Four Addictions: The MMPI and Discriminant Function Analysis

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ABSTRACT. Over the past twenty years many MMPI studies of substance abuse have investigated the complex relationship between personality profile and drug of choice. This work has repeatedly established that alcoholics, heroin, cocaine and polydrug addicts share 4-2/2-4 (Psychopathy and Depression) or 4-8/8-4 (Psychopathy and Thought Disorder) MMPI profiles, but that the substance abuse populations differ in the plane of severity in that general profile. The alcoholics occupy the least disturbed sector, the polydrug abusers the most disturbed level and the heroin and cocaine addicts positions of moderate disturbance. The vast majority of studies, however, cite only group means to buttress their conclusions. Our work probed more deeply into the data using Discriminant Function Analysis. With this methodology we discovered important differences between the groups, previously hidden, which may carry

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Groups of drug abusers and alcoholics have been well studied with the MMPI. Research designs, however, have been surprisingly incomplete along at least three dimensions, rendering important questions about group differences still unanswered.

1. Four major addictions: alcohol, heroin, cocaine and polydrug abuse have not been included in the same large study. Investigators usually approach one, two or rarely three groups in the same research, cocaine versus heroin addicts, heroin versus cocaine versus hallucinogen abusers, etc.
2. Both sexes are usually not studied or discriminated between within the same design. Moreover possible racial and social class-employment differences are often ignored.
3. Investigators usually concentrate on comparing the mean profiles of drug groups under study and rarely use multivariate approaches to search for the dimensions that underlie the apparent differences between groups.

Our large Discriminant Function Analysis study differs in all three respects from predecessors and identifies new and important dimensions of psychopathology that distinguish those in the major categories of substance abuse–alcoholics, heroin, cocaine and polydrug addicts. The previously unexplored psychopathological dimensions shed new light on more traditional group mean research and suggest important treatment implications.

The interaction between psychopathology and drug abuse, particularly the relationship between that pathology and drug of choice, has preoccupied clinicians and researchers for much of this century.[1] The MMPI, long in circulation and readily administerable to large groups simultaneously, has been used in a plethora of studies.

Over the past 20 years, a large number of investigators have found that alcoholics, heroin, cocaine and polydrug abusers contribute a similar general, mean MMPI profile, a 4-2/2-4 or 4-8/8-4 code type: psychopathy and depression; psychopathy and idiosyncratic thinking. However, to summarize broadly, alcoholics offer the least disturbed rendition of this profile and polydrug and amphetamine abusers the most disturbed example of it. The heroin and cocaine addicts fall between the two extreme groups in this general spectrum.

To review specific studies, Carrol and Zuckerman[2] compared the MMPI profiles of abusers of depressants (heroin or barbiturates), stimulants (cocaine or amphetamine) and hallucinogens (LSD or mescaline). The 4-8/8-4 composite profile emerged for all groups, suggesting acting out and poor relationships to authority paired with odd thinking, but the hallucinogen abusers contributed high psychotic scales, as did the stimulant abusers to a lesser degree. Dolan, Black et al.[3] and Malow, West et al.[4] found polydrug abusers (speed-ballers) more disturbed than those who abused heroin or cocaine alone, although all three groups contributed the now predictable 4-2/4-8 composite profiles.

Penk, Fudge et al.[5] found that heroin, barbiturate and amphetamine addicts all exhibited the 4-8/4-9 (Psychopathy-Odd Thinking/Psychopathy-Hypomania) mean profiles but that heroin addicts were less disturbed than the barbiturate or amphetamine abusers. Sutker and Archer[6] reviewed multiple studies and reported that amphetamine and polydrug abusers contributed more disturbed mean profiles than did opiate or alcohol abusers. Craig[7] reported striking similarity between cocaine and heroin addicts on the MMPI. The former contributed a 4-2 (Psychopathy-Depression) code and the latter a 4 point code, with subspikes on 2 and 9. Craig summarized his own results and integrated those with others:

> The cocaine addict is characterized by acting out traits, rebelliousness, problems modulating anger and shows moderate levels of depression and hyperactivity. Compared to the MMPI's of amphetamine abusers reported in the literature, the cocaine patients seem less pathological on all MMPI scales, although the configuration of their profiles is quite similar (Penk et al., 1979). Compared to the MMPI's of the heroin study who were characterized by acting out traits, rebelliousness, depression, anxiety, alienation and hyperactivity, the cocaine abusers are characterized by similar traits but at modulated levels of severity. (p. 602)[7]

