J Gambl Stud (2015) 31:1107–1117
DOI 10.1007/s10899-015-9533-2

ORIGINAL PAPER

Smoking and Gambling Disorder: Does Tobacco Use Influence Treatment Outcome?

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Published online: 10 March 2015

Abstract The purpose of this study was to verify whether tobacco use influenced treatment outcome in a population of treatment seeking individuals with gambling disorder. Gambling disorder is defined as persistent and maladaptive gambling behaviour which meets four or more outlined criteria in the DSM-5. Tobacco use is the most frequent comorbidity with gambling disorder. A total of 676 treatment seeking individuals with gambling disorder were assessed at the National Problem Gambling Clinic in London. We analysed differences in socio-demographic, clinical and gambling variables between smokers and non-smokers and the relation between smoking behaviour and treatment completion and outcome. 46.4 % (314) of our sample were daily tobacco users and were significantly younger, less likely to be in a stable relationship, more likely to be unemployed and have a lower education level. They were also significantly more likely to score higher on the AUDIT-C score and were significantly more likely to have used drugs in the last 30 days. There was no significant difference in PGSI score between smokers and non-smokers. We found that tobacco smokers did not have higher PGSI scores than non-smokers. Moreover, there was no significant difference between tobacco users and nonusers in terms of treatment completion and treatment outcome.

Keywords Gambling disorder · Pathological gambling · Comorbidity · Tobacco · Treatment · Smoker

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Introduction

In the UK, gambling is a legal and legitimised recreational activity (Meyer et al. 2009). The Health Survey for England (2012) found that, out of a sample of 9000 people, 68 % men and 61 % of women had gambled in the last 12 months. Although many of these people gamble recreationally, the survey found that 0.8 % of men and 0.2 % of women met the criteria for being 'pathological gamblers' according to the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV). 'Pathological gambling' has been renamed 'gambling disorder' in the DSM-5 and moved to the category of drug and alcohol use disorders as common characteristics are shared with substance use disorders (American Psychiatric Association 2013).

A considerable amount of research has looked at the comorbidity of gambling disorder and other problematic behaviours. This includes the association between gambling disorder and illicit drug/alcohol abuse/dependence (Afifi et al. 2010; Cunningham-Williams et al. 1998; Kessler et al. 2008; Park et al. 2010); gambling disorder and psychiatric conditions such as major depression, bipolar disorder (Cunningham-Williams et al. 1998; Kessler et al. 2008; Park et al. 2010; Petry 2005) and any anxiety disorders (Kessler et al. 2008; Petry 2005; Park et al. 2010) and gambling disorder and nicotine dependence (Cunningham-Williams et al. 1998; Kessler et al. 2008; Park et al. 2010; Petry 2005). A meta-analysis was conducted about the prevalence of gambling disorder comorbidities; it found that highest mean prevalence was for nicotine dependence (60.1 %), followed by a substance use disorder (57.5 %), any type of mood disorder (37.9 %) and any type of anxiety disorder (37.4 %) (Lorains et al. 2011). This finding that nicotine dependence is the most frequent comorbidity is well supported by other research (Grant et al. 2008; Morasco et al. 2006; Odlaug et al. 2013; Petry and Oncken 2002).

To date the research into the comorbidity of gambling disorder and smoking has yielded many interesting findings. Tobacco dependence is higher in a population of people with gambling disorder than in the general population. The range of tobacco dependent individuals within a treatment seeking population of problem gamblers is somewhere between 41 and 69 % (Crockford and El-Guebaly 1998; Cunningham-Williams et al. 1998; Potenza et al. 2004; Smart and Ferris 1996; Stinchfield and Winters 1996). Findings have also demonstrated that people who are tobacco dependent have a higher frequency of psychiatric problems and higher gambling severity (Crockford and El-Guebaly 1998; Fagan et al. 2007; Grant and Potenza 2005; Grant et al. 2008; Grant et al. 2009a; McGrath and Barrett 2009; Petry and Oncken 2002; Shaffer et al. 1999; Smart and Ferris 1996; Stinchfield and Winters 1996; Toneatto et al. 2002). Tobacco dependent individuals also have been found to report more problems with other drugs other than alcohol such as marijuana, cocaine and opiates than non-tobacco dependent individuals (Petry et al. 2005). Research has demonstrated that within a treatment seeking population of gamblers factors such as severity of gambling, co-occurring psychiatric symptoms and higher family and social conflict can impact on treatment outcome (Petry and Oncken 2002). There is also evidence that co-occurring addictions can have an adverse effect on treatment outcomes (Grant and Potenza 2005; Mooney et al. 2011). Tobacco use specifically has been found to negatively affect treatment outcome for alcohol (Bobo et al. 1998).

