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Delay and Probability Discounting in Pathological Gamblers With and Without a History of Substance Use Problems

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Abstract

Rationale—Pathological gambling and substance use disorders are highly comorbid, possibly because they both stem from a similar process—impulsivity. Although much data exist regarding the association between delay discounting and these psychiatric disorders, relatively little research has examined probability discounting and its relationship with either substance use or gambling.

Objectives—The goal of the current study was to compare rates of probability and delay discounting in a large population of pathological gamblers with and without a history of substance use problems.

Methods—Treatment-seeking pathological gamblers with ($n=117$) and without ($n=119$) a history of substance use problems completed questionnaires about discounting of hypothetical monetary outcomes and the Eysenck Impulsivity Questionnaire. The delay discounting questionnaire involved choices between a smaller amount of money delivered immediately versus a larger amount delivered later, and the probability questionnaire was comprised of choices between a smaller certain versus a larger probabilistic monetary outcome. Hyperbolic functions estimated delay and probability discounting rates based on the indifference points obtained through the questionnaires.

Results—Results revealed significant effects of substance use problem status on delay but not on probability discounting, with no significant correlation noted between the two discounting processes. Only delay discounting correlated with Eysenck impulsivity scores.

Conclusions—These data suggest that delay and probability discounting tap different dimensions, and delay discounting is more closely linked with substance use problem histories in pathological gamblers.

Keywords

pathological gamblers; substance use problems; choice; delay discounting; probability discounting; impulsivity

Pathological gamblers often engage in behavior patterns that have short-term reinforcing effects but devastating long-term consequences. Risking relationships, committing fraud or theft, and becoming imprisoned are examples of activities and consequences related to pathological gambling (American Psychiatric Association (APA) 1994; Toce-Gerstein et al. 2003). Pathological gambling is classified as an impulse control disorder in the Diagnostic and Statistical Manual of Mental Disorders, revision IV (APA 1994), but it shares high rates

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of comorbidity with substance use disorders. Lifetime prevalence rates of alcohol and drug use disorders among pathological gamblers are about 73% and 38%, respectively (Petry et al. 2005).

Pathological gambling and substance use disorders may co-occur at high rates because they both may stem from a similar process—impulsivity. Impulsivity is a multidimensional construct (e.g., Eysenck and Eysenck 1978; Gerbing et al. 1987), which has been defined in many different ways (see Evenden 1999). It is often viewed as the incapacity to tolerate delays (e.g., Ainslie 1992) and/or a tendency to take risks (e.g., Richards et al. 1999; see Myerson et al. 2003). From a behavioral perspective, impulsivity can be conceptualized in the context of patterns of choices between (1) smaller sooner versus larger delayed reinforcers (in the case of delay discounting), or (2) smaller certain versus larger probabilistic reinforcers (in the case of probability discounting). Choices for smaller sooner or for larger probabilistic reinforcers may be operationally defined as impulsive (Green and Myerson 2004; Logue 1988), and both behavioral processes can be analyzed within the framework of discounting (Green and Myerson 2004). Within this paradigm, the terms *delay* and *probability* discounting refer to the decline in subjective value of a reinforcer as a function of delay or probability, respectively. As the delay or odds against receiving a reinforcer increases, the subjective value of the reinforcer decreases. The higher the delay discounting rate is, the more steeply delayed reinforcers are discounted or devalued. Theoretically, steep delay discounting reflects incapacity to wait for delayed outcomes, and thus indicates impulsivity. In regards to probability discounting, low discounting rates represent greater subjective value for probabilistic reinforcers. Theoretically, shallow probability discounting (i.e., low discounting rates) reflects tendency to take risk, and thus indicates impulsivity. Therefore, if impulsivity is viewed as incapacity to tolerate delays and a tendency to take risks, the two discounting measures should be negatively correlated (Green and Myerson 2004).

