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Alcohol Use and Prior Substance Abuse Treatment in Relation to Gambling Problem Severity and Gambling Treatment Outcome

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Recent research has made it clear that problematic gambling is often accompanied by problematic alcohol use. Unfortunately, little is known about the nature of this association, especially as it relates to gambling treatment outcome. The purpose of this study is to explore the effect of current alcohol use level and previous substance abuse treatment on the symptoms of a large cohort of pathological gamblers as well as on their response to treatment for pathological gambling. The sample included 464 men and 301 women recruited at six gambling treatment programs in Minnesota. Gambling treatment patients were assessed on a number of gambling problem severity and related clinical variables using the Gambling Treatment Outcome Monitoring System (GAMTOMS). Patients with frequent alcohol use had greater gambling involvement at baseline than infrequent alcohol users. Patients with a previous history of substance abuse treatment had more severe psychosocial problems, ostensibly resulting from their gambling behavior, than patients without past substance abuse treatment. A MANOVA with repeated measures showed that neither pretreatment alcohol use, nor past substance abuse treatment exerted significant effects on gambling treatment outcome. While the level of pretreatment alcohol use and a history of substance abuse treatment are markers for greater gambling problem severity, treatment outcome for pathological gambling was not adversely impacted by these variables.

KEY WORDS: gambling treatment outcome; alcohol use; substance abuse treatment.

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Stemming from changes in legislation pertaining to gambling, the past two decades have witnessed an unprecedented expansion in all types of wagering (e.g., casino gambling). Not surprisingly, as accessibility to legal gambling venues has increased, there has been a corresponding increase in the rate of gambling. A recent U.S. national survey found that both gambling participation rates and gambling expenditures have increased from 1975 to 1999 (National Opinion Research Center, 1999). A meta-analysis of relevant studies published between 1988 and 1997 (Shaffer, Hall, & Vander Bilt, 1999) estimates that nearly 90% of adults have wagered money at some point in their life and that just over 70% have wagered money in the previous 12 months. About 1–2% of adults surveyed across the studies reviewed could be classified as pathological gamblers (PG) using a conservative diagnostic algorithm (e.g., DSM-IV) and as many as 5% could be classified as problematic gamblers using a more liberal diagnostic algorithm (probable pathological gamblers; PPG). These estimates are highly consistent with the findings in the most recent large-scale (2600 U.S. adults) epidemiological survey of gambling behavior (Welte, Barnes, Wieczorek, Tidwell, & Parker, 2001), in which 80% reported wagering money in the 12 months preceding the survey with 1.9 and 5.5% meeting a stricter and less strict definition of problematic gambling, respectively.

Relative to other impulse control disorders recognized in the DSM (e.g., kleptomania), the essential concept of pathological gambling is more closely associated with that of the substance use disorders (SUDs). For example, general features of addictive behaviors, such as an intense desire to satisfy a need, loss of control related to fulfilling a need, and continuing to engage in behavior related to fulfilling the need despite negative consequences (e.g., World Health Organization, 1993), also apply to the current understanding of PG. In particular, the DSM-IV criteria for PG include the concepts of preoccupation, loss of control, tolerance and withdrawal. The similarities between the concepts of PG and SUDs led Potenza et al. (2001) to label PG as an ''addiction without the drug.''

Recent research demonstrates that there is a robust relationship between PG and alcohol use disorders (AUDs). In the Welte et al. (2001) randomized telephone survey described above, it was reported that the risk for either current alcohol dependence or pathological gambling was increased by a factor of over 23, given the presence of the other. Similarly,

while pathological gambling in the general U.S. community appears to range from 2 to 5% (above), the rate of PG among alcoholism treatment patients ranges from about 9% to as much as 33% (Daghestani, Elenz, & Crayton, 1996; Giacopassi, Stitt, & Vandiver, 1998; Haberman, 1969; Lesieur, Blume, & Zappa, 1986; Lejoyeux, Feuche, Loi, Solomon, & Ades, 1999). A similar pattern of association emerges between PG and SUDs in general. For example, Bland, Newman, Orn, and Stebelesky (1993) reported that the risk for an SUD was increased nearly four-fold among Canadian community residents who also reported problematic gambling behavior. A similar pattern of findings has been demonstrated in U.S. community residents (e.g., Cunningham-Williams, Cottler, Compton, & Spitznagel, 1998; Feigelman, Wallisch, & Lesieur, 1998; Welte et al., 2001).

What are the rates of alcohol and other drug abuse among patients being treated for PG? In one of the few studies to address this question, Toneatto, Skinner, and Dragonetti (2002) reported that nearly 30% of 169 PG treatment outpatients had a lifetime history of alcohol use problems with about half of these individuals having undergone past alcoholism treatment. This rate approaches a three-fold increase in risk for an AUD among PG patients as compared to the U.S. community at large (e.g., Regier, Farmer, Rae, Locke, Keith, Judd, & Goodwin, 1990).

The fact that PG covaries with AUDs and other SUDs, raises a number of theoretical and clinical questions. Referring to the latter, more than 30 years ago, Feinstein (1970) outlined a number of clinical issues pertaining to an index disorder that should be considered whenever a comorbid disorder is present. The primary questions raised are practical, focusing on potential modifications in diagnostic, course of disease, and treatment parameters as a result of the comorbid condition. Notably, these questions are posed to address the causal status of the relationship between the index and comorbid disorder. That is, Feinstein (1970) argued for an empirical approach (at least initially) to judging the clinical relevance to the index disorder of the comorbid condition. This empirical program would, once developed, inform us further concerning: (a) the relevance of this relationship for further study; and, (b) hypotheses concerning theoretical questions such as whether PG and SUDs share a common etiological substrate, interact with one another in an etiologically significant way, or are only incidentally related via a shared third variable (e.g., Kushner, Abrams,

& Borchardt, 2000). Given the prevalence of comorbid AUDs and other SUDs in PG, and the current lack of information concerning clinical implications of such comorbidity (e.g., Winters & Kushner, in press), we decided to pursue the empirical questions raised by Feinstein (1970), while leaving the theoretical questions for future work.