Given that there are factors which exist that are known to affect treatment outcomes in individuals with gambling disorder, the evidence is clear for the importance of assessing the effects of tobacco smoking on treatment outcome (Crockford and El-Guebaly 1998; Grant and Potenza 2005; Mooney et al. 2011). To our knowledge very little research has

been conducted which has looked at the effect of tobacco dependence on individuals with gambling disorder, and how this might affect treatment outcome despite the fact that it has been noted in the literature that it is vital to look at this effect. Such knowledge would better equip practitioners, serve to give patients the most effective treatment and would also expand the literature on the various factors that may affect gambling treatment (Grant et al. 2008; Odlaug et al. 2013). There is evidence to suggest that gambling may have an adverse effect on individuals who are trying to stop smoking (Grant et al. 2008), although we have found few studies that have specifically looked at the impact of tobacco use on treatment outcome for gambling disorder. One study found tobacco was the strongest predictor of relapse to gambling after response to psychotherapy (Grant et al. 2009b). Another suggested that tobacco use is associated with higher relapse rates after cognitive behavioural therapy treatment (Grant et al. 2011). Conversely another paper concluded that daily tobacco use had no significant effect on treatment completion or the number of days gambled at the 6 month post treatment follow up (Odlaug et al. 2013). Given the very high proportion of individuals with gambling disorder who use nicotine (Crockford and El-Guebaly 1998; Cunningham-Williams et al. 1998; Potenza et al. 2004; Smart and Ferris 1996; Stinchfield and Winters 1996) and the knowledge that co-occurring addictions have an adverse effect on treatment outcome (Grant and Potenza 2005; Mooney et al. 2011; Petry and Oncken 2002; Winters and Kushner 2003) in alcohol treatment, which has found to share many similarities with gambling disorder (Grant et al. 2006), it seems that assessing the impact of tobacco use on treatment outcome is extremely prudent (Odlaug et al. 2013).

The aim our research, therefore, is to determine if daily tobacco use affects treatment outcome for our population of individuals seeking treatment for gambling disorder. In line with the aforementioned literature, we hypothesize that daily tobacco use will have an effect on treatment outcome, both in terms of treatment completion and treatment success. Success within our study is measured using PGSI score, validated in a number of studies (Holtgraves 2009), the number of days gambled out of the last 30 days, and we will also use the General Anxiety Scale (GAD-7), a widely used 7 item scale which looks at anxiety over the past 2 weeks (Spitzer et al. 2006) and the Patient Health Questionnaire (PHQ-9) a widely used 9 item scale for measuring depression within the past 2 weeks (Kroenke et al. 2001). Scores are measured at the start of treatment, the end and follow up treatments.

Methods

Sample

Data was collected from clients who were voluntarily seeking treatment at the National Problem Gambling Clinic (NPGC) between January 2011 and December 2012. The NPGC is the first and only National Health Service clinic in the UK that provides treatment for pathological gamblers. Cognitive Behavioural therapy is the main type of treatment offered, and is delivered in three different ways; in a group setting, individually, and remotely over the phone for those who are unable to travel weekly to the clinic. On first time into treatment clients are assessed; this assessment is an opportunity to gain information about the clients gambling behaviour and related information, including clinical variables (e.g. PHQ-9, GAD-7). Socio-demographic variables were obtained from the referral form which each client is required to fill in prior to assessment. During the assessment, clients

were informed that information collected from the referral and assessment forms would be analysed by researchers in order to increase understanding about problem gambling. Oral consent was obtained from clients before filling in the assessment from. Over the course of the present study, 736 clients were assessed at the clinic. From this initial sample there were a number of clients excluded from the study (n = 52 due to missing data about the use of tobacco, and n = 8 due to a PGSI score <3). The final sample therefore consisted of 676 clients.