Greene, Adyanthaya et al.[8] found that cocaine and marijuana abusers contributed 2-4 mean profiles which did not significantly differ from one another. These profiles were compared to data bases of alcoholic and psychiatric patients who contributed 4-2/4-8 pictures respectively. Although significance testing was not performed comparing the drug abusers with these latter two groups, cursory inspection indicates similar overall mean profiles between the four groups, with the alcoholics the least disturbed, the cocaine and marijuana people falling in the middle and the psychiatric in-patients and out-patients occupying the most pathological position on the spectrum.

Studying cocaine addicts alone, Dougherty and Lesswing[9] found that cocaine addicts exhibited 4-9/9-4 profiles and Walfish, Massey et al.[10] and Moss and Werner[11] corroborated these data. Likewise Helfrich, Crowley et al.[12] found a very similar mean profile for cocaine patients with a spike 4 code type.

How would the MMPI's of alcoholics compare or contrast with those of other drug abusers? Graham and Strenger[13] exhaustively reviewed MMPI studies of alcoholics. They concluded that, while a 4-2/2-4 code frequently obtained for groups of male and female alcoholics, there was no one alcoholic profile, and there were many distinctive subtypes within the population. These authors underscored the difficulty in differentiating alcoholics from other psychiatric patients.

In an earlier review, Craig[14] reported that alcohol and heroin addicts contributed similar 4-2/4-9 MMPI profiles, but alcoholics were higher on 2, 3 (Hysteria) and 7 (Psychasthenia) and the heroin addicts on 4 and 9. The higher the Pd scale (4), the more likely the owner to be a heroin abuser versus an alcoholic. Sutker and Archer[6] came to similar conclusions about the personality distinctions between alcoholics and heroin addicts.

Worth noting are a smattering of negative findings which call into some question the idea that drug of choice corresponds to a specific MMPI profile. Brown and Fayek[15] compared alcoholics to a second group who abused both cocaine and alcohol. The alcoholics showed a 2-4-7 profile and the alcoholic-cocaine abusers a 2-9-8 profile. The latter group produced a profile significantly higher on SC(8) and MA(9) versus the former. Interestingly, once age was corrected for only PT(7) differentiated between the groups on the original MMPI clinical scales. Moreover other researchers report that the MMPI did not discriminate between heroin and polydrug abusers[16] or between alcohol and other drug abusers if age were controlled for.[17] (Small sample size however may have accounted for these negative findings. This was not discussed.)

Also there has been little research on sex differences within addict populations. Kline and Snyder[18] using cluster analysis found three replicated subgroups for male and female alcoholics 8-2-4, 9-8-4, 4-9 for men and 4-8-9, 4-3, 4-9 for women. For women, severity of MMPI profile correlated with severity of drinking behavior but not for men. Craig[14] did note that male and female alcoholics and heroin abusers all seemed to contribute 4/9 profiles so that sexual distinctions were impossible to establish. Anglin, Weisman, et al.[19] cited few research findings differentiating male from female narcotic addicts on the MMPI but still concluded that "cross gender generalizations of findings is inappropriate" (p. 872).

Finally it is worth noting that there is considerable racial, gender and

treatment setting heterogeneity within samples. For example Helfrich et al.[12] included in-patients and out-patients in the same study; Walfish et al.[10] studied adolescents only; Craig[7] used a hospitalized sample. Moss and Werner[11] reported on a sample 45% black; Greene et al.[8] investigated a sample approximately 80% male and 20% female. In addition, no research has controlled for age although we know that MMPI profiles change with age.[20]

In contrast to earlier work, our study included age as a covariate and was much larger in sample size than previous research. The present work encompassed four addiction groups, both sexes and one race, Caucasian. In addition, Discriminant Function Analysis uncovered findings hidden from previous researchers.

