The Prediction of Drug Use Among College Students From MMPI, MCMI, and Sensation Seeking Scales

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This study examines the ability of five self-report assessment measures to predict college students' drug use across 12 pharmacological drug categories. Subjects were 125 female and 61 male university undergraduate students. The test battery included the following instruments: (a) the Psychopathic Deviancy (Pd) scale of the Minnesota Multiphasic Personality Inventory (MMPI); (b) the MacAndrew Alcoholism scale (MAC), a special scale of the MMPI; (c) the Sensation Seeking Scale (SSS); (d) the Millon Alcohol Abuse Scale; and (e) the Millon Drug Abuse Scale. Scores from these instruments were utilized in linear combinations to predict individual drug use outcomes as well as polydrug versus single drug use patterns. The drug categories included in this investigation are coffee, tobacco, alcohol, marijuana, tranquilizers, depressants, amphetamines, LSD, other hallucinogens, solvents, narcotics, and cocaine. Results demonstrate significant and meaningful relationships between predictors and drug use levels among college students. Weighted equations derived from linear discriminant function analyses were generally capable of accurately classifying subject's drug use levels across drug categories and in discriminating single drug use from polydrug use patterns. Typically, the Sensation Seeking Scale entered as the most powerful predictor of substance use and abuse.

The use of objective inventories to detect, describe, and predict substance abuse problems has increased greatly over the past 40 years. The standard MMPI scales, and MMPI derivative special scales, have been particularly popular media for studying drug abusers and addicts. Butcher and Owen (1978) reported a total of 96 MMPI publications addressing alcohol and drug abuse issues between 1972 and 1977 alone. Findings from this MMPI literature have indicated that Pd scale elevations are strongly associated with drug abuse histories across a large variety of psychoactive substances (Sutker & Archer, 1979). Among MMPI special
scales, MacAndrew (1965) has derived a 49-item alcoholism (MAC) scale that has shown high degrees of construct validity (e.g., Schwartz & Graham, 1979), concurrent validity (e.g., Apfeldorf, 1978), and which may also have substantial predictive validity (Hoffman, Loper, & Kammeier, 1974).

In addition to the MMPI, other instruments have been used to measure or identify characteristics among individuals who abuse drugs or alcohol. The Sensation Seeking Scale (Zuckerman, 1979), which measures the individual's tendency to seek out varied, novel, and complex sensations and experiences, has shown significant associations with substance abuse and addiction. Specifically, higher Sensation Seeking Scale (SSS) scores have been related to higher levels of drug abuse among samples of college students (Segal & Singer, 1976; Zuckerman, 1970), U.S. veteran polydrug abusers (Kilpatrick, Sutker, & Smith, 1976), middle class drug abusers (Khavari, Humes, & Mabry, 1977), heroin addicts in treatment (Sutker, Archer, & Allain, 1978), and psychiatric outpatients (McGlothlin & Arnold, 1971). In general, the strongest substance abuse relationships found for the SSS have involved use of the total or general sensation seeking score, rather than prediction from individual SSS subscales (Platt, 1975). Millon (1977) has developed the Millon Clinical Multiaxial Inventory, which includes an Alcohol Abuse scale designed to identify respondents with alcoholism histories and the Drug Abuse scale to identify individuals with drug abuse histories. Millon (1977) has reported correlations between the Drug Abuse and Alcohol Abuse scales and the Pd scale of .37 and .31, and between these Millon scales and the MAC of .51 and .41, respectively. Millon (1977) has also reported classification accuracy rates of 89% for the Alcohol Abuse scale and 90% for the Drug Abuse scale when employing optimal T-score cutoffs specifically designed for use in particular samples.

