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Personality Measures In Former Heroin Users Receiving Methadone or in Protracted Abstinence from Opiates

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Abstract

Objective—Methadone Maintenance Therapy (MMT) and detoxification to abstinence are among the most common treatment options for opiate-dependent patients. This paper compares personality traits in detoxified former heroin users and those on MMT in order to assess their relevance to treatment selection.

Methods—Twenty-six formerly heroin-dependent subjects receiving MMT (MM), 33 formerly heroin-dependent subjects withdrawn from MMT (MW), and 43 healthy controls were compared on the Millon Clinical Multiaxial Inventory-II (MCMI-II) and the Temperament and Character Inventory (TCI).

Results—On the TCI, MM patients had higher Novelty Seeking and lower Self Directedness scores than controls. Both MM and MW subjects scored higher than controls on multiple MCMI-II scales. MW but not MM subjects scored higher than controls on 2 Cluster A scales and the Delusional Disorder scale.

Conclusions—Schizophrenia-spectrum pathology in former opiate users may be greater than previously recognized and could potentially be relevant to treatment selection.

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Keywords

Methadone; Personality; Personality Disorders; Opiates; Heroin; Addiction; Substance Abuse

Introduction

Methadone maintenance therapy (MMT) is the primary treatment modality offered to opiate-dependent patients in the United States (1,2). Discontinuation from methadone is an option for patients who wish to become entirely drug-free (3). Little is known, however, about the factors differentiating patients who choose methadone discontinuation over methadone maintenance. This paper assesses personality pathology in detoxified and methadone maintained former heroin abusers in order to establish its possible relationship with the choice of either MMT or methadone discontinuation to abstinence.

Although many patients continue to abuse heroin even while receiving MMT (4), the treatment has substantial benefits. It dramatically decreases the symptoms of opiate withdrawal, reduces criminal activity, and is associated with a lower occurrence of relapse in comparison to other treatment methods (5). There is also evidence that patients on MMT have a radically lower mortality rate than do opiate abusers not in active treatment (6). Nonetheless, some argue that methadone merely serves as a replacement drug for heroin and as such brings risk of inappropriate usage, and even overdose (6,7). Moreover, MMT appears to impact cognitive functioning. In one study patients on MMT demonstrated greater cognitive impairment than abstinent former users withdrawn from MMT (8). Likewise, there are reports that discontinuation of MMT did not lead to any greater amount of relapse or other behavioral problems than was found in patients receiving long term MMT (9). In another report, patients who received rapid detoxification exhibited a 67% rate of abstinence at the three-month follow-up mark while only 33% of a methadone maintenance group receiving MMT achieved abstinence at the same follow-up date (10). Thus despite its clear benefits, MMT is not without disadvantages and some patients may benefit from MMT discontinuation.

Given the difficulty in maintaining abstinence, however, it is possible that discontinuation of MMT is only appropriate for a subgroup of patients. Such a subgroup might be characterized by less severe personality pathology, which might be associated with better tolerance of the stress of maintaining abstinence following detoxification from methadone. Thus investigation of the degree of character pathology in patients choosing either MMT or discontinuation to abstinence may help elucidate the relationship between personality impairment and choice of treatment.

There is robust evidence in the literature of personality pathology in opiate abusers. Calsyn et al. (11) found that ninety percent of a sample of opiate abusers exhibited significant character pathology and exceeded the threshold for a DSM-III-R Axis-II disorder on the Millon Clinical Multi-Axial Inventory (MCMI-II) (12). Thirty-six percent showed elevated scores on Antisocial and Narcissistic subscales, which were the highest scored scales in this sample. Craig (2000) found that a sample of opiate abusers scored highest on scales for Antisocial, Passive – Aggressive (Negativistic), and Depressive personality disorders as measured by the MCMI-III (13). Another sample of opiate abusers scored highest on the MCMI-I scales of Antisocial, Narcissistic, Histrionic, and Paranoid personality disorders (14). Additionally, Ball & Cecero (15) found that a sample of methadone maintained subjects met criteria for Antisocial, Borderline, Avoidant, or Depressive personality disorders on the Structured Clinical Interview for DSM-IV for Axis-II (SCID II) (16). Thus Cluster B and C traits and disorders, particularly Antisocial Personality Disorder, appear to be the most common in this patient group.

