Substance abuse, pathological gambling, and impulsiveness

Nancy M. Petry *

Department of Psychiatry, University of Connecticut School of Medicine, 263 Farmington Avenue, Farmington, CT 06030-1517, USA

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Abstract

This study evaluated behavioral and self-report indices of impulsiveness in pathological gambling substance abusers (n = 27), non-pathological gambling substance abusers (n = 63), and non-pathological gambling/non-substance abusing controls (n = 21). The Bechara card task measured preferences for decks of cards that ranged in magnitude and probability of delayed and immediate rewards and punishers. The Stanford Time Perception Inventory (STPI) assessed orientation to the future, the Zuckerman Sensation Seeking Scale evaluated sensation seeking, and the Eysenck and Barratt scales measured impulsivity. A Principal Components analysis revealed that these personality measures comprised three distinct measures of impulsivity: impulse control, novelty seeking and time orientation. Linear contrast analyses revealed that substance abuse and pathological gambling resulted in additive effects on the impulse control and time orientation factors, but not on the novelty-seeking scale. Performance on the card task did not correlate with any of the three factors derived from the personality scale scores, but the presence of both substance abuse and pathological gambling had an additive effect on preferences for decks containing greater immediate gains but resulting in large punishers and overall net losses. These results provide further evidence of an association among substance abuse, pathological gambling, and impulsivity. © 2001 Elsevier Science Ireland Ltd. All rights reserved.

Keywords: Substance abuse; Gambling; Impulsivity

1. Introduction

Pathological gambling is a frequent comorbid diagnosis in substance abusers, and the South Oaks Gambling Screen (SOGS; Lesieur and Blume, 1987) is the most commonly used instrument for assessing pathological gambling (e.g. Shaffer et al., 1999). Scores above 5 on this instrument are indicative of a DSM diagnosis of pathological gambling (Lesieur and Blume, 1987). Using this index, rates of pathological gambling range from 7 to 16% in methadone maintenance patients (Feigelman et al., 1995; Spunt et al., 1995). Steinberg et al. (1992) evaluated gambling problems in 298 treatment-seeking cocaine abusers using and found a 15% prevalence rate of pathological gambling. In studies of drug- and alcohol-dependent patients, rates of pathological gambling range from 13 to 33% (Castellani and Rugle, 1995; Dagnestani et al., 1996; Lesieur et al., 1986; McCormick, 1993; Petry, 2000a; see Spunt et al., 1998 for review).

One explanation for the co-occurrence of substance use disorders and pathological gambling is that both may be manifestations of an underlying personality trait such as impulsivity. Longitudinal studies identify impulsivity in children as a risk for later substance abuse (Dawes et al., 1997; White et al., 1994), and cross-sectional studies show levels of impulsiveness are associated with substance use and abuse in college students (e.g. Jaffe and Archer, 1987). In patient populations, numerous studies demonstrate that substance abusers score higher than controls on personality inventories of impulsivity (Allen et al., 1998; Chalmers et al., 1993; Cookson, 1994; Eisen et al., 1992; McCormick et al., 1987; Patton et al., 1995; Rosenthal et al., 1990; Sher and Trull, 1994). One study finds that impulsiveness may be related to the number of different types of impulse-control incidents displayed, such as substance abuse, criminal activities, fire setting, and repeated aggression (Stanford and Barratt, 1992).

Pathological gambling is classified as a disorder of impulse control, but the evidence is mixed regarding whether pathological gamblers are more impulsive than controls. While some research finds high levels of im-
pulsivity in pathological gamblers (Blaszczynski et al., 1997; Carlton and Manowitz, 1994; Castellani et al., 1996; McCormick et al., 1987; Steel and Blaszczynski, 1998), other data indicate that pathological gamblers score no higher than controls, and sometimes even lower, on scales assessing impulsivity and related traits (Allcock and Grace, 1988; Blaszczynski et al., 1986, 1990; Dickerson et al., 1987). In part, these discrepancies may be reflective of the high rates of substance use disorders in gamblers. Because up to 50% of pathological gamblers have a history of drug or alcohol use disorders (Lesieur et al., 1986; Ramirez et al., 1983), increased levels of impulsivity may be related to substance use, rather than gambling per se. Many of the studies assessing impulsiveness in gamblers failed to report drug use histories. The small sample sizes used in many studies of pathological gamblers may contribute to the dissimilar findings as well (e.g. Allcock and Grace, 1988).