Assessment

Clinical Interview

During the interview clients were asked to describe their gambling behaviour (type of gambling, frequency, money spent, age noted gambling became problematic, history of gambling behaviour, debts, total amount lost on gambling, previous treatment) psychiatric, medical and forensic history, family psychiatric history, family structure and impact of gambling on family and personal history.

Assessment Forms

Self-administered questionnaires

- Problem Gambling Severity Index (PGSI). Validated by a number of studies (Holtgraves 2009), the PGSI is a 9 item questionnaire which measures gambling severity. It consists of four questions that assess problematic gambling behaviour and five questions that assess adverse consequences of gambling. The items are scored from 0 to 3 based on symptom frequency; (0 = never, 1 = sometimes, 2 = most of the time, 3 = almost always). The score that can be obtained from the PGSI ranges from 0 to 27. Gambling risk is then divided into categories; with a score of 0 indicating a non-problem gambler, a score of 1–2 indicates a 'low-risk' gambler; 3–7 indicates a 'moderate risk' gambler and a score of 8 and above indicates a 'problem' gambler (Ferris and Wynne 2001).
- Patient Health Questionnaire (PHQ-9). The PHQ-9 is a 9-item instrument which is widely used to measure severity of depression. The questionnaire evaluates each of the 9 DMS-IV criteria for depression, measuring each item on a scale from 0 to 3 depending on the frequency of symptoms (0 = not at all; 1 = several days; 2 = more than half the days; 3 = nearly every day) (Kroenke et al. 2001). Scores of 5, 10, 15 and 20 are used as cut-off points for mild, moderate, moderately severe, and severe depression. The PHQ-9 has been commended for its high sensitivity and specificity for diagnosing depression, good internal consistency, convergent and discriminant validity, robustness of factor structure, and responsiveness to change (Kroenke et al. 2010).
- Generalised Anxiety Disorder (GAD-7). The widely used 7-item GAD-7 measures anxiety over the previous 2 weeks. Individuals respond to questions on a scale of 0–3(0 = not at all; 1 = several days; 2 = more than half the days; 3 = nearly every day) (Spitzer et al. 2006). Scores range from 0 to 27; Scores of 5, 10, and 15 are taken as the cut off points for mild, moderate, and severe anxiety (Kroenke et al. 2007). The GAD-7 has been credited with having good convergent validity with other measures of anxiety (Kroenke et al. 2010) and described as having good sensitivity and specificity for Generalised Anxiety Disorder (Spitzer et al. 2006).

- Alcohol Use Disorders Identification Test-Consumption Questions (AUDIT-C). The AUDIT-C consists of three questions; two of which assess regular drinking in terms of frequency and quantity, the third assessing binge drinking (which is defined as six or more alcoholic drinks in one sitting, at least once a month in the preceding 3 months) (Bush et al. 1998). Answers are ranked from 0 to 4, and the final score is the sum of each question. A score of five or more indicates hazardous drinking. The AUDIT-C is a validated and well established screening tool (Frank et al. 2008; Meneses-Gaya et al. 2010).
- Tobacco Behaviour: All subjects were questioned about their tobacco use [frequency (i.e. daily) and amount (i.e. 20)].
- Drug Use: To determine other drug use we administered a specific questionnaire that asked about each drug in turn (marijuana, cocaine, crack cocaine, opiates, opiate substitutes, ecstasy). For each drug we asked about lifetime use, current use and number of days used in the past 30 days.