We set out to examine the separate and interactive effects of current alcohol use and prior substance abuse treatment on multiple clinical parameters in PG treatment patients over time. Specifically, we examined the effect of alcohol use and prior substance abuse treatment on: (1) the severity of PG symptoms at baseline (i.e., start of PG treatment); (2) change from baseline to 6 months following PG treatment (''follow-up'') on PG variables; and (3) change from baseline to follow-up in alcohol and other substance use behavior. In this effort, we were (to the best of our knowledge) able to access the largest single cohort of PG treatment patients reported on to date ($N = 792$). Assessment of this large cohort at baseline (i.e., the beginning of their PG treatment), allowed us to make a more rigorous inquiry (relative to previous studies) into question (1), while the 6 month prospective clinical follow-up arm allowed us to make relatively firm statements concerning questions (2) and (3).

METHOD

Participants

This study is a secondary analysis of an existing gambling treatment outcome study database (for more details about participants, methods, and instruments see Stinchfield & Winters, 2001). Gambling treatment patients were recruited between April 1992 and July 1995 from six outpatient gambling treatment programs in Minnesota. Patients were referred to gambling treatment by a variety of sources including mental health practitioners, and the Minnesota Gambling Helpline. Participants included 464 men and 301 women with an age range from 18 to 74 years and a mean age of 39 ($SD = 10.7$). The sample was predominantly white, more than half were not married, two-thirds were employed full-time, and half had some college or more education. Table 1 shows the demographic characteristics of the sample. All patients were asked to participate in a gambling treatment

Table 1
Demographic and Clinical Characteristics of Sample ($N = 765$)

Demographic and Clinical Variables	*Count*	*Percent*
Gender		
Male	464	60.7
Female	301	39.3
Age		
<21	24	3.1
21–29	113	14.8
30–39	261	34.1
40–49	213	27.8
50–59	93	12.2
>59	28	3.7
Race		
White	685	89.5
American-Indian	23	3.0
African-American	12	1.6
Asian	11	1.4
Hispanic	3	0.4
Other and missing	31	4.1
Preferred Game		
Cards (Blackjack, 21, Poker, etc.)	262	34.2
Slot machines	247	32.3
Pull tabs	102	13.3
Other games (bingo, dice, sports betting, etc.)	82	10.7
Previously sought help for gambling problem	373	48.8
Frequent alcohol use (weekly/daily)	239	31.1
Prior substance abuse treatment	256	33.5
Prior mental health treatment	348	45.5
Legal problem	149	19.6

Note: Not all columns add to 765 or 100% due to missing data.

outcome study and 94% agreed to participate. Patients were referred to gambling treatment from a variety of sources including the gambling helpline, self-referrals, mental health care providers, courts, etc.

Instruments

The Gambling Treatment Outcome Monitoring System (GAMTOMS) was administered to patients and includes intake, discharge and 6 month post-discharge assessments. See Stinchfield (1999) and Stinchfield and Winters (2001) for a complete description of the GAMTOMS and its development. The instruments are self-administered paper-and-pencil questionnaires. Table 2 shows the instruments, time of assessment, content/scales assessed, and estimates of internal consistency.

Gambling Treatment Admission Questionnaire (GTAQ)

This 91-item questionnaire assesses demographics, clinical history, gambling behavior, gambling frequency, gambling-related financial and legal problems, substance use frequency, and psychosocial problems. The GTAQ includes the South Oaks Gambling Screen

Table 2
GAMTOMS Instruments and Variables

Gambling Treatment Admission Questionnaire (91 items)	*Patient 6 months Follow-up Questionnaire (95 items)*
Demographics (12 items)	Demographics (6 items)
Clinical history (3 items)	
Gambling behavior and history (11 items)	Post-treatment gambling behavior (6 items)
Gambling frequency (10 items)	Gambling frequency (10 items)
Gambling problem severity (SOGS, 20 items)	Gambling problem severity (SOGS, 20 items)
Gambling-related financial problems scale (20 items) and gambling-related debt	Gambling-related financial problems (20 items) and gambling-related debt
Gambling-related legal problems (8 items)	Gambling-related legal problems (4 items)
Substance use frequency (4 items)	Substance use frequency (4 items)
Psycho-social functioning scale (12 items)	Psycho-social functioning scale (12 items)

(SOGS), a 20-item measure of gambling problem severity that has demonstrated satisfactory reliability and validity (Lesieur & Blume, 1987; Stinchfield, 2001).

Gambling frequency was measured by asking how often the patient played ten gambling activities on a five point scale (never, less than monthly, monthly, weekly, and daily). The Psychosocial Problems Scale is made up of 12 items (e.g., relationship with spouse) that ask the patient to rate their functioning on a four-point scale (excellent, good, fair, poor). Scores range from 0 to 36 and the higher the score, the greater the problems in psychosocial functioning and the lower the score, the better the functioning.

The two independent variables, AOD (Alcohol and Other Drug) treatment history and alcohol use frequency, were assessed at admission. Patients were asked if they had used any treatment services for substance abuse prior to gambling treatment. This variable is admittedly non-specific to alcohol treatment, however, in the absence of a detailed treatment history, it is reasonable to use a general AOD treatment variable. For alcohol use, patients were asked how often they drank alcohol (beer, wine, liquor) during the 6 months prior to gambling treatment and the response options were: never (0), less than monthly (1), monthly (2), weekly (3), and daily (4). For the purpose of this study, the alcohol use variable was dichotomized into monthly or less often drinkers, referred to as ''low frequency alcohol users'' and weekly/daily drinkers, referred to as ''high frequency alcohol users''. These same response options were used for substance use frequency.