Thus far, no studies have compared the differential utility of these five objective measures in predicting drug use or abuse. Only two studies have compared standard MMPI clinical scales, including scale Pd, with the MAC scale in terms of investigating differential utility in identifying substance abusing individuals (Clopton & Klein, 1978; Clopton, Weiner, & Davis, 1980). Although the initial findings of the 1978 study indicated standard MMPI scales to have a more accurate classification rate, the 1980 cross-validation found an opposite pattern of results. No studies have compared the predictive accuracy of Zuckerman's SSS or the Millon scales with either the MMPI Pd or MAC scales among drug users and abusers. Further, with the exception of investigations of college students employing the SSS, these scales have typically been individually employed to categorize and identify substance abuse among samples of individuals manifesting chronic and pathological substance abuse or dependence patterns. The usefulness of these instruments in the prediction and understanding of more moderate or experimental levels of substance abuse, such as those that might be reported by college students, is largely unknown.

Several researchers have established a high degree of correspondence between
self-reports of opiate use and independent estimates of abuse as derived by such techniques as urine analysis (e.g., Page, Davies, Ladner, Alfassa, & Tennis, 1977). Similarly, self-reports on cigarette smoking among adolescents has consistently demonstrated high intercorrelations with evaluations based on air carbon monoxide levels (e.g., Bauman, Koch, & Bryan, 1982). Thus, the current study investigated the utility of these objective inventories in predicting substance use self-reports within a college undergraduate sample. Additionally, sex and racial effects for the Pd, MAC, SSS, and Millon measures, and the relative frequency of polydrug use, were also investigated.

METHOD

Subjects

A total of 186 university undergraduates was successfully recruited from psychology courses for this study. Subjects had a mean age of 20 years, 9 months, with a range from 17 to 47 years (SD = 4.4 years). Of the total subject pool, 125 were female and 61 were male. Further, 138 subjects were white, 35 were black, and 13 were of Asian ethnic origins.

Procedures

Subjects were tested in small group formats and received an assessment battery that included the Pd scale, the MAC scale, the SSS, the Alcohol Abuse scale, and the Drug Abuse scale. Additionally, all subjects completed the Alcohol and Drug Research Survey (Segal & Singer, 1976), which was designed to assess an individual's drug taking pattern for each of 12 psychoactive drug categories. These 12 drug categories are coffee, tobacco, alcohol, marijuana, tranquilizers, depressants, amphetamines, LSD, other hallucinogens, solvents, narcotics, and cocaine. The order of presentation of assessment instruments was counterbalanced across subjects to control for possible sequence or ordinal effects. Items that were shared across two or more subscales (e.g., eight items common to the MAC or Pd) were presented only once to reduce questionnaire length and item redundancy. Subjects were assured that their responses were confidential and that individual response patterns would not be evaluated.

RESULTS

The Alcohol and Drug Research Survey, the dependent measure employed in this study, was used to evaluate subjects' level of drug use for each of 12 drug categories. Subjects' scores reflected the frequency of their use pattern on a 7-point
continuum ranging from never having tried to using several times a day. Based on the small number of subjects who endorsed the higher frequencies of use in most drug categories, responses were reclassified into a smaller number of response categories. As shown in Table 1, subjects’ responses for coffee, tobacco, alcohol, and marijuana were classified into three groups of nonuse, infrequent use, and frequent use. Additionally, self-reports of frequency of use for the illicit drugs including tranquilizers, barbiturates, amphetamines, LSD, hallucinogens, solvents, narcotics and cocaine were reclassified into two categories of never tried and tried.

To identify motives for drug taking behaviors, subjects were asked on the Alcohol and Drug Research Survey to select from among 17 drug taking motives related to each drug category for which they reported drug use. These 17 categories of motives were then collapsed into three broad dimensions identified by Naditch (1975) as the primary motives for drug use in college populations (i.e., social reasons, therapeutic intent, and experience and/or pleasure seeking). The frequency of students who endorsed each of these three motive categories for five representative drug classes appears in Table 2.