Another explanation for the discrepant findings is that impulsiveness is a multi-dimensional construct (Gerbing et al., 1987). It includes orientation toward the present, diminished ability to delay gratification, behavioral disinhibition, risk taking, sensation seeking, boredom proneness, reward sensitivity, hedonism, and poor planning. Some types of impulsiveness may be characteristic of substance use disorders, such as sensation seeking, while other aspects of impulsiveness may be related to pathological gambling, such as excessive sensitivity to reward. Other aspects of impulsiveness may be representative of both disorders, such as present orientation, hedonism, disinhibition, and poor planning (e.g. Vitaro et al., 1999).

One specific aspect of impulsiveness that can be measured behaviorally is the inability to tolerate long delays to reinforcer presentation, or preference for smaller more immediate rewards over larger but more delayed rewards (Logue, 1995). Several studies found that substance abusers prefer smaller more immediate rewards over larger but more delayed rewards (Kirby et al., 1999; Madden et al., 1997; Vuchinich and Simpson, 1998). Recently, we found that substance abuse and pathological gambling had additive effects on preferences for immediate rewards (Petry and Casarella, 1999).

Ainslie (1975) extended this behavioral definition of impulsivity to include the “choice of a small, short term gain at the expense of a large, long term loss,” a definition that seems to characterize both substance abuse and pathological gambling. The choice to use drugs or gamble excessively may produce immediate pleasurable sensations or excitement, but the long-term effects of drug use and excessive gambling include unemployment, legal problems, and financial difficulties. Bechara et al. (1994, 1997) developed a task that seems to capture Ainslie’s (1975) definition of impulsiveness. Subjects select cards from four different decks that range in probability and magnitude of rewards and punishments. Decks that provide immediate larger gains also result in long-term net losses. Heroin abusers made more impulsive choices on this task than controls (Petry et al., 1998). Gamblers likewise would be expected to perform poorly on this task due to their putative lack of sensitivity to punishment (Vitaro et al., 1999).

The purpose of this study was to compare substance abusers with and without pathological gambling to controls on this task and other measures of impulsivity. The hypothesis was that substance abusers would score higher than controls on the behavioral as well as the self-report measures, and that subjects demonstrating dual addictive disorders (substance abuse and pathological gambling) would evidence the greatest impulsivity. By including a variety of measures, we could assess common dimensions of impulsivity across different instruments, and whether these groups differed across all measures, or just certain components, of impulsivity.

2. Methods

2.1. Sample

All subjects were recruited from newspaper advertisements and flyers distributed at local substance abuse treatment programs, in low-income housing projects, and at social service agencies throughout the greater Hartford, CT, area. The ad stated, “Individuals needed for a study of personality and decisions making. Earn up to $60.”

A telephone screen assessed eligibility criteria among respondents. Specifically, after answering questions about demographics, employment, and health, individuals were asked if they ever (and if so how frequently) used alcohol, marijuana, cocaine, sedatives and heroin. Substance users were asked to participate in the study if they reported a lifetime history of alcohol, cocaine, or heroin abuse or dependence via items derived from the Structured Clinical Interview for DSM-IV (Spitzer et al., 1992). Controls were invited to participate if they reported no history of substance abuse (no lifetime use of illicit drugs, no lifetime regular use of alcohol, and no more than 3 days of alcohol use in the past 30 days with no more than two drinks/drinking day). Controls were selected based on age, race, and education similarities to substance abusers.

Suicidal ideation and psychosis were exclusion criteria. Another purpose of the larger study of which this paper is one part was to evaluate HIV risk behaviors in individuals who were not HIV positive (Petry, 2000b). Therefore, individuals with known HIV-positive status were excluded. Individuals who telephoned in response...
to the ads were not informed of the inclusion/exclusion criteria and were not told why they did not qualify. Over 70% of screened applicants did not qualify, e.g., not enough drug use to constitute abuse, too much drug use to participate as a control, or no drug use but high income or educational level. Individuals who met criteria via the phone screen were invited to participate in the study. All subjects provided written informed consent upon coming into the laboratory for the impulsivity measures.

