

THE EFFECTS OF NICOTINE ON VIDEO LOTTERY TERMINAL GAMBLING IN
REGULAR GAMBLERS WHO SMOKE

by

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Submitted in partial fulfilment of the requirements
for the degree of Doctor of Philosophy

at

Dalhousie University
Halifax, Nova Scotia
November 2012

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DALHOUSIE UNIVERSITY
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DALHOUSIE UNIVERSITY

DATE: November 13, 2012

AUTHOR: Daniel Stephen McGrath

TITLE: THE EFFECTS OF NICOTINE ON VIDEO LOTTERY TERMINAL
GAMBLING IN REGULAR GAMBLERS WHO SMOKE

DEPARTMENT OR SCHOOL: Department of Psychology

DEGREE: PhD CONVOCATION: May YEAR: 2013

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Table of Contents

List of Tables	viii
List of Figures	ix
Abstract	x
List of Abbreviations Used	xi
Acknowledgements	xii
CHAPTER ONE: INTRODUCTION	1
Introduction	3
Gambling in Canada	4
Electronic Gaming Machines (EGMs)	4
Co-morbid Substance Use and Gambling	5
Tobacco Use and Gambling	6
Aetiological Models of Comorbid Smoking and Gambling	9
Neurobiological Influences	9
Psychological Influences	13
Social Influences	16
Effects of Smoking Bans on Gambling	17
Treatment of Comorbid Smoking and Gambling	19
Limitations of Previous Research	21
Prologue to the Dissertation Investigations	23
CHAPTER TWO: SECONDARY DATA ANALYSIS: A COMPARISON OF GAMBLING BEHAVIOUR, PROBLEM GAMBLING INDICES, AND REASONS FOR GAMBLING AMONG SMOKERS AND NON-SMOKERS WHO GAMBLE: EVIDENCE FROM A PROVINCIAL GAMBLING PREVALENCE STUDY	25
Abstract	26

Introduction	27
Methods	29
Questionnaire Respondents	29
Statistical Analysis	32
Results	32
Discussion	35
CHAPTER THREE: EXPERIMENT ONE: THE EFFECTS OF ACUTE DOSES OF NICOTINE ON VIDEO LOTTERY TERMINAL GAMBLING IN DAILY SMOKERS	40
Abstract	41
Introduction	42
Methods	43
Participants	43
Measures	44
Visual Analog Scales (VAS; Bond & Lader, 1974)	44
Post-VLT Play Questionnaire	44
Apparatus	45
Inhalers	45
VLTs	45
Heart Rate Monitor	46
Procedure	46
Data Analyses	48
Results	48

Visual Analog Scales (VAS; Bond & Lader, 1974)	48
Post-VLT Play Questionnaire	50
Betting Patterns	51
Heart Rate	52
Tests for the Presence of Order Effects	53
Discussion	54
CHAPTER FOUR: EXPERIMENT TWO: THE INFLUENCE OF ACUTELY ADMINISTERED NICOTINE ON CUE-INDUCED CRAVING FOR GAMBLING IN AT-RISK VIDEO LOTTERY TERMINAL GAMBLERS WHO SMOKE	59
Abstract	60
Introduction	61
Methods	65
Study Recruitment	65
Participants	66
Procedure	66
Blinding	66
Test Procedures	66
Cue Presentations	67
Lozenges	68
Measures	69
Visual Analog Scales (VAS; Bond & Lader, 1974)	69
Gambling Craving Scale (GACS; Young & Wohl, 2009)	69
Questionnaire of Smoking Urges - Brief (QSU-B; Cox et al., 2001)	69
Behavioural Task	69

Apparatus	70
Carbon Monoxide Reader	70
Heart Rate Monitor	70
VLTs	70
Data Analyses	70
Results	71
Visual Analog Scales (VAS; Bond & Lader, 1974)	71
Gambling Craving Scale (GACS; Young & Wohl, 2009)	74
Questionnaire of Smoking Urges - Brief (QSU-B; Cox et al., 2001)	76
Behavioural Task	76
Heart Rate	76
Assessment of Carryover Effects	77
Discussion	78
CHAPTER FIVE: GENERAL DISCUSSION AND CONCLUSION	83
References	97
Appendix A: Government of Newfoundland and Labrador-Gambling Prevalence Study Final-August 30, 2005	111
Appendix B: Study 1 Informed Consent	127
Appendix C: Study 1 Telephone Screen and FTND	132
Appendix D: Study 1 Measures Administered	135
Appendix E: Study 2 Informed Consent Form	142
Appendix F: Study 2 Telephone Screen, FTND, & PGSI	152
Appendix G: Study 2 Measures Administered	159
Appendix H: Copyright Release Letters	165

List of Tables

Table 1		
<i>Chi-Square Analyses for Demographic Characteristics of Non-smokers versus Smokers for the Secondary Data Analysis in Chapter Two.</i>		31
Table 2		
<i>Binary Logistic Regression for Gambling Involvement among Non-smokers and Smokers for the Secondary Data Analysis in Chapter Two.</i>		33
Table 3		
<i>Binary Logistic Regression for Problem Gambling Correlates among Non-smokers and Smokers for the Secondary Data Analysis in Chapter Two.</i>		34
Table 4		
<i>Binary Logistic Regression for Reasons for Gambling among Non-smokers and Smokers for the Secondary Data Analysis in Chapter Two.</i>		35

List of Figures

Figure 3.1

Unadjusted Mean Ratings for VAS Item ‘Crave Cigarette’ for Nicotine Inhaler (NI) and Placebo Inhaler (PI) Conditions at: Baseline (T1); Following Inhaler Administration (T2); During VLT Play (T3); And Post-VLT Play (T4) in Experiment 1.

49

Figure 3.2

Unadjusted Mean Ratings for VAS Item ‘Want to Play VLT’ for Nicotine Inhaler (NI) and Placebo Inhaler (PI) Conditions at: Baseline (T1); Following Inhaler Administration (T2); During VLT Play (T3); And Post-VLT Play (T4) in Experiment 1.

50

Figure 3.3

Average ‘Number of Bets Per Minute’, ‘Dollars Spent Gambling’, and ‘Number of Maximum Bets Made’ During VLT Sessions for Nicotine Inhaler (NI) and Placebo Inhaler (PI) Conditions in Experiment 1.

52

Figure 4.1

Unadjusted Mean Ratings for VAS Item ‘Crave Cigarette’ for Nicotine Lozenge (NL) and Placebo Lozenge (PL) Conditions at: Baseline (T1); Following Lozenge Administration (T2); Following Neutral-Cue Presentation (T3); and Following Gambling-Cue Presentation (T4) in Experiment 2.

72

Figure 4.2

Unadjusted Mean Ratings for VAS Item ‘Crave VLTs/Slots’ for Nicotine Lozenge (NL) and Placebo Lozenge (PL) Conditions at: Baseline (T1); Following Lozenge Administration (T2); Following Neutral-Cue Presentation (T3); and Following Gambling-Cue Presentation (T4) in Experiment 2.

73

Figure 4.3

Unadjusted mean ratings for VAS item ‘Crave VLTs/slots’ for nicotine lozenge (NL) and placebo lozenge (PL) conditions at: following neutral-cue presentation (T3) and following gambling-cue presentation (T4) in Experiment 2.

74

Figure 4.4

Unadjusted Mean Ratings for GACS (Young & Wohl, 2009) Factors ‘Anticipation of Gambling’, ‘Desire for Gambling’, and ‘Relief of Negative Affect’ for Nicotine Lozenge (NL) and Placebo Lozenge (PL) Conditions at: Baseline (T1); Following Lozenge Administration (T2); Following Neutral-Cue Presentation (T3); and Following Gambling-Cue Presentation (T4) in Experiment 2.

75

Abstract

A growing body of evidence has established that smoking and gambling frequently co-occur. Despite high rates of co-occurrence, few studies have attempted to examine the extent to which nicotine can directly affect gambling behaviour. This dissertation further explores the relationship between smoking and gambling through a secondary data analysis and two laboratory-based experiments. First, a secondary data analysis was conducted using epidemiological data collected from a gambling prevalence survey in Newfoundland and Labrador. The results from this analysis revealed several associations between smoking and past 12 month gambling. Significant relationships were found between smoking and problem gambling severity scores, use of alcohol/drugs while gambling, money spent gambling, use of video lottery terminals (VLTs), and reasons for gambling related to positive reinforcement/reward and negative reinforcement/relief. Experiment 1 consists of a laboratory investigation of the acute effects of nicotine on subjective and behavioural responses to VLT gambling among gamblers who smoke. Twenty-eight (15 male) regular gamblers who smoke daily took part in two double-blind laboratory sessions where subjective and behavioural responses to gambling were assessed following administration of nicotine inhalers (NI; 4mg deliverable) or placebo inhalers (PI). It was found that NI significantly decreased tobacco-related cravings but did not affect gambling-related cravings, VLT betting, or subjective responses. In Experiment 2, the acute effects of nicotine on subjective, physiological, and behavioural gambling responses were examined in VLT players who smoke following exposure to gambling-related cues. Thirty (20 male) VLT gamblers (identified as ‘moderate risk’ or ‘problem gamblers’) who smoke daily were assigned to a nicotine lozenge (NL; 4mg deliverable) or placebo lozenge (PL) condition. Subjective and behavioural responses were assessed at baseline, following lozenge administration, following neutral cues, and following gambling cues. It was found that NL significantly reduced tobacco-related cravings but didn’t affect gambling-related cravings, the decision to play a VLT, or other subjective responses. The aggregate findings of Experiments 1 & 2 indicate that acutely administered nicotine reduced tobacco-related cravings without increasing the reinforcing value of gambling. These results suggest that use of nicotine replacement therapies (NRT) may be a safe option for gamblers who are attempting to quit smoking.

List of Abbreviations Used

Canadian Problem Gambling Index	CPGI
Electronic Gaming Machine	EGM
Fagerström Test for Nicotine Dependence	FTND
The Gambling Crave Scale	GACS
Heart Rate	HR
Nicotine Inhaler	NI
Nicotine Lozenge	NL
Nicotine Replacement Therapy	NRT
Placebo Inhaler	PI
Placebo Lozenge	PL
Problem Gambler	PG
Problem Gambling Severity Index	PGSI
Questionnaire of Smoking Urges - Brief	QSU-B
South Oaks Gambling Screen	SOGS
Substance Use Disorder	SUD
Visual Analog Scale	VAS
Video Lottery Terminal	VLT

Acknowledgements

Completing a doctoral dissertation is a considerable task that requires years of planning, execution, dedication, and a great deal of assistance from many people. There are number of fantastic individuals that I would like to thank for helping me achieve this goal. To begin, I would like to express my sincere gratitude to my graduate supervisor Dr. Sean Barrett. I feel very fortunate to have had the opportunity to complete my doctoral studies in your lab. Your mentorship, understanding, flexibility, and dedication to helping your students succeed have been invaluable to me. I look forward to continuing to foster our friendship and research partnership for many years to come.

I would like to gratefully acknowledge several agencies that have provided me with funding during my time at Dalhousie. Thank you to the Canadian Tobacco Control Research Initiative (CTCRI), the Dalhousie Department of Psychiatry, and Gambling Awareness Nova Scotia (GANS) for providing research grants for my doctoral research. Also, I would like to express a sincere thank you to both the Nova Scotia Health Research Foundation (NSHRF) and the Ontario Problem Gambling Research Centre (OPGRC) for helping to fund my graduate studies. Completion of the research projects contained in this dissertation would not have been possible without the generous financial assistance provided by these agencies.

I would also like to acknowledge those who have provided their advice and guidance for my dissertation as well as for other requirements of my PhD. A special thanks to the members of my dissertation committee, Dr. Vin LoLordo and Dr. Steven Smith, for all of the constructive feedback and suggestions. Sincere thanks to the supervisor of my comprehensive projects, Dr. Simon Sherry. I very much appreciated the opportunity to learn more about perfectionism as well as new research methodologies, which will undoubtedly serve to benefit my future research endeavors. Also, I would like to offer a special thank you to Dr. Sherry Stewart and Dr. Ray Klein. You have both been instrumental in guiding my graduate training and providing me with opportunities to grow as a scientist.

Several other individuals provided valuable assistance to me in completing my research. Special thanks to the students who had a direct role in the data collection process, specifically: Lyndsay Bozec, Evan Schmid, Anders Dorbeck, Tracy Monaghan, and Karen Hecimovic. Also, thank you to other staff members of the Dalhousie Gambling Laboratory that were always willing to help out when asked. Notably, the assistance provided by Pam Collins was invaluable. I would also like to thank the faculty and staff at Mount Allison University for allowing me to pursue a long-held goal of working as a professor at my alma matter.