Data Analysis

We used the SPSS 20.0 computer software program to conduct statistical analyses. All hypothesis tests were performed using a two-sided significance level ($\alpha = 0.05$). The first step of our analysis was to compare the socio-demographic, gambling-related information and clinical variables between tobacco users and nonusers. We used a two-tailed *t* test or Mann–Whitney test for continuous variables and a Chi-square and Fisher's exact testing for categorical variables. The second step was to identify if there was significant difference between the two groups in relation to the treatment outcome (completed, DNA, drop out treatment and other), using Chi-square and Fisher's tests. In the third step of the analysis we included only the people who completed treatment to verify the effectiveness of the treatment in both groups, using *t*-test and the PGSI, GAD-7, PHQ-9 scores and days gambled in the previous 30 days as outcome variables. At the beginning we analysed the scores in both groups separately to evaluate if there was an improvement, i.e. a reduction in scores. We then compared the data at treatment end data to verify if there was a significant difference between tobacco users and nonusers. The fourth step of our study involved using logistic regression to examine the relationship between demographic and clinical characteristics measured at baseline and treatment completion, using a Nagelkerke R^2 (Nagelkerke 1991). The dependent variable was treatment outcome (completed or drop out); we included two kinds of predictor in the model:

- socio-demographic variables: gender, age, ethnicity (white/not white), marital status (married or in a stable relationship/not married or in a stable relationship), employment status (employed/not employed) and educational level (GCSE or more/not GCSE or more);
- clinical variables: scores at PGSI, PHQ-9, GAD-7, AUDIT-C tests, use of drugs in the last 30 days (yes/not), gambled in the last 30 days (yes/not), past treatment for gambling disorder (yes/not).

Results

Of the 684 pathological gamblers assessed, 314 (46.4 %) reported tobacco use and 362 (53.6 %) reported no tobacco use. All tobacco users were cigarette smokers. Socio-demographic and clinical data comparison between smokers and nonsmokers is presented in

Table 1. Tobacco users were significantly younger than nonusers ($p = .001$), the education level of tobacco users was overall lower than that of nonusers ($p < .01$), and they also had a lower rate of employment ($p < .01$) and were less likely to be engaged, married or in a stable relationship ($p < .01$). Clinical characteristics also showed significant differences in substance use, the AUDIT-C score was higher among smokers ($p < .01$), and tobacco smokers were more likely to have used substances other than alcohol in the 30 days before assessment ($p < .01$).

A total of 239 individuals either did not attend treatment after it was offered to them or did not complete treatment; this was either by mutual consent or for other reasons, and they were therefore excluded from further analysis. In the remaining sample (n = 437), 237 (54.2 %) were found to be nonsmokers, while 200 (45.8 %) were smokers. A total of 315 patients out of 437 completed treatment (72.1 %) and 122 (27.9 %) dropped out. Among the 315 patients who completed treatment, 178 (56.5 %) were nonsmokers, and 137 (43.5 %) were smokers; among the 122 patients who dropped out of treatment, 59 (48.4 %) were nonsmokers, while 63 (51.6 %) were smokers. We assessed for changes in smoking behaviour at follow-up, and found that a total of eight subjects had started using tobacco during treatment, while 12 had quit. Chi-squared tests showed no significant difference in likelihood of completing treatment with regard to smoking behaviour.

A comparison of clinical variables at the time of assessment and at follow-up is presented in Table 2. Clinical variables showed significant improvement between client intake and follow-up, but no significant difference between tobacco use groups.

Lastly, we examined the relationship between smoking behavior and treatment completion through logistic regression, which was carried out in three models: Model I was limited to tobacco use and accounted for <1 % of the variance according to Nagelkerke R^2 ($R^2 < .01$), Model II controlled for significant socio-demographic factors, accounting for 8.8 % of the variance ($R^2 = .088$) whereas Model III controlled for socio-demographic factors and clinical variables and accounted for 13 % of variance ($R^2 = .13$). All models showed no significant difference in treatment completion between tobacco users and nonusers. When we controlled for socio-demographic and clinical variables, the only factors that showed significant correlation with treatment completion were age (OR .972; CI .947–997; $p < .05$) and having at least completed primary education (OR 4.08; CI 1692–9848; $p < .01$).

