of pain conditions reported 30 years later. In men these were MMPI Scale 1 (mean, 51.94; $r = .074$; $P = .003$), Scale 3 (mean, 56.91; $r = .062$; $P = .013$), and Scale 5 (mean, 62.33; $r = .102$; $P = .0001$). Thus, in men, higher scores on hypochondriasis, hysteria, and masculinity-femininity scales predicted a greater number of reported chronic pain conditions at mid-life.

The results of the correlational analyses conducted for women in the study sample (n = 498) showed that scores on MMPI Scale 1 (mean, 50.34; $r = .109$; $P = .023$), Scale 3 (mean, 55.36; $r = .096$; $P = .046$), and Scale 6 (mean, 56.96; $r = .109$; $P = .023$) predicted the number of pain conditions reported 30 years later. Thus, in women, higher scores on hypochondriasis, hysteria, and paranoia predicted a greater number of reported chronic pain conditions at mid-life.

A hierarchical cluster analysis was performed, with squared Euclidean distances for the measure of similarity, to ascertain whether there were homogeneous, replicable MMPI profile subgroups that might be differentially related to reports of chronic pain. Two random samples of 100 participants were selected within each gender to cross-validate the cluster solution. The Ward Method was used to create the clusters by having each case begin as its own cluster and merging subsequent clusters if such a merger results in the minimum increase in the sum of squared deviations between each case within a cluster and the average similarity. In this study the cluster analysis failed to identify homogenous clusters in either gender that replicated in the cross-validation sample. Given this low rate of successful replication, we concluded that replicable, homogenous MMPI subgroups based on the MMPI clinical scales could not be identified in this sample.

Discussion

This study found that MMPI scale scores obtained at the time of college entry were related to the report of

chronic pain conditions 30 years later. Among both men and women, scores on MMPI scales measuring Hypochondriasis and Hysteria were related to the report of a higher number of chronic pain conditions. In interpreting this finding, it is important to realize that many items on these scales might be endorsed because an individual is actually experiencing unpleasant symptoms, rather than simply somatizing.[25] Nonetheless, none of the participants in this study was found to have had a diagnosed chronic pain condition at time of study entry. Thus, our findings indicate that persons who are prone to report troubling physical complaints at the time of early adulthood (eg, True answers to: "I have a great deal of stomach trouble; Much of the time my head seems to hurt all over ") are much more likely to report a history of chronic pain conditions later in life. Interestingly, prior cross-sectional studies have shown that the Hypochondriasis and Hysteria scales of the MMPI are related to higher levels of pain and poorer adjustment in patients who already have established chronic pain conditions.[17,26,32] In addition, a recent prospective population-based study in the United Kingdom showed that relatively high baseline scores on measures of somatization (ie, Somatic Symptom Checklist and the Illness Behavior subscale of the Illness Attitude Scales) predicted the development of widespread pain during a 1-year follow-up among 1868 individuals ranging in age from 18 to 65 years.[23] To our knowledge, however, the current study is the first that has shown that a tendency to report troubling physical symptoms during young adulthood is related to reports of chronic pain occurring during a 30-year follow-up interval.

One of the most interesting findings of this study was that there were differences in the pattern of MMPI predictors of chronic pain in men versus women. Although elevations on Scales 1 and 3 (Hypochondriasis and Hysteria) at the time of college entry were related to reports of chronic pain conditions at mid-life in both men and women, men and women differed in other scales that were predictive of chronic pain. Only in men were elevations on Scale 5 (Masculinity-Femininity) at college entry predictive of chronic pain conditions. A high score on this scale has been shown to be correlated with higher levels of education and a broad range of interests including those associated with more traditionally feminine sensitivity and interests, whereas a lower score has been shown to be correlated with a more traditionally masculine identification and interests. However, 18 of the masculinity-femininity items reflect a tendency to frequently worry and to be sensitive to the reactions of others.[12,13] These include False responses to "I am entirely self-confident" or "In a group of people I would not be embarrassed to be called up to start a discussion or give an opinion about something I know well." It is interesting to note that Benjamin et al[2] reported that anxiety disorders (as measured by the General Health Questionnaire) were associated with chronic, widespread pain in the population-based study described above.[23]

In contrast, only in women were elevations on Scale 6 (Paranoia) at time of college entry predictive of chronic pain conditions. A higher score on this scale has been shown to be related to oversensitivity and difficulty establishing and maintaining interpersonal relationships. However, persons without psychiatric disorders who produce relatively high scores on the paranoia are described as interpersonally sensitive. Moreover, several of these items deal with subjective feelings of anxiety or tension (eg, True: "I work under a great deal of tension", "I have certainly had more than my share of things to worry about").[13] Thus, it appears that, among both men and women, relatively high levels of interpersonal sensitivity might be associated with the occurrence of persistent pain during a 30-year period. It is not apparent, however, why the Masculinity-Femininity and Paranoia scales might differ in salience to men and women. Nevertheless, it is possible that, in contrast to women, men might be reluctant to provide "True" responses to the "obvious" items that indicate interpersonal sensitivity on Scale 6 but are more willing to provide "False" responses to the relatively "subtle" items indicative of interpersonal sensitivity on Scale 5.