Finally, I would like to express my appreciation to my friends and family. Thank you to Mom, Dad, and my brother Jamie; you have always been there to encourage me to follow my dreams. Most importantly, I would like to offer my sincere gratitude and love to my wife Pauwlina and my children Paloma and Sophia. Pauwlina, without your unwavering support none of this would have been possible, I love you very much. To our twin girls, you have brought great joy to my life and I look forward to all of the adventures we will have as a family. Also, don't worry; Daddy doesn't expect you to read this dissertation when you are older.

CHAPTER ONE: INTRODUCTION

Sections of this chapter were taken from the following:

McGrath, D. S., & Barrett, S. P. (2009). The comorbidity of tobacco smoking and gambling: A review of the literature. *Drug and Alcohol Review*, 28(6), 676-681. doi: 10.1111/j.1465-3362.2009.00097.x

McGrath, D. S., Barrett, S.P., McGrath, P.R., & Stewart, S. H. (2012). A comparison of gambling behaviour, problem gambling indices, and reasons for gambling among smokers and non-smokers who gamble: Evidence from a provincial gambling prevalence study. *Nicotine & Tobacco Research*, 14(7), 833-839. doi:10.1093/ntr/ntr294

McGrath, D. S., Barrett, S.P., Stewart, S.H., & Schmid, E.A. (2012). The effects of acute doses of nicotine on Video Lottery Terminal gambling in smokers. *Psychopharmacology*, 220, 155-161. doi: 10.1007/s00213-011-2465-3

McGrath, D. S., Dorbeck, A., & Barrett, S.P. (under review). The influence of acutely administered nicotine on cue-induced craving for gambling in at-risk video lottery terminal (VLT) gamblers who smoke. Manuscript submitted for publication in *Behavioural Pharmacology*, Dalhousie University.

Daniel McGrath served as first author for each of the manuscripts included in this document. He took the lead role in conducting a review of the relevant literature, planning and conducting the research, writing original manuscript drafts, and making revisions based on suggestions from co-authors, editors, and peer reviewers.

Introduction

The purpose of this dissertation is to more fully examine the relationship between tobacco smoking and gambling behavior. The overall goal is to further examine the influences of gambling-related variables on smoking status and to experimentally investigate the extent to which nicotine influences video lottery terminal (VLT) gambling behavior and cue-induced craving for gambling. First, the literature pertaining to co-occurring smoking and gambling behaviour is reviewed. The review includes an overview of epidemiological findings, aetiological models of smoking and gambling, the effects of smoking bans on gambling, treatment of co-morbid smoking and gambling dependence, and limitations of previous research. Following the literature review, three individual research studies are presented. The first study was comprised of a secondary-data analysis comparing gambling involvement, problem gambling correlates, and motives for gambling between smokers and non-smokers who are also regular gamblers. The data for this section comes from a provincial gambling prevalence study conducted in Newfoundland and Labrador in 2005. Next, two laboratory-based experiments are presented. The first is a within-subjects design experiment which examines the effects of nicotine lozenges (versus placebo) on VLT gambling behavior. The participants included in this study were regular gamblers who smoke daily. The second laboratory experiment consists of a within-between subjects design which compared the influence of nicotine lozenges (versus placebo lozenges). The participants recruited for this study were 'moderate' and 'problem' gamblers who smoke daily. Lastly, a general discussion is presented which elaborates further on the findings of the three investigations as well as

the limitations and strengths of this dissertation and areas for future studies of smoking and gambling.

Gambling in Canada

Gambling continues to be an increasingly popular form of entertainment in Canada with gambling revenues for all government-controlled forms of gambling growing from \$2.7 billion CAD in 1992 to \$13.8 billion CAD in 2009 (Marshall, 2010). Coinciding with the availability of recreational gambling has been a rapid increase in problematic gambling (Cox, Yu, Afifi, & Ladouceur, 2005; Shaffer, Hall, & Vander Bilt, 1999). Indeed, recent general population-based estimates of past 12-month problem gambling as identified on the Canadian Problem Gambling Index (CPGI; Ferris & Wynne, 2001) were 4.9% for men and 2.7% for women (Afifi, Cox, Martens, Sareena, & Enns, 2010a). While problem gamblers (PGs) represent a small minority of the total number of individuals who gamble in Canada, they have been found to disproportionately contribute to total gambling revenues (Williams & Wood, 2004).

Electronic Gambling Machines (EGMs)

In 2009, approximately 19% of all gambling revenue was directly attributable to VLTs (Marshall, 2010). Among currently available forms of gambling in Canada, evidence indicates that electronic gambling machines (EGMs) (e.g., slot machines, VLTs) are particularly associated with problematic gambling (Afifi, Cox, Martens, Sareen, & Enns, 2010b; Holtgraves, 2009). For instance, a recent gambling prevalence study from the Canadian province of Nova Scotia found that among self-identified problem gamblers, 67% mentioned that VLTs played a role in their gambling problem (Focal Research, 2007). Similarly, in neighboring Prince Edward Island, Doiron (2006)

found that VLT players were 37.97 times more likely to have a gambling problem than those who did not gamble on VLTs. In addition to higher rates of problematic gambling, Breen and Zimmerman (2002) also found that onset of PG occurred significantly sooner among primarily EGM players (average of 1.08 years) when compared to other ‘traditional’ forms of gambling (average of 3.58 years). Moreover, EGMs are also commonly linked to various psychosocial difficulties. For example, Petry (2003) reported that slot machine players experienced higher rates of bankruptcy and more psychiatric difficulties compared to individuals who preferred other types of gambling. In aggregate, these findings indicate that EGMs, possibly to a greater extent than other forms of gambling, are associated with gambling-related problems and harms.

Co-morbid Substance Use and Gambling

A sizable body of evidence suggests that problem gambling is highly comorbid with a number of substance use disorders (SUDs). A large epidemiological report, which surveyed over 43,000 households in the United States, found that most individuals who met the DSM-IV criteria for PG also reported having at least one other co-morbid SUD at some point during their life (Petry, Stinson, & Grant, 2005). Among the PGs surveyed, 73.2% reported an alcohol use disorder, 60.4% were nicotine dependent, and 38.1% abused other substances. These results are in line with earlier work which indicated that PGs were 23.1 times more likely to be alcohol dependent than non-PGs (Welte, Barnes, Wieczorek, Tidwell, & Parker, 2001). Using Canadian-based epidemiological data from Statistics Canada, el-Guebaly et al. (2006) found that respondents who reported substance dependence or harmful alcohol use were 2.9 times higher to meet the criteria for ‘moderate risk’ or ‘problem’ gambling according to the CPGI (Ferris & Wynne, 2001)

than those who did not. Finally, a recent epidemiological investigation suggests that rates of PG increase in step with the severity of an SUD (Rush, Bassani, Urbanoski, & Castel, 2008). For instance, the prevalence of moderate risk/problem gambling was found to be 1.0% among respondents who were 'abstinent' from substance use (i.e., alcohol or illicit drugs), 1.5% among 'non-problem users', 4.1% among 'problem users', and 9.1% among those who were 'substance dependent'.

Tobacco Use and Gambling

Several epidemiological surveys report very high rates of comorbid tobacco use among PGs ranging from 41% (Smart & Ferris, 1996) to as high as approximately 60% (Cunningham-Williams, Cottler, Compton, & Spitznagel, 1998; Lorains, Cowlshaw, & Thomas, 2011; Petry et al., 2005). Moreover, when the odds ratios for individual disorders were considered, tobacco dependent individuals were found to be approximately seven times more likely to be PGs than nonsmokers. The odds ratios for women versus men also show a significant sex difference. Tobacco dependent women were 14 times more likely to be PGs than nonsmoking women, whereas tobacco dependent males were five times more likely to be PGs than nonsmoking men (Petry et al., 2005). The authors suggest that the especially high rates of PG among women who smoke may be related to higher rates of other comorbid mental illness among women compared to men such as depression and anxiety.

Studies that have examined gambling behaviour and other substance use in treatment settings have also found high rates of tobacco use among gamblers (Petry, 2007). In one sample of problem gamblers seeking treatment, 69% were found to be regular tobacco smokers (Stinchfield & Winters, 1996). Another study reported a slightly

lower figure, with 62% of their treatment-seeking sample indicating that they smoke daily (Petry & Oncken, 2002). In the only study to specifically report the type of gambling activity that clients were seeking treatment for (i.e., poker playing), it was found that over 65% used nicotine (MacCallum & Blaszczynski, 2002). In addition to their co-occurrence at the syndrome level, gambling and tobacco smoking also appear to co-occur at the event level (e.g. Room, 2005). The majority of regular electronic gaming machine (EGM) players, including those classified as non-problem gamblers, report that they smoke while gambling (Stewart, McWilliams, Blackburn, & Klein, 2002). In a study of EGM players, it was found that problem gamblers were significantly more likely to also be smokers than non-problem gamblers (82.8% vs. 46.2%) (Rodda, Brown, & Phillips, 2004). Finally, there have been anecdotal reports of gamblers increasing their regular rates of tobacco consumption during gambling sessions (e.g., Focal Research, 1998).

Epidemiological surveys and treatment studies have established that tobacco dependence is highly comorbid with gambling; however, little research has attempted to expand our understanding of the relationship between smoking and gambling. There is some evidence to suggest that tobacco dependence is associated with greater severity of gambling problems, whereas other studies contradict this finding. In a retrospective analysis of data from 345 treatment-seeking gamblers, it was found that those who were current daily smokers reported less ability to control their gambling, more severe gambling problems, and more days and money spent gambling per month than nonsmoking PGs (Petry & Oncken, 2002). A second study of gamblers who contacted a 'problem gambling hotline' failed to find significant differences between daily smokers

and nondaily smokers on gambling duration, financial problems, or types of debt (Potenza et al., 2004) but observed a trend towards greater problems among smokers on a more distal gambling-related difficulties (i.e., family problems, financial problems, illegal behaviour without arrest and with arrest). Discrepancies in the findings of these studies might be associated with differences in the populations sampled and/or how smoking status was defined.

There is also evidence to suggest that problem gamblers who smoke experience stronger urges to gamble than nonsmoking gamblers. In a study of tobacco use and gambling among 225 outpatients who met the DSM-IV criteria for pathological gambling, of whom 49% reported current daily smoking and 21% reported prior daily smoking, it was found that gamblers who were currently or had been tobacco dependent reported significantly stronger urges to gamble than those who were never daily smokers (Grant & Potenza, 2005). These results support those of an earlier study which also found that problem gamblers who smoked daily were more likely than nonsmokers to report higher scores on a 10-point Likert scale measuring the strength of cravings to gamble over the past month (Petry & Oncken, 2002). They suggest that stronger cravings, in combination with lower perceived ability to control their gambling, might lead to more severe gambling problems in treatment-seeking gamblers who are also tobacco dependent. Finally, tobacco dependence among problem gamblers also appears to be associated with increased severity of psychosocial problems including issues with anxiety, psychiatric symptoms (Petry & Oncken, 2002), and the presence of other substance abuse disorders (Cunningham-Williams et al., 1998). Tobacco-dependent gamblers have been found to be more likely than nonsmoking gamblers to report

problems with alcohol, marijuana, cocaine, and opiates, such as heroin (Potenza et al., 2004).

Aetiological Models of Comorbid Smoking and Gambling

Neurobiological Influences

Although there is currently no direct evidence that tobacco use affects the propensity to gamble, a growing body of evidence does suggest that tobacco smoke might have neurochemical effects that might be expected to enhance gambling behaviour and reinforcement. Virtually all abused substances (e.g., Di Chiara & Imperato, 1988), nicotine included (e.g., Pontieri, Tanda, Orzi, & Di Chiara, 1996), increase dopamine neurotransmission in mesocorticolimbic regions, an effect thought to be critical to their reinforcing properties (e.g., Wise, 1996). In a double blind placebo-controlled study, amphetamine, a potent dopamine releasing drug, increased gambling motivation among problem gamblers (Zack & Poulos, 2004); and numerous reports of Parkinson's patients developing gambling problems during the treatments with dopamine releasing medications (e.g., Avanzi, Baratti, Cabrini, Uber, Brighetti, & Bonfà, 2006; Gallagher, O'Sullivan, Evans, Lees, & Schrag, 2007) offer some support for this notion. Moreover, the receipt of an uncertain monetary reward has been linked to increased dopamine neurotransmission in the same brain regions that have been associated with the rewarding effects of tobacco smoking (Barrett, Boileau, Okker, Pihl, & Dagher, 2004; Zald et al., 2004).