These concepts of discounting might help elucidate important aspects of both substance use and gambling problems. For example, individuals with substance use or gambling problems may devalue benefits associated with abstinence, such as better jobs and social relationships, because these are generally delayed in time, while the benefits of substance use or gambling are more immediate (e.g., a rush or a chance of winning). Numerous studies find that individuals with substance use disorders across a variety of drug classes discount delayed money at higher rates than those without drug use disorders (e.g., see Bickel and Marsch 2001; and Reynolds 2006, for reviews). For instance, individuals with dependence on opioids (e.g., Kirby et al. 1999), alcohol (e.g., Bjork et al. 2004), cocaine (e.g., Coffey et al. 2003), and methamphetamine (e.g., Hoffman et al. 2006), discount at higher rates than controls. Steep delay discounting has also been reported in populations of cigarette smokers (e.g., Bickel et al. 1999) and college students who drink heavily (Vuchinich and Simpson 1998).

In addition, individuals with gambling problems discount delayed monetary reinforcers at higher rates than non-problem gambling controls (Alessi and Petry 2003; Dixon et al. 2003; Ledgerwood et al. 2009; Petry 2001a; Petry and Casarella 1999). Importantly, the presence of both gambling and substance use problems results in an additive effect on delay discounting, such that individuals with both problems have higher rates of discounting than those with either problem alone (Petry 2001a; Petry and Casarella 1999).

Although much data exist regarding the association between delay discounting and substance use and gambling problems, relatively little research has examined probability discounting and its relationship to either substance use or gambling, and the limited data yield inconsistent results. To our knowledge, all the studies involving probability

discounting in substance users have focused on cigarette smokers. Reynolds et al. (2004) found that heavy cigarette smokers discount probabilistic money more than non-smokers, while Mitchell (1999) and Ohmura et al. (2005) found no group differences in discounting between moderate smokers and controls. Discrepancies across studies may have resulted from methodological differences, such as the use of different discounting instruments, or the severity of the problem behavior in each sample (see Yi et al. 2007, 2010, for review). Further, because high probability discounting indicates risk averseness, the results reported by Reynolds et al. (2004) are intriguing when interpreted in reference to impulsivity. They suggest that heavy smokers are more risk averse than non-smokers, contrary to the view of impulsivity as a risk-taking tendency (Yi et al. 2010).

In terms of studies on probability discounting and gambling, Shead et al. (2008) found no association between severity of gambling problems and discounting of probabilistic money in a sample of college students. In a similar sample, Holt et al. (2003) reported that problem gambling college students had more shallow discounting of probabilistic reinforcers (i.e., they were more risk prone) than their non-problem gambling counterparts. However, neither of these studies assessed substance use problems in the samples. Because substance use problems are highly correlated with gambling problems in college students (Engwall et al. 2004; Labrie et al. 2003; Lesieur et al. 1991), any effects of gambling on discounting rates may have been confounded by substance use problems. In a small sample of 19 pathological gamblers without substance use problems, Madden et al. (2009) also found that pathological gamblers had more shallow discounting of probabilistic reinforcers than matched controls, but the two groups did not differ significantly with respect to delay discounting. The failure to find group differences in delay discounting is inconsistent with previous reports in problem and pathological gamblers (Alessi and Petry 2003; Dixon et al. 2003; Ledgerwood et al. 2009; Petry 2001a; Petry and Casarella 1999) and may have been related to the small sample size included in the study.

Because of the inconsistencies in findings across studies and populations, more research investigating associations between probability discounting in participants with different addiction problems is needed. The one study in a substance use population that found differences in probability discounting rates reported that cigarette smokers discounted more than non-smokers (Reynolds et al. 2004). Conversely, two studies found that gamblers discount probabilistic reinforcers less than controls (Holt et al. 2003; Madden et al. 2009). The presence of gambling and substance use problems appears to have an additive effect on rates of delay discounting (Petry 2001a; Petry and Casarella 1999), but no research has examined the impact of substance use problems on probability discounting in pathological gamblers.

The goal of the current study was to compare rates of probability and delay discounting in a large population of pathological gamblers with and without a history of substance use problems. If the concomitant presence of gambling and substance use problems is associated with higher impulsivity in both domains, individuals with dual problems should evidence greater inability to tolerate delays and greater propensity to take risks, relative to those with just pathological gambling alone. The former tendency would be reflected in steeper delay discounting, whereas the latter would be reflected in more shallow probability discounting, and the two discounting processes should be negatively correlated (Green and Myerson 2010; Holt et al. 2003; Myerson et al. 2003).