In total, 111 male subjects participated in this study. Twenty-seven subjects were substance abusers who scored above 5 on the SOGS (Lesieur and Blume, 1987), and for the purposes of this study are defined as “pathological gamblers.” The average SOGS score in this group was 9.3 (SD = 2.8). Sixty-three subjects were substance abusers who scored below 5 on the SOGS (mean score = 1.1 ± 1.1). Twenty-one subjects participated as controls, with no history of substance abuse or pathological gambling (mean SOGS score = 0.9 ± 1.0).

2.2. Assessments

2.2.1. Drug use testing, questionnaires, interviews, and compensation

During the assessment, subjects provided a breath sample that was screened for alcohol using an Alcosensor IV Alcometer (Intoximeters, St. Louis) and a urine specimen that was screened for opioids, cocaine, and marijuana using EZScreen (Editek, Inc., Burlington, NC). Substance abusers completed the Addiction Severity Index (ASI; McLellan et al., 1985), which provides problem severity scores in seven domains for the preceding 30-day period, with higher scores reflective of greater problems. Subjects were compensated $50 for completion of the assessment, plus a $10 bonus for performance on the card task (see below). Substance abusers who were not in treatment were referred for treatment.

2.2.2. Impulsivity measures

On the Stanford Time Perception Inventory (STPI; Zimbardo, 1992), subjects indicated on a 1 to 5 scale how applicable each of 38 items was to him/herself. Four subscale scores were determined: Future Orientation, Past Orientation, Present Hedonism, and Present Fatalism. Items that comprised the Future Orientation scale included: “I believe that a person’s day should be planned ahead each morning,” and “Thinking about the future is pleasant to me.” A Past Orientation item was: “I enjoy stories about how things used to be in the good old days.” An example of an item on the Present Hedonism scale was: “I feel that it’s more important to enjoy what you are doing than to get the work done on time.” The Present Fatalism score was derived from items such as “My life is controlled by my destiny rather than by my actions.”

The 72-item Zuckerman Sensation Seeking Scale (Zuckerman, 1979) was used to evaluate sensation seeking constructs, which have been linked to impulsivity (e.g., Zuckerman et al., 1978). This questionnaire contains five subscales: General Sensation Seeking (e.g. “I like to explore a strange city of section of town by myself, even if it means getting lost”), Thrill and Adventure Seeking (“I enjoy many of the rides at amusement parks”), Experience Seeking (“I would like to hitchhike across the country”), Disinhibition (“I like wild, uninhibited parties”), and Boredom Susceptibility (“I get bored seeing the same old faces”).

The 54-item Eysenck Impulsivity Scale (Eysenck and Eysenck, 1978; Eysenck and McGurk, 1980) is a widely-used questionnaire assessing impulsivity. It contains three subscales: Impulsivity, which measures impulsiveness related to a failure to evaluate risk (e.g. “Do you generally do and say things without stopping to think?”); Venturesomeness, which measures a type of behavior in which risk is consciously perceived and accepted (e.g. “Would you enjoy parachute jumping?”); and Empathy, which was included to add variety to the questionnaire (e.g. “Do you get very upset when you see someone cry?”). Scores are associated with a wide variety of impulsive behaviors (e.g. Kennedy and Grubin, 1990; McCown, 1989; Stein et al., 1995).

The 34-item Barratt Impulsivity Scale (Barratt, 1985) contains three scales related to impulsiveness: non-planning (e.g. “I plan tasks carefully”), motor (e.g. “I am restless at the theater or lectures”), and cognitive (e.g. “I have ‘racing’ thoughts”). This scale demonstrates good reliability and validity with other measures of impulsiveness (e.g. Barratt, 1994; Carlton and Manowitz, 1994; O’Boyle and Barratt, 1993; Stein et al., 1994).