Another important finding of this study relates to the magnitude of the correlations between pre-morbid personality traits and the subsequent report of multiple chronic pain conditions. Although baseline elevations on Hypochondrias and Hysteria, for example, were highly significant predictors of the report of chronic pain conditions, the magnitude of these relationships was relatively small. This raises an issue regarding the statistical versus clinical significance of the findings. One might suggest, for example, that the associations among the MMPI scales and future reports of chronic pain are spurious findings that are due primarily to the large sample size involved in the investigation. However, given the large number of events that could have influenced health status between the baseline MMPI administration and the 30-year follow-up assessment, it is reasonable to

Table 2. *t* Test Results for Gender Differences on MMPI Data

Scale Name	t	Degress of Freedom	P Value
Lie	−1.70	2330	.090
Frequency	1.40	2330	.160
Defensiveness	.671	2330	.502
Hypochondriasis	4.01	2330	.000*
Depression	1.99	2330	.047*
Hysteria	4.04	2330	.000*
Psychopathic Deviance	4.65	2330	.000*
Masculinity-Femininity	35.02	2330	.000*
Paranoia	−5.12	2330	.000*
Psychasthenia	3.87	2330	.000*
Schizophrenia	2.05	2330	.041*
Mania	3.24	2330	.001*
Social Isolation	−7.58	2330	.000*

Abbreviation: MMPI, Minnesota Multiphasic Personality Inventory.
*T-score values above 65 are interpreted as clinically significant.

conclude that (1) individuals' MMPI responses during young adulthood account for a small, albeit significant, amount of variance in their reports of chronic pain as middle-age adults; and (2) additional studies might determine the factors that, in combination with MMPI responses, best predict the development of chronic pain syndromes.

What additional factors, in combination with MMPI responses, might contribute to improved prediction of future development of chronic pain syndromes? Certainly the literature suggests that family history of specific syndromes, such as fibromyalgia, is associated with increased risk of these syndromes in siblings or children.[6] In addition, events that occur during childhood or adulthood might further increase the risk of chronic pain in later life. For example, physical injury is a risk factor for musculoskeletal diseases or disorders characterized by persistent pain such as knee osteoarthritis.[3] Similarly, stressors or altered stress response mechanisms might increase the likelihood of chronic pain syndromes such as fibromyalgia.[19] In addition to these background factors, several factors that occur during childhood or adulthood might further increase the risk of chronic pain in later life. Recent research also suggests another set of baseline variables that might possibly be related to the development of chronic pain, specific gene polymorphisms. For example, research suggests that a specific polymorphism characterized by a short-short allele in the regulatory region of the serotonin transporter gene (5–hydroxytryptamine transformer) is associated with a history of fibromyalgia, migraine headache, and anxiety disorders.[9,24] Similarly, a common functional polymorphism (met/met) of the cathechol-O-methyltransferase (COMT) gene, which helps modulate adrenergic/noradrenergic neurotransmission involved in pain modulation, is associated with diminished μ opioid system activation and relatively high pain scores during administration of noxious stimulation in healthy young adults.[33]

To assess the predictive power of family history, psychosocial, and biologic factors such as those noted above, it is necessary to design and perform prospective longitudinal studies of the development of well-defined, chronic pain syndromes. These studies also might benefit from repeated administration of the MMPI and pain measures so that the stability of MMPI scores in response to possible changes in pain (eg, onset or cessation) could be examined.

The present investigation has several limitations. First, the participants were highly educated, white individuals who agreed to participate in a longitudinal study. Furthermore, the vast majority of participants were men, reflecting college admissions policies at the time of baseline evaluation. Thus, the sample is not representative of the population at large. For these reasons, the findings of this study need to be replicated in future studies that use a heterogeneous population that is more representative in terms of age, ethnic background, and sex. Second, although the current study did assess the report of chronic pain conditions, it failed to measure important characteristics of pain such as pain intensity, pain quality, and pain-related disability. Future studies need to incorporate a more detailed pain assessment to more precisely document how pre-morbid personality traits relate to how individuals adjust to pain.

There are several important directions for future research. First, the present longitudinal investigation followed participants from the start of college through a 30-year follow-up period. At this point participants were at mid-life, but they had not yet faced the challenges of being an older adult. Older adults often must cope with chronic degenerative conditions, many of which are painful. We are currently following this cohort of participants and plan to conduct a more detailed study of their pain and pain coping when they reach age 60 years. Second, in future longitudinal studies, the MMPI and pain measures could be administered repeatedly so that the stability of personality characteristics in response to possible changes in pain (eg, onset or cessation) could be examined.

Another potential clinical issue is that the MMPI responses at college entry in this study did not reach levels that were clinically significant. Clinicians should be cautioned in applying the findings of the current study in a clinical setting. Clinical use of the MMPI requires background and training in the instrument and a careful consideration of profile configurations based on all scales and other sources of information. Nevertheless, it might be that even moderate elevations on MMPI scales such as Hypochondriasis and Hysteria, in combination with additional background and environmental variables, might contribute to the prediction of future reports of chronic pain conditions.

In conclusion, the current study suggests that personality traits assessed at college entry are related to reports of chronic pain conditions at mid-life. Future research is warranted to explore the clinical utility and generalizability of these findings.

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