Opiate abusers may also share several common personality *traits*. Two samples of opiate abusers exhibited elevated scores on measures of Novelty Seeking and Harm Avoidance on the Temperament and Character Inventory (TCI; 17) (18,19). In the latter study, opiate abusers also scored lower than controls on TCI scales of Cooperativeness and Self-Directedness (19). As none of these studies assessed subjects prior to the onset of addiction, however, it is not known to what extent these traits preceded opiate abuse or developed within the course of the addiction.

Nonetheless, the presence of personality pathology may be an important predictor of treatment outcome and a number of studies show an association between the two in opiate addicts and other substance abusers. The presence of personality disorders correlated positively with attrition from MMT (20), suggesting that patients with more severe character pathology may have more difficulty or less motivation to sustain participation in MMT. In other studies, methadone patients, alcoholics, and polysubstance abusers with antisocial personality disorder were more likely to relapse than those without antisocial personality disorder (21,22). Thus available data suggests that more severe character pathology may be associated with difficulty in sustaining structured treatment for opiate dependence.

Thus those with greater personality pathology may be more likely to *drop out* of MMT programs rather than sustain structured treatment. However, dropping out of MMT should be distinguished from discontinuation from MMT into sustained abstinence from all opiates. In fact, discontinuation to abstinence should demand a higher level of stress tolerance than would continuing in MMT. This is particularly so if the discontinuation program is highly structured and demanding. Therefore, we hypothesize that patients who discontinue from MMT into sustained abstinence require better impulse control and frustration tolerance than patients who remain in MMT.

Aims of the Study

This study compared former opiate users in methadone maintenance treatment, those in a structured program to detoxify from methadone and healthy controls on two measures of personality pathology, the MCMI-II and the TCI. Our hypotheses were the following: 1) Both MM and MW subjects, as compared to healthy controls, will have higher levels of Cluster B and Cluster C disorders on the MCMI, particularly Antisocial and Borderline Personality Disorders. 2) The MM and MW groups will have higher levels of Novelty Seeking and lower levels of Cooperativeness and Self-Directedness on the TCI than the control group. 3) MM subjects will show higher scores than MW subjects on the personality traits listed in Hypotheses 1 and 2, reflecting their lowered aptitude for complying with a highly structured methadone discontinuation program.

Material and Methods

Subjects

This study was part of a larger program investigating neuropsychiatric function in opiate dependent subjects. Twenty-six methadone-maintained (MM) and 33 methadone-withdrawn (MW) subjects with a DSM-IV diagnosis of opiate dependence within the last two years were recruited from Su Casa Residential Treatment Center (Manhattan, New York). Su Casa offers two forms of residential treatment for opiate addiction. A 6-month program is available for clients who currently are receiving MMT but seek greater structure than outpatient services can offer, and a 12-18 month program is offered to individuals interested in discontinuing from MMT (Methadone to Abstinence Treatment-MTAR). Some MM subjects (11%) were recruited from the Beth Israel Medical Center Outpatient Methadone Maintenance Treatment Program (BIMC MMT). MM subjects had been maintained on a stable dose of methadone for at least

6 months prior to the study. MW subjects had discontinued MMT at least 6 months prior to the study and had received methadone for at least 6 months prior to that time. Forty-three healthy control subjects were recruited through advertising in The Village Voice newspaper (New York, NY).

Exclusion criteria for all groups included a current or lifetime DSM-IV Axis I diagnosis other than tobacco dependence, major medical or neurological disease and mental retardation. Exclusion criteria for control subjects included current or significant history of illicit drug abuse; however control subjects were not excluded for moderate alcohol use (≤ 15 alcoholic beverages per week), caffeine use or occasional marijuana use (≤ 1 marijuana cigarette per month).

Subject Evaluation

MW and MM subjects were first recruited on site at SuCasa. MM subjects from BIMC MMT programs were recommended by counselors. Those who expressed interest were then screened more exhaustively over the phone, and scheduled for an appointment at Beth Israel Medical Center (BIMC) for further evaluation and explanation of study protocol. Control subjects were initially screened by telephone. Information on medical and substance use history was obtained and the research study briefly explained. Those still interested were invited for a face-to-face interview. All subjects were screened for Axis I disorders using the Structured Clinical Interview for DSM (SCID-I) interview (23). The subjects were also screened for depression with the Hamilton Rating Scale for Depression (24), and subjects with scores over 12 were removed from the study.

Further, all subjects were administered a “surprise” urine drug screen at their initial interview. A subset of subjects (45 in total) who participated in additional studies received two further urine drug screens. The “surprise test” was used as subjects could have brought “clean” urines in anticipation of urine tests. Su Casa counselors also confirmed that no subjects from their facility had ever submitted positive urine drug test.