Method

Participants

Data from 226 participants were examined in this retrospective analysis. Participants were recruited via media advertisement for a clinical trial investigating the efficacy of different psychotherapies for pathological gambling (Petry et al. 2006). Participants were included in the study if they were 18 years or older, capable of reading at 5th grade level or higher, met criteria for pathological gambling according to the Diagnostic and Statistical Manual for Mental Disorders (DSM)-IV, and gambled in the previous two months. They were ineligible to participate if they were currently receiving gambling treatment, had active suicidal intent, or presented with past-month psychotic symptoms. Individuals who met the inclusion criteria provided written informed consent approved by the University of Connecticut Health Center Institutional Review Board before initiation of the study.

Procedures

Prior to randomization to treatment conditions, participants completed a 3-hour baseline interview in which data were collected about demographic information, substance use history, gambling severity, personality and discounting. For a description of the treatment conditions and overall procedure, the reader should refer to the primary source (Petry et al. 2006).

Assessments Instruments

The South Oaks Gambling Screen (SOGS) assessed the severity of gambling-related problems in the past 30 days. The SOGS is a 20-item assessment with satisfactory reliability and validity (Lesieur and Blume 1987; Stinchfield 2002), with higher scores indicating more severe gambling problems. The Addiction Severity Index (ASI, McLellan et al. 1985) with a gambling component (ASI-G) included, assessed drug and alcohol, psychosocial, and gambling-related problems. The scoring scheme ranges from 0 to 1, with higher values being indicative of greater severity of current (past 30 days) problems. The ASI also contains items that assess histories of lifetime regular (weekly or more often) substance use and treatment participation. Reliability and validity of both the ASI and ASI-G have been well established (Leonhard et al. 2000; Lesieur and Blume 1991, 1992; McLellan et al. 1985; Petry 2003, 2007).

Frequency and amount of gambling and substance use in the last 30 days were assessed through the Timeline Follow-Back method (TLFB; Sobell and Sobell 1992), which uses a calendar to prompt gambling and substance using days. This instrument is reliable and valid for assessing substance use and gambling (Fals-Stewart et al. 2000; Petry 2003; Weinstock et al. 2004). To examine personality characteristics, the Eysenck Impulsivity Questionnaire (I₇, Eysenck et al. 1985) was administered. This is a 54-item true/false self-report inventory from which venturesomeness, empathy, and impulsivity subscales are derived. Only the impulsivity subscale is reported in this analysis. This measure has good psychometric properties (Eysenck et al. 1985; Luengo et al. 1991), and has been widely used in studies with gamblers (e.g., Alessi and Petry 2003; Krueger et al. 2005; Petry 2001a; Zack and Poulos 2009).

Delay discounting questionnaire

The delay discounting questionnaire developed by Kirby and Marakovic (1996) and modified by Kirby et al. (1999) is comprised of 27 questions. Each question describes a hypothetical scenario involving a choice between a smaller (S) monetary amount delivered now versus a larger (L) monetary amount delivered following *x* number of days. Hypothetical monetary amounts ranged from \$11 to \$85 and the delays ranged from 7 to 186

days. Three ranges of values containing nine questions each were used for the L alternative: small (\$25-\$35), medium (\$50-\$60), and large (\$75-\$85).

Delay discounting estimation procedure

The delay discounting estimation procedure used is identical to the method proposed by Kirby and colleagues and described elsewhere. For a detailed description of scoring methods, the reader should refer to the original sources (Kirby and Marakovic 1996; Kirby et al. 1999).

The following model proposed by Mazur (1984) was used to describe delay discounting:

$$V = \frac{A}{1+kD} \quad (1)$$

where V is the present value of a reinforcer delivered at delay D , A is the undiscounted value of a reinforcer, and k is a constant that determines how sharp the value of a reinforcer decreases with the passage of time.