Patient 6 month Follow-up Questionnaire

The 95-item patient 6 month follow-up questionnaire repeated the baseline content domains: demographics, gambling frequency, gambling problem severity (SOGS), financial problems, legal problems, psychosocial problems, post-treatment service utilization (e.g., GA participation), and substance use frequency.

Treatment approaches

The six treatment programs offered outpatient treatment for pathological gambling; Stinchfield and Winters (2001) provide a more detailed description of treatment approach, length of treatment and treatment completion rates. The six programs were similar in terms of

therapeutic orientation, treatment methods, and delivery of therapeutic services. The therapeutic goal was abstinence from gambling. The purpose of treatment was to teach skills to avoid gambling, learn ways of living without gambling, and to provide the setting within which to practice these new skills. The predominant treatment modality was outpatient group therapy, however, the treatment programs offered multimodal treatment and included the following methods: education about pathological gambling; structured group therapy; individual therapy; educational activities such as lectures and homework assignments; financial counseling; education and support for family members; and orientation to Gamblers Anonymous (GA) and encouragement to attend GA meetings. The length of treatment varied somewhat across programs, but was typically 3–4 therapy sessions per week for approximately 2 months. The average number of treatment sessions was 26 ($SD = 13$) with a mode of 20. Treatment completion was determined by treatment sta and typically required that the patient participate in a set number of sessions, complete homework assignments, and show eort to make progress in their recovery process. Just over one-fourth (27%) of the sample did not complete treatment.

Procedures

Admission questionnaires were administered to participants by treatment program staff. Treatment staff were trained in the administration of assessment instruments prior to the onset of data collection. During the intake assessment, treatment staff informed patients about the treatment outcome study by reading a consent form and inviting them to participate in the study. Patients who agreed to participate signed the consent form and were given a copy of the form. Admission questionnaires obtained at the six programs were mailed to the research office each month. At 6 months after discharge, patients were contacted by research staff and administered the follow-up questionnaire by mail or telephone. Six month follow-up data was collected from 529 patients which represents a 69% follow-up response rate. Because 31% of the sample was not followed-up at 6 months post-treatment, a comparison was made between those contacted and those not contacted at follow-up, to see if they differed significantly. This comparison showed that the non-contacted group had a higher

percentage of males, younger age, lower income, and legal problems than the contacted group. There were no differences for race, gambling frequency, SOGS score, financial problems, psycho-social problems, employment status, education, preferred game, previously sought help, tobacco, alcohol, marijuana, and other substance use. Therefore, it would appear that there is not a significant bias in gambling problem severity between the group that could not be followed-up at 6 months post-treatment and those who were contacted.

Statistical Analysis

The statistical analysis involved two independent dichotomous variables: (1) previous AOD treatment vs. no previous AOD treatment; and (2) pretreatment high frequency alcohol use vs. low frequency alcohol use. Dependent variables included gambling frequency, number of games played, SOGS score, psychosocial problems, number of days absent from work due to gambling, pull-tab frequency, and tobacco, marijuana, and other drug use. Pull-tab play was a focus of this study because it is the only form of gambling in Minnesota that is played predominantly in bars where alcohol is served. A pull tab is an instant win game in the form of a card with tabs that are pulled back to reveal rows of symbols similar to those on a slot machine. Pull tabs are a form of charitable gambling in Minnesota. To address the first question of severity of PG symptoms at baseline, a two by two multivariate analysis of variance with two main effects and one interaction was computed. To address the second question of response to PG treatment at follow-up, time was added as an independent variable in a multivariate analysis of variance with repeated measures and the model examined change from pre-treatment to post-treatment and has three main effects, three two-way interactions, and one three-way interaction. To address the third question of change in alcohol use, a paired *t*-test and chi-square were computed between pretreatment and post-treatment alcohol use.

RESULTS

Description of the Sample

One-third of the sample reported having received previous substance abuse treatment and just under one-third reported

consuming alcohol on a high frequency (i.e., weekly/daily) basis during the 6 months prior to treatment. The cross-tabulation of these two independent variables is shown in Table 3. The two independent variables were not related as indicated by a phi coefficient of .08.

Cross-Sectional Comparisons (baseline)

Using an alpha of .01, a MANOVA with two independent variables yielded statistically significant main effects for past AOD treatment ($F = 3.8$; df = 11,412; $p < .001$) and pretreatment alcohol use ($F = 5.5$; df = 11,412, $p < .001$), but no significant interaction ($F = 1.5$; df = 11,412; $p = .13$). Therefore, Table 4 displays the univariate results for each main effect.

Table 3
Crosstabulation of Pretreatment Alcohol Use and Previous Alcohol and Other Drug Treatment ($N = 765$)

	Previous AOD Treatment	
Pretreatment Alcohol Use	No Count (row, column, and total percent)	Yes Count (row, column, and total percent)
Low frequency Alcohol use	337 64% 66% 44%	189 36% 74% 25%
High frequency alcohol use	172 72% 34% 22%	67 28% 26% 9%

Note: Phi coecient between pretreatment alcohol use and previous substance abuse treatment is .08. Pretreatment alcohol use was assessed at admission and inquired about alcohol use frequency during the 6 months prior to admission. Low frequency alcohol use is defined as monthly or less often use in the 6 months prior to gambling treatment. High frequency alcohol use is defined as weekly or daily use in the 6 months prior to gambling treatment. Substance abuse treatment was assessed at admission and inquired about past treatment for substance abuse prior to admission.