All interested subjects who met inclusion and exclusion criteria were entered into the study after signing a consent form, approved by the BIMC Institutional Review Board.

Materials

Millon Clinical Multiaxial Inventory-II (MCMI-II)—(12) This 175-item questionnaire measures personality disorders as well as several Axis I disorders and syndromes (as defined in DSM-III-R). Seventeen scale scores were calculated according to the scoring key in the MCMI-II manual. No corrections were used in scoring. All 13 Axis II diagnoses and four Axis I dimensions – thought, delusional, anxiety and dysthymic disorder- were analyzed in this study. In order to maintain continuity with earlier data collection, the MCMI-II was used instead of the MCMI-III.

Temperament and Character Inventory (TCI)—(17) Adapted from the Tridimensional Personality Questionnaire, this 240-item questionnaire assesses 4 dimensions of temperament (Harm Avoidance, Novelty Seeking, Reward Dependence and Persistence) and 3 dimensions of character (Self Directedness, Cooperativeness, and Self Transcendence).

Substance Use Inventory—(25) This consists of a series of self-report questions about quantity and frequency of use of various substances (opiates, cocaine, alcohol, marijuana, amphetamines, sedatives, PCP, and prescription medications).

Based on the SUI and additional background information, five variables related to substance use history were selected for analysis. These were years of heroin abuse, years of methadone maintenance, age of onset, typical methadone dose, and for MW subjects only, years since methadone detoxification. Five demographic variables were also assessed (age, sex, ethnicity, years of education, and mothers' years of education).

Statistical Analysis

Initial analyses compared groups on three demographic variables (age, education and mother's education) and four substance use variables (years of heroin use, methadone maintenance, age of onset, and typical methadone dose) with Analyses of Variance (ANOVA's). Univariate analyses were used instead of multivariate analyses to reduce the impact of missing data. Ethnicity and sex were compared across groups by Chi-Square analyses.

To analyze personality measures across groups, five separate Multivariate Analyses of Covariance (MANCOVAs) were performed, along with follow-up univariate F tests, and Tukey's pairwise comparisons. Four MANCOVA's were performed for the MCMI and one for the TCI. Years of education was entered into all analyses as a covariate. The four MCMI MANCOVA's included the following dependent variables: 1) Cluster A Scales (Schizoid, Schizotypal and Paranoid Personality Disorder), 2) Cluster B Scales (Histrionic, Narcissistic, Aggressive-Sadistic, Antisocial and Borderline), 3) Cluster C Scales (Avoidant, Dependent, Passive Aggressive, Self Defeating, and Obsessive Compulsive), and 4) Axis I Syndromes (Anxiety, Dysthymia, Thought and Delusional Disorder Scales). As a secondary analysis, the same 4 MANCOVA's were performed for MCMI scores transformed into base rate scores. All seven TCI scales were entered into a single MANCOVA. Finally, five composite personality variables (Cluster A, Cluster B, Cluster C and total MCMI scores along with total TCI scores) were correlated with the five measures of substance use history.

Results

Demographics

With regard to demographic variables, the three groups did not differ significantly on gender or ethnicity but did differ on age, years of education, and mother's years of education. By Tukey's pairwise comparisons, MW subjects were older than controls and their mothers had fewer years of education than those of controls. Both substance abuse groups had fewer years of education than did controls. (See Table 1)

Moreover, although group differences on ethnicity did not reach significance, there was a trend towards significance ($\chi^2=16.54, p=.085$). Thus, in the interest of ensuring the comparability of both groups of former substance abusers, ethnicity was examined in greater detail. In particular, the number of African American and European American subjects across MW and MM groups were compared by χ^2 analysis. The results were not significant ($\chi^2=2.17, p=.140$).

Substance Abuse History

The two groups of substance abusers did not significantly differ on the measures of drug abuse (years of heroin use, years of methadone maintenance, age of onset, or typical methadone dosage), although groups did differ marginally on age of onset ($F(1,55)=2.9, p=.092$). MM subjects recruited from SuCasa (18, 89%) were also compared to those recruited from BIMC (4, 11%) on demographic and substance use variables. Groups did not differ on any demographic or substance use variable except years of methadone maintenance ($t(24)=-2.91, p=.008$) such that BIMC subjects had more years of MMT than SuCasa subjects. Nonetheless, the MM group as a whole did not differ from the MW group on this variable.

In order to determine whether any of the group differences found might confound the personality analyses, the three demographic variables that significantly differed across groups were correlated with a composite personality score (total MCMI score). Only years of education ($r = -.310$, $p < .002$) significantly correlated with total MCMI scores. Therefore years of education was entered as a covariate on all subsequent analyses.