Mazur's hyperbolic discounting model estimated delay discounting rates—represented by the parameter k —based on the indifference points obtained through the questionnaire. By assuming that at the indifference point the subjective value of both alternatives is equal, it is possible to estimate the delay discounting rate yielding indifference between the choice alternatives by solving for k in Equation 1. To determine participants' k values, questionnaire items are rank ordered with respect to the k values reflecting indifference points at each alternative. Choices for the S alternative indicate that the participant's discounting rate is larger than the k at the indifference point associated with that specific pair of alternatives, whereas choice for the L alternative indicates the reverse. The point in which the participant switches from one alternative to the other defines the range of values from which the k value is taken. To illustrate, two questions were extracted from the questionnaire: (1) “Would you prefer \$54 today, or \$80 in 30 days; (2) “Would you prefer \$41 today, or \$75 in 20 days?” The discounting rate at indifference is 0.016 for (1) and 0.041 for (2) above. Thus, if a participant chooses the S alternative in (1) and the L alternative in (2), his/her k is > 0.016 and < 0.041 , and we used the geometric mean of these two values. We assigned the k value that was most consistent with each participant's choice across all 27 questions, with consistency being defined as the proportion of choices throughout the questionnaire compatible with each of the possible alternative k values. In cases with > 2 k values with equal consistency, we took the arithmetic mean. If the participant selected the S or L alternative exclusively, we assigned the highest or lowest value, respectively, derived from the questionnaire (0.25 or 0.00016).

Probability discounting questionnaire

The probability discounting questionnaire was also comprised of three parts, each containing 10 hypothetical questions involving choices between different monetary amounts delivered probabilistically. Each item involves a smaller but certain monetary amount pitted against a larger but probabilistic one. For example: “Would you prefer \$20 for sure, or a 3-in-4 chance (75%) of winning \$80?” Within each part, the monetary amounts of the smaller certain and larger probabilistic alternatives were held constant. The amounts were \$20 vs. \$80, \$40 vs. \$100, and \$40 vs. \$60, for parts 1, 2, and 3, respectively. The probabilities of obtaining the larger outcome ranged from .10 to .83; .18 to .91; and .40 to .97, for parts 1, 2, and 3, respectively. Refer to Madden et al. (2009) for a more thorough description of this questionnaire and the method used to estimate probability discounting, which is briefly outlined below.

Probability discounting estimation procedure

A similar hyperbolic function was used to describe probabilistic outcomes (Rachlin et al. 1991). This function is represented algebraically as

$$V = \frac{A}{1+h\Theta} \quad (2)$$

In this equation, h is a free parameter that determines the degree of probability discounting, and Θ represents the odds against receiving the reinforcer (i.e., $\Theta = (1 - p)/p$, where p refers to the probability of obtaining the reinforcer).

Equation 2 estimated the probability discounting rate—represented by parameter h in Equation 2—based on the indifference points obtained in the questionnaire. Similarly to the method used for estimating delay discounting, the point at which participants switched from one alternative to the other determined the range of values from which the midpoint was taken. We assigned the h value most consistent with each participant's choice throughout the questionnaire; when choices were consistent with more than a single h value, the most consistent value was taken. When participants exhibited exclusive preference for the probabilistic or certain outcome, we used the lowest or highest endpoints values, respectively (i.e., 0.33 or 16.17).

Classification of histories of substance abuse problems

The gambling treatment study did not formally diagnose substance use disorders, so we utilized the ASI-drug and alcohol modules to determine lifetime histories of substance use problems. We classified gamblers as having a history of substance use problem if they met one or more of the following three conditions: (1) ever received professional treatment for substance use; (2) ever attended a 12-step program for substance use—i.e., Alcoholic Anonymous, Cocaine Anonymous, or Narcotics Anonymous; or (3) ever tried to stop using drugs or alcohol without help. These criteria were employed because they appeared to accurately distinguish individuals with and without histories of substance use problems as outlined below.