The Card task was identical to that described by Bechara et al. (1994). Subjects were presented with four decks of cards, equal in appearance and size. They were told that the game consisted of card selections from any of the four decks. Half of the cards had red circles on the underside, and half had blue circles on the underside. After turning over each card, subjects were told how much money they earned, and the amount earned varied with the deck. Cards with red circles on the underside resulted only in wins, and no losses. After turning over a card with a blue circle, subjects were told how much they earned and were sometimes asked to pay a penalty as well. The amount of the penalty varied with the deck and the card’s placement in the deck.

The schedule of earnings and losses was unknown to the subjects. The subjects were told that the goal was to maximize profit. They also were informed that if they earned more money than they lost, they would receive $10. They were told that they may turn over cards from any deck and they may switch decks at any time and as often as they like. They were not told how many card selections must be made, but the game was stopped after 100 cards were selected.
Turning over any card (either red or blue) from decks A and B yielded $100. When the card contained a blue circle, subjects sometimes had to pay a penalty. The penalties in deck A were frequent and of a moderate magnitude. For example, ten cards played from deck A resulted in $1000 in earnings ($100 per card), but five unpredictable punishments (ranging from $-150 to $-350) totaled $-1250, or a net loss of $250. Playing ten cards from deck B resulted in a similar net loss of $-250; while each card earned $100 as in deck A, the entire loss resulted from a single blue punishment card ($-1250) located nine cards into the deck.

Playing from decks C and D resulted in net gains. Turning over any card from decks C or D yielded lower earning per card ($50/card), but the penalties were also lower. In deck C, punishment was more frequent (on average every other card) but of a lower magnitude (range -$25 to -$75). Punisher cards appeared less frequently in deck D (on average once 10th card, similar to deck B), but these punisher cards each resulted in a penalty of -$250.

In summary, deck A resulted in an overall loss from higher individual rewards with moderate but frequent punishment; deck B resulted in overall loss from higher individual rewards with very large but infrequent punishment; deck C resulted in overall gain via lower individual returns and frequent, low punishment; and deck D resulted in overall gain via lower individual returns and moderate but infrequent punishment.

2.3. Data analysis

2.3.1. Demographics

Differences in demographics between the groups were evaluated using Chi square tests for nominal variables and analysis of variance for continuous variables, followed by post-hoc t-tests, or non-parametric tests as appropriate. For the two substance abusing groups, differences in drug use characteristics and ASI scores were evaluated using t-tests for independent groups.

2.3.2. Principal components analysis and evaluation of differences across groups

The mean scores on the different subscales of the impulsivity instruments are shown in figures. Scores on many of these subscales were interrelated. For example, the Eysenck Impulsivity scale score correlated significantly (range 0.22 to 0.67, \( P < 0.05 \)) with all other personality measures of impulsivity, including the Zuckerman Sensation Seeking Scale, the Barratt scales, and the STPI scales of Hedonism, Fatalism, and Future Orientation (negative correlation). For the card task, the percent of disadvantageous cards played (decks A and B) was the main dependent variable of interest. Card task performance was correlated with the Non-planning scale of the Barratt Questionnaire, \( r = 0.20, P < 0.05 \), but not with other scores. Because of the interrelationships among the variables, a Principal Components Analysis with varimax rotation was used to evaluate common factors assessed by the different personality scale scores. (Card task performance did not load on any of the factors in an initial iteration, and therefore, it was kept as a separate variable for analysis.) To test the hypothesis that substance abuse and gambling would lead to incremental levels of impulsivity on the different factors identified in the Principal Components Analysis, a linear contrast (e.g., Rosenthal and Rosnow, 1984) was used, with contrast weights of -1, 0, and 1 for controls, non-pathological gambling substance abusers, and pathological gambling substance abusers, respectively. These contrasts were used to evaluate performance on the card task as well. The alpha value was Bonferroni corrected for the number of tests performed, and \( P < 0.05 \) was considered significant.