Personality Data Analyses

MCMI-II—By MANCOVA, groups differed significantly on Cluster A disorders, Cluster B disorders, and the four dimensional traits and differed marginally on Cluster C disorders. See Table 2.

Of the Cluster A disorders, schizotypal and paranoid scores differed across groups by a univariate F-test while the schizoid score differed marginally. Of the Cluster B disorders, antisocial, aggressive, and borderline scores differed across groups, and of the Cluster C disorders, passive aggressive, self-defeating, avoidant, and dependent personality disorder scores differed across groups. Of the Axis I syndromes, the groups differed on anxiety, dysthymia, thought, and delusional disorder.

By Tukey's pairwise comparisons, MM subjects scored higher than Controls on 9 MCMI scales. MW subjects, however, scored higher than Controls on 13 MCMI scales, 5 of which did not differentiate MM subjects from controls. The scores on which MW but not MM subjects differed from controls were the Schizoid, Paranoid, Aggressive-Sadistic, Dependent, and Delusional Disorder scales. MM subjects scored higher than MW subjects on the anxiety subscale.

In order to provide an estimate of impairment relative to established norms, translations of MCMI-II raw scores into base rate scores are presented in Table 3. A base rate score of 75 is considered a cut-off score indicating the presence of the disorder with a base rate score of 85 indicating the disorder is highly prominent (12). Results from the group comparisons of MCMI-II base rate scores were essentially identical to that of the MCMI-II raw scores, with the exception of a significant overall difference on Cluster C disorders, a marginally significant univariate F test on the obsessive-compulsive scale and a significant pairwise comparison between MW and controls but not MM subjects on anxiety. Additionally, MW subjects scored significantly higher than MM subjects on the paranoid scale.

Finally, a composite score of the MCMI scores did not correlate with any of the heroin abuse measures. Neither Cluster A, B, C total scores nor any of the axis I syndrome scales correlated separately with any heroin abuse measure.

TCI—By MANCOVA there was a significant difference in TCI scores across groups. By univariate F-test, groups differed significantly on Novelty Seeking and Self-Directedness. (See Table 4.) By Tukey's pairwise comparisons, MM subjects scored higher than controls on the Novelty Seeking, and lower than controls on the Self-Directedness. No TCI scales correlated with any heroin abuse measure.

MCMI Validity Scales—The MCMI-II includes the Social Desirability and Debasement scales, which measure, respectively, the tendency to under-report and over-report psychiatric symptoms. Examination of these validity scales allows us to consider the potential effect of reporting bias on personality data. Social Desirability did not differ across groups (13.46 ± 5.3 for MM, 14.39 ± 3.4 for MW, and 13.74 ± 4.6 for NC; $F(2,101) = 0.35$, $p = .70$), suggesting the tendency to under-report was comparable across the sample. Debasement, however, did vary across groups by one-way ANOVA (11.50 ± 10.3 for MM, 8.85 ± 6.5 for MW, and 2.47 ± 6.4 for NC; $F(2,101) = 13.18$, $p < .001$). By Scheffe paired comparison, both MM and MW differed

from NC. Thus both substance abuse groups may have been more likely to over-report than the control group. Nonetheless, extremely high correlations with MCMI personality scales raise questions about the discriminant validity of the Debasement scale, such that the tendency to over-report may not be well distinguished from valid reporting of severe pathology. Debasement correlated 0.77 with total Axis II scale scores, 0.82 with total Cluster A scores, and 0.72 with both total Cluster B and Cluster C scores.

Discussion

Consistent with the literature and our first two hypotheses, research subjects who had been heroin dependent manifested higher levels of Cluster B and Cluster C disorders on the MCMI-II compared with control subjects, irrespective of whether they were receiving MMT. They also had abnormal scores on Cluster A and Axis I scales, indicating a broader level of impairment than previously reported (13,14,15,16). The data also provides some preliminary support that MM and MW subjects may exhibit different degrees of personality pathology, in keeping with our third hypothesis. MM but not MW subjects had higher levels of Novelty Seeking and lower levels of Self Directedness on the TCI than control subjects. Contrary to our hypotheses, however, MW subjects evidenced greater impairment relative to controls than did MM subjects on the MCMI-II. As this impairment was primarily in scales related to Cluster A pathology, these differences may lie largely in the psychotic spectrum.