Because 12-step programs are a commonly accessed intervention for individuals with substance use disorders in the United States (e.g., Compton et al. 2007; Hasin et al. 2007; National Survey on Drug Use and Health 2010; Oleski et al. 2010), both 12-step and professional treatments were considered in classifying individuals as having a lifetime history of a substance use problem. In this sample, only 18 individuals had attended 12-step meetings without also accessing professional treatment; these 18 individuals had substantial 12-step involvement, attending a median (interquartile range) of 40 (495) 12-step meetings. Further, of the 107 pathological gamblers classified as having a history of a substance use problem by the above criteria, only 28 had not sought formal substance abuse treatment or attended 12-step meetings. Of these 28 non-intervention seeking individuals, 17 reported histories of drinking to intoxication at least weekly, 15 reported histories of at least weekly marijuana use, and 10 reported histories of at least weekly cocaine use (with some reporting regular histories of use of two or more substances). Given these histories of self-reported substance use in conjunction with epidemiological data indicating that up to 60% of individuals with substance use disorders never seek or receive treatment (e.g., Compton et al. 2007; Hasin et al. 2007; Kessler et al. 1994), we classified these 28 individuals as having a history of a substance use problem.

Data Analytic Procedure

Baseline characteristics between those with and without a history of substance use problems were analyzed using independent *t*-tests and chi-square tests. Baseline characteristics that were not normally distributed were analyzed with a Mann-Whitney non-parametric test.

General Linear Model Univariate Analysis of Variance (UNIANOVA) evaluated discounting between pathological gamblers with and without histories of substance use problems. Discounting parameters were not normally distributed and were log-transformed prior to analysis. Years of education was included as a weighted variable in the UNIANOVA because it differed significantly between groups and was related to delay discounting in this sample ($p = .002$) and others (e.g., de Wit et al. 2007; Jaroni et al. 2004). Race and income also differed between groups, but they were not entered in the model because neither were significantly associated with delay discounting ($ps > .05$), and income was highly correlated with education ($p < .001$). Partial eta squares (η^2_{partial}) were calculated to determine the effect size for substance use status on logged delay and probability discounting rates.

To evaluate the impact of recent substance use on discounting, we conducted similar analyses as above including a variable related to alcohol use to intoxication in the past month or any illicit substance use in the past month in the model. Spearman rank correlation coefficients measured the association between logged delay and probability discounting rates, and their associations with Eysenck impulsivity scores. All analyses were conducted on SPSS (v.15).

Results

Table 1 shows baseline characteristics for pathological gamblers with ($n = 107$) and without ($n = 119$) a history of substance use problems. Years of education, income, and race differed significantly between the groups. Patients with a history of substance use problems had fewer years of education and lower incomes than those without. Patients with history of substance use problems were less likely to be Caucasian, and more likely to be African American and Hispanic, relative to the patients without a history of substance use problems. No significant differences were found on severity of gambling problems. As expected, the two groups differed in terms of substance-related problems and use, as well as Eysenck impulsivity scores, with participants with histories of substance use problems scoring higher than those without.

After controlling for years of education, UNIANOVA revealed significant effects of substance use status on logged *k* values, $F(1, 224) = 4.03$, $p = .04$, with patients with a history of substance use problems showing higher delay discounting rates than patients without a history of substance use problems. The relationship between probability discounting rates and substance use was not significant, $F(1, 224) = .75$, $p = .38$. Figure 1 shows delay and probability discounting rates estimated across the two groups. The mean (SE) *k* value was 0.026 (0.007) for participants with a history of substance use problems and 0.016 (0.006) for those without. The mean (SE) *h* values were 1.22 (0.32) and 1.41 (0.29) for the two respective groups. The effect size (η^2_{partial}) of the interaction between substance use history status and logged delay and probability discounting rates were 0.018 and 0.003, respectively.

These associations were similar when controlling for any illicit substance use or drinking to intoxication in the past month. For example, the any past month use variable was not significantly related to *k* values, $F(1, 223) = 0.03$, $p = .87$, but the history of substance use

problems variable remained significantly associated with k values, $F(1, 223) = 4.00$, $p = .04$. There remained no associations between substance use variables and h values, $ps > .05$.