Preliminary tests were also performed to evaluate the extent to which demographic variables including sex and race (white, black, and Asian) affected scores on the objective inventories employed in this study. To evaluate the effects of sex and race on the five predictor scales, a series of five two-way analyses of variance (ANOVAs) were performed with sex and race as the independent variables. In

### TABLE 1
Frequency of Occurrence and Percentage of Total for Drug Use Levels by 12 Drug Categories After Reclassification

<table>
<thead>
<tr>
<th>Drug Category</th>
<th>Nonuse</th>
<th>Infrequent Use</th>
<th>Frequent Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coffee</td>
<td>142 (76%)</td>
<td>22 (12%)</td>
<td>22 (12%)</td>
</tr>
<tr>
<td>Tobacco</td>
<td>131 (70%)</td>
<td>23 (12%)</td>
<td>32 (17%)</td>
</tr>
<tr>
<td>Alcohol</td>
<td>32 (17%)</td>
<td>110 (59%)</td>
<td>44 (24%)</td>
</tr>
<tr>
<td>Marijuana</td>
<td>131 (70%)</td>
<td>27 (14%)</td>
<td>28 (15%)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Drug Category</th>
<th>Never Tried</th>
<th>Tried (and/or Used)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tranquilizers</td>
<td>142 (76%)</td>
<td>44 (24%)</td>
</tr>
<tr>
<td>Barbiturates</td>
<td>153 (82%)</td>
<td>33 (18%)</td>
</tr>
<tr>
<td>Amphetamines</td>
<td>112 (60%)</td>
<td>74 (40%)</td>
</tr>
<tr>
<td>LSD</td>
<td>156 (84%)</td>
<td>30 (16%)</td>
</tr>
<tr>
<td>Hallucinogens (other)</td>
<td>162 (87%)</td>
<td>24 (13%)</td>
</tr>
<tr>
<td>Solvents</td>
<td>168 (90%)</td>
<td>18 (10%)</td>
</tr>
<tr>
<td>Narcotics</td>
<td>177 (94%)</td>
<td>11 (6%)</td>
</tr>
<tr>
<td>Cocaine</td>
<td>133 (71.5%)</td>
<td>53 (28.5%)</td>
</tr>
</tbody>
</table>

**Note.** The term nonuse refers to nonuse of a substance at the current time. The exception to this is for the category of coffee, for which nonuse refers to once per month or less.
<table>
<thead>
<tr>
<th>Motives</th>
<th>Alcohol (n = 179)</th>
<th>Marijuana (n = 135)</th>
<th>Stimulants (n = 87)</th>
<th>Hallucinogens (n = 36)</th>
<th>Depressants (n = 49)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sociality and pressure</td>
<td>121</td>
<td>91</td>
<td>38</td>
<td>22</td>
<td>7</td>
</tr>
<tr>
<td>Experience seeking</td>
<td>160</td>
<td>116</td>
<td>56</td>
<td>31</td>
<td>21</td>
</tr>
<tr>
<td>Self-medication</td>
<td>50</td>
<td>35</td>
<td>39</td>
<td>12</td>
<td>10</td>
</tr>
</tbody>
</table>

Note. Categories of motives were comprised of the following items: Sociality and pressure: Friends were using it. To be socially accepted. To be sociable. For prestige—to show off for others. Friends pressured me into it. Experience seeking: For a pleasant effect. To experience something new. To get "kicks" or "high." To satisfy my curiosity. Self-medication: To get better insight. To overcome feelings of depression. To give me pep or energy. To relieve anxiety or tension. To be more creative. To relate better to my friends. To expand my awareness.

these and all other analyses, the total SSS score was employed rather than particular SSS subscales. Significant main effects for sex were found on the SSS, F(1, 181) = 4.30, p < .05, and the MAC scale, F(1, 181) = 6.21, p < .05, such that males produced higher scores on these measures than did females. Significant main effects were also found for race on the SSS F(2, 181) = 13.76, p < .001, and the Pd scale, F(2, 181) = 3.44, p < .05. Duncan's multiple range subsequent tests showed that whites scored lower than blacks and Asians on the Pd scale, whereas blacks scored lower than both whites and Asians on the SSS. No other main or interactive effects for race or sex were found for the five objective measures.