METHOD

Our final sample consisted of 491 men and 155 women, all Caucasian, consecutive admissions to a private, in-patient, detoxification rehabilitation center located in a blue-collar suburb of Boston, MA. Exclusion criteria included:

1. A history of brain injury or chronic psychosis;
2. Inability to read or comprehend the MMPI;
3. An F scale score greater than 110;
4. Submission of an incomplete protocol;
5. Non-Caucasian race. (There were only a few non-whites originally in the study, so to control for race we excluded those few.)

In all we dropped 18 subjects from the original sample, leaving us with the 491 men and 155 women.

The examiners established the patient's drug preference in corroboration with either the social work assessment report or the psychiatric examination. There was 100% agreement in drug preference from these data sources by discharge and it was this designation of preference that we used. All subjects met DSM-III-R (APA, 1987) criteria for alcoholism. The heroin addicts, in addition, met DSM-III-R criteria for heroin addiction but for no other substance save alcohol, the cocaine addicts for cocaine addiction but for no other addictions except alcohol. The polydrug abusers met DSM-III-R criteria for polydrug addiction, i.e., the addiction to alcohol plus two or more substances, cocaine and amphetamine, etc. Readmission data indicated that these drug preferences were long term.

Alcoholism seemed ubiquitous among the subjects, but a heroin addict, for example, never had been previously admitted for cocaine abuse.

The size and mean age of the four drug groups emerged as follows. The male sample included: alcoholics N = 242, mean age = 38.56; heroin addicts N = 59, mean age = 32.22; cocaine addicts N = 116, mean age = 29.66 and polydrug abusers N = 74, mean age = 27.30. The female sample demonstrated a similar distribution and mean age: alcoholics N = 67, mean age = 41.58; heroin N = 21, mean age = 29.76; cocaine N = 45, mean age = 27.22 and polydrug N = 22, mean age = 24.27. Analysis of Variance (ANOVA) and Tukey's studentized range (HSD) pair wise testing indicated that for both sexes the alcoholics were significantly older ($p < .01$ for men; $p < .05$ for women), than the members of each of the other drug groups. In addition among the men the heroin addicts were significantly older than the polydrug users ($p < .01$).

Each subject completed the medically supervised detoxification phase of treatment prior to testing; the mean length of detox stay was seven days. Two psychologists administered the MMPI's either individually or in groups, six to ten days after admission.

RESULTS

MMPI Analyses–Group Means

We performed Analysis of Covariance (ANCOVA) for each clinical subscale separately for each sex, with drug preference group as the independent variable and age entered as a covariate, since as noted, there were significant age differences between drug groups. These analyses were followed by post-hoc Tukey's HSD comparisons with an alpha of .01 for the men. Because there were substantially fewer women, thus reducing the power of our analyses, we used an alpha of .05 for their post-hoc comparisons.

Among the men the alcoholics demonstrated a 4-2 pattern, as did heroin addicts, although at a greater plane of severity. The cocaine abusers presented a 4-9 profile and the polydrug patients an 8-2-7 profile.

For the men, all MMPI subscales showed significant differences (see Table 1). The alcoholics were less extreme in their profile than the other groups, while the polydrug group was generally the most disturbed. Tukey's comparisons indicated that the alcoholics and polydrug groups differed significantly on all subscales. (See Table 1.)

The MMPI profiles of the four female samples closely resembled those of the males for each corresponding drug group. The alcoholic women

TABLE 1. MMPI Scale Scores by Drug Means (Men): Descriptive Statistics and Tests of Group Differences

Scale	ETOH Mean (SD)	Heroin Mean (SD)	Cocaine Mean (SD)	Polydrug Mean (SD)	F
HS (1)	56.66[a] (11.51)	63.15[b,c] (13.46)	60.47[b,c] (16.04)	67.64[c] (12.03)	15.07***
D (2)	66.29[a] (13.18)	77.34[b] (14.98)	67.85[a] (14.58)	82.41[b] (15.29)	30.90***
Hy (3)	59.00[a] (9.85)	64.81[a,b,c] (10.04)	61.38[b] (10.51)	68.32[c] (12.40)	17.11***
PD (4)	68.16 (10.38)	82.58[a] (9.74)	78.89 (11.03)	82.06[a] (9.97)	57.17***
MF (5)	58.12[a] (10.86)	62.71[a,b] (8.68)	61.39[a,b] (11.44)	63.43[b] (12.51)	5.13***
PA (6)	60.53 (8.82)	67.66[a] (8.71)	68.41[a] (12.70)	73.85 (10.87)	39.70***
PT (7)	61.71 (11.93)	72.31[a] (11.35)	70.14[a] (13.43)	80.69 (13.45)	48.74***
SC (8)	61.60 (13.20)	70.92[a] (17.56)	72.85[a] (15.35)	87.00 (15.78)	65.80***
MA (9)	64.53[a] (10.39)	66.70[a,b] (13.46)	74.96[c] (11.71)	70.97[b,c] (9.09)	26.07***
SI (10)	53.38[a] (10.64)	56.47[a,b] (11.60)	59.73[a] (1.03)	60.55[b] (10.61)	8.62***