Gambling problem severity

As shown in the first major row heading of Table 4, there were no statistically significant differences between patients with and without past AOD treatment. Patients with high pretreatment alcohol use played more games than patients with no or low frequency pretreatment alcohol use; however, they did not differ on overall gambling frequency and SOGS scores.

Gambling in Bars

Patients with high pretreatment alcohol use played pull tabs more frequently than patients with no or low frequency pretreatment alcohol use.

Gambling Consequences

Patients with past AOD treatment had higher psychosocial problems scores; however, they did not differ on days absent from work to gamble. There were no differences between current alcohol use groups on any of the gambling consequence variables.

Other Substance Use

Patients with past AOD treatment smoked cigarettes and used other drugs more often patients who had not previously gone through AOD treatment. Patients with high pretreatment alcohol use used marijuana more frequently than low alcohol users.

Summary of Cross-sectional Findings

Overall, patients with past AOD treatment had more severe psychosocial problems and exhibited higher rates of tobacco and other substance use. Patients who were frequent alcohol drinkers played more games, played pull tabs more frequently, and used marijuana more frequently than low frequency alcohol users.

Prospective Comparisons (baseline to 6 months follow-up)

Using an alpha of .01, a MANOVA with repeated measures for two independent variables yielded statistically significant main effects for pretreatment alcohol use ($F = 3.8$; df = 10,240; $p < .001$) and time ($F = 89.7$; df = 10,240; $p < .001$). There were also two significant interactions of pretreatment alcohol use by time ($F = 3.6$;

Table 4
Comparison of Alcohol Use and Alcohol and Other Drug (AOD) Treatment Groups on Pretreatment Variables

	Group			*AOD treatment*	*Alcohol use*
Pretreatment variables	*AOD treatment*	*Alcohol use*[1]	*M (SD)*	*F (p)*	*F (p)*
Gambling Problem Severity Variables					
Highest level of gambling[2]	no	Low	3.1 (.8)	.13 (.715)	3.6 (.057)
		high	3.4 (.6)		
	yes	Low	3.3 (.7)		
		high	3.3 (.5)		
Number of games played[3]	no	Low	4.5 (2.0)	4.0 (.047)	15.4 (<.001)
		high	5.1 (2.0)		
	yes	Low	4.6 (2.0)		
		high	5.8 (1.8)		
SOGS[4]	no	Low	12.6 (3.7)	4.4 (.036)	.3 (.591)
		high	12.7 (3.5)		
	yes	Low	13.3 (3.5)		
		high	13.6 (2.3)		
Gambling in Bars					
Pull tabs frequency[2]	no	Low	1.2 (1.2)	1.6 (.212)	33.5 (<.001)
		high	2.3 (1.4)		
	yes	Low	1.6 (1.2)		
		high	2.2 (1.2)		
Gambling Consequence Variables					

Psychosocial problems[5]	no	Low	23.0 (6.5)	12.5 (<.001)	0.1 (.73)
		high	21.7 (6.4)		
	yes	Low	24.5 (6.4)		
		high	25.3 (5.5)		
Days absent from work	no	Low	7.0 (15.6)	1.7 (.198)	1.3 (.26)
		high	7.4 (16.5)		
	yes	low	12.7 (26.3)		
		high	7.3 (13.1)		
Other substance use variables					
Tobacco use[2]	no	Low	2.5 (1.9)	15.2 (<.001)	5.3 (.022)
		high	2.8 (1.8)		
	yes	Low	3.1 (1.6)		
		high	3.7 (1.0)		
Marijuana use[2]	no	Low	.1 (.4)	4.9 (.028)	10.4 (.001)
		high	.3 (.7)		
	yes	Low	.2 (.6)		
		high	.5 (1.1)		
Other drug use[2]	no	Low	.3 (.9)	10.4 (.001)	.1 (.73)
		high	.3 (.9)		
	yes	Low	.7 (1.4)		
		high	.6 (1.3)		

Note: [1]Alcohol use group membership: monthly use or less vs. weekly or daily use during the 6 months prior to treatment.
[2]0 = none, 1 = (monthly, 2 = monthly, 3 = weekly, 4 = daily.
[3]Number of games played ranged from 0 to 10.
[4]SOGS scores ranged from 0 to 20.
[5]Psychosocial problems included 12 items with a four-point response option (0–3) and total score ranged from 0 to 36.

df = 10,240, $p < .001$), and past AOD treatment and time ($F = 2.7$; df = 10,240; $p = .004$). There were no statistically significant dierences for the main eect of AOD treatment ($F = 1.7$; df = 10,240; $p = .08$), the two-way interaction of AOD treatment by alcohol use ($F = 0.7$; df = 10,240; $p = .74$), and the three-way interaction of AOD treatment by alcohol use by time ($F = 1.3$; df = 10,240; $p = .26$). Therefore, Table 5 displays the univariate results for each dependent variable within each significant main effect and interaction.

Alcohol Use Frequency

In terms of alcohol use from pre- to post-treatment, the sample as a whole showed a statistically significant decline from admission (*mean* = 1.6; *SD* = 1.3) to follow-up (*mean* = 1.3; *SD* = 1.2) with a paired t-test ($t = 6.8$; df = 525; $p < .001$). The average dropped from monthly to less than monthly alcohol use. Pretreatment alcohol use groups (low vs. high frequency) had dierent alcohol use outcomes at 6 months follow-up. The pretreatment low frequency alcohol use group had 90% who remained at low frequency use at 6 months follow-up and only 10% increased to high frequency alcohol users. On the other hand, the pretreatment high frequency alcohol use group had 46% remain as high frequency users at 6 months follow-up, and over half (54%), became low frequency alcohol users at 6 months follow-up. The chi-square test of dependence was statistically significant ($\chi^2 = 90.6$; df = 1; $p < .001$).