A number of recent studies have examined the effect that an individual component of tobacco, namely nicotine, has on other non-smoking behaviours. Although primary reinforcing effects of nicotine are generally modest (Caggiula et al., 2001;

Palmatier et al., 2006), growing evidence from animal models suggests that nicotine can also enhance the reinforcement value of other behaviours (Chaudhri et al., 2006). For instance, both contingent and noncontingent nicotine can enhance the reinforcement value of lever pressing to visual stimuli through non-associative mechanisms in rats (e.g., Chaudhri et al., 2007; Donny et al., 2003; Palmatier et al., 2006). Additionally, larger doses of nicotine are associated with higher rates of responding to a stimulus (i.e., light) that was previously paired with nicotine than lower doses (Palmatier et al., 2008). Studies of the reinforcement-enhancing effects of nicotine in humans appear to be less conclusive. In a series of experiments, overnight tobacco-abstinent smokers displayed reduced responsiveness to a card-sorting test that was paired with a financial incentive when compared to a non-abstinent condition (Al-Adawi & Powell 1997; Powell, Dawkins, & Davis, 2002). Similarly, smokers in a nicotine lozenge condition exhibited greater responsiveness to a card-sorting test over a placebo (Dawkins, Powell, West, Powell, & Pickering, 2006). Barr, Pizzagalli, Culhane, Goff, and Evins (2008) also reported that non-smokers who wore nicotine patches demonstrated increased responding toward a more rewarding stimulus (e.g., monetary reward) than those given placebo. However, in a recent study of non-dependent smokers, nicotine administered via nasal spray or cigarette did not significantly increase the number of responses for money, music, or the removal of an aversive stimulus (Perkins, Grottenthaler, & Wilson, 2009). The aggregate findings from these human experiments are mixed. While most suggest that nicotine can enhance the reinforcement of conditioned behaviours in smokers, others do not support this notion.

It is also possible that nicotine influences other processes central to gambling behaviour. For instance, Businelle et al. (2009) found that heavy smokers performed more poorly than never smokers on the Gambling Task (GT; Bechara, Damasio, Damasio, & Anderson, 1994; Bechara, Tranel, & Damasio, 2000), a decision-making task that contains choice, rewards, and negative outcomes. This finding suggests that heavy smokers on average preferred short-term rewards at the expense of sustaining longer-term losses. There is also evidence to indicate that smokers perform more poorly on tasks measuring impulsivity such as delay and probability discounting procedures. For example, a number of recent studies have found that compared to non-smokers, smokers on average tend to discount real and hypothetical rewards at a significantly higher rate (e.g., Bickel, Odum, & Madden, 1999; Ohmura, Takahashi, & Kitamura, 2005; Reynolds, 2004). Problem gamblers also display higher rates of delay discounting compared to non-gamblers (Petry & Casarella, 1999; Petry, 2001) and it has been suggested that other substance use/abuse may additively contribute to rates of delay-discounting among problem gamblers (Reynolds, 2006). While these studies suggest that smokers and non-smokers differ in their responses, the extent to which these differences are due to nicotine per se is not known. Also, these underlying processes may or may not be mutually exclusive (e.g., nicotine's effects on reinforcement sensitivity could possibly explain experimental delayed discounting effects); however, in their totality they do suggest that nicotine might influence processes directly involved in gambling.

Additionally, there have been numerous accounts of nicotine enhancing the reinforcement value of other substances and behaviours. For instance, nicotine has been found to increase self-administration of alcohol (Barrett, Tichauer, Leyton, & Pihl, 2006)

and to augment methadone self-administration in opiate-dependent smokers (Spiga, Schmitz, & Day, 1998). Theoretically, if the addictive aspects of gambling behaviour are mediated by a similar dopaminergic action, then it is possible that the dopamine agonist properties of nicotine could also augment these aspects of gambling. Finally, there is evidence to suggest that nicotine might enhance aspects of cognitive performance, such as attention (Sacco, Bannon, & George, 2004); an effect which might contribute to increased focus during gambling sessions.

Lastly, it is also possible that certain non-nicotine constituents of tobacco smoke might also have the potential to affect addictive behaviours, such as gambling. For example, regular tobacco smoking has been showed to inhibit monoamine oxidase (MAO), an enzyme that is involved in the breakdown of neurotransmitters implicated in addictive processes including dopamine. This inhibition of MAO by chronic tobacco smoking appears to occur through mechanisms that are independent of nicotine (Fowler et al., 1994). Similarly, there is some evidence for the inhibition of MAO in pathological gambling, with decreased platelet MAO activity being noted among male PGs when compared with controls (Blanco, Orensanz-Muñoz, Blanco-Jerez, & Saiz-Ruiz, 1996). Interestingly, in animal studies, MAO inhibition dramatically increases the motivation for nicotine (e.g., Guillem et al., 2005), suggesting that MAO inhibition might act synergistically with nicotine to produce some of tobacco's addictive properties. It is possible that MAO inhibition might also contribute to smoking's effects on other addictive behaviours including gambling.

Psychological Influences

In addition to direct pharmacological effects, it is also possible that psychological factors, such as conditioned effects and personality characteristics, might play a role in the comorbidity of smoking and gambling. For instance, the cue-reactivity paradigm has become an increasingly important framework for investigating the role of cue-induced craving in addictive processes (Tiffany & Wray, 2009). Cue-reactivity paradigms involve exposing individuals to drug-related stimuli (e.g., images, video, in vivo) commonly associated with the use of a particular substance. In most cases, behavioural reactions, subjective responses, and/or physiological changes following exposure to stimuli are recorded and examined (Carter & Tiffany, 1999). Research indicates that cue-reactivity models are also useful for understanding gambling behaviour. For example, a cue-reactivity paradigm using exciting gambling video was found to elicit greater urges to gamble among pathological gamblers compared to social gamblers (Sodano & Wulfert, 2010). Some evidence also suggests that gambling-related audio (Blanchard, Wulfert, Freidenberg, & Malta, 2000) as well as imagining gambling (Sharpe, 2004) can increase physiological arousal (e.g., heart rate) in problem gamblers compared to social gamblers. These results compliment a number of studies finding heightened physiological arousal among regular gamblers exposed to actual gambling (e.g., Coventry & Constable, 1999; Meyer et al., 2004; Krueger, Schedlowski, & Meyer, 2005).

Finally, recent neuroimaging investigations with problem gamblers reveal dorsolateral prefrontal activity while watching gambling-related video (Crockford, Goodyear, Edwards, Quickfall, & el-Guebaly, 2005) and fronto-parietal activation following exposure to a blackjack scenario (Miedl, Fehr, Meyer, & Herrmann, 2010),

indicating that memory networks associated with gambling are triggered by gambling-related cues. In a sample of treatment-seeking problem gamblers exposed to gambling cues, Goudriaan, de Ruiter, van den Brink, Oosterlaan, and Veltman (2010) found increased activity in brain regions implicated in motivation and visual processing, areas also associated with cue-reactivity in other forms of substance dependence, including tobacco dependence. Although gambling-focused cue-reactivity research is still in its infancy, the aggregate of these findings suggests that this paradigm may show promise for studying craving in gamblers.

A select number of studies have revealed that nicotine may also potentiate the hedonic value of cues unrelated to smoking itself. Reid, Mickalian, Delucchi, Hall, and Berger (1998) examined craving for cocaine following exposure to cocaine-related cues among daily smokers who also have a history of crack cocaine use. Participants were required to abstain from tobacco overnight (12-hours), and were assigned to either a nicotine or placebo transdermal patch condition during the experimental session. Compared to placebo, nicotine was found to significantly increase subjective cocaine craving following cocaine-related cues. Recently, Attwood, Penton-Voak, & Munafò (2009) investigated the extent to which nicotine enhances ratings for attractive faces among non-daily smokers. Following 24-hour tobacco abstinence, participants were assigned to either a nicotine or denicotinized cigarette condition and were asked to rate 40 photographic facial stimuli. Those who received nicotine-containing cigarettes, on average, rated the faces as being significantly more attractive. The authors proposed that nicotine potentiated the reinforcing properties of other positive cues found in the social environment in which non-daily tobacco users typically smoke. The findings from these

investigations suggest that nicotine may enhance ratings for a variety of other visual stimuli conceivably conditioned with smoking. Given that smoking and gambling frequently co-occur, it may also be possible that similar effects could be found with gambling-related cues.

The literature pertaining to personality and addiction suggests that tobacco dependence and problem gambling might share similar underlying personality characteristics that could concurrently influence both disorders. There is evidence to indicate that certain personality variables play a role in the genesis and maintenance of addiction. For instance, some of the personality traits found to be associated with smokers include being high on neuroticism and low on conscientiousness as defined by the five-factor model of personality (Terracciano & Costa, 2004), and being high on Eysenck's psychoticism (Spielberger & Jacobs, 1982). Numerous studies have also implicated impulsivity in smoking, with smokers being more impulsive than nonsmokers on various measures of impulsivity (Mitchell, 2004). Several of the personality characteristics that have been indicated in tobacco use have also been identified in studies of problem gambling. For example, an investigation of personality characteristics in a sample of PGs and non-PGs using the five-factor model found that PGs scored higher on neuroticism and lower on conscientiousness than non-PGs (Bagby et al., 2007). It was also found that PGs scored higher on an index of impulsivity. This result offers support to previous studies that have found links between pathological gambling and higher levels of impulsivity (e.g., Alessi & Petry, 2003; Nower, Derevensky, & Gupta, 2004). Interestingly, studies that have measured impulsivity among groups of problem gamblers with comorbid substance abuse issues such as tobacco dependence and gamblers without

a substance abuse disorder have found that the comorbid groups score higher on a measure of impulsivity (for a review see Verdejo-García, Lawrence, & Clark, 2008). It has been suggested that impulsivity predisposes individuals to developing problem gambling tendencies and increases the risks of comorbid substance use among problem gamblers. Unfortunately, there are no studies that have directly examined impulsivity and comorbid tobacco dependence in problem gamblers. Although there is evidence to indicate substantial overlap of several personality traits in tobacco dependence and problem gambling, research investigating the aetiological role that personality plays in comorbid smoking and gambling is required before any conclusions regarding its influence can be drawn.

Social Influences

Although current evidence suggests that interindividual characteristics, such as biological and psychological factors, might play a role in comorbid smoking and gambling, it is also possible that psychosocial influences might contribute to this association. In both the smoking and gambling literature there is evidence to suggest that social factors independently influence dependence. In the smoking literature, the role of social influences on behaviour is considerable. For instance, over two-thirds of young adult smokers have been identified as social smokers, that is, they use tobacco in social situations often in the presence of others (Waters, Harris, Hall, Nazir, & Waigandt, 2006). Perceived social norms have been found to play a role in the maintenance of smoking in adolescents and adults. Evidence suggests that having friends who smoke or perceiving that friends want you to smoke predicts smoking among young adults. Additionally, having a romantic partner who smokes or perceiving that your partner

wants you to smoke is predictive of smoking (Etcheverry & Agnew, 2008). Smoking cessation by a spouse or by a close friend has been found to decrease one's chances of smoking by 67% and 36%, respectively (Christakis & Fowler, 2008).

In the gambling literature there is also evidence suggesting that social situations and norms influence gambling behaviour. In a recent laboratory experiment, it was found that gambling in the presence of others, especially when others are perceived to be winning, led to intensified gambling behaviour and lower payouts (Rockloff & Dyer, 2007). As has been found in the smoking literature, there is also evidence indicating that perceived injunctive norms influence gamblers. The perception that family and friends approve of gambling has been found to be positively associated with a person's gambling behaviour (Neighbors, Lostutter, Whiteside, Fossos, Walker, & Larimer, 2007). Although social influences and norms clearly affect both smoking and gambling in isolation, the extent of this influence on comorbid tobacco use and gambling is unknown. We failed to identify any studies that have investigated the role that social influences (e.g. friends, family and peers) or perceived social norms have on the development and maintenance of comorbid tobacco use and gambling.

Effect of Smoking Bans on Gambling

A great deal of the research investigating tobacco smoke and gambling has focused on the environmental hazards related to exposure to second-hand smoke. In response to the health hazards connected to secondhand smoke, several jurisdictions have implemented smoking bans in public places including bars and casinos. A recent study on the impact of smoke-free policies on gambling in the Australian state of Victoria indicates that smoking bans can directly affect gaming revenues (Lal & Siahpush, 2008).

Over a 7 year period since the introduction of the smoking ban, total gambling revenues had decreased by approximately 14%. The study also notes a subsequent decline in gambling participation among regular smokers. Before the introduction of the smoking ban, 20% of regular smokers gambled at least once per month compared with 14% after the first 2 years of the ban. The reduction in gambling revenue and smoker participation provides anecdotal support for the influence of smoking on gambling behaviour.