Note: *** p - .001
Drug groups with same letter superscript are not significantly different by Tukey's highly significant difference test ($\alpha = .01$). The test of group differences controlled for age using age as a covariate.

exhibited a 4-9-2 profile as did the female cocaine addicts, the female heroin patients a 4-8-9 picture and the polydrug women an 8-4 profile.

For the women, the ANCOVA demonstrated significant differences for all subscales except 5 (MF) and 10 (Social Introversion). Post-hoc comparisons indicated that the alcoholic and polydrug female groups differed

significantly from each other for six of the subscales. As with the men, the alcoholics were the *least* disturbed and the polydrug users the *most* disturbed on the MMPI scale comparisons. (See Table 2.) Now we turn to Discriminant Function Analysis which permitted clarifications of the dimensions distinguishing the four drug groups.

Discriminant Functional Analysis

As noted below, the Discriminant Function Analysis did not differ remarkably for the sexes so we represent the figures for the total sample. We found that three discriminant functions were statistically significant; we report on these three dimensions.

In Table 3 we see the three Discriminant Functions that emerged. Function 1 *Level Of Disturbance* reflects a generally elevated profile, particularly on the psychotic scales 6 (Paranoia), 7, and 8 as well as 2. Function 2 *Mania versus Alienated Depression* reflects a loading on scale 9 and a negative representation on 4 and 2. Function 3 *Odd Thinking and Introversion versus Psychopathic Acting Out* is defined by a high representation on scales 2, 7, 8 and 10 and a negative loading on scale 4.

Table 4 depicts the means of each of the drug groups on each discriminant function. We see there that polydrug users scored highest on the first discriminant function indicating anxiety, paranoia, odd thinking and impulsivity. The alcoholics' mean was lowest on Function 1 while cocaine and heroin addicts were similar to each other at moderate levels.

We see further that Function 2 *Mania versus Alienated Depression* distinguishes the heroin addicts who have the highest negative loading, suggesting a distinctive hostility, depression and alienation versus the other three groups. Interestingly the polydrug users and the alcoholics, so different on Function 1, are very similar here with a near zero loading. Cocaine addicts, with a positive loading on this function, demonstrate excitability and lability versus the depressed alienation of the heroin addicts to whom they seem so similar on group MMPI means in all studies including ours.

Turning to Function 3 *Odd Thinking and Introversion versus Psychopathic Acting Out* we notice that the polydrug users were introverted and withdrawn, particularly in comparison to the heroin patients who registered a negative loading on this function.[1]

DISCUSSION

In this study we replicated earlier work on the MMPI investigation of substance abuse groups. However we included both sexes and four major

TABLE 2. MMPI Scale Scores by Drug Group (Women): Descriptive Statistics and Tests of Group Differences