Logged delay discounting rates were significantly positively correlated with Eysenck impulsivity scores ($\rho = .25$, $p < .001$). The correlations between the two discounting rates were not significant ($\rho = -.03$, $p = .66$), nor was significant the correlation between probability discounting and Eysenck impulsivity scores ($\rho = -.09$, $p = .16$).

Discussion

The analysis of participants' pattern of choices in the delay discounting task show that pathological gamblers with a history of substance use problems discount delayed hypothetical monetary outcomes more rapidly than pathological gamblers without a history of substance use problems. These data are consistent with a vast literature showing that delay discounting rates are increased in individuals who meet diagnostic criteria for substance use disorders (see Reynolds 2006, for a review). These data are also in line with previous studies reporting that the presence of both substance use and gambling problems results in additive effects on delay discounting rates (Petry 2001a; Petry and Casarella 1999).

The literature is limited and mixed on the association of probability discounting with substance use problems. The current analysis of participant's pattern of choices in the probability discounting task revealed no significant differences between pathological gamblers with and without a history of substance use problems. These data are similar to those reported by Mitchell (1999) and Ohmura et al. (2005) who found no differences in probability discounting between moderate smokers and controls, but inconsistent with Reynolds et al.'s (2004) report showing that heavy smokers discount probabilistic outcomes more than non-smokers. Together, these results indicate that probability discounting appears to be a less important construct underlying smoking and other substance use problems than delay discounting. The finding that differences in discounting were observed in heavy smokers—but not moderate smokers or individuals with lifetime histories of substance use problems—might suggest that higher discounting exists only in individuals with more severe patterns of drug use or that probability discounting tasks are less sensitive to detecting group differences than delay discounting tasks (Yi et al. 2010).

The current study sheds some light on the association between the two discounting processes, an area with limited empirical research. The non-significant correlation reported here and elsewhere (Holt et al. 2003; Madden et al. 2009; Ohmura et al. 2005; Reynolds et al. 2004; but see Mitchell 1999; Myerson et al. 2003; Richards et al. 1999) suggests that delay and probability are two independent behavioral processes. Of the two processes, delay is more readily impacted by histories of substance use problems in pathological gamblers, and appears to be more closely associated with a self-report impulsivity measure.

One limitation of this study includes the lack of a control group without pathological gambling. Because the entire sample was comprised of treatment seeking pathological gamblers, the range of probability discounting rates may have been restricted, making it more difficult to detect between group differences based on histories of substance use problems. A restricted range may also account for the lack of correlation between probability and delay discounting in this sample. Another limitation is that substance use disorders were not assessed formally. Classification of participants as having a history of substance use problems relied on self-report related to treatment seeking or trying to stop using. Although the classification system seems to have construct validity, it has potential for misclassification of individuals. Furthermore, results may have differed if probability

discounting was assessed for losses with chances of gains, a construct more similar to gambling than probability discounting of exclusive gains.

Strengths of this study include the large sample size and the use of few exclusion criteria. A heterogeneous sample of pathological gamblers was included in the sample, which increases generalization of the findings. This study is the first to assess delay and probability discounting in a sizeable sample of pathological gamblers, and the sample size was sufficient to detect small to medium effect sizes between those with and without a history of substance use problems. Another strength of the report is that delay and probability discounting were evaluated using equivalent methodological procedure and techniques of analysis, including mathematical modeling. This similar procedural and analytical framework—the discounting framework—seems to be well suited to analyze the relationship between delay and probability discounting, as well as their association with impulsivity (Green and Myerson 2004, 2010; Myerson et al. 2003).

A better understanding of discounting is important because it might help elucidate important aspects underlying addiction, including its treatment. Data from this study suggest that patients with comorbid pathological gambling and substance use problems are more impulsive in the sense of exhibiting incapacity to wait for delayed rewards, but not in the sense of exhibiting risk taking tendencies, than patients presenting with pathological gambling alone. Due to their steep delay discounting rates, patients with comorbid gambling-substance use problems may be in greater need of interventions that provide more immediate and/or frequent reinforcement, such as contingency management (see Petry 2000). As suggested by Petry (2001b), treatments that focus on consequences that are substantially delayed in time, such as better jobs, health, or social relationships, might be ineffective in individuals with high discounting rates because the subjective value of such delayed consequences becomes too small. Alternatively, individuals with steep delay discounting might benefit from interventions that can produce direct changes in discounting. Neurocognitive training of working memory decreases delay discounting rates of stimulant dependent individuals (Bickel et al. 2011). Future studies may evaluate the efficacy of interventions that reduce discounting in the context of improving substance use outcomes.