Chi-square analyses were performed to evaluate separately the effects of sex and race (white, black, Asian) on frequency of drug use for each of 12 drug categories. The results of analyses of sex effects indicated significant findings for only two drug categories, alcohol, χ²(2, N = 186) = 7.75, p < .05, and cocaine, χ²(1, N = 186) = 4.48, p < .05. Specifically, males were found to report more frequent involvement with alcohol and cocaine than did females. Results of a series of analyses indicated significant racial effects on drug use frequencies for tobacco, χ²(4, N = 186) = 14.80, p < .005; alcohol, χ²(4, N = 186) = 20.16, p < .001; tranquilizers, χ²(2, N = 186) = 8.54, p < .05; barbiturates, χ²(2, N = 186) = 8.45, p < .05; amphetamines, χ²(2, N = 186) = 15.04, p < .001; and cocaine, χ²(2, N = 186) = 10.76, p < .005. Subsequent tests revealed that whites used tobacco more frequently than either blacks or Asians and that whites and Asians reported more frequent alcohol use than black respondents. For the remaining four drug categories, white students reported higher levels of drug use than blacks, with Asian students not differing significantly from the other racial groups in these drug categories.

A chi-square analysis was also performed to evaluate differences in the relative frequencies of polydrug use versus single drug use. Seventeen subjects who re-
ported no drug use across all drug categories were excluded from this analysis. Subjects who reported drug use in more than one drug category were defined as polydrug users, and subjects who reported use of only one drug category were defined as single drug users. The results of this analysis revealed that the frequency of individuals classified as polydrug users (n = 125) was significantly greater, χ²(1, N = 169) = 38.82, p < .001, than that of individuals classified as single drug users (n = 44). When a similar chi-square analysis was completed based on illicit drug use patterns only, χ²(1, N = 105) = 19.41, p < .001, polydrug use (n = 72) was found to be more frequent than single drug use patterns (n = 33).

A series of linear stepwise discriminant functions was performed to determine the degree to which linear combinations of predictors could discriminate between levels of drug use for particular drug classes. An F to enter or remove of 1.5 was employed in these analyses. Table 3 shows the findings of these analyses for each of the 12 drug categories. Included in this table are the standardized weighted equations, overall accuracy of classification values, and the chi-square values reflecting the overall significance of the classification functions. For purposes of these analyses, coffee, tobacco, alcohol, and marijuana represented drug use categories involving three drug use levels (i.e., nonuse, infrequent use, and frequent use). For the remaining drug categories, two categories of use were employed that included never tried and tried or currently using.

Finally, discriminant function analyses were also performed to determine the usefulness of the five predictor inventories in discriminating subjects who engaged in single drug versus polydrug use. In the first analysis, the classification of single versus polydrug use was based on drug use self-reports across categories of

<table>
<thead>
<tr>
<th>Drug Category</th>
<th>Classification Functions</th>
<th>Accuracy Rates</th>
<th>Chi Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coffee</td>
<td>.91Drug − .87SS</td>
<td>45%</td>
<td>9.24</td>
</tr>
<tr>
<td>Tobacco</td>
<td>.83MAC + .42SSS</td>
<td>46%</td>
<td>14.58***</td>
</tr>
<tr>
<td>Alcohol</td>
<td>.94SSS − .46Alcohol + .36MAC</td>
<td>44%</td>
<td>40.00***</td>
</tr>
<tr>
<td>Marijuana</td>
<td>.86SSS + .40Alcohol</td>
<td>57%</td>
<td>27.33***</td>
</tr>
<tr>
<td>Tranquilizers</td>
<td>.62SSS + .45Alcohol + .34Pd</td>
<td>66%</td>
<td>22.31***</td>
</tr>
<tr>
<td>Barbiturates</td>
<td>.93Alcohol + .69SSS − .46Drug</td>
<td>69%</td>
<td>23.60***</td>
</tr>
<tr>
<td>Amphetamines</td>
<td>.78SSS + .65Alcohol − .31Drug + .26MAC</td>
<td>72%</td>
<td>37.64***</td>
</tr>
<tr>
<td>LSD</td>
<td>.73SSS + .40Alcohol + .27MAC</td>
<td>69%</td>
<td>17.98***</td>
</tr>
<tr>
<td>Hallucinogens (other)</td>
<td>.77SSS + .71Alcohol − .53Drug + .33MAC</td>
<td>74%</td>
<td>22.86***</td>
</tr>
<tr>
<td>Solvents</td>
<td>.70Alcohol + .60SSS</td>
<td>73%</td>
<td>18.42***</td>
</tr>
<tr>
<td>Narcotics</td>
<td>.98SSS − .74Drug</td>
<td>61%</td>
<td>2.31</td>
</tr>
<tr>
<td>Cocaine</td>
<td>.98SSS + .49Alcohol − .45Drug + .35MAC</td>
<td>70%</td>
<td>36.30***</td>
</tr>
</tbody>
</table>