Similarly, an investigation of how a smoking ban in Delaware affected that state's gaming industry found that average gaming revenues declined by as much as 13% from the year preceding the implementation of the ban (Pakko, 2006).

Significant and sustained decreases in gaming revenue that have occurred following the implementation of public smoking bans offers further anecdotal support for the reinforcing effects of comorbid tobacco use on gambling. Smoking bans also offer a unique opportunity to help shed light on the relationship between smoking and gambling. For instance, individual gambling expenditure might be curbed as smokers take breaks in play to leave the venue to smoke (Lal & Siahpush, 2008). These breaks might be an important opportunity to reflect on one's gambling activity, resulting in players stopping their gambling sooner than they would otherwise (Harper, 2003). Although this might be the case, there are other potentially important factors associated with smoking bans in casinos that have yet to be considered. For instance, if players return to the gaming floor they might still be influenced by the chemical effects of the tobacco they ingested just minutes before. Also, some smokers might switch to tobacco in smokeless forms, such as snuff or chewing tobacco while they gamble. Finally, little is known regarding the use or impact of nicotine replacement therapies in a gambling context. It is conceivable that

some smokers might choose to wear nicotine patches or chew nicotine gum while they gamble in an effort to manage cravings and avoid taking breaks in play. To date, no studies have attempted to systematically control for these variables, making it even more difficult to interpret the relationship between smoking and gambling in a real world context.

Treatment of Comorbid Smoking and Gambling

Presently, very few studies offer insight into the effectiveness of treatment options for concurrent tobacco and gambling dependence. Important distinctions that might affect treatment outcomes have been found among smokers who seek treatment for problem gambling including: increased severity of gambling problems, more family and social conflict, and concurrent psychiatric symptoms (Petry & Oncken, 2002). It is unclear whether tobacco dependence directly interferes with the efficacy of gambling treatment; although it has been suggested that gambling problems might hamper tobacco cessation efforts (Potenza et al., 2004). To date, only one known study has examined the influence of tobacco smoking on gambling treatment outcomes. Odlaug, Stinchfield, Golberstein, and Grant (2012) compared tobacco using (63.4%) and non-smoking treatment-seeking pathological gamblers on several treatment outcomes. Although tobacco-using clients presented with more severe gambling, there were no significant differences between smokers and non-smokers on treatment completion or other treatment outcomes (e.g., number of days gambled at 6-month follow-up). The authors suggest that while tobacco may contribute directly to gambling symptoms, it may not influence the effects of therapeutic intervention for gambling. However, given that tobacco has been linked to poorer treatment outcomes for other substance use, the authors caution that more research

is needed before any firm conclusions can be made for gambling treatment specifically. Finally, although evidence is currently lacking, it has been suggested that treating both smoking and gambling concurrently with pharmacotherapy might be efficacious. For instance, simultaneously treating nicotine and gambling addictions with an opioid antagonist or bupropion is a potentially promising option (Grant & Potenza, 2005). Despite these suggestions, more studies are needed to identify the best psychological or pharmacological options for treating comorbid smoking and gambling.

Nicotine replacement therapy (NRT) is among the most frequently used pharmacological options for smoking cessation in Canada. NRT is widely commercially available and is sold in several different doses and formats including: gum, transdermal patch, nasal spray, inhaler, and sublingual tablets/lozenges (Stead, Perera, Bullen, Mant, & Lancaster, 2008). These NRT modalities are administered orally (with the exception of nasal spray and transdermal patches) and are designed to reduce the physical symptoms associated with acute tobacco withdrawal following an attempt to quit smoking (West & Shiffman, 2001). A considerable body of evidence finds support for the therapeutic use of NRT. For instance, a recent review and meta-analysis of NRT use in smoking cessation suggests that it increases the rate of quitting by 50-70% (Stead et al., 2008). In addition, in the early days of an attempt to quit, NRT use has been found to increase the odds of abstaining for at least one day by 16.8 times over nonuse of NRT (Amodei & Lamb, 2010). While the benefits of NRT in smoking cessation are widely acknowledged, there is some laboratory evidence to indicate that acute NRT use may also influence other addictive behaviour. For instance, Acheson, Mahler, Chi, and de Wit (2006) had a sample of light smokers wear a transdermal nicotine (7 or 14mg) patch or a placebo patch and

gave participants the opportunity to purchase or consume alcohol. They found that the NRT significantly increased alcohol consumption and subjective arousal among men while it decreased alcohol consumption and positive mood among women. McKee, O'Malley, Shi, Mase, and Krishnan-Sarin (2008), however, found decreased self-administration of alcohol among both women and men in a nicotine patch condition in a sample comprised of heavy smokers and drinkers. The authors suggest that, while in some respects contradictory, these findings indicate that NRT may interact with the temporal effects of alcohol priming and could ultimately influence alcohol consumption.

Theoretically, if NRT can influence a second addictive behaviour such as drinking alcohol, it is also possible that its use may affect other forms of substance use and/or behavioural dependence. Given the widespread availability of both NRT as well as opportunities to gamble, knowing the extent to which NRT may or may not influence gambling behaviour could have important research and clinical implications. However, the exact nature of this relationship is yet to be determined as no known studies have directly investigated the implications of NRT use on gambling behaviour.

Limitations of Previous Research

While the amount of research examining co-occurring tobacco smoking and gambling has been increasing in recent years, most of the studies conducted to date contain inherent limitations that restrict our understanding of the smoking – gambling relationship. First, many of the studies investigating the co-occurrence of smoking and gambling have consisted of epidemiological population-based surveys (e.g., Cunningham-Williams et al., 1998; Lorains et al., 2011; Petry et al., 2005). Although these investigations provide valuable insight into prevalence rates as well as correlates

associated with smoking and/or gambling, by their nature, they do not allow for inferences of cause and effect. Conversely, a number of studies have examined smoking and gambling among clinical samples of gamblers in treatment settings (e.g., MacCallum & Blaszczynski, 2002; Petry & Oncken, 2002; Stinchfield & Winters, 1996). It is possible that treatment-seeking gamblers who smoke differ qualitatively from community-recruited samples on several important criteria (e.g., gambling and/or smoking severity, number/extent of psychosocial problems, other co-morbid psychiatric disorders, etc.). The extent to which these findings generalize to the majority of gamblers is unknown.

Another line of research has focused on the extent to which acutely administered nicotine directly influences behaviour in animal models and humans. Basic research conducted with rats suggests that nicotine can enhance the reinforcement value of other conditioned behaviours (Chaudhri et al., 2007; Donny et al., 2003; Palmatier et al., 2006). While using animal models as experimental analogues is often advantageous, the generalizability of these findings to actual behaviour in humans is not clear. Although a number of recent studies have begun to examine the effect of nicotine on other reinforced behaviour in humans, these too contain a number of important limitations. Primarily, several studies have examined rates of responding to ‘gambling-like’ tasks paired with financial incentives such as card-sorting (Dawkins et al., 2006), a novel signal detection task (Barr et al., 2008), and a computer task reinforced by money, music, or the removal of an aversive stimulus (Perkins et al., 2009). While these tasks may have a great deal of experimental utility, their ecological validity appears to be limited. That is, the structural characteristics of real-world gambling (e.g., VLTs, poker, casino games, lotteries, etc.)

differ from the tasks used in these experiments. Lastly, a select number of studies have investigated the extent to which nicotine influences cue-reactivity for stimuli unrelated to smoking (e.g., Attwood et al., 2009; Reid et al., 1998). These findings reveal that nicotine may influence ratings for other positive environmental cues; however, the extent to which this phenomenon also applies to gambling-related cues has yet to be directly tested and remains unknown.

In sum, most of the research on the association between smoking and gambling to date has been primarily correlational or descriptive in nature. Very little research has focused on disentangling the exact dynamics of this relationship. The select few experimental studies on nicotine and gambling have often used tasks that may not adequately represent actual gambling and no known cue-reactivity experiments using gambling-related cues have been conducted. More research is needed, especially laboratory studies, which explore the effect of nicotine dependence on gambling behaviour. For instance, researchers could gain a greater understanding by studying gambling-related craving and behaviour during a real-world gambling task (e.g., electronic gaming) in a laboratory setting under various nicotine and placebo conditions. Lastly, more studies that include community-recruited gamblers who are not currently receiving treatment are required to increase the external validity of research findings.

Prologue to the Dissertation Investigations

This dissertation is comprised of three individual manuscripts and a general discussion. The first paper describes a secondary data analysis of epidemiological data from a gambling prevalence survey conducted in Newfoundland and Labrador in 2005. The analysis compared gamblers identified as non-smokers with gamblers who smoke on

numerous gambling-related variables. This study was designed to replicate and extend previous epidemiological work by examining gambling involvement, problem gambling, and motives for gambling in gamblers who smoke. The second manuscript was based on a laboratory experiment that examined the acute effects of nicotine on subjective and behavioural gambling responses to video lottery terminal (VLT) gambling among regular gamblers who smoke. The third paper was based on a second laboratory experiment in which the acute effects of nicotine on subjective, physiological, and behavioural gambling responses were examined in regular VLT players who smoke following exposure to gambling-related cues. Finally, the last chapter of the dissertation is composed of a general discussion of the aggregate results of the three individual investigations. The implications of this research for policy makers, treatments providers, and future academic work are discussed.

CHAPTER TWO: SECONDARY DATA ANALYSIS: A COMPARISON OF GAMBLING BEHAVIOUR, PROBLEM GAMBLING INDICES, AND REASONS FOR GAMBLING AMONG SMOKERS AND NON-SMOKERS WHO GAMBLE: EVIDENCE FROM A PROVINCIAL GAMBLING PREVALENCE STUDY

Sections of this chapter were taken from the following:

McGrath, D. S, Barrett, S.P., Stewart, S. H., & McGrath, P.R. (2012). A comparison of gambling behaviour, problem gambling indices, and reasons for gambling among smokers and non-smokers who gamble: Evidence from a provincial gambling prevalence study. *Nicotine & Tobacco Research, 14*(7), 833-839. doi:10.1093/ntr/ntr294

Daniel McGrath served as first author of the manuscript included in this chapter. He took the lead role in conducting a review of the relevant literature, planning and conducting the research, writing original manuscript drafts, and making revisions based on suggestions from co-authors, editors, and peer reviewers.

Abstract

Numerous epidemiological and clinical studies have found that tobacco use and gambling frequently co-occur. Despite high rates of smoking among regular gamblers, the extent to which tobacco potentially influences gambling behaviour and vice versa is poorly understood. The current study aimed to provide more insight into this relationship by directly comparing non-smoking and smoking gamblers on gambling behaviour, problem gambling indices, and reasons for gambling. The data for this study came from the 2005 Newfoundland and Labrador Gambling Prevalence Study. Gamblers identified as non-smokers ($N = 997$) were compared to gamblers who smoke ($N = 622$) on numerous gambling-related variables. Chi-square analyses were used to compare groups on demographic variables. Associations between smoking status and gambling criteria were assessed with a series of binary logistic regressions. The regression analyses revealed several significant associations between smoking status and past 12 month gambling. Higher problem gambling severity scores, use of alcohol/drugs while gambling, amount of money spent gambling, use of video lottery terminals (VLTs), and reasons for gambling which focused on positive reinforcement/reward and negative reinforcement/relief were all associated with smoking. The findings suggest an association between smoking and potentially problematic gambling in a population-based sample. More research focused on the potential reinforcing properties of tobacco on the development and treatment of problematic gambling is needed.

Introduction

A sizable body of evidence suggests that tobacco use often co-occurs with problem gambling (McGrath & Barrett, 2009; Petry, 2007), with smoking prevalence rates ranging from 41% (Smart & Ferris, 1996) to 60% (Cunningham-Williams et al., 1998; Lorains et al., 2011) among problem gamblers. However, beyond prevalence rates, relatively few studies have directly compared smoking and non-smoking gamblers. Each study that has done so focused on problem gamblers seeking treatment for their gambling. Their findings suggest that problem gamblers who smoke have higher problem gambling severity scores (Grant, Kim, Odlaug, & Potenza, 2008; Petry & Oncken, 2002), experience more psychiatric symptoms (Grant et al., 2008; Petry & Oncken, 2002; Potenza et al., 2004) are more likely to have other substance use disorders (Petry & Oncken, 2002; Potenza et al., 2004), report stronger urges/cravings to gamble (Grant & Potenza, 2005; Petry & Oncken, 2002) spend more time gambling (Petry & Oncken, 2002), spend/lose more money gambling (Grant et al., 2008; Petry & Oncken, 2002), experience more financial problems (Grant et al., 2008; Potenza et al., 2004), and more often choose non-strategic/riskier forms of gambling such as electronic gaming (Grant et al., 2008; Potenza et al., 2004). The aggregate of these studies indicates that tobacco use is associated with a host of psychosocial difficulties among problem gamblers.