3. Results

3.1. Demographic characteristics and substance abuse histories

Of the 90 male substance abusers tested, 27 (30%) evidenced pathological gambling as assessed by scores higher than 5 on the SOGS. Demographic characteristics of the substance abusers with and without gambling problems are shown in Table 1, along with the demographic characteristics of the controls. Among the three groups, the only statistically significant difference noted was a difference in age, \( F(2,108) = 3.60, P < .05 \). Post-hoc analyses indicated that controls were younger than non-pathological gambling substance users, \( t(82) = 2.42, P < .05 \). The two groups of substance abusers did not differ, and controls were of similar age to pathological gambling substance abusers. Addiction Severity Index scores and drug use characteristics for the substance abusers also appear in Table 1. Importantly, no significant differences were noted between pathological gambling and non-pathological gambling substance abusers on any of these variables.

3.2. Personality inventory scores

The top panel of Fig. 1 shows mean scores of the three groups on the subscales of the STPI. The bottom panel shows scale scores on the Zuckerman Sensation Seeking Scale.

Data from the three subject groups on subscale scores of the Eysenck Questionnaire are shown in the top panel of Fig. 2. Means on the Barratt scale are shown in the bottom panel.
3.3. Principal components analysis

For the personality inventories, a principal components analysis using varimax rotation was used. This multivariate technique simplifies the description of a set of related variables by defining a smaller set of combinations that explains most of the variance in the way that individuals score on each variable. The principal components analyses for the 15 subscales of these four personality questionnaires revealed three distinct factors that together explained 62.3% of the total variance. Inspection of both the scree plot and individual eigenvalues disclosed a drop in eigenvalues between the 3rd and 4th factors. All subscales loaded above 0.4 on the first three factors, and each had eigenvalues of >1. The three latent constructs identified were theoretically viable. Table 2 shows the subscale loadings on the three factors.

The first factor was one consisting of measures of Impulse control: the Impulsivity and Empathy scales of the Eysneck Scale, the Non-planning, Motor and Cognition scales of the Barratt Scale, and the Hedonism and Fatalism scales of the STPI. This factor accounted for 23.1% of the variance. The second factor, account-

### Table 1
Demographic data and drug use characteristics of subjects. All values are means and standard deviations, unless otherwise indicated