Gambling Problem Severity

Effects relevant to gambling problem severity are shown in the first major row heading of Table 5. There were no significant interactions. In terms of main effects, there was a significant difference between alcohol use groups on number of games played; and all of the gambling problem severity variables showed statistically significant improvement over time.

Gambling in Bars

There was a statistically significant alcohol use by time interaction for pull tab frequency, where frequent alcohol drinkers showed a greater reduction in pull tab play over time than the low frequency drinkers. In terms of main effects, there was a significant difference between alcohol use groups on pull tab frequency; and pull tab frequency showed a statistically significant decline over time.

Gambling Consequences

Effects relevant to gambling consequences are shown in the second major row heading of Table 5. There were no significant interaction effects for gambling consequences and no main effect for alcohol use. Both psychosocial problems and number of days absent from work due to gambling showed statistically significant improvement over time.

Other Substance Use

Effects relevant to other substance use are shown in the last major row heading of Table 5. A significant two-way interaction was observed between pretreatment alcohol use level and Time for marijuana use, as well as a main effect for alcohol use level, where frequent alcohol drinkers showed a greater reduction in marijuana use than low frequency drinkers. Follow-up simple effects analyses revealed that while both low frequency and high frequency alcohol drinkers showed statistically significant decreases in marijuana use from pre-treatment to follow-up, they differed significantly at pretreatment. Therefore, patients who were frequent drinkers at pretreatment came to gambling treatment with higher levels of marijuana use than patients who were low frequency drinkers, but both groups reduced their marijuana use to similarly low levels by follow-up. A similar result was observed for previous AOD treatment, where patients with previous AOD treatment showed greater reduction in other drug use over time than patients without past AOD treatment. While marijuana and other drug use declined over the time, tobacco use was unchanged.

Summary of Prospective Comparisons

Overall, patients showed improvement from pre-treatment to 6 months follow-up on almost all dependent variables, with the exception of tobacco use, which was fairly stable over time. Patients with previous AOD treatment and patients who were frequent alcohol users tended to show greater improvement than patients with no past AOD treatment and patients who were low frequency drinkers, primarily due to the fact that they came into treatment with higher levels of other substance use. One caveat to consider in comparing groups across time, is that greater baseline problem severity is more susceptible to regression to the mean.

Table 5
Comparison of Pretreatment and 6-month Follow-up Assessment by Pretreatment Alcohol Use and AOD treatment history

	Group		*pretx*	*posttx*	*Alcohol Use*	*Time*	*Alcohol Use by Time*	*AOD Treatment by Time*
Outcome variable	*A*	*B*[1]	*M* (*SD*)	*M* (*SD*)	*F* (*p*)	*F* (*p*)	*F* (*p*)	*F* (*p*)
Gambling Problem Severity Variables								
Highest level of gambling[2]	no	Low	3.2 (.8)	0.8 (1.2)	4.0 (.046)	562 (<.001)	0.1 (.78)	1.1 (.30)
		High	3.4 (.6)	0.9 (1.1)				
	Yes	Low	3.3 (.7)	0.8 (1.0)				
		High	3.3 (.5)	1.3 (1.3)				
Number of games played[3]	no	Low	4.4 (2.1)	0.9 (1.3)	10.6 (.001)	476 (<.001)	3.7 (.06)	0.1 (.91)
		High	5.3 (2.0)	1.1 (1.6)				
	yes	Low	4.6 (2.0)	1.1 (1.3)				
		High	5.7 (2.0)	1.4 (1.8)				
SOGS[4]	no	Low	12.7 (3.5)	3.0 (4.4)	0.3 (.610)	645 (<.001)	0.5 (.48)	0.2 (.65)
		High	12.7 (3.5)	2.5 (4.0)				
	yes	Low	13.1 (3.4)	3.8 (4.5)				
		High	14.0 (2.5)	4.1 (4.9)				
Gambling in Bars								
Pull tabs frequency[2]	no	Low	1.2 (1.2)	0.1 (0.5)	21.4 (<.001)	270 (<.001)	12.9 (<.001)	0.2 (697)
		High	2.4 (1.4)	0.4 (0.9)				
	yes	Low	1.6 (1.3)	0.2 (0.5)				
		High	2.2 (1.3)	0.3 (0.7)				
Gambling Consequence Variables								
Psychosocial problems[5]	no	Low	22.8 (6.7)	13.5 (7.2)	0.2 (.89)	314 (<.001)	0.2 (.63)	0.9 (.34)

		High	22.5 (6.5)	12.8 (5.5)				
	yes	Low	24.3 (6.0)	14.1 (6.3)				
		high	25.4 (5.9)	14.5 (5.5)				
Days absent from work	no	Low	4.9 (8.5)	0.5 (1.9)	0.1 (.92)	29.5 (<.001)	1.0 (.33)	0.8 (.39)
		High	6.4 (15.3)	0.3 (1.6)				
	yes	Low	10.6 (22.9)	0.3 (1.1)				
		high	6.6 (10.4)	2.5 (10.9)				
Substance Use Variables								
Tobacco Use[2]	no	Low	2.4 (1.9)	2.4 (1.9)	4.9 (.03)	0.93 (.34)	0.6 (.43)	.3.0 (.08)
		high	3.0 (1.7)	3.0 (1.7)				
	yes	Low	3.0 (1.7)	2.9 (1.8)				
		high	3.6 (1.2)	3.4 (1.4)				
Marijuana Use[2]	no	Low	0.1 (0.4)	0.05 (0.2)	9.8 (.002)	24.2 (<.001)	8.8 (.003)	4.5 (.04)
		high	0.2 (0.5)	0.06 (0.2)				
	yes	Low	0.1 (0.3)	0.0 (0.0)				
		high	0.5 (1.1)	0.05 (0.2)				
Other drug use[2]	no	Low	0.3 (0.9)	0.1 (0.4)	0.3 (.58)	29.4 (<001)	0.4 (.51)	10.4 (.001)
		high	0.3 (0.9)	0.1 (0.6)				
	yes	Low	0.6 (1.3)	0.1 (0.5)				
		High	0.9 (1.5)	0.0 (0.0)				