The overall findings from the two personality measures are largely consistent with previous research on personality pathology in samples of methadone patients versus healthy controls. Both methadone groups showed elevated scores on measures of Antisocial, Passive-Aggressive, Borderline, Avoidant and Paranoid personality disorders, as demonstrated in other studies (11,13,14), but did not show elevation on other measures, such as Narcissistic or Histrionic personality disorders, as has been found previously (14).

Moreover, TCI scores from this sample are highly consistent with previous findings. As in other samples, the MM group showed elevated scores on scales of Novelty Seeking, while controls scored higher on scales of Self-Directedness (19,28). The methadone groups, however, did not show significant elevation on the scale for Harm Avoidance, as was demonstrated in other samples (18). Nonetheless, our findings support a consistent picture of personality impairment, characterized by impulsivity, poor affect regulation, and impaired self-concept and interpersonal skills. Such information has previously been the basis of targeted treatments for opiate addicted patients (29,30).

As noted above, however, both MM and MW subjects scored higher than controls on scales related to Cluster A pathology and psychotic syndromes. Such findings may relate to the concept of a schizophrenia spectrum, a group of disorders characterized by positive psychotic or psychotic-like symptoms (such as paranoid delusions or ideation), and by negative symptoms (such as social withdrawal). Schizophrenia spectrum disorders include schizophrenia and schizotypal personality disorder (26), as well as additional Axis I and Axis II disorders, such as schizoaffective disorder and paranoid personality disorder (27). Supporting the relationships among these different disorders, a recent study of comorbidity in new onset schizophrenics showed elevated Cluster A scores (Paranoid, Schizoid and Schizotypal) relative to both a healthy control group and a sample of patients with non-schizophrenic psychotic disorders (31). Moreover, the comorbidity between schizophrenia-related disorders and substance abuse has been noted previously (32). In linking our findings to the schizophrenia spectrum, however, we do not suggest that opiate addicts show identical pathology to schizophrenia-related disorders, i.e., in etiology, course, onset, etc. Rather we suggest there may be phenomenological similarities with this group of disorders, which may, in turn, indicate overlapping neurobiological substrates and pharmacological response patterns.

Such findings in former heroin users have fewer precedents than data on Cluster B and C pathology. Although Craig et al (33) reported that alcoholics had higher MCMI scores than opiate addicts on Schizotypal and Paranoid personality subscales, three reports did suggest a distinct subgroup of opiate addicts with schizoid/ schizotypal pathology. These patients had more legal problems (34), and required a higher methadone dose (35) than opiate addicts with less Cluster A pathology. Our results extend and underscore these reports, suggesting that former heroin users may exhibit not only schizotypal features but possibly a high level of psychoticism in general.

One explanation for the suggestion of greater schizophrenia-spectrum pathology in MW compared to MM subjects is that methadone detoxification itself results in the emergence of such symptomatology. The effects of either opiate administration or opiate detoxification on schizophrenia-spectrum pathology is not known. A number of reports link schizophrenia-spectrum pathology (including both schizophrenia and schizotypal personality disorder) to dopamine dysregulation in the striatum (26,36). Opioids may act as neuromodulators of the dopaminergic system and in general increase the synthesis, release, reuptake, and metabolism of dopamine (37).

Consistent with these theories, the mu-agonist methadone, and a mixed agonist-antagonist buprenorphine provided transient relief for paranoid psychosis (38) and methadone has been suggested as adjunctive treatment for schizophrenia (39). Case reports describe frank psychosis or organic delusional syndromes due to withdrawal from methadone (40) and oxycodone (41). Our results suggest that former heroin users on MMT may already have elevated schizophrenia-spectrum pathology, possibly making them vulnerable to changes in opioidergic neuromodulation of dopaminergic terminals during detoxification. This vulnerability may result in a higher level of schizophrenia-spectrum pathology that would emerge during detoxification and persist during protracted abstinence. Future prospective studies of personality pathology following detoxification from methadone would test this hypothesis. Moreover, the fact that elevated schizophrenia-spectrum traits are found in subjects 6-18 months after discontinuation from MMT suggests that methadone discontinuation may result in a protracted opiate withdrawal syndrome (42,43). Protracted withdrawal syndromes were also found in studies of phencyclidine (PCP) (44) and alcohol (45) addiction and may influence vulnerability to relapse.

A second explanation for our findings of possibly higher schizophrenia-spectrum pathology in former heroin addicts in protracted abstinence is that preexisting symptoms that were partially treated with MMT reemerged after detoxification. This explanation is consistent with the Endogenous Opioid Deficiency Theory that postulates self-medication by opiate addicts with illegal opiates in order to treat dysphoria due to endogenous opioid deficiency (46). Consistent with the opioid system's neuromodulatory effect on dopamine, such dysphoria may be related to dopaminergic dysfunction.