Note. Drug refers to the Millon Drug Misuse scale. Alcohol refers to the Millon Alcohol Abuse scale.

*p < .05. **p < .01. ***p < .001.
both licit and illicit drugs. The resulting linear equation of \( .90 \times SSS + .30 \times MAC \) was capable of correctly identifying 71\% of students’ drug taking patterns, \( \chi^2(2, N = 169) = 22.67, p < .001 \). When the single versus polydrug use classification procedure was based exclusively on current use of illicit substances, the resulting linear equation of \( .70 \times SSS + .62 \times Million Alcohol Abuse scale was capable of correctly identifying 73\% of students’ drug taking patterns, \( \chi^2(2, N = 105) = 31.39, p < .001 \).

**DISCUSSION**

The frequencies of alcohol and drug use found for this sample of college students are generally consistent with findings from a recent national survey on the substance use patterns of young adults (Miller, 1983). In general, the level of drug involvement for the vast majority of these students corresponds to the categories of experimental drug use and social recreational drug use as defined by the National Commission on Marijuana and Drug Abuse (1972). These levels of drug use, conceptualized as the initial drug involvement stages on the overall dimension or continuum of drug abuse and dependence, have typically received little research attention. Prior research among chronic substance abusers has demonstrated that these individuals typically report polydrug use patterns rather than exclusive “specialization” within a single drug category (e.g., Chambers, Taylor, & Moffett, 1972; Cox & Smart, 1972). Current findings also show that even among young adults with levels of drug involvement characterized as experimental or social recreational, polydrug use is prevalent and may constitute normative drug consumption behaviors among college students. These latter findings underscore the importance of studying polydrug use behaviors in experimental investigations of drug taking among light to moderate drug users.

Results of discriminant function analyses demonstrate significant relationships between scores on the objective inventories used in this study and college students’ drug and alcohol consumption patterns. Among the drug categories used as individual outcome measures in the linear discriminant function analyses, the SSS was the most effective and powerful predictor in 7 of 10 significant discriminant function equations, having Z-score values ranging from .73 to .99 in the linear classification functions. In the remaining analyses, SSS was selected as the second step in the stepwise procedure. Additionally, the SSS entered as the first step in both equations predicting polydrug use patterns. The relative strength of “SSS, in comparison to other predictors, may be attributable to several factors. First, sensation seeking was selected as the primary motive for drug use in this college sample. Thus, among the predictors used in this research, the SSS was the one most closely associated with the primary reason subjects used drug substances. In addition, the SSS is unique among the predictor measures in that it was normed and developed primarily with nonpathological or normal
samples. Our results indicate that the SSS shows substantial and marked sensitivity in predicting the range of drug use patterns typically reported among college students.