<table>
<thead>
<tr>
<th>Variable</th>
<th>Controls</th>
<th>Non-pathological gambling substance abusers</th>
<th>Pathological gambling substance abusers</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>21</td>
<td>63</td>
<td>27</td>
</tr>
<tr>
<td>Age (years)</td>
<td>36.1 (11.5)</td>
<td>42.0 (9.2)</td>
<td>39.1 (6.8)</td>
</tr>
<tr>
<td>Race (%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Caucasian</td>
<td>52</td>
<td>52</td>
<td>56</td>
</tr>
<tr>
<td>African American</td>
<td>43</td>
<td>33</td>
<td>33</td>
</tr>
<tr>
<td>Other</td>
<td>5</td>
<td>13</td>
<td>11</td>
</tr>
<tr>
<td>Years of Education</td>
<td>12.6 (1.6)</td>
<td>12.5 (2.2)</td>
<td>12.1 (2.1)</td>
</tr>
<tr>
<td>Annual legal income</td>
<td>$14,066 (9,357)</td>
<td>$7,868 (10,520)</td>
<td>$9,073 (10,713)</td>
</tr>
<tr>
<td>Addiction Severity Index Scores</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Medical</td>
<td>2.0 (3.2)</td>
<td>2.8 (3.3)</td>
<td></td>
</tr>
<tr>
<td>Employment</td>
<td>6.1 (3.3)</td>
<td>6.0 (3.0)</td>
<td></td>
</tr>
<tr>
<td>Alcohol</td>
<td>2.9 (2.2)</td>
<td>2.3 (2.1)</td>
<td></td>
</tr>
<tr>
<td>Drug</td>
<td>1.1 (1.2)</td>
<td>1.4 (1.1)</td>
<td></td>
</tr>
<tr>
<td>Legal</td>
<td>1.4 (2.1)</td>
<td>2.0 (2.5)</td>
<td></td>
</tr>
<tr>
<td>Family and Social</td>
<td>1.8 (2.0)</td>
<td>2.5 (2.3)</td>
<td></td>
</tr>
<tr>
<td>Psychiatric</td>
<td>2.2 (2.4)</td>
<td>2.8 (2.4)</td>
<td></td>
</tr>
<tr>
<td>Breath and urinalysis results (% positive)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alcohol</td>
<td>0</td>
<td>6</td>
<td>0</td>
</tr>
<tr>
<td>Marijuana</td>
<td>0</td>
<td>16</td>
<td>15</td>
</tr>
<tr>
<td>Cocaine</td>
<td>0</td>
<td>31</td>
<td>30</td>
</tr>
<tr>
<td>Opioids</td>
<td>0</td>
<td>13</td>
<td>19</td>
</tr>
<tr>
<td>For any drug</td>
<td>0</td>
<td>40</td>
<td>33</td>
</tr>
<tr>
<td>Primary drug of abuse (%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alcohol</td>
<td>0</td>
<td>33</td>
<td>22</td>
</tr>
<tr>
<td>Cocaine</td>
<td>0</td>
<td>37</td>
<td>37</td>
</tr>
<tr>
<td>Heroin</td>
<td>0</td>
<td>30</td>
<td>41</td>
</tr>
<tr>
<td>Self-reported use in past 30 (days)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alcohol (to intoxication)</td>
<td>0</td>
<td>6.7 (9.2)</td>
<td>4.7 (8.7)</td>
</tr>
<tr>
<td>Marijuana</td>
<td>0</td>
<td>2.0 (6.0)</td>
<td>1.6 (4.1)</td>
</tr>
<tr>
<td>Cocaine</td>
<td>0</td>
<td>4.7 (7.4)</td>
<td>3.6 (6.8)</td>
</tr>
<tr>
<td>Opioids</td>
<td>0</td>
<td>2.8 (8.0)</td>
<td>2.3 (5.6)</td>
</tr>
<tr>
<td>Benzodiazepines</td>
<td>0</td>
<td>0.4 (2.1)</td>
<td>0.4 (2.0)</td>
</tr>
<tr>
<td>Subjects with lifetime abuse or dependence (%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alcohol</td>
<td>0</td>
<td>84</td>
<td>82</td>
</tr>
<tr>
<td>Marijuana</td>
<td>0</td>
<td>65</td>
<td>67</td>
</tr>
<tr>
<td>Cocaine</td>
<td>0</td>
<td>64</td>
<td>78</td>
</tr>
<tr>
<td>Opioids</td>
<td>0</td>
<td>39</td>
<td>54</td>
</tr>
<tr>
<td>Benzodiazepines</td>
<td>0</td>
<td>16</td>
<td>22</td>
</tr>
<tr>
<td>Intravenous drug users (%)</td>
<td>0</td>
<td>29</td>
<td>33</td>
</tr>
<tr>
<td>Currently in substance abuse treatment (%)</td>
<td>0 45</td>
<td></td>
<td>63</td>
</tr>
</tbody>
</table>

* Significantly different from non-pathological gambling substance abusers (P < 0.05).
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3.4. Card task performance

Preferences for the decks in the Card task are shown in Fig. 3, with the dashed line indicating selections expected by chance. Both groups of substance abusers tended to play more cards from the disadvantageous decks (A and B) than controls, with pathological gambling substance abusers showing a preference for Deck B (large but infrequent punishers). The mean number of disadvantageous cards selected for the three respective groups was 41, 47, and 50. The contrast evaluating incremental levels of impulsivity across the three groups was significant, \( t(108) = 2.73, P < .01 \). The mean hypothetical amounts earned was $37 for controls, -$355 for non-pathological gambling substance abusers, and $578 for pathological gambling substance abusers. 43% of controls earned the $10 bonus, compared with 23% of non-pathological gambling substance abusers and 11% of pathological gambling substance abusers.

Variations in card task performance were not related to differential sampling of the decks across the groups, as subjects in all groups sampled from all the decks. Over 90% of subjects from each group made at least 10 selections from each deck, with one exception—29% of controls ceased playing from Deck A (frequent and large punishers) after the 5th card. Therefore, subjects in all groups experienced the rewards and punishers associated with each deck.