A third explanation for higher levels of schizophrenia-spectrum pathology in MW subjects is that patients characterized by such pathology self-selected for discontinuation of MMT. Such an explanation would be inconsistent with our hypotheses that patients who succeed in methadone discontinuation to abstinence will demonstrate less severe character pathology. This explanation is also inconsistent with the literature, which shows that greater personality impairment predicts to poorer treatment adherence and outcome (20,21,22). In this study the discontinuation program was 6 to 12 months longer and more rigorous than the structured MMT program. Thus this explanation may be the least likely of the three. Nonetheless, MMT patients with elevated schizophrenia-spectrum pathology may self-select for methadone detoxification for other unknown reasons and we cannot dismiss this hypothesis conclusively.

in the absence of prospective studies assessing MM and MW subjects prior to and following methadone discontinuation.

Whatever the source of elevated schizophrenia-spectrum psychopathology in patients detoxified from methadone, the presence of such pathology may be an indication for continuing long-term MMT. Such pathology may also be an indication for treatment with neuroleptic medication either for patients in MMT or in protracted abstinence. Low dose risperidone has proved superior to placebo in treating negative, positive and general symptoms of schizotypal personality disorder (47).

Finally the lack of any relationship between personality pathology and indices of heroin addiction is not completely explained. It may be attributable to a ceiling effect, as all of the former heroin user subjects had severe addiction histories and 93% had drug-related criminal convictions. Perhaps in populations with less severe histories, a relationship between indices of heroin abuse and personality function could be detected.

This study has several limitations. First, we did not assess subjects prior to their enrollment in the residential treatment facility and cannot determine with certainty whether group differences preceded or followed discontinuation of MMT. Nor could we assess the stability of MCMI-II and TCI measures over time. Furthermore, some of the MM subjects may have elected detoxification after completion of our study, complicating findings on group differences. Data may also have been influenced by self-report response biases, although social desirability did not appear to differentiate the groups. Moreover, despite our attempts to control for demographic differences, the groups were not identical and such differences may have affected the data in unpredictable ways. Future research would also need to carefully account for demographic variables. Finally, interpretation of schizophrenia-spectrum pathology must be done with caution in the absence of structured diagnostic interviews.

Nonetheless, the present study is the only one, to our knowledge, that compares methadone maintained and detoxified subjects on standardized and well-known personality instruments. Our data is consistent with previous research on the prevalence of cluster B and C pathology and adds new data on Cluster A personality pathology in former heroin users. Further, our subjects were rigorously screened for comorbid substance abuse, which is a common confound in the study of methadone maintained patients.

In summary, within its limitations, our study suggests that former heroin users both in long-term MMT and in protracted abstinence have global character pathology that includes Cluster A, B, and C symptoms. In addition, former heroin users in protracted abstinence may have more pronounced Cluster A pathology which may be amenable to therapeutic intervention.

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Table 1**Characteristics of Research Participants**

	Methadone Maintained N = 26	Methadone Withdrawn N = 33	Controls N = 43	Statistic and p value
Age	39.38 ± 9.3	44.12 ± 6.2	36.23 ± 8.9	F(2,101)=8.53, p<.001
Education	13.22 ± 5.1	12.06 ± 2.5	15.35 ± 2.3	F(2,101)=9.63, P<.001
Mother's Education	11.50 ± 2.8	9.60 ± 3.4	13.29 ± 3.9	F(2,101)=7.79, P=.001
Sex (No.Males)	21 (81%) male	26 (79 %) male	33 (77%) male	X ² (2)=0.16, p= ns
Ethnicity				X ² (10)= 16.54, p =.085
African American	6 (23%)	13 (39%)	16 (37%)	
Caucasian	11 (42%)	9 (27%)	16 (37%)	
Hispanic	8 (31%)	10 (30%)	3 (7%)	
Asian/Native American	0 (0%)	0 (0%)	5 (12%)	
Other	1 (4%)	1 (3%)	3 (7%)	
Drug Use History				
Years of Heroin Use	13.72 ± 8.4	16.95 ± 9.5		F(1,58)=1.86, p=ns
Years MMT	8.19 ± 8.8	7.55 ± 7.6		F(1,58)=0.09, p=ns
Years Opiate Free	N/A	1.60 ± 4.1		
Stable Meth Dose	75.77 ± 25.8	82.86 ± 19.8		F(1,53)=1.30, p=ns
Age of Onset (Heroin Use)	18.96 ± 5.8	22.55 ± 9.1		F(1,55)=2.9, p=.092