Note: Group A = Alcohol and Other Drug (AOD) treatment; and Group B = Alcohol use.
[1]Alcohol use group membership: monthly use or less vs. weekly or daily use during the 6 months prior to treatment.
[2]z0 = none, 1 = < monthly, 2 = monthly, 3 = weekly, 4 = daily.
[3]Number of games played ranged from 0 to 10.
[4]SOGS scores ranged from 0 to 20.
[5]Psychosocial problems included 12 items with a four-point response option (0–3) and total score ranged from 0 to 36.

DISCUSSION

The primary purpose of this study was to explore the association of AOD treatment history and current alcohol use on the symptoms and outcomes of patients undergoing treatment for pathological gambling. Results can be grouped grossly as those related to cross-sectional associations vs. those related to prospective associations. Results can be further subcategorized based on type of dependent variable including those related to: (a) gambling problem severity; (b) gambling in bars; (c) gambling consequences; and (d) other substance use behavior.

Cross-sectional Findings

AOD treatment history did not strongly predict PG symptom status in our baseline sample and current level of alcohol use was only positively associated with number of games played and was not predictive of higher levels of gambling or SOGS scores. Confidence that this pattern represents a valid finding is increased by the fact that it has also been obtained by others studying this population. Notably, this pattern of findings provides the context for some interesting theoretical conjectures concerning the nature of the association between gambling and alcohol use. As suggested by Smart and Ferris (1996), alcohol use serves to promote problematic gambling as a direct real-time effect (e.g., via disinhibition of reckless gambling behavior), we would expect the exact pattern of results obtained; that is, worse gambling behavior among those who report more drinking. In this regard, Welte et al. (2001) also found a dose response relationship between alcohol intake and gambling with those drinking more than four drinks per day being over five times more likely to display problematic gambling. Of course, this pattern of findings is equally consistent with the conclusion reached by Stewart, McWilliams, Blackburn, and Klein (2002), who found that frequent gamblers tend to drink more when gambling than when engaged in a control activity. We also found that pull tab play that occurs in bars was played at a higher frequency among the frequent drinkers. That is, our findings are also consistent with the view that frequent gambling promotes alcohol use. Finally, as we discuss in more detail below, the fact that both gambling and drinking behavior seemed to have improved by the post-treatment follow-up is consis-

tent with the idea of a shared pathophysiology or other common causal influence in these disorders.

Experimental studies are well suited to disentangle confounded causal effects. In fact, several studies have examined the impact of alcohol consumption on gambling behavior with, unfortunately, less than consistent findings. Smart and Ferris (1996), for example, found that alcohol intake was associated with increased gambling behavior, as did Kyngdon and Dickerson (1999) and Baron and Dickerson (1999). Sjoberg (1969), on the other hand, found that people were less willing to gamble with their own money when given a relatively high dose of alcohol as compared to those given a placebo or non-alcohol control beverage; however, a low dose of alcohol (more typical of what gamblers report drinking when gambling) was associated with increased gambling. Still other studies found no association between alcohol consumption and willingness and/or ability to gamble (Breslin, Sobell, Cappell, & Vakili, 1999; Cutter, Green, & Harford 1973; Meier, Brigham, Ward, & Myers, 1996). It's difficult to draw conclusions from this set of mixed findings. Further complicating matters, each used differing methods, which may limit their comparability. In short, while greater current alcohol use is associated with more extreme gambling behavior (e.g., our findings and also see those of Welte, et al., 2001), the causal connection between drinking behavior and problematic gambling is by no means clear. Furthermore, there is no logical contradiction in bi-directional causal influences between comorbid disorders or in the simultaneous or sequential influence of other various maintaining factors.

Even within our own data set, conflicting trends were noted. For example, while current alcohol use, but not history of AOD treatment, was related to PG symptom severity (above), the reverse trend was noted concerning gambling consequences. As shown in Table 4, psychosocial problems were more severe among those with a history of AOD treatment, yet unrelated to current level of alcohol use. One potentially important caveat here is that we cannot be sure that these problems are directly related to gambling. For example, while it is a reasonable assumption that much of the psychosocial problems of these gambling treatment patients are related to gambling behavior, this is not strictly shown in our data. Therefore, we must exercise caution in suggesting that a past history of AOD treatment is associated with greater negative consequences from gambling. More conserva-

tively, this history is associated with greater negative life consequences, which may or may not be related to gambling.

Finally, we found that both a past history of AOD treatment and current alcohol use were positively associated with tobacco and marijuana use. That past AOD treatment is related to greater drug use seems obvious in that the extremely high comorbidity between various substance use disorders is well known (e.g., Regier et al., 1990). The association between level of current alcohol use and pull-tab gambling, while not necessarily obvious, also makes a good deal of sense. Because pull-tab gambling in Minnesota is primarily conducted in bars, it should not be surprising that heavier drinkers migrate toward this type of gambling. More generally speaking, this finding might suggest that drinking can lead to problematic gambling when the latter is made available in explicit drinking environments. This assumes that individuals went to the bar primarily to drink/socialize and ended up gambling because of its proximity and, possibly, because of behavioral disinhibition resulting from alcohol use. Obviously, this conjecture goes beyond the present data and is presented as stimulus for future work.