Scale	ETOH Mean (SD)	Heroin Mean (SD)	Cocaine Mean (SD)	Polydrug Mean (SD)	F
HS (1)	57.48[a] (11.43)	61.05[a,b] (11.59)	61.56[a,b] (11.63)	66.95[b] (12.76)	3.69*
D (2)	64.10[a] (10.24)	69.86[a,b] (11.85)	67.82[a] (11.17)	76.36[b] (17.06)	6.17***
HY (3)	60.70[a] (10.84)	67.19[a] (11.07)	64.56[a] (9.93)	65.00[a] (11.36)	2.641
PD (4)	67.63 (10.51)	85.33[a] (12.61)	76.69[b] (9.32)	78.68[a,b] (12.79)	17.65***
MF (5)	57.52[a] (12.38)	49.38[a] (10.47)	55.07[a] (12.56)	58.55[a] (15.80)	2.58
PA (6)	60.63 (10.29)	71.00[a] (12.03)	69.26[a] (10.52)	76.64[a] (13.76)	14.31***
PT (7)	61.39 (10.26)	69.19[a,b] (11.75)	68.27[a] (10.43)	76.69[b] (15.66)	11.21***
SC (8)	61.93[a] (13.22)	71.19[a,b] (17.14)	73.22[b] (13.87)	84.36 (17.88)	14.50***
MA (9)	65.34[a] (9.94)	70.57[a,b] (12.26)	74.98[b] (12.55)	73.32[b] (11.25)	7.42***
SI (10)	53.40[a] (9.42)	57.14[a,b] (12.57)	53.67[a] (9.71)	64.55[b] (9.97)	7.00***

Note: * $p < 0.5$
** $p < .01$
*** $p < .001$

Drug groups with same letter superscript are not significantly different by Tukey's highly significant difference test ($\alpha = .05$). The tests of group differences controlled for age using age as a covariate.

TABLE 3. Discriminant Function Structure

	Function 1	Function 2	Function 3
Hs	.39	−.15	.19
D	.48	−.58	.27
Hy	.38	−.25	.04
Pd	.76	−.33	−.46
MF	.14	−.02	.18
PA	.68	.09	.17
PT	.70	−.14	.29
SC	.80	.03	.58
MA	.40	.80	−.06
SI	.30	−.30	.33

TABLE 4. Means of Discriminant Functions by Drug Group

Drug	Function 1	Function 2	Function 3
ETOH	−.73	−.07	.08
Heroin	.60	−.49	−.60
Cocaine	.40	.51	−.14
Poly	1.17	−.22	.49

drug abuse categories in the same large sample design. We accounted for age and race as well as sex. Our findings were deepened through Discriminant Functional Analysis. We identified three functions in the data, *Level of Disturbance, Mania versus Alienated Depression* and *Odd Thinking and Introversion versus Psychopathic Acting Out* which distinguished between the groups along important dimensions.

We need to address the use of the MMPI here versus the newer MMPI 2. The data were gathered with the MMPI before the MMPI 2 was commonly used. In the context of MMPI 2 we assume our results to retain validity since the two tests correlate so highly.[20,21] Secondly, we planned this

study to replicate and add perspective to the earlier literature which we reviewed. All of the former studies employed the MMPI so our new findings complement those using the same instrument. Subsequent authors who continue in this area must reconcile MMPI 2 results with the reservoir of earlier MMPI data.

Furthermore we doubt that our data represent simply withdrawal phenomena. First, many previous authors cite similar findings to our own. Subjects in that spectrum of earlier studies had been abstinent from periods ranging from a few days to a few weeks. Sherer et al.[22] found that alcoholics tested 10-11 days post the last drink contributed more reliable MMPI readings than if they were assessed at the earliest phases of detox. Our subjects were tested 6-10 days post-admission suggesting that these profiles had already stabilized and would remain fairly consistent over time and were thus not dramatically influenced by acute withdrawal.

Additional sample characteristics require reflection and comment as well. Unlike the majority of earlier work this study is an entirely Caucasian versus a mixed race sample so findings here can not be attributed to racial differences. However this also means that our findings may not be generalizable to Hispanic, African American or mixed race samples.

Since the MMPI demonstrates changes with age, we control for this variable as well, a safeguard which few if any of our predecessors have included in their designs. Finally ours is a largely employed sample entirely supported by third party insurance, again an important characteristic. These are the patients likely to appear in the managed care panels of the future. Because all the patients are employed, or the dependents of an employed adult, it is likely that they fall into the middle or lower middle class demographically, although no specific social class analysis was pursued. They would thus be somewhat more free of the extreme social economic pressures, i.e., poverty, unemployment, legal difficulties, to which the members of some previous samples were probably exposed.

The findings suggest that although the four groups of drug abusers demonstrate the same general profile and in this way resemble earlier samples,[8,14,6] there are meaningful differences between the drug groups revealed by discriminant function analysis. These specific group characteristics not only cause us to re-evaluate the perspective of the group mean studies but may suggest differential treatment implications.