The correlation between number of disadvantageous cards played and \( z \)-scores on the Impulse control factor was 0.15. The correlation between card performance and \( z \)-scores on the Novelty seeking factor was -0.05, and between card performance and the Time orientation factor was 0.14. None of these correlations were significant.
Table 2
Principal-Components Analysis: Varimax-rotated pattern matrix

<table>
<thead>
<tr>
<th></th>
<th>Impulse control</th>
<th>Novelty seeking</th>
<th>Time orientation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Impulsivity</td>
<td>0.77</td>
<td>0.24</td>
<td>0.13</td>
</tr>
<tr>
<td>Hedonism</td>
<td>0.77</td>
<td>0.19</td>
<td>0.06</td>
</tr>
<tr>
<td>Cognition</td>
<td>0.74</td>
<td>0.06</td>
<td>0.29</td>
</tr>
<tr>
<td>Motor</td>
<td>0.69</td>
<td>0.26</td>
<td>0.31</td>
</tr>
<tr>
<td>Fatalism</td>
<td>0.68</td>
<td>−0.12</td>
<td>−0.17</td>
</tr>
<tr>
<td>Non-planning</td>
<td>0.58</td>
<td>0.04</td>
<td>0.57</td>
</tr>
<tr>
<td>Empathy</td>
<td>0.44</td>
<td>0.10</td>
<td>−0.36</td>
</tr>
<tr>
<td>Ventresomeness</td>
<td>0.10</td>
<td>0.91</td>
<td>0.08</td>
</tr>
<tr>
<td>General sensation seeking</td>
<td>0.08</td>
<td>0.91</td>
<td>0.14</td>
</tr>
<tr>
<td>Thrill &amp; adventure seeking</td>
<td>0.05</td>
<td>0.90</td>
<td>−0.13</td>
</tr>
<tr>
<td>Experience seeking</td>
<td>0.22</td>
<td>0.60</td>
<td>0.39</td>
</tr>
<tr>
<td>Boredom susceptibility</td>
<td>0.18</td>
<td>0.58</td>
<td>0.41</td>
</tr>
<tr>
<td>Disinhibition</td>
<td>0.34</td>
<td>0.28</td>
<td>0.60</td>
</tr>
<tr>
<td>Future orientated</td>
<td>−0.18</td>
<td>0.06</td>
<td>−0.80</td>
</tr>
<tr>
<td>Past orientated</td>
<td>0.11</td>
<td>−0.13</td>
<td>−0.63</td>
</tr>
</tbody>
</table>

4. Discussion

The presence of both substance abuse and pathological gambling (as assessed by scores higher than 5 on the SOGS) was associated with increased impulsiveness on a variety of behavioral and self-report measures. Compared to controls, substance abusers played significantly more cards from decks that resulted in greater immediate rewards, but resulted in overall net losses. Substance abusers with gambling problems performed even more impulsively than their non-pathological gambling counterparts, and they showed a strong preference for Deck B, which resulted in infrequent but very large punishers. These findings are consistent with other studies showing increased preferences for larger more immediate rewards among heroin addicts on this same task (Petry et al., 1998), as well as among substance abusing problem gamblers on other tasks assessing preferences for immediate and delayed rewards (Petry and Casarella, 1999). On the personality inventories, substance abusers as a whole scored higher than controls on most measures of impulsivity, and substance abusers with pathological gambling tended to score even higher than those without significant gambling problems. Principal components analyses revealed that the personality instruments measured three distinct aspects of impulsiveness: Impulse control, Novelty seeking, and Time orientation. The contrasts revealed that substance abuse and pathological gambling had linear effects on two of these factors: Impulse control and Time orientation. Novelty seeking did not differ among the groups.

Choices on the card task were not correlated with any of these personality factors, suggesting that this task may measure a different construct of impulsiveness than the personality inventories. Specifically, this task evaluates preferences for immediate rewards that result in long-term negative consequences. Because this definition of impulsiveness may parallel some of the behavioral patterns that characterize addictive disorders (Bickel et al., 1998; Herrnstein and Prelec, 1992), future research should evaluate further performance of individuals with addictive disorders on this and related behavioral tasks and its association (or non-association) with other personality measures assessing impulsivity.