Discussion

The purpose of our study was to determine if daily tobacco use would influence treatment outcome in problem gamblers. Consistent with previous findings 46.4 % of the individuals within our population were daily tobacco users (Crockford and El-Guebaly 1998; Cunningham-Williams et al. 1998; Potenza et al. 2004; Smart and Ferris 1996; Stinchfield and Winters 1996), which is significantly higher than the 20 % figure found in the general British population (Office for National Statistics 2012). At baseline we found daily tobacco users within our population to be significantly younger than nonusers ($p = .001$), in keeping with previous studies (McGrath and Barrett 2009; Odlaug et al. 2013). Significant differences were found between daily tobacco users and non-users, with tobacco users less likely to be in a stable relationship ($p < .01$). We also found tobacco users less likely to be employed ($p = .000$) and with a lower level of qualification ($p < .01$). Consistent with previous findings daily tobacco users had significantly higher AUDIT-C scores ($p < .01$),

Table 1 Baseline demographic and clinical variables of the sample grouped by tobacco use (n = 676)

Variable	No tobacco use (n = 362)	Tobacco use (n = 314)	
Demographics			
Age Mean (SD)	37.28 (11.591)	34.59 (10.030)	$t = 3.193$ ($p = .001$)
Male N (%)	338 (54.2)	286 (45.8)	$X^2 = 1.239$ ($p = .266$)
Female N (%)	24 (46.2)	28 (53.8)	
Ethnicity			
White N (%)	260 (53.5)	226 (46.5)	$X^2 = .006$ ($p = .938$)
Other N (%)	91 (53.9)	78 (46.2)	
Educational level			
No education N (%)	30 (44.1)	38 (55.9)	$X^2 = 14.893$ ($p = .002$)
GCSE/A N (%)	118 (51.5)	111 (48.5)	
Degree N (%)	128 (61.8)	79 (38.2)	
Other N (%)	13 (33.3)	26 (66.6)	
Marital status			
Single, divorced, separated, widowed N (%)	192 (48.7)	202 (51.3)	$X^2 = 10.416$ ($p = .001$)
Married, living together N (%)	148 (61.9)	91 (38.1)	
Employment status			
Employed N (%)	254 (57.7)	186 (52.3)	$X^2 = 23.287$ ($p = .000$)
Unemployed N (%)	51 (44.3)	64 (55.6)	
Student N (%)	8 (44.4)	10 (66.6)	
Retired N (%)	13 (92.9)	1 (7.1)	
Other N (%)	26 (37.7)	43 (62.3)	
Gambling variables			
PGSI Score Mean (SD)	19.42 (5.046)	20.16 (4.729)	$t = -1.948$ ($p = .066$)
Days gambled in pre-assessment month Mean (SD)	11.93 (10.193)	11.76 (10.476)	$t = .202$ ($p = .840$)
Clinical variables			
Patient Health Questionnaire score Mean (SD)	12.88 (8.768)	13.18 (7.069)	$t = -.476$ ($p = .634$)
Generalised Anxiety Disorder score Mean (SD)	9.91 (6.109)	10.58 (5.925)	$t = -1.43$ ($p = .151$)

Table 1 continued

Variable	No tobacco use (n = 362)	Tobacco use (n = 314)	
Alcohol Use Disorders Identification Test consumption score Mean (SD)	4.36 (2.798)	5.21 (3.018)	$t = -3.774$ ($p = .000$)
Use of drugs in pre-assessment month			
No N (%)	328 (60.0)	219 (40.0)	$X^2 = 50.49$ ($p = .000$)
Yes N (%)	26 (23.9)	86 (76.1)	

Table 2 Clinical variables at intake and follow-up by smoking behavior

Variable	Tobacco use group	Assessment Mean (SD)	Follow-up Mean (SD)
PGSI	No	19.71 (4.86)	8.49 (8.45)
	Yes	19.35 (4.78)	9.35 (8.36)
# Days gambled in the last month	No	11.89 (10.57)	1.95 (4.62)
	Yes	10.49 (10.04)	2.41 (4.83)
PHQ	No	12.78 (10.05)	4.93 (5.45)
	Yes	12.25 (7.03)	5.65 (6.02)
GAD	No	9.25 (5.92)	3.61 (4.45)
	Yes	9.57 (5.77)	4.88 (5.45)

and had reported a higher frequency of drug use in the past 30 days prior to assessment ($p < .01$) (Afifi et al. 2010; Cunningham-Williams et al. 1998; Kessler et al. 2008; Park et al. 2010; Petry 2005).