Table 2
MCMJ-II Scores in Methadone Maintained, Methadone Withdrawn and Healthy Control Subjects

	Methadone Maintained N=26	Methadone Withdrawn N=33	Control N=43	Statistic*	P value	Pairwise Comparisons
CLUST. A				Wilk's λ (6,192) = 0.078	<.001 ^d	
Schizoid	18.81 $\pm$ 9.1	20.55 $\pm$ 7.8	15.63 $\pm$ 7.9	2.49	.065	b
Schizotypal	20.12 $\pm$ 15.5	19.45 $\pm$ 12.2	9.86 $\pm$ 11.3	5.86	.001	a,b
Paranoid	25.93 $\pm$ 15.7	32.30 $\pm$ 13.6	23.30 $\pm$ 13.6	3.96	.010	b
CLUST. B				Wilk's λ (10,188) = 0.633	<.001	
Histrionic	33.04 $\pm$ 12.6	33.48 $\pm$ 11.9	30.60 $\pm$ 9.5	1.11	ns	
Narcissistic	36.54 $\pm$ 12.8	39.42 $\pm$ 12.7	37.49 $\pm$ 12.0	1.13	ns	
Antisocial	32.73 $\pm$ 14.9	37.06 $\pm$ 9.9	24.12 $\pm$ 12.7	7.74	<.001	a,b
Aggressive	31.35 $\pm$ 13.5	34.4 $\pm$ 10.4	26.74 $\pm$ 10.0	5.07	.003	b
Borderline	32.65 $\pm$ 22.1	32.45 $\pm$ 15.2	12.21 $\pm$ 15.2	12.94	<.001	a,b
CLUST. C				Wilk's λ (10,188) = 0.833	.062	
Compulsive	36.73 $\pm$ 7.4	38.91 $\pm$ 6.7	36.84 $\pm$ 7.6	2.08	ns	
Passive Aggressive	26.38 $\pm$ 17.4	27.94 $\pm$ 11.9	17.21 $\pm$ 11.7	6.30	.001	a,b
Self Defeating	19.77 $\pm$ 14.9	19.58 $\pm$ 11.8	8.00 $\pm$ 9.7	9.13	<.001	a,b
Avoidant	19.27 $\pm$ 14.06	23.33 $\pm$ 12.11	10.67 $\pm$ 10.40	7.89	<.001	a,b
Dependent	27.23 $\pm$ 7.93	28.76 $\pm$ 7.40	24.09 $\pm$ 6.40	4.00	.010	b
AXIS I Syndromes				Wilk's λ (8,190) = 0.64	<.001 ^d	
Anxiety	11.12 $\pm$ 11.19	7.27 $\pm$ 5.78	3.30 $\pm$ 6.61	6.81	<.001	a,c
Dysthymia	17.92 $\pm$ 13.50	16.52 $\pm$ 10.38	5.70 $\pm$ 9.63	9.57	<.001	a,b
Thought Disorder	11.81 $\pm$ 10.89	14.27 $\pm$ 9.94	6.16 $\pm$ 8.54	4.53	.005	a,b
Delusional	12.31 $\pm$ 9.19	16.67 $\pm$ 8.84	10.44 $\pm$ 7.29	3.10	.030	b

* All statistics in this column are univariate F tests (degrees of freedom = 3,101) unless otherwise marked. For pairwise comparisons: a C vs. MM, p $\leq$.05, b C vs. MM, p $\leq$.05, c MM vs. MW, p $\leq$.05, d significant at p $\leq$.05 for MM vs. MW in 2 Group MANCOVA.

Table 3

MCMJ-II Base Rate Scores in Methadone Maintained, Methadone Withdrawn and Healthy Control Subjects