Prospective Findings

Change from Pre- to Post-treatment

Time effects shown in Table 5 are our best indicator of overall gambling treatment outcomes; i.e., change in gambling-related variables from the baseline assessment to the 6 month assessment. (However, note the fact that the present study did not employ a control group or standardized treatment protocol; thus, inferences about treatment effects based on time effects are accordingly weakened.) These time effects were significant for almost all classes of outcomes including, gambling problem severity, gambling consequences, and drug use other than alcohol. In sum, gambling treatment appeared to have been effective (i.e., significant changes from pre- to post-treatment in significant outcome measures) and there was no indication of increases in other addictive behaviors as gambling behavior decreased. To the contrary, other substance use showed a general trend toward reduction following gambling treatment, with the exception of tobacco.

Effects of Alcohol Use Level and History of AOD Treatment on Gambling Treatment Outcomes

As a practical matter, it is imperative to understand the impact on gambling treatment outcomes of frequently co-occurring addictive behaviors. The prospective clinical follow-up in the present study provides a direct investigation of this topic. Referring specifically to gambling problem severity measures as outcomes (first major row heading of Table 5), neither current alcohol use level, nor history of AOD treatment, significantly interacted with time. That is to say, the degree to which patients improved on core gambling severity measures following PG treatment was not impacted significantly by their level of alcohol use at baseline or by whether or not they had a history of AOD treatment. A highly similar pattern emerged in prospective analyses looking at outcomes involving gambling consequences. Both psychosocial problems and days absent from work declined over time and did not interact with past AOD treatment or current alcohol use.

Contrary to the general pattern of results just discussed, several interactions were obtained in prospective analyses using pull-tab frequency and other substance abuse as the outcome variables. Regarding the former, we found that frequent drinkers reported significantly greater reduction in the frequency of their pull-tab gambling as compared to low frequency drinkers. Part of this result may be due to the fact that frequent drinkers had higher rates of pull tab play and substance use prior to admission and this would contribute to a greater reduction toward the mean in these patients over time. Nonetheless, this pattern of results is consistent with our discussion of the cross-sectional findings; that is, these prospective findings may suggest that the greater proximity of pull-tab gambling experienced by those attracted to drinking establishments may lead to more frequent pull-tab gambling. If true, limitation of gambling venues in drinking establishments would be expected to lower problematic gambling among a significant segment of the population. Ellery, Stewart, and Loba (this issue) come to the same conclusion based on experimental data. In summary, the prospective arm of the study showed that use of other substances, with the exception of tobacco, decreased from pre- to post-PG treatment.

Study Limitations

We did not employ a formal diagnostic interview in this study. One consequence of this methodological limitation is that we cannot assert definitively that all of our participants met full DSM criteria for PG at baseline or that they no longer met DSM criteria for PG at follow-up. However, the mean SOGS score was over 12 at baseline, which is more than double the standard benchmark of that screen indicating problematic gambling (i.e., 5) (Lesieur & Blume, 1987; Stinchfield, 2001), and under this benchmark, on average, following PG treatment. Another consequence of the absence of formal diagnostic procedures is that we cannot make formal statements about ''dual diagnosis'' status in our participants and its effect on change from pre- to post-PG treatment on the outcome variables. As described above, however, this limitation did not preclude our examining important and interesting associations related to current alcohol use level (arguably more informative than categorical diagnostic information) and past AOD treatment history. That the latter could reasonably be taken as a proxy for a past (i.e., lifetime) SUD diagnosis, somewhat mitigates the absence of DSM SUD diagnoses in the sample. A second limitation is that some of our outcome variables presumed to be consequences of PG may be related to other problems. That is, our measures of occupational, financial, psychosocial problems, and other drug use could be effected by other patient behaviors besides gambling or gambling treatment. A third limitation of the study was our reliance on a gross measure of drinking frequency in determining drinking status. Because of this, it is possible that we classified low volume drinkers in our ''high'' frequency drinking category. Given this possibility, we must be accordingly tentative in drawing conclusions based on this measure. A fourth limitation is that the history of substance abuse treatment was not specific to alcohol and included ''any substance use disorder treatment.'' However, we would emphasize our general belief that the limitations inherent in the data set do not preclude us from addressing the stated goals of the study in a meaningful way.

Overall Conclusions

Based on our findings, it would appear that the content and timing of traditional PG treatment need not be modified to accommodate the presence of a history of AOD treatment or frequent

alcohol use at pre-treatment. In fact, our findings point to the likelihood that many types of substance use will, if anything, decline as a result of a standard PG treatment. However, these conclusions should not be taken to indicate that a frank alcohol or drug use disorder, active at the time PG treatment is sought, should be ignored. On the one hand (and as addressed above), our data were not capable of directly addressing the latter problem squarely (i.e., information necessary for making an SUD diagnosis was not available at the baseline assessment). Independent of this, however, sound clinical judgment would dictate that patients should receive treatment, or a referral for treatment, for all active disorders identified, including those involving drugs or alcohol. With this said, our findings provide a strong rationale for hypothesizing that the presence of an active SUD would not preclude successful PG treatment. Finally, we found no evidence that standard PG treatment promotes a substitution of gambling behavior with alcohol or drug abuse.

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REFERENCES

Baron, E., & Dickerson, M. G. (1999). Alcohol consumption and self-control of gambling behaviour. *Journal of Gambling Studies, 15*, 3–15.

Bland, R. C., Newman, S. C., Orn, H., & Stebelesky, G. (1993). Epidemiology of pathological gambling in Edmonton. *Canadian Journal of Psychiatry, 38*, 108–112.

Breslin, F. C., Sobell, M. B., Cappell, H., & Vakili, S. (1999). The effects of alcohol, gender, and sensation seeking on the gambling choices of social drinkers. *Psychology of Addictive Behaviors, 13*, 243–252.