However, we found no difference in PGSI scores or in the clinical variables (GAD-7 and PHQ-9) between daily tobacco users and nonusers, in contrast with findings that smokers with gambling disorder present with a higher severity of psychiatric problems (Cunningham-Williams et al. 1998; Kessler et al. 2008; McGrath and Barrett 2009; Odlaug et al. 2013; Park et al. 2010; Petry 2005;). Moreover, contrary to our hypothesis, daily tobacco use had no significant effect on whether a client would complete or drop out of treatment, a finding that was reported in only one prior study (Odlaug et al. 2013), and suggests that daily tobacco use had no adverse effect on treatment outcome. At the end of treatment, we examined clinical variables, PGSI score, and the number of days the individual had gambled out of the previous 30. All of these variables significantly improved at treatment end, i.e. PGSI, PHQ-9, GAD-7 scores all decreased, as did number of days gambled. Previous research had shown that daily tobacco smokers have higher comorbidity and higher severity with other psychiatric disorders than non-smokers (Grant et al. 2009a; Odlaug et al. 2013); however, our analysis of depression, anxiety, alcohol and drug use comorbidities showed that they were non-significant predictors of treatment outcome, although it must be noted that the typology and extent of drug use was not examined in the present study. Finally, when all socio-demographic and clinical variables were controlled, we found that the only factor that correlated with treatment completion was education,

namely that those who had completed a least primary education were more likely to complete treatment.

There is also evidence that nicotine alters the processes in gambling; with heavy smokers performing poorer than non-smokers on a simulated task of gambling (Businelle et al. 2009; McGrath et al. 2012). There is also evidence in the drug and alcohol literature that that those who stopped smoking alongside their treatment were 25 % more likely to maintain long term abstinence from alcohol and illicit drugs (Prochaska et al. 2002). It has been suggested that, although tobacco contributes to more severe gambling symptoms, potentially through a complex biological, environmental and genetic aetiology, it might not interfere on the therapeutic effects of treatment on gambling (Grant and Potenza 2005; Grant et al. 2009c; Odlaug et al. 2013).

This study has some limitations. Firstly, our sample is a voluntary treatment seeking population which may be different from non-treatment seeking gamblers in the general population. Secondly, subjects were classified on current tobacco use, so an individual's past episode use (e.g., "chipping"), or other form of tobacco consumption were not classified. Moreover, we considered daily tobacco smokers as the only group. We didn't consider additional information about type, duration, age of onset of tobacco use, as well as of quantity. Such information could be useful to better understand the relationship between tobacco and gambling disorder. Thirdly because 35.4 % of our clients who were assessed had yet to start treatment, or who completed treatment before the end (and therefore couldn't be considered as drop outs), we couldn't use all clients for the last step of our analysis.

In conclusion, we found that daily tobacco use had no statistically significant effect on treatment completion in the short term. One possible explanation for these results is that treatment on gambling might also influence tobacco use, since the neurobiological bases and treatment methods for different addictions largely overlap. Another consideration that should be made is that treatment-seeing pathological gamblers might significantly differ from those who do not seek treatment, in that comorbid psychiatric conditions and substance use may be more severe among the latter. Further studies on this matter should take the extent of tobacco use in consideration, and include follow-up data on cessation of gambling in relation to tobacco use behaviour. We conclude that treatment for tobacco use should be undertaken on the grounds of the negative effects of tobacco on general and psychiatric health, but it does not influence immediate gambling disorder treatment outcome, although follow-up studies would be necessary to confirm this hypothesis in the long term.

Conflict of interest The authors declare that they have no conflict of interest.

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