The alcoholics are less disturbed than the other three groups as reflected both in the group means and the Discriminant Functional Analysis–Function 1 in particular. Furthermore none of the mean scores of the alcoholics reached the clinical cut off of greater than 70 (see also Greene et al.[8]). We conclude that alcoholics on average did not demonstrate dramatic psy-

chiatric symptomatology and might be well treated in intensive out-patient versus in-patient models after a medically supervised detox. Self-help rather than highly structured, highly monitored treatment programs might be the most cost-effective way to approach much of this population. In this time of cost consciousness and increasingly scrutinized treatment planning these ideas may have great utility in offering the least invasive but still appropriate pattern of care.

The discriminant function analysis demonstrates that the cocaine and heroin abusing populations, although quite similar in this and all other studies in terms of general mean MMPI profile, can in fact be distinguished. The group mean studies have led us astray in this respect. The heroin users appear depressed and hostilely alienated. Possibly, like the alcoholics, they may not require extensive hospitalization for these difficulties. The depression might be treated psychotherapeutically and psychopharmacologically but on an out-patient basis. The alienation must be seriously addressed. It is not clear that alienation is a psychiatric difficulty parallel to depression, for example. Specific, ingenious strategies must be developed to confront the alienation, however. Perhaps in conjunction with methadone maintenance, long term group counseling with an emphasis on psycho-education and life management might be a promising approach but this need not be an inpatient intervention.

The particular difficulty of the cocaine patients, is demonstrated by their high loading on Function 2, lability of mood, excitability and impulsivity. These symptoms, potentially dangerous for the patient and for others can be targeted psychopharmacologically and psychotherapeutically. For the cocaine users, depressed alienation is not the issue. Unfortunately in the early stages of treatment, given the impulsivity, more versus less hospitalization may be desirable. Unlike the heroin addicts, however, there is no evidence from our data that a long-term approach to life readjustment is required.

The polydrug patients suffer at a level all their own, one that distinguishes them from the other three groups in the elevation and specificity of their pathology. Described by one of the researchers as "so disorganized that they will take any drug at any time including cigarette butts and half-empty beer cans they find in the street," (HFK–personal communication), these people are acutely disturbed with paranoid thinking, massive anxiety and profound withdrawal. Here again the group means fail to highlight important differences between the classes of drug abuse. The group means imply escalating withdrawal and odd thinking for the alcoholics through the polydrug abusers. In fact, the polydrug users are by themselves in terms of general level of disturbance (Function 1) and

thought disorder and schizoid withdrawal (Function 3). These findings on Functions 1 and 3 imply very serious, complicated psychopathology distinct from the other three groups. The polydrug abusers may require careful ongoing psychiatric monitoring and probably acute hospitalization and aggressive psychopharmacology. Given their level and complexity of disturbance, the long-term follow up needs of the polydrug group might be at least as extensive as those of general psychiatric inpatients.

Since we meet these patients one to two weeks post-detox, we are no doubt encountering an admixture of short and long term drug effects as well as psychopathology. This research design cannot partial out the significance of each. Psychopharmacologically, heroin abuse probably does lead to depressed alienation, cocaine abuse to excitation and lability, and polydrug abuse to psychotic like organization.[23] However, our findings may point toward the specific management and psychiatric needs of the patients as they finish acute detox and begin a treatment career. Any successful therapy plan will include regular monitoring and re-evaluation as that plan proceeds. This MMPI research, particularly the Discriminant Function Analysis, points to appropriate starting places in treatment for the four groups and emphasizes that those starting points differ markedly from group to group. The extended treatment needs of these groups may also differ significantly, but these must be assessed sequentially as that treatment unfolds.

NOTES

1. We do not include separate Discriminant Function Analysis data for each sex because the findings were quite similar but we now offer a brief look at the women for comparative purposes. Function 1 for both men and women indicated a general level of disturbance and again the polydrug women loaded strongly on this dimension and alcoholics negatively. Function 2 for females indicated a propensity for odd thinking and withdrawal versus hostility and anti-authoritarian thinking; this Function matched quite closely Function 3 for the males. In both groups the polydrug addicts loaded high on this dimension but the heroin patients negatively. In the women the third discriminant function was not statistically significant so we do not report on it here.

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