The MAC scale and the Millon Alcohol Abuse scale were also significantly involved in predicting a variety of individual drug classes and in predicting polydrug use patterns. These findings suggest that both of these measures, originally developed specifically to identify alcohol abuse and dependence, may be useful in identifying abuse of a wide variety of other substances. In the case of the MAC scale, this latter finding is consistent with results from other investigations (e.g., Lachar, Berman, Grisell, & Schoof, 1976; Sutker, Archer, Brantley, & Kilpatrick, 1979). The multidrug sensitivity of the Millon Alcohol Abuse scale, however, had not been established in prior research. Of the two Millon scales (i.e., alcohol abuse and drug abuse), the former clearly appeared to be more effective in predicting a variety of drug use categories. In our current study, however, the intercorrelation between these two Millon measures was .65, a figure much higher than the intercorrelation of -.08 reported by Millon (1977). Therefore, it appears uncertain whether these two scales are actually independent (there are 15 items that appear on both scales) and whether they perform in a manner consistent with their scale labels.

The Pd scale was generally a weak predictor of drug use across drug classes. With the exception of the use of tranquilizers, the Pd scale was unable to significantly account for unique proportions of variance in drug use levels. Given that much of the drug use reported by respondents in the current investigations could be viewed as socially "nondeviant" drug experimentation, perhaps the failure of the Pd scale to serve as an effective predictor reflects the nonpathological or normative characteristics of our sample. This perspective may explain why the Pd scale has been the high point of mean MMPI profiles in studies of chronic illicit drug abusers across a variety of substances (Craig, 1982; Sutker & Archer, 1979), whereas it did not appear to discriminate effectively among less pathological and abusive drug use patterns.

When the effects of sex and race were analyzed on predictor scales, the results confirm prior findings reported in the literature; that is, males scored higher on both the SSS (Zuckerman, 1979) and MAC (Wolfson & Erbaugh, 1984) than did females, and whites scored higher than blacks on the SSS (Carrol & Zuckerman, 1977; Kaesmiller, Rosen, & Appel, 1977; Sutker et al., 1978). In relation to the current findings of higher Pd scale scores for black than white subjects, this result is consistent with the MMPI literature on normal samples (e.g., Gynther, 1972) and opposite to the pattern often found in studies of hardcore drug addict samples (e.g., Penk, Woodward, Robinowitz, & Hess, 1978). This latter finding may also underscore the observation that subjects in the present study essentially were normally functioning college students. In additional analyses not reported in the Results section, ANOVA findings indicated that the SSS, Pd, and MAC were generally related to drug use for both males and females and for
blacks and whites. The exception to this latter pattern was found in terms of the MAC scale, which was unrelated to alcohol or cocaine use among males. These MAC findings are similar to those reported by Schwartz and Graham (1979) and Wolfson and Erbaugh (1984) in that elevated MAC scales were more sensitive indicators of alcohol abuse among females than among male respondents. Based on the recognition that MAC scores may be more sensitive indicators for females, differential raw score values reflecting lower "cutoff" scores for females have been recommended by a variety of MMPI researchers including Graham (1985). Although the pattern of results of analyses of the SSS, Pd, and MAC by race and sex is consistent with prior findings, the total number of black and male subjects in the current investigation was small, and further research is necessary to confirm these observations for populations of experimental and social recreational drug users.

Our study offers empirical support for the contention that several commonly used objective self-report scales are significantly related to experimental drug use patterns in college undergraduates. Thus, this study may serve as a link between the epidemiological investigations of drug use in normal populations and the established literature on the relationship of personality measures to drug use in chronic drug abusing or drug addicted samples. Linear combinations of these predictive measures were found to classify the drug use patterns of the majority of college students accurately, with particularly powerful effects found for the SSS. These discriminant function findings are clearly tentative and require cross-validation in independent samples to establish the degree to which shrinkage may occur in predictive accuracy. Although it is very likely that the current beta weights will be modified by findings in future studies, it also seems probable that the relative strength of these predictors, in terms of order of entry into the predictive equations, will be found to remain consistent. Future research might also explore the extent to which our findings may be generalized to other samples that vary in racial and gender composition.

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REFERENCES


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