Cunningham-Williams, R. M., Cottler, L. B., Compton, W. M., & Spitznagel, E. L. (1998). Taking chances: Problem gamblers and mental health disorders–results from the St. Louis Epidemiologic Catchment Area (ECA) Study. *American Journal of Public Health, 88*, 1093–1096.

Cutter, H. S. G., Green, L. R., & Harford, T. C. (1973). Levels of risk taken by extraverted and introverted alcoholics as a function of drinking whiskey. *British Journal of Social and Clinical Psychology, 12*, 83–89.

Daghestani, A. N., Elenz, E., & Crayton, J. W. (1996). Pathological gambling in hospitalized substance abusing veterans. *Journal of Clinical Psychiatry, 57*, 360–363.

Ellery, M., Stewart, S. H., Loba, P., & Klein, R. M. (2005). Alcohol's effects on video lotto terminal (VLT) play among probable pathological and nonpathological gamblers. *Journal of Gambling Studies, 21*, 299–324.

Feigelman, W., Wallisch, L. S., & Lesieur, H. R. (1998). Problem gamblers, problem substance users, and dual-problem individuals: An epidemiological study. *American Journal of Public Health, 88*, 467–470.

Feinstein, A. R. (1970). The pre-therapeutic classification of comorbidity in chronic disease. *Journal of Clinical Epidemiology*, *23*, 455–468.

Giacopassi, D., Stitt, B. G., & Vandiver, M. (1998). An analysis of the relationship of alcohol to casino gambling among college students. *Journal of Gambling Studies, 14*, 135–149.

Haberman, P. W. (1969). Drinking and other self-indulgences: Complements or counter-attractions? *International Journal of Addiction, 4*, 157–167.

Kushner, M. G., Abrams, K., & Borchardt, C. (2000). The relationship between anxiety disorders and alcohol use disorders: A review of major perspectives and findings. *Clinical Psychology Review, 20*, 149–171.

Kyngdon, A., & Dickerson, M. (1999). An experimental study of the effect of prior alcohol consumption on a simulated gambling activity. *Addiction, 94*, 697–707.

Lejoyeux, M., Feuche, N., Loi, S., Solomon, J., & Ades, J. (1999). Study of impulse-control disorders among alcohol-dependent patients. *Journal of Clinical Psychiatry, 60*, 302–305.

Lesieur, H. R., & Blume, S.B (1987). The South Oaks Gambling Screen (SOGS): A new instrument for the identification of pathological gambling. *American Journal of Psychiatry, 144*, 1184–1188.

Lesieur, H. R., Blume, S.B, & Zappa, R. (1986). Alcoholism, drug abuse and gambling. *Alcoholism Clinical and Experimental Research, 10,* 33–38.

Meier, S. E., Brigham, T. A., Ward, D. A., & Myers, F. (1996). Effects of blood alcohol concentrations on negative punishment: Implications for decision making. *Journal of Studies on Alcohol, 57*, 85–96.

National Opinion Research Center, (1999). *Gambling impact and behavior study: Report to the National Gambling Impact Study Commission*. Chicago, Illinois: University of Chicago.

Potenza, M. N., Steinberg, M. A., McLaughlin, S. D., Wu, R., Roundsaville, B. J., & O'Malley, S. S. (2001). Gender-related differences in the characteristics of problem gamblers using a gambling helpline. *American Journal of Psychiatry, 158*, 1500–1505.

Regier, D. A., Farmer, M. E., Rae, D. S., Locke, B. Z., Keith, S. J., Judd, L. J., & Goodwin, F. K. (1990). Comormidity of mental disorders with alcohol and other drug abuse: Results from the Epidemiologic catchment area (ECA) Study. *Journal of the American Medical Association, 264*, 2511–2518.

Shaffer, H. J., Hall, M. N., & Vander Bilt, J. (1999). Estimating the prevalence of disordered gambling behavior in the United States and Canada: A research synthesis. *American Journal of Public Health, 89*, 1376.

Sjoberg, L. (1969). Alcohol and gambling. *Psychopharmacologia, 14*, 284–298.

Smart, R. G., & Ferris, J. (1996). Alcohol, drugs and gambling in the Ontario adult population. *Canadian Journal of Psychiatry, 41*, 36–45.

Stewart, S. H., McWilliams, L. A., Blackburn, J. R., & Klein, R. A. (2002). Laboratory-based investigation of the influence of video lottery terminal (VLT) play on mood and alcohol consumption among regular VLT players. *Addictive Behaviors, 27*, 819–835.

Stinchfield, R. (2001). Reliability, validity, and classification accuracy of the South Oaks Gambling Screen (SOGS). *Addictive Behaviors, 27*, 1–19.

Stinchfield, R. (1999). Gambling Treatment Outcome Monitoring System, In K. M. Coughlin (Ed.), *Behavioural Outcomes and Guidelines Source book* (pp. 533–535). New York: Faulkner & Gray.

Stinchfield, R., & Winters, K. C. (2001). Outcome of Minnesota's gambling treatment programs. *Journal of Gambling Studies, 17*, 217–245.

Toneatto, T., Skinner, W., & Dragonetti, R. (2002). Patterns of substance use in treatment-seeking problem gamblers: Impact on treatment outcomes. *Journal of Clinical Psychology, 58*, 853–859.

F, J., Barnes, G., Wieczorek, W., Tidwell, M. C., & Parker, J. (2001). Alcohol and gambling pathology among U.S. adults: Prevalence, demographic patterns, and comorbidity. *Journal of Studies on Alcohol, 62*, 706–712.

Winters, K. C., & Kushner, M. G. (2003). Treatment issues pertaining to pathological gamblers with a comorbid disorder. *Journal of Gambling Studies, 19*, 261–278.

World Health Organization (WHO), (1993). *Tenth Revision of the International Statistical Classification of Diseases and Related Health Problems (ICD-10).* Geneva: WHO.