To date, however, no known studies have specifically addressed tobacco use within a general population sample which encompasses the entire continuum of gamblers (i.e., from non-problem to severe problem gamblers). Outside of clinical samples, much remains unknown regarding how smoking and non-smoking gamblers might potentially differ in their gambling behaviour or level of risk for problematic gambling. In addition,

an increasing emphasis in the gambling literature has been placed on identifying underlying reasons or “motives” for gambling as a means for differentiating gambler subtypes (Milosevic & Ledgerwood, 2010; Neighbors, Lostutter, Cronce, & Larimer, 2002). Studies on motives for drinking (e.g., Cooper, 1994) and gambling (e.g., Stewart & Zack, 2008) indicate that both positive and negative reinforcement processes underlie motivation to drink or gamble. Other research suggests that smokers may also be driven to smoke by similar underlying motives (Battista, Stewart, Fulton, Steeves, Darredeau, & Gavric, 2008; Pomerleau, Fagerström, Marks, Tate, & Pomerleau, 2003). However, no known research has acknowledged potential differences between smokers and non-smokers in their reasons for gambling. Identifying potential patterns in gambling involvement, problem gambling risk, and motivation for gambling among smokers may have implications for the prevention and treatment of problem gambling in this population.

In the current investigation, we attempted to address important gaps in the existing literature on tobacco use and gambling. Specifically we explored differences in gambling behaviour, problem gambling indices, and reasons for gambling among gamblers who are smokers and non-smokers in a representative Canadian population-based sample. In line with previous clinical and epidemiological evidence (e.g., Grant et al., 2008; Petry & Oncken, 2002; Potenza et al., 2004), we hypothesized that smoking among gamblers would be associated with (1) greater gambling involvement, (2) higher problem gambling severity scores, and (3) participation in riskier forms of gambling (e.g., electronic gaming). Based on previous motives research (e.g., Battista et al., 2008;

Stewart & Zack, 2008), it was also predicted that tobacco use would be associated with (4) reasons for gambling that either increase positive affect or decrease negative affect.

Methods

Questionnaire Respondents

The sample in this report was compiled from the 2005 Newfoundland and Labrador Gambling Prevalence Study (Market Quest Research Group Inc., 2005). The questionnaire consisted of 65 questions organized into four major sections: demographic variables, gambling involvement (including reasons for gambling), problem gambling behaviour and adverse consequences, and correlates of gambling. Data was collected province-wide via telephone between September 7th and October 20th, 2005. All respondents were 19 years or older. The sample included 2,154 respondents who reported gambling during the past 12 months; however, smoking status data was only available for 1,619 gamblers (only these respondents were included in our analyses). Sampling was stratified by gender and region but was otherwise random. The total response rate was unavailable. A demographic comparison of smokers ($N = 622$) and non-smokers ($N = 997$) is provided in Table 1 on page 30.

Respondents were asked several questions regarding their gambling involvement and behaviour during the past 12 months. These included: types of gambling activities they had participated in, total number of activities participated in, and total dollar amount spent gambling. In the present investigation, amount spent gambling underwent a square root transformation as a result of a non-normal distribution and the presence of outliers. Three gambling activities (i.e., internet gambling, arcade or video games, and short term stock) were excluded due to low rates of endorsement ($< 5\%$).

The questionnaire also included Problem Gambling Severity Index (PGSI) scores from the Canadian Problem Gambling Index (CPGI; Ferris & Wynne, 2001) to determine past 12-month problem gambling severity (higher scores denote increased risk for problem gambling). The CPGI displays strong psychometric properties including good internal consistency ($\alpha = 0.84$), test–retest reliability ($r = 0.78$), and high convergent validity ($r = 0.83$) (Ferris & Wynne, 2001) with the South Oaks Gambling Screen (SOGS; Lesieur & Blume, 1987). In the current study, the PGSI displayed a high degree of internal consistency ($\alpha = 0.93$). In addition, questions on known correlates of problem gambling were included such as: age first gambled, remembering first big win, agreement with the ‘gambler’s fallacy’, use of a ‘certain system or strategy while gambling’, using alcohol or drugs while gambling, and gambling while drunk or high.

Lastly, respondents were asked to provide the main reasons why they gamble. They were free to list as many reasons for gambling as they wished. Each verbatim response was then placed by the interviewer into one of the following categories: ‘it’s an opportunity to socialize’, ‘it is exciting/fun’, ‘I can win money’, ‘it’s a hobby’, ‘to support worthy causes/charities’, ‘out of curiosity’, and ‘because I am good at it’. The answer choices also included: ‘I can forget about my problems’, ‘it decreases my boredom’, and ‘to be alone’. Previous research suggests that motives for gambling can be meaningfully categorized according to the extent to which they increase ‘positive emotions’ or decrease ‘negative emotions’ (e.g., Stewart, Zack, Collins, & Klein, 2008). Individual motives were combined for the current report into three motives groups based on their conceptual similarity: (1) positive reinforcement/reward [socialize, exciting/fun, win money, hobby, curiosity, & being good at it] ($N = 1,375$), (2) negative

reinforcement/relief [forget problems, decrease boredom, & to be alone] ($N = 151$), and (3) charitable motives [support causes/charities] ($N = 456$). All reasons for gambling provided by respondents were included, with some providing more than one motive. Reasons for gambling were grouped according to the previously outlined categories following consensus by the researchers involved in this study; however, coding was completed by the first author only (as such inter-rater reliability is provided). Previous research suggests that conceptually similar items load onto broader gambling motive constructs and usefully differentiate gambler subtypes (e.g., Stewart & Zack, 2008).

Table 1. Chi-Square Analyses for Demographic Characteristics of Non-smokers versus Smokers for the Secondary Data Analysis in Chapter Two.

Demographic Characteristic	Non-Smokers ($N=997$)	Smokers ($N=622$)	χ^2	df	p-value
Gender: n (%)					
Male	496 (49.7)	322 (51.8)	0.63	1	0.44
Female	501 (50.3)	300 (48.2)			
Age Group: n (%)			97.26	3	0.01*
19-34 years	188 (18.9)	206 (33.1)			
35-54 years	459 (46.0)	321 (51.6)			
55-64 years	168 (16.9)	64 (10.3)			
65+ years	182 (18.3)	31 (5.0)			
Marital Status: n (%)			48.82	2	0.01*
Married/common law	796 (80.0)	418 (67.4)			
Widowed/ separated/divorced	114 (11.5)	76 (12.3)			
Single	85 (8.5)	126 (20.3)			
Household Income: n (%)			8.65	3	0.03*
\$20,000 or less	96 (13.1)	69 (14.3)			
\$20,001 to \$40,000	240 (32.7)	191 (39.5)			
\$40,001 to \$80,000	276 (37.6)	163 (33.7)			
\$80,000 or more	123 (16.6)	61 (12.5)			

Note. * $p < .05$

Statistical Analysis

Data analyses for this study were performed with SPSS software. Hypotheses were tested by comparing non-smokers and smokers across criterion variables. Categorical demographic measures were examined with individual chi-square analyses. Three binary logistic regressions were conducted in an effort to identify which (1) gambling involvement variables, (2) problem gambling correlates, and (3) reasons for gambling differentially distinguish non-smokers and smokers. No violations of the assumptions of linearity or multicollinearity were detected.

Results

Non-smoking and smoking gamblers differed on several demographic variables (see Table 1). While no differences in gender composition were noted, gamblers who smoke were on average found to be younger, more likely to be single/not married, and have lower incomes than gamblers who don't smoke.

The regression model for gambling involvement was significant, Cox & Snell Pseudo $R^2 = .06$, $\chi^2(10) = 88.92$, $P < 0.001$. Amount of money spent gambling (OR = 1.01) and use of VLTs (OR = 1.77) in the past 12 months both predicted smoking over non-smoking (see Table 2). Only raffle ticket (OR = 0.66) participation predicted non-smoking. Remaining gambling involvement variables were not significant.

Table 2. Binary Logistic Regression for Gambling Involvement among Non-smokers and Smokers for the Secondary Data Analysis in Chapter Two.

Gambling Involvement	Non-Smokers (N=997)	Smokers (N=622)	Wald	Exp (B)	95% CI	
					lower	upper
Number of activities:						
<i>M (SE)</i>	2.7 (0.05)	3.2 (0.07)	0.66	1.43	0.60	3.40
Amount spent gambling (dollars):						
<i>M (SE)†</i>	336.5 (53.1)	724.7 (133.8)	5.93	1.01*	1.00	1.02
Type of Gambling						
Lottery tickets: <i>n (%)</i>	881 (88.5)	532 (85.7)	3.17	0.67	0.43	1.04
Scratch tickets: <i>n (%)</i>	489 (49.0)	388 (62.6)	0.36	1.14	0.74	1.78
Raffle tickets: <i>n (%)</i>	565 (56.7)	320 (51.5)	4.89	0.66*	0.46	0.95
Cards & Poker: <i>n (%)</i>	142 (14.2)	146 (23.5)	0.81	1.21	0.80	1.84
Sports, horses, games of skill: <i>n (%)</i>	79 (7.9)	73 (11.7)	0.01	1.02	0.62	1.69
Bingo: <i>n (%)</i>	112 (11.2)	123 (19.8)	2.52	1.39	0.93	2.09
VLTs: <i>n (%)</i>	92 (9.2)	142 (22.8)	6.84	1.77*	1.15	2.71
Casino games: <i>n (%)</i>	49 (4.9)	33 (5.3)	2.52	0.63	0.35	1.12

Note. * $p < .05$; † Original means and standard errors reported.

For problem gambling correlates, the regression analysis revealed several significant associations with smoking status, Cox & Snell Pseudo $R^2 = .04$, $\chi^2 (7) = 52.68$, $P < 0.001$. The odds ratios (OR) for average score on the PGSI (Ferris & Wynne, 2001) (OR = 1.08) and use of alcohol/drugs while gambling (OR = 1.58) significantly predicted smoker group membership (see Table 3). The remaining problem gambling correlates were not significant.

Table 3. Binary Logistic Regression for Problem Gambling Correlates among Non-smokers and Smokers for the Secondary Data Analysis in Chapter Two.

Problem Gambling Correlates	Non-Smokers (N=997)	Smokers (N=622)	Wald	Exp (B)	95% CI	
					lower	upper
PGSI score: <i>M (SE)</i>	0.33 (0.06)	1.02 (0.14)	8.54	1.08*	1.03	1.13
Age first gambled (years): <i>M (SE)</i>	23.3 (0.36)	22.3 (0.39)	0.32	0.99	0.99	1.01
Remember first big win: <i>n (%)</i>	38 (3.9)	37 (6.0)	1.66	1.22	0.90	1.64
Endorse ‘gamblers fallacy’: <i>n (%)</i>	45 (4.7)	40 (6.6)	0.18	1.11	0.68	1.82
Use system or strategy: <i>n (%)</i>	90 (9.7)	76 (12.9)	0.56	1.15	0.80	1.65
Use alcohol/drugs while gambling: <i>n (%)</i>	120 (12.3)	146 (23.7)	6.98	1.58*	1.13	2.22
Gambled while drunk/high: <i>n (%)</i>	37 (3.8)	63 (10.3)	3.04	1.61	0.94	2.74

Note. * $p < .05$

Finally, the reasons for gambling regression model was also significant, Cox & Snell Pseudo $R^2 = .02$, $\chi^2 (3) = 23.50$, $P < 0.001$. ‘Positive reinforcement/reward motives’ (OR = 1.53), and ‘negative reinforcement/relief motives’ (OR = 2.22), each predicted smoker group membership (see Table 4). ‘Charitable’ motives were not found to be significant.

Table 4. Binary Logistic Regression for Reasons for Gambling among Non-smokers and Smokers for the Secondary Data Analysis in Chapter Two.

Reasons for Gambling	Non-Smokers (N=997)	Smokers (N=622)	Wald	Exp (B)	95% CI	
					lower	upper
Positive reinforcement/reward: <i>n</i> (%)	837 (87.9)	538 (90.3)	4.88	1.53*	1.05	2.22
Negative reinforcement/relief: <i>n</i> (%)	70 (7.4)	81 (13.6)	18.88	2.22*	1.55	3.19
Charitable: <i>n</i> (%)	297 (31.2)	159 (26.7)	0.72	0.90	0.71	1.15

Note. * $p < .05$; Gambling reasons are not mutually exclusive with participants free to endorse more than one reason

Discussion

The purpose of this study was to investigate potential differences between non-smokers and smokers on several gambling-related criteria. Consistent with our predictions, smoking gamblers were differentiated from non-smoking gamblers across numerous gambling behaviours, problem gambling indices, and gambling motives.