	Methadone Maintained N=26	Methadone Withdrawn N=33	Control N=43	Statistic*	P value	Pairwise Comparisons
CLUST. A				Wilk's λ (6, 192) = 0.799	.001	
Schizoid	58.49 $\pm$ 26.3	62.52 $\pm$ 21.5	49.12 $\pm$ 24.7	2.18	.095	b
Schizotypal	57.05 $\pm$ 27.1	61.48 $\pm$ 20.4	39.02 $\pm$ 25.3	7.09	<.001	a,b
Paranoid	56.88 $\pm$ 28.7	70.67 $\pm$ 17.3	55.60 $\pm$ 20.8	4.20	.008 ^d	b,c
CLUST. B				Wilk's λ (10, 188) = 0.597	<.001	
Histrionic	64.85 $\pm$ 27.1	66.76 $\pm$ 27.0	64.07 $\pm$ 20.0	0.53	ns	
Narcissistic	67.96 $\pm$ 30.6	75.33 $\pm$ 24.7	71.53 $\pm$ 24.8	1.24	ns	
Antisocial	72.85 $\pm$ 28.9	82.76 $\pm$ 17.5	56.30 $\pm$ 24.9	8.48	<.001	a,b
Aggressive	68.88 $\pm$ 30.4	75.30 $\pm$ 20.4	58.51 $\pm$ 22.2	5.31	.002	b
Borderline	60.58 $\pm$ 30.4	66.76 $\pm$ 19.4	28.35 $\pm$ 37.1	15.67	<.001	a,b
CLUST. C				Wilk's λ (10, 188) = 0.791	.013	
Compulsiv	65.62 $\pm$ 17.2	69.48 $\pm$ 15.6	64.05 $\pm$ 18.9	2.40	.072	
Passive Aggressive	59.08 $\pm$ 40.4	65.82 $\pm$ 26.5	36.81 $\pm$ 29.7	7.27	<.001	a,b
Self Defeating	61.50 $\pm$ 35.8	62.39 $\pm$ 26.5	31.00 $\pm$ 26.6	10.42	<.001	a,b
Avoidant	61.54 $\pm$ 39.0	69.64 $\pm$ 27.8	32.84 $\pm$ 29.2	10.54	<.001	a,b
Dependent	58.73 $\pm$ 29.2	63.06 $\pm$ 27.0	45.98 $\pm$ 28.9	3.39	.021	b
AXIS I Syndromes				Wilk's λ (8, 190) = 0.641	<.001 ^d	
Anxiety	51.12 $\pm$ 39.5	34.80 $\pm$ 32.5	11.19 $\pm$ 24.3	6.81	<.001	a,b
Dysthymia	49.58 $\pm$ 35.6	44.97 $\pm$ 31.5	11.67 $\pm$ 24.1	9.57	<.001	a,b
Thought Disorder	31.62 $\pm$ 27.8	31.15 $\pm$ 26.5	15.53 $\pm$ 23.5	4.53	.005	a,b
Delusional	48.19 $\pm$ 27.6	59.00 $\pm$ 18.1	44.86 $\pm$ 24.0	3.10	.030	b

* All statistics in this column are univariate F tests (degrees of freedom = 3,101) unless otherwise marked. For pairwise comparisons: a C vs. MM, p $\leq$.05, b C vs. MM, p $\leq$.05, c MM vs. MW, p $\leq$.05, d significant at p $\leq$.05 for MM vs. MW in 2 Group MANCOVA.

Table 4
TCI Scores in Methadone Maintained, Methadone Withdrawn and Healthy Control Subjects

	Methadone Maintained N=20	Methadone Withdrawn N=18	Controls N=25	Statistics* Wilk's $\lambda(14,106)=0.567$	P value	Paired Comparisons
All TCI Scales						
Novelty Seek.	22.30 $\pm$ 4.27	19.50 $\pm$ 3.93	16.64 $\pm$ 4.74	6.24	.004	a
Harm Avoid.	12.75 $\pm$ 3.91	11.44 $\pm$ 4.71	10.32 $\pm$ 5.19	1.29	.ns	
Reward Dep.	13.35 $\pm$ 3.34	14.56 $\pm$ 2.53	12.16 $\pm$ 3.34	2.06	.ns	b
Perseverance	6.30 $\pm$ 5.30	5.72 $\pm$ 1.02	5.68 $\pm$ 1.55	1.31	.ns	
Self-Directed.	26.45 $\pm$ 6.48	28.50 $\pm$ 5.76	31.00 $\pm$ 6.22	2.82	.047	a
Cooperation	29.00 $\pm$ 5.92	30.50 $\pm$ 6.00	32.12 $\pm$ 6.50	1.19	.ns	
Self Trans.	16.90 $\pm$ 4.52	16.50 $\pm$ 6.08	14.80 $\pm$ 6.36	0.64	.ns	

* All statistics in this column are univariate F tests (degrees of freedom = 3,62) unless otherwise marked. For pairwise comparisons: ^a C vs. MM, $p \leq .05$, ^b C vs. MW, $p \leq .05$, ^c MM vs. MW, $p \leq .05$.