In summary, we found significant effects of substance use status on delay but not probability discounting, and a non-significant correlation between the two discounting processes. These data suggest that these two constructs tap different dimensions of impulsivity, and that delay discounting is more closely linked to substance use problem histories in pathological gamblers. A better understanding of aspects of impulsivity, especially delay discounting impulsivity, may elucidate methods to improve treatments for individuals with pathological gambling, substance use, and multiple addiction problems.

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Fig. 1. Delay (k value) and probability (h value) discounting parameters. Mean estimates obtained by pathological gamblers with substance use problems (shaded bars) and pathological gamblers without substance use problems (white bars). Error bars depict standard errors. Note that for this display the mean log values were reversed back to their natural forms to enhance interpretability of the results, and that the y-axes scales differ between the two graphs

Table 1

Baseline characteristics of pathological gamblers by history of substance use problems status

Variable	No History of Substance Use Problems (<i>n</i> = 119)	History of Substance Use Problems (<i>n</i> = 107)	Statistic (<i>df</i>)	<i>p</i>
Male, % (n)	50.4 (60)	62.6 (67)	$\chi^2(1) = 3.41$	.07
Race, % (n)			$\chi^2(3) = 20.56$	<.001
Caucasian	94.1 (112)	73.8 (79)		
African American	1.7 (2)	15.9 (17)		
Hispanic	1.7 (2)	7.5 (8)		
Other	2.5 (3)	2.8 (3)		
Married, % (n)	41.2 (49)	34.6 (37)	$\chi^2(1) = 1.04$	.31
Employed full time, % (n)	59.7 (71)	52.3 (56)	$\chi^2(1) = 1.23$	.27
Age ^a	45.9 ± 11.60	43.52 ± 9.97	<i>t</i> (224) = 1.65	.10
Years of education ^a	14.4 ± 2.16	13.40 ± 2.62	<i>t</i> (224) = 3.28	.001
Annual income ^b	\$45,000 ± 36,000	\$30,000 ± 36,000	<i>U</i> = 4650.0	<.001
ASI Gambling scale score ^b	0.702 ± 0.24	0.730 ± 0.26	<i>U</i> = 6326.5	.94
ASI Alcohol scale score ^b	0.006 ± 0.07	0.06 ± 0.19	<i>U</i> = 4946.5	.003
ASI Drug scale score ^b	0.00 ± 0.00	0.00 ± 0.01	<i>U</i> = 5107.5	<.001
Past month substance use, % (n)				
Any alcohol use to intoxication	10.9 (13)	25.2 (27)	$\chi^2(1) = 7.92$	.005
Any illicit drug use	7.6 (9)	15.9 (17)	$\chi^2(1) = 3.84$	.05
Age at first use				
Cigarette ^b (n)	15.0 ± 4.0 (82)	14.0 ± 3.0 (91)	<i>U</i> = 3156.0	.078
Alcohol ^b (n)	17.0 ± 3.0 (113)	15.0 ± 4.2 (106)	<i>U</i> = 4359.0	<.001
Illicit drug ^b (n)	19.0 ± 6.0 (71)	16.0 ± 5.7 (92)	<i>U</i> = 2271.0	.001
Participants meeting each substance use criteria, % (n)				
Attended 12-step meetings	0	66.4 (71)	N/A	N/A
Received professional substance use treatment	0	57.0 (61)	N/A	N/A
Tried to stop using	0	97.2 (104)	N/A	N/A
Eysenck Impulsivity score ^a	9.76 ± 4.64	11.20 ± 4.55	<i>t</i> (223) = -2.33	.02

^aMean ± standard deviation^bMedian (interquartile range)

ASI=Addiction Severity Index