Tobacco use in this study was associated with increased odds of elevated PGSI scores, using alcohol/drugs while gambling, and spending more money gambling in the previous 12 months. Additionally, VLT participation was the only gambling activity that significantly predicted smoker group membership with an increase of 1.77 in the log odds. These findings from a general population-based sample are generally consistent with the profile of tobacco-using gamblers derived from clinical studies (Grant et al., 2008; Grant & Potenza, 2005; Petry & Oncken, 2002; Potenza et al., 2004). While smokers and non-smokers significantly differed on several gambling involvement variables, the extent to which these findings are clinically relevant must also be

considered. Specifically, the odds ratios for ‘amount spent gambling’ (OR = 1.01) and PGSI score (OR = 1.08) while significant, could be considered small in terms of magnitude. As such, other variables identified in this study as being associated with smoking (e.g., VLT participation, substance use while gambling) may have more clinical utility for identifying smokers at risk for problematic gambling outcomes. Our results also suggest that the motivation to gamble for smokers and non-smokers may be different. Motives centered on positive reinforcement/reward as well as negative reinforcement/relief were strongly associated with tobacco use. These two groups of motives closely correspond to previous reports of ‘enhancement’ and ‘coping’ motives for alcohol use (Cooper, 1994) and for problematic gambling (Stewart & Zack, 2008; Stewart et al., 2008), respectively. This trend toward gambling for riskier reasons that decrease negative affect (i.e., ‘escape’) and increase positive affect (i.e., ‘excitement’) among smokers in our sample appears to parallel their increased association with problem gambling severity, substance use while gambling, and choice of riskier types of gambling.

Overall, these results suggest that tobacco use is associated with potentially problematic gambling outcomes and motives. It is conceivable that smoking and gambling share a number of common underlying mechanisms which may help to explain their association. For instance, evidence indicates that both nicotine (Pontieri et al., 1996) and problem gambling (Lader, 2008; Linnet, Peterson, Doudet, Gjedde, & Møller, 2010) are reinforced via neurochemical processes including increased dopamine neurotransmission. Theoretically, it is conceivable that tobacco use during gambling may augment reinforcement through dopamine mediation. The relationship between smoking

and gambling may also be behaviourally conditioned. For example, evidence indicates that the presence of environmental cues can elicit cravings in a number of substance use disorders (Carter & Tiffany, 1999) as well as problem gambling (Sodano & Wulfert, 2010). In animal models, nicotine has been found to facilitate the release of dopamine in response to other reinforcing stimuli (e.g., Chaudhri et al., 2007). In humans nicotine has been shown to increase sensitivity to cocaine-related cues (Reid et al., 1998) and there is some evidence which suggests it can increase other addictive behaviours such as alcohol consumption (Barrett et al., 2006) while other studies have found NRT can decrease consumption (e.g., McKee et al., 2008). While as yet to be tested, it is feasible that cue reactivity or the reinforcement-enhancing properties of nicotine contribute to the problematic gambling behaviour exhibited by smokers who gamble. It is also possible that co-occurring tobacco-use and gambling is influenced through cognitive factors. For instance, a recent laboratory study found that pathological gamblers who were heavy smokers made fewer errors on tests of cognitive flexibility than lighter smokers (Mooney, Odlaug, Kim, & Grant, 2011). The authors suggest that nicotine may serve as a putative cognitive enhancer for pathological gamblers. Finally, there is evidence to indicate that smokers and gamblers share common personality characteristics. In particular, higher levels of impulsivity have been reported among smokers (e.g., Mitchell, 2004), pathological/problem gamblers (e.g., Alessi & Petry, 2003; Nower et al., 2004), and pathological gamblers with substance-use disorders (Verdejo-García et al., 2008). It is conceivable that certain personality characteristics differentially influence the genesis and maintenance of co-occurring tobacco use and gambling. These possible underlying mechanisms warrant further experimental exploration.

This study contains a number of limitations. First, as the questions were not designed for this investigation, additional information that would have been desirable (e.g., co-use of tobacco while gambling) was not available. Second, demographic differences (i.e., age, marital status, income) were found between smokers and non-smokers. It would have been preferable to control for these differences; however, continuous information was unavailable. Third, the cross-sectional design of the survey did not allow for an examination of cause and effect. The present study highlights a number of associations between smoking and gambling but the directionality or causality of these effects cannot be inferred. Another potential limitation is that only one Canadian province was included at one time. Laws surrounding gambling and smoking vary; it's possible that our results do not extrapolate to other jurisdictions. Finally, the timing of data collection may have affected results. On July 1, 2005, Newfoundland and Labrador amended the Smoke-free Environment Act (2002), prohibiting smoking in all public places including establishments which host gaming. The gambling prevalence survey was administered in September and October, 2005. As such, the smoking ban had been in effect for two months prior to the start of data collection. It is unclear how this could affect responses, especially for those questions surrounding smoking. However, most of the gambling-related questions focused on 'the past 12 months', with the majority of those months occurring prior to the amendment.

The current study may have important implications for both researchers and clinicians. First, pathological gambling may soon be reclassified as an addictive disorder in the upcoming fifth edition of the American Psychiatric Association Diagnostic and Statistical Manual of Mental Disorders (DSM-V) (Grant, Potenza, Weinstein, &

Gorelick, 2010; Holden, 2010). If the diagnostic classification of pathological gambling changes to more closely resemble that of substance-use disorders, including tobacco dependence, an opportunity exists for researchers to further investigate common features (e.g., genetics, personality, neurobiology) associated with both gambling and other substance dependence including smoking. A strength of the methodology employed in the current investigation is that it allows for the identification of important associations between gambling and other addictive behaviors. Also, in addition to previous work that examined clinical samples of gamblers (e.g., Grant et al., 2008; Petry & Oncken, 2002), the present study indicates that smoking is also commonly associated with gambling-related problems in the general population. For clinicians, these results provide awareness of potentially problematic gambling motives, correlates, and activities associated with tobacco use and may ultimately lead to better prevention efforts for smokers at risk for problem gambling.

The present study was the first to systematically compare a population-based sample of non-smokers and smokers on gambling behaviour, problem gambling indices, and motives for gambling. Our results indicate that tobacco use among gamblers was associated with increased participation in riskier forms of gambling, increased problem gambling severity, and endorsement of motives linked to problematic gambling. Future work should address the potential effect of nicotine on the development, reinforcement, and treatment of problematic gambling. Of particular importance, more controlled laboratory studies are needed to accurately elucidate the role that smoking plays in gambling behaviour, craving, and motivation.

CHAPTER THREE: EXPERIMENT ONE: THE EFFECTS OF ACUTE DOSES
OF NICOTINE ON VIDEO LOTTERY TERMINAL GAMBLING IN DAILY
SMOKERS

Sections of this chapter were taken from the following:

McGrath, D. S., Barrett, S.P., Stewart, S.H., & Schmid, E.A. (2012). The effects of acute doses of nicotine on Video Lottery Terminal gambling in smokers. *Psychopharmacology*, 220, 155-161. doi: 10.1007/s00213-011-2465-3

Daniel McGrath served as first author of the manuscript included in this chapter. He took the lead role in conducting a review of the relevant literature, planning and conducting the research, writing original manuscript drafts, and making revisions based on suggestions from co-authors, editors, and peer reviewers.

Abstract

A growing body of evidence suggests that gambling frequently co-occurs with smoking, yet little is known about the degree to which nicotine and/or tobacco use influences gambling behavior. Nonetheless, an increasing number of studies suggest that acute administration of nicotine may alter other reinforcing behaviors in both animal and human models, raising the possibility that nicotine may also influence gambling behavior and craving. The purpose of this study was to examine the acute effects of nicotine on subjective and behavioral gambling responses. Twenty-eight (15 male) regular gamblers who smoke daily completed two double-blind laboratory sessions where their subjective and behavioural responses to video lottery terminal (VLT) gambling were assessed, following the administration of nicotine inhalers (NI; 4mg deliverable) or placebo inhalers (PI). NI significantly decreased tobacco-related cravings ($p < 0.05$) but did not affect gambling-related cravings, VLT betting patterns, or subjective responses ($ps > 0.1$). NI were found to acutely suppress tobacco-related cravings without influencing gambling. These results suggest that use of nicotine replacement therapies may be a safe option for gamblers who are attempting to quit smoking.

Introduction

An accumulating body of evidence has established the frequent co-occurrence of tobacco use and gambling (McGrath & Barrett, 2009). Despite high rates of co-occurrence there is sparse evidence to indicate whether nicotine can directly affect gambling behaviour. However, a number of recent research findings suggest that nicotine may alter processes that are involved in gambling. For instance, Businelle et al. (2009) found that heavy smokers performed more poorly than never smokers on the Gambling Task (GT; Bechara et al., 1994; Bechara et al., 2000), a decision-making task that contains choice, rewards, and negative outcomes. Based on what this test assesses, this finding suggests that heavy smokers on average preferred short-term rewards at the expense of sustaining longer-term losses. There is also evidence to indicate that smokers perform more poorly on tasks measuring impulsivity such as delay and probability discounting procedures. For example, a number of recent studies have found that compared to non-smokers, smokers on average tend to discount real and hypothetical rewards at a significantly higher rate (e.g., Bickel et al. 1999; Ohmura et al., 2005; Reynolds, 2004). Problem gamblers also display higher rates of delay discounting compared to non-gamblers (Petry and Casarella, 1999; Petry, 2001) and it has been suggested that other substance use/abuse may additively contribute to rates of delay-discounting among problem gamblers (Reynolds, 2006). While these studies suggest that smokers and non-smokers differ in their responses, the extent to which these differences are due to nicotine *per se* is not known. However, a number of recent studies have found that nicotine affects other conditioned behaviours in animals and in humans. For example, acute nicotine administration has been found to enhance lever pressing to visual

stimuli through non-associative mechanisms in rats (e.g., Chaudhri et al. 2006; Chaudhri et al. 2007; Donny et al. 2003; Palmatier et al. 2006). In humans, acute administration of nicotine has been found to result in greater responsiveness to a card-sorting test over a placebo (Dawkins et al. 2006) as well increased responding when a response-contingent monetary reward was available (Barr et al., 2008). However, other research did not find increased positive reinforcement following nicotine administration (Perkins et al., 2009). Although the sum total of this evidence indicates that nicotine may influence behaviours that are paired with financial incentives, no known experimental research has specifically examined if acutely administered nicotine affects actual gambling behaviour.

In the present study, we examined the potential for nicotine to influence video lottery terminal (VLT) gambling. Given the influence of operant conditioning processes in the maintenance of electronic gaming (Delfabbro & Winefield, 1999), VLT gambling represents a common and externally valid form of conditioned behaviour. Daily smokers who regularly gamble on slot machines/VLTs were recruited for a within-subjects study involving nicotine inhaler (NI) and placebo inhaler (PI) conditions. Based on previous animal and human findings, it was predicted that nicotine would augment VLT gambling over placebo, as indexed by subjective ratings (e.g., gambling craving) and observable gambling behaviour.

Method

Participants

Participants were 28 (15 males) regular VLT gamblers (i.e., VLT gambling at least once per month for past three months) who smoked daily and were at least 19 years of age or older ($M = 37.5$ years; $SD = 13.1$). The sample reported smoking an average of

13.9 ($SD = 5.8$) cigarettes per day (ranging from 4-25) and had a mean Fagerström Test for Nicotine Dependence (FTND; Heatherton, Kozlowski, Frecker, & Fagerström, 1991) score of 4.1 ($SD = 1.6$) with scores ranging from 1-7. The FTND (Heatherton et al., 1991) is designed to measure nicotine dependence, with a score of 6 or greater indicating a ‘high’ level of dependence. It has been found to possess strong psychometric properties including good internal consistency ($\alpha = 0.72$) and high test–retest reliability over a 6-week period ($r = 0.91$) among regular smokers (see Meneses-Gaya, Zuardi, Loureiro, & Crippa, 2009 for a review). Average score on the SOGS (Lesieur & Blume, 1987) in the sample was 5.3 ($SD = 4.9$) with a range of 0-19. A score of 5 or more indicates a ‘probable pathological gambler’. The SOGS is a commonly used instrument to assess pathological gambling severity that has good internal consistency ($\alpha = 0.97$), test–retest reliability over a 4-week period ($r = 0.71$), and convergent validity with the DSM-III-R (American Psychiatric Association [APA], 1987) pathological gambling criteria ($r = 0.94$) (Lesieur & Blume, 1987). Lastly, all participants were compensated \$20 CAD per session plus any amount won while gambling.