This study differs from previous studies showing increased impulsiveness in that it included a variety of different measures of impulsiveness, including behavioral and personality measures. While some of these measures were highly interrelated and loaded on similar factors across instruments, others seem to tap different dimensions of impulsiveness (e.g. the card task). This study also differed from many previous ones in that it evaluated constructs of impulsiveness in individuals with single (substance abuse) and dual (substance abuse and pathological gambling) problems.
and pathological gambling) problem behaviors. Because both of these groups had similar substance abuse histories, the differences that emerged cannot be explained simply by more severe substance use problems in the dual disorder group. A method to confirm these findings would be to recruit a group of individuals who score high on behavioral and personality measures of impulsiveness, and then compare their severity of substance abuse and gambling problems.

These data suggest that the co-occurrence of substance abuse and gambling problems are associated with increased impulsivity, but several limitations to this study must be noted. First, these data are derived from a relatively small, but heterogeneous, sample of substance abusers in a New England city. The inclusion of alcohol, cocaine, heroin and polydrug abusers, including individuals receiving and not receiving substance abuse treatment, increases the generalization of the findings. However, because participants were respondents to advertisements, the sample may not be representative of the more general population of substance abusers. A study employing random selection techniques from community samples may be needed to confirm the generalization of these results to other substance abusing populations.

Although this study found increased impulsiveness associated with substance abuse and pathological gambling, it did not evaluate impulsiveness in pathological gamblers without a history of substance abuse. Pathological gamblers without drug use disorders may be a distinct population from those with substance use disorders (e.g., Steel and Blaszczynski, 1998). In addition, only male substance abusers were included in the present sample. Women seem to develop gambling problems at lower rates than men (e.g. Petry, 2000b), and women tend to be less impulsive than men (e.g. Eysenck et al., 1985). Future research should assess impulsiveness ultimately may provide more information about the types and nature of impulsivity found in substance abusers and pathological gamblers.

Additionally, this study used SOGS scores of higher than 5 as an indicator of pathological gambling. Although this questionnaire is the most frequently used instrument for assessing gambling problems (Shaffer et al., 1999), its validity as a diagnostic instrument has been questioned (see Petry and Armentano, 1999, for review). Future studies may utilize other measures of assessing diagnostic criteria for pathological gambling or severity of gambling problems to assess the relationship between impulsivity and gambling problems.

Data from this study demonstrate that substance abuse and pathological gambling are associated with increased impulsiveness, but this study did not evaluate the temporal or causal relationships between addictive disorders and impulsivity. Impulsiveness may be a risk factor for, or a consequence of, addictive behaviors. Alternatively, impulsivity may be associated with a pre-existing condition that is linked with addictive behaviors, such as delinquency or Antisocial Personality Disorder (ASP). Up to 50% of male substance abusers (Dinwiddie and Reich, 1993; Rounsaville et al., 1982) and up to 50% of male pathological gamblers (Blaszczynski and Steel, 1998; Steel and Blaszczynski, 1998) meet DSM criteria for anti-social personality disorder. Impulsiveness is associated with delinquency and ASP in both substance abusers (e.g. Robins and McEnvo, 1990) and gamblers (Blaszczynski et al., 1997; Vitaro et al., 1997). Therefore, increased impulsivity in this sample may be linked to a co-occurring disorder, rather than a drug abuse or gambling problem per se.

Although some data indicate impulsiveness may be related to specific disorders such as ASP, substance abuse or pathological gambling, impulsiveness may also be regarded as a behavioral adaptation to chaotic and unpredictable environments. These same environments may place individuals at increased risk for drug abuse and pathological gambling. Subsequent studies may investigate further the origin of impulsivity and its relationship to substance use disorders and pathological gambling. Employing multidimensional measures to assess impulsiveness ultimately may provide more information about the types and nature of impulsivity found in substance abusers and pathological gamblers.

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