Measures

Visual Analog Scales (VAS; Bond & Lader, 1974). Used to measure subjective state, the VAS contained 7 items: ‘confident’, ‘intoxicated’, ‘bored’, ‘high’, ‘unsure’, ‘crave cigarette’, and ‘want to play VLT’. Each item was rated from 1 = “not at all” to 10 = “extremely”, with participants asked to rate their current feelings. Similar scales have been used in previous studies of drug impacts on gambling (e.g., Zack & Poulos, 2004).

Post-VLT Play Questionnaire. This short author-compiled multi-item questionnaire was used to assess enjoyment/excitement from gambling and desire to

continue gambling. Three items were of interest in this study (e.g., ‘did you enjoy the game you just played?’), with each measured on a scale from 1 = “not at all” to 7 = “absolutely”. As this questionnaire was designed specifically for the current study, the psychometric properties (e.g., reliability) of the scales have not been fully explored.

Apparatus

Inhalers. Nicotine was administered via inhalers (10 mg; 4 mg deliverable, Pharmacia, Mississauga, Ontario, Canada) flavored with menthol spray. Placebo inhalers contained a pharmacologically inert substance sprayed with menthol. The experimenter and participants were blind to the content of the inhalers (i.e., inhalers were prepared by a research assistant who was not involved in data collection). In both conditions, inhalers were administered at a rate of one deep inhalation every 10 seconds for 20 consecutive minutes, totalling 120 puffs. In their review of the nicotine inhaler, Schneider, Olmstead, Franzon, and Lunell (2001) reported that a nicotine inhaler puffed 80 times for 20 minutes results in an average plasma nicotine concentration of 8.1 µg/L at 30 minutes following the start of inhaler administration. In the current study, VLT gambling was initiated approximately 30 minutes after the beginning of inhaler administration. The decision to use inhalers over other forms of nicotine administration was influenced by their tolerability, and similarity to cigarettes on sensory motor qualities and method of administration (Schneider, Cortner, Gould, Koury, & Olmstead, 2005).

VLTs. Gambling occurred on authentic VLT’s (i.e., identical to those in the marketplace) provided by the Atlantic Lotto Corporation and the Nova Scotia Gaming Corporation. The VLTs were located in a ‘bar-lab’ decorated to resemble a real-world VLT gambling environment (see Stewart, Blackburn, & Klein 2000 for a more detailed

description). Participants were provided with \$60 CAD to gamble. VLT play was limited to one spinning reels game (i.e., Royal Spins) to ensure a similar gambling experience for all participants in both conditions (Ellery, Stewart, & Loba, 2005). However, in an effort to increase external validity, restrictions on gambling play were minimized wherever possible. Participants could place any size bet per spin (ranging from 5 cents to \$2.50) and could play the VLT for as long as they wished for up to 30 minutes. Single wagers of \$2.50 via a single button press constitute a maximum bet. The amount spent per bet and the number of spins was recorded by the experimenter, who was seated behind the participant, out of view. Printouts provided by the VLT machine recorded the total amount played and the total amount won/lost per session. The average number of bets per minute, total dollars played on the VLT, average bet size, and the average number of maximum bets were examined in this study. Any amount won by participants (or remaining from the initial \$60) was paid out at the end of the experimental session.

Heart Rate Monitor. A heart rate monitor (Polar Electro Canada Inc., Lachine, QC) was used to measure average heart rate (HR). The monitor was strapped to the participant's chest and the average number of beats was recorded over a 3-minute interval for each individual measurement period. HR recordings have been used in previous VLT studies to record physiological changes from baseline following a drug challenge (e.g., Stewart, Collins, Blackburn, Ellery, & Klein, 2005; Stewart, Peterson, Collins, Eisnor, & Ellery, 2006).

Procedure

Participants were community recruited from the Halifax Regional Municipality, Nova Scotia. The experiment included two double-blind sessions completed during the

morning ($M = 5.7$, $SD = 6.5$ days apart), with each participant taking part in counter-balanced NI and PI conditions. For each session, 12-hour overnight tobacco abstinence was verbally confirmed at the outset of the session and verified with a breath carbon monoxide (CO) reading of less than 20 ppm (Vitalograph Breath CO, Lenexa, KS). This cut-off was chosen based on recommendations for verifying overnight abstinence outlined by the Society for Research on Nicotine and Tobacco (SRNT) Subcommittee on Biochemical Verification which suggests that the long drug half-life during sleep can result in CO ratings as high as 30ppm despite overnight abstinence (Benowitz et al., 2002). The CO readings were found to range from 1ppm – 19ppm in both the NI ($M = 8.9$, $SD = 4.6$) and PI ($M = 7.6$, $SD = 4.4$) conditions. Following informed consent (first session), the experiment began. Participants first completed a questionnaire packet of baseline subjective measures (T1) and the first heart rate reading was recorded (average over 3 minutes). Next, the inhaler (NI or PI) was administered with inhalation occurring every 10 seconds for 20 consecutive minutes. A second HR reading was taken during the first 3 minutes of inhaler administration and a second measures package was completed (T2). Upon completion of the measures, participants were brought to the VLT laboratory where they were provided with \$60 CAD and permitted to play a VLT for up to 30 minutes. A third HR reading was taken during the start of VLT-play, and another measures package was completed after 15 minutes of VLT-play (T3). The final HR reading was taken after 15 minutes of VLT-play and the last measures package was completed at the end of VLT-play (T4). Participants were then debriefed on the nature of the experiment (following the second session) and compensated for their time.

Data Analyses

Analyses were conducted using SPSS Version 15 (Chicago, Illinois, USA). Dependent variables were: VAS ratings, average HR, post-VLT ratings, and betting patterns (i.e., average number of bets per minute, total dollars played on the VLT, average bet size, average number of maximum bets). Mixed modeling was used to analyze the data with pharmacology (NI, PI) and time [following inhaler administration (T2), during VLT play (T3), and post-VLT play (T4)] entered as fixed and repeated factors, respectively; sex was entered as a fixed factor and pre-administration baseline scores (T1) were entered as a time-varying covariate. No analyses involving time were conducted for post-VLT ratings or betting patterns as only a single measurement was taken per testing session. Covariance structures were selected on the basis of model simplicity and the likelihood ratio test (West, 2009). For VAS items and HR, interactions of pharmacology with time were the outcomes of interest. For the post-VLT play questionnaire and VLT betting patterns, main effects of pharmacology were the outcomes of interest.

Results

Visual Analog Scales

There was a significant interaction of pharmacology x time on ratings of ‘crave cigarette’, $F(3, 22) = 3.85, p = 0.02$, indicating lower craving in the NI condition relative to the PI condition at T2 and T3 (following inhaler and during VLT play) and a similar marginal effect ($p = 0.06$) at T4 (post-VLT play) (see Figure 3.1). There was no significant interaction of pharmacology x time for ratings of ‘want to play VLT’, $F(3, 27) = 1.60, p = 0.21$ (see Figure 3.2). Similarly, no interactions of pharmacology x time

were found for ratings of ‘confident’ $F(3, 25) = 1.62, p = 0.21$, ‘intoxicated’ $F(3, 28) = 0.74, p = 0.54$, ‘bored’ $F(3, 28) = 2.18, p = 0.11$, ‘high’ $F(3, 24) = 0.84, p = 0.49$, or ‘unsure’ $F(3, 28) = 2.29, p = 0.10$. There were no significant interactions involving sex for any of the VAS measures.

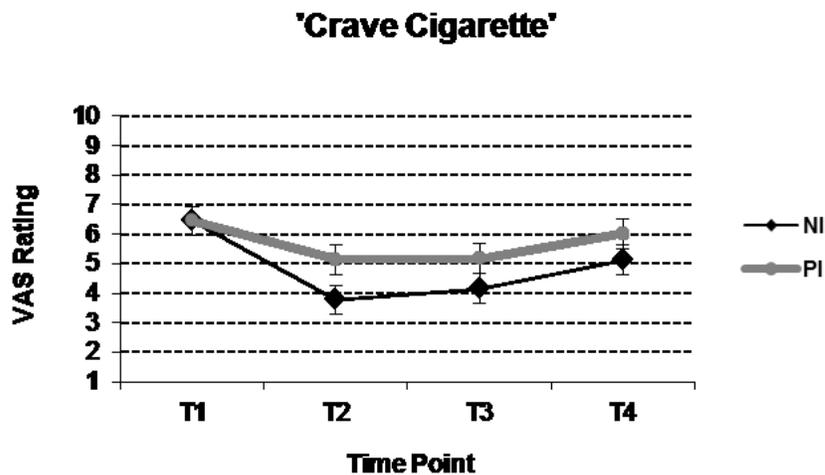


Figure 3.1. Unadjusted mean ratings for VAS item ‘crave cigarette’ for nicotine inhaler (NI) and placebo inhaler (PI) conditions at: baseline (T1); following inhaler administration (T2); during VLT play (T3); and post-VLT play (T4) in Experiment 1. Baseline values were used as time-varying covariates. NI reduced ratings for ‘crave cigarette’ at T2, T3, and T4 relative to PI. Note: Bars represent standard errors (SE).

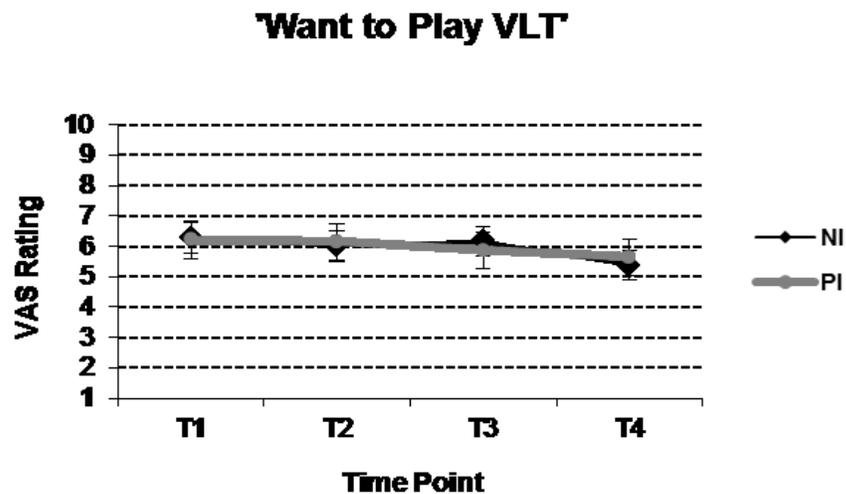


Figure 3.2. Unadjusted mean ratings for VAS item ‘want to play VLT’ for nicotine inhaler (NI) and placebo inhaler (PI) conditions at: baseline (T1); following inhaler administration (T2); during VLT play (T3); and post-VLT play (T4) in Experiment 1. Baseline values were used as time-varying covariates. No differences were observed between NI and PI at any time point on ratings for ‘want to play VLT’. Note: Bars represent standard errors (SE).

Post-VLT Play Questionnaire

No significant differences were found between NI ($M = 4.94, SE = 0.35$) and PI ($M = 4.70, SE = 0.35$) on ratings of ‘enjoy the VLT game’, $F(1, 55) = 0.22, p = 0.64$. Similarly, no differences were found between NI ($M = 4.32, SE = 0.35$) and PI ($M = 4.29, SE = 0.35$) on ratings of ‘the VLT was exciting’, $F(1, 55) = 0.01, p = 0.96$. Finally, no significant differences between NI ($M = 4.21, SE = 0.36$) and PI ($M = 3.88, SE = 0.37$) were found for ‘the VLT reduced tensions/worries’, $F(1, 55) = 0.39, p = 0.54$. The

interactions of pharmacology x sex were not significant for any of the three post-VLT play questions.

Betting Patterns

Participants were given \$60 to gamble with for up to 30 minutes in both NI and PI conditions. All participants in both conditions did gamble on the VLT; however, only 13 participants in the NI and 13 participants in PI condition played the VLT for the entire allotted 30 minutes. An examination of the average number of bets per minute suggests that NI and PI did not significantly differ, $F(1, 56) = 0.18, p = 0.89$ (see Figure 3.3a). For dollars spent gambling, no significant differences were found between NI and PI, $F(1, 56) = 0.11, p = 0.75$ (see Figure 3.3b). Also, there were no significant differences between NI ($M = \$0.99, SE = 0.24$) and PI ($M = \$0.61, SE = 0.24$) on average bet size, $F(1, 56) = 1.19, p = 0.28$. Lastly, no differences were found for average number of maximum bets between the NI and PI conditions, $F(1, 56) = 0.06, p = 0.81$ (see Figure 3.3c). No significant main or interaction effects of sex were observed for any of the indices of betting patterns.

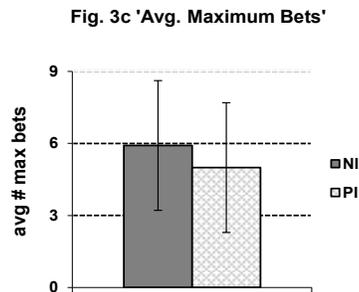
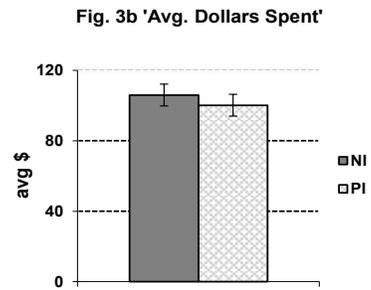
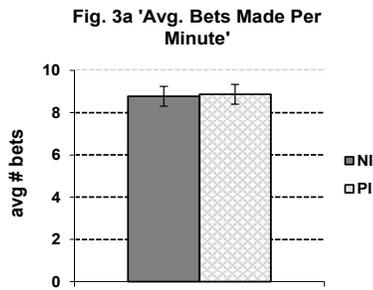


Figure 3.3. Average ‘number of bets per minute’, ‘dollars spent gambling’, and ‘number of maximum bets made’ during VLT sessions for nicotine inhaler (NI) and placebo inhaler (PI) conditions in Experiment 1. No significant differences were found between NI and PI on any betting outcomes. Note: Bars represent standard errors (SE).

Heart Rate

There was a significant interaction of pharmacology x time on average HR, $F(3, 28) = 8.57, p = 0.01$. Average HR in the NI condition was higher than the PI condition at T2 (following inhaler) [$M = 74.53 (SE = 0.72)$ vs. $M = 73.07 (SE = 0.57)$, $p = 0.03$], T3

(following inhaler and during VLT play) [$M = 78.93$ ($SE = 0.74$) vs. $M = 74.73$ ($SE = 0.80$), $p = 0.01$], and T4 (post-VLT play) [$M = 76.70$ ($SE = 1.13$) vs. $M = 72.82$ ($SE = 0.79$), $p = 0.01$]. Thus, significant effects of inhaler condition were present at all three time points (HR greater in NI than PI) although the effects were somewhat stronger during and following VLT play relative to post-inhalation/pre-VLT play. There were no significant interactions involving sex.

Tests for the Presence of Order Effects

Although our two experimental sessions were counter-balanced, we examined whether a participant's gambling 'strategy' in the second session may have been influenced by the results of their first gambling session. Specifically, we re-examined the VAS item that reached significance, the HR index, and VLT betting patterns by including 'session received nicotine' as a between-subjects variable. For 'crave cigarette', the interaction of pharmacology x time remained significant [$F(3, 22) = 3.54$, $p = 0.03$], and the interaction of pharmacology x time x session was not significant, $F(3, 23) = 1.32$, $p = 0.29$. Similarly, for average HR, the interaction of pharmacology x time remained significant [$F(3, 28) = 9.44$, $p = 0.01$], and the interaction of pharmacology x time x session was not significant, $F(3, 29) = 2.43$, $p = 0.09$. These results indicate no order effects were present for either variable. In terms of VLT practice effects, no main effects were found for 'session received nicotine' on: average number of bets per minute [$F(1, 56) = 2.52$, $p = 0.12$], dollars spent gambling [$F(1, 56) = 0.15$, $p = 0.70$], average bet size [$F(1, 56) = 0.18$, $p = 0.67$], or number of maximum bets [$F(1, 56) = 2.99$, $p = 0.09$]. These results suggest no order effects were present for any of the betting patterns of interest.

Discussion

The present study examined the effect of nicotine on subjective and objective measures of gambling behaviour in smokers. No differences were found between the NI and PI conditions on most VAS items including ‘want to play VLT’. Similarly, NI and PI did not differ on post-VLT ratings: ‘enjoy the VLT game’, ‘the VLT was exciting’, or ‘playing the VLT reduced tensions/worries’. Moreover, no differences between NI and PI were evident for VLT betting patterns including average number of bets per minute, amount spent, average bet-size, and number of maximum bets. Thus, contrary to predictions, the aggregate of these results indicate that acute administration of nicotine does not augment craving for gambling or VLT gambling behaviour.

Nicotine decreased subjective cigarette cravings to a greater extent than placebo. Participants in the study were required to abstain from tobacco for the duration of both study sessions. Evidence suggests that receiving nicotine replacement therapy (NRT) during tobacco abstinence reduces craving and withdrawal (e.g., Schneider et al., 2008; Shiffman, Ferguson, Gwaltney, Balabanis, & Shadel, 2006). Our results indicate that NI can reduce cigarette cravings without influencing VLT gambling, suggesting that NRTs may be an efficacious and safe option for gamblers who wish to quit smoking. This potential benefit warrants further consideration.

One possible reason for the lack of effects of nicotine on gambling could be the high incentive value of VLT gambling itself. That is, unlike other reinforced behaviours (e.g., card sorting tasks) which could be considered to have low incentive value, the already strong incentive value of gambling (at least among regular gamblers) may not be further enhanced by substances such as nicotine. While conceivable, there is evidence to

suggest that nicotine does enhance craving for other addictive behaviours. For instance, Reid et al. (1998) examined the extent to which acute nicotine (vs. placebo) delivered via transdermal patch affected craving following exposure to cocaine cues in individuals with a history of smoking crack cocaine. While all participants reported an increase in cocaine craving and changes in physiological measures (e.g., skin conductance) following cue exposure, craving was strongly enhanced by nicotine. In addition, previous studies conducted in our lab indicate that VLT gambling may also be sensitive to alcohol manipulations. For example, Stewart et al. (2005) examined heart rate responses to VLT play between an alcohol condition and a non-alcoholic control beverage condition. They found that those in the alcohol condition exhibited increased heart rate from predrinking to VLT play relative to controls. Similarly, Ellery et al. (2005) assigned non-pathological and probable pathological gamblers to either an alcohol dose condition or a non-alcoholic control beverage condition and had them play a VLT video poker game. They found that probable pathological gamblers in the alcohol condition spent more time playing the VLT and had a higher rate of power-betting (doubling a bet after seeing two cards of the five card poker hand) than those in the control condition. No differences were found for either behaviour among non-pathological gamblers in the alcohol and control conditions. These studies suggest that the VLT behavioural assay is sensitive to pharmacological challenges. Nevertheless, future work looking at whether nicotine affects gambling would benefit from the inclusion of a neutral (non-gambling) control condition (e.g., Wulfert, Maxson, & Jardin, 2009) to rule out the possibility that the lack of effects of nicotine on gambling in the present study was due to the high incentive value of VLT gambling.

The study has some limitations. First, the degree to which nicotine alters real-world gambling compared to laboratory-based gambling remains unclear. This experiment placed limits on the amount that could be spent and time available to gamble -- constraints that do not exist in everyday gambling. However, previous findings suggest that lab-based gambling can serve as a valid analogue when real-world cues (e.g., real VLT's) are provided (see review by Stewart & Jefferson, 2007). In addition, the gambling frequency criteria of playing 'VLT games' at least once per month for past three months' may have been too liberal. It is unclear if our results would generalize to heavier VLT-use (e.g., daily or weekly use) or to clinical populations of gamblers. Next, the participants included in the study were daily smokers. There is evidence to suggest that nicotine elimination is slow in regular smokers and nicotine can remain in body tissues for up to several days during abstinence (see Matta et al., 2007). While we exceeded the 8 hours of overnight tobacco abstinence recommended for in vivo studies (Matta et al., 2007), it is possible that chronic tolerance to nicotine affected subjective craving to gamble in our pharmacological conditions. Additionally, although the sample was comprised of daily smokers, the relatively low average number of cigarettes smoked per day ($M = 13.9$, $SD = 5.8$) and relatively low FTND scores (Heatherton et al., 1991) ($M = 4.1$, $SD = 1.6$) suggest that a wide range of smokers were included in the study. Although the sample as a whole could be considered moderately dependent smokers based on average FTND scores, the wide range of scores (1 to 7) indicates that at least some of the participants may not have been nicotine dependent. It is possible that more robust effects would have been observed in a sample of more heavy/highly dependent smokers. Moreover, because of slow overnight elimination of CO (Benowitz et al., 2002)

and the early morning scheduling of the experimental sessions, the maximum CO cutoff to verify abstinence was set at 20ppm. While all participants also verbally confirmed abstinence at the start of each session, this CO cutoff is likely inadequate to verify abstinence in light smokers. The current study also relied solely on one method of nicotine delivery - the inhaler. The inhaler was designed to 'wean' smokers off of nicotine (Schneider et al., 2001) and produces lower acute blood nicotine levels than cigarettes. For instance, the administration of a nicotine inhaler with a 10mg cartridge over 20 minutes results in an average blood nicotine concentration of 8.1 *ng/ml*. In comparison, a cigarette smoked over 5 minutes results in an average venous blood nicotine concentration between 15-30 *ng/ml* (Hukkanen, Jacob, & Benowitz, 2005). It is possible that the dose of nicotine used in the current study was insufficient to induce secondary reinforcement enhancing effects for gambling. Future work should attempt to replicate our methodology with other forms of NRT that produce more rapid increases in blood nicotine levels or alternatively compare nicotine containing with denicotinized cigarettes. In addition, a manipulation check for inhalers was not included in the protocol. That is, participants were not explicitly asked if they could distinguish nicotine from placebo inhalers at the end of the testing sessions. It is possible that participants were able to discern the content of the inhaler following administration in the first sessions, which could potentially influence expectancy effects for their second experimental session. Lastly, nicotine was acutely administered in this study, whereas NRT is typically used over a longer time period. It is uncertain how prolonged NRT use would affect gambling.

In conclusion, acute administration of nicotine via inhaler did not affect gambling cravings or betting behaviour. Nicotine did, however, reduce subjective craving for

cigarettes and increase heart rate. These findings suggest that use of NRTs may be appropriate for gamblers attempting to quit smoking.

CHAPTER FOUR: EXPERIMENT TWO: THE INFLUENCE OF ACUTELY
ADMINISTERED NICOTINE ON CUE-INDUCED CRAVING FOR GAMBLING
IN AT-RISK VIDEO LOTTERY TERMINAL GAMBLERS WHO SMOKE

Sections of this chapter were taken from the following:

McGrath, D. S, Dorbeck, A., & Barrett, S.P. (under review). The influence of acutely administered nicotine on cue-induced craving for gambling in at-risk video lottery terminal (VLT) gamblers who smoke. Manuscript submitted for publication in *Behavioural Pharmacology*, Dalhousie University.

Daniel McGrath served as first author of the manuscript included in this chapter. He took the lead role in conducting a review of the relevant literature, planning and conducting the research, writing original manuscript drafts, and making revisions based on suggestions from co-authors, editors, and peer reviewers.

Abstract

Evidence indicates that tobacco use and gambling often co-occur. Despite this association, little is known about how tobacco use affects the propensity to gamble. Nicotine, the putative addictive component of tobacco, has been found to potentiate the hedonic value of other non-smoking stimuli. Environmental cues have been identified as an important contributor to relapse in addictive behavior; however, the extent to which nicotine can affect the strength of gambling cues remains unknown. This study examined whether nicotine influences subjective ratings for gambling following exposure to gambling cues. In a mixed within/between-subjects design, thirty (20 male) video lottery terminal (VLT) gamblers ('moderate risk' or 'problem gamblers') who smoke daily were assigned to nicotine (NL; 4mg deliverable) or placebo lozenge (PL) conditions. Subjective and behavioural responses were assessed at baseline, following lozenge, following neutral cues, and following presentation of gambling cues. NL was found to significantly reduce tobacco-related cravings ($p < 0.05$) but did not affect gambling-related cravings, the choice to play a VLT, or other subjective responses. Nicotine was found to reduce tobacco-related cravings but did little to affect gambling craving following gambling cues. These results suggest that nicotine replacement therapies (NRT) do not increase cue-induced craving for gambling in at-risk VLT gamblers who smoke.

Introduction

Tobacco-use and gambling frequently co-occur (McGrath & Barrett, 2009). Rates of smoking among pathological gamblers (PGs) range from 41% (Smart & Ferris, 1996) to 60% (Cunningham-Williams et al., 1998) and numerous studies have also found that both regular gamblers and PGs who use tobacco experience poorer psychosocial and gambling-related outcomes compared to PGs who don't smoke (e.g., Grant & Potenza, 2005; Petry & Oncken, 2002; Potenza et al., 2004).

Contemporary studies on smoking and gambling suggest that these addictive behaviors may also share some common underlying mechanisms. For instance, research on the neurochemical underpinnings of tobacco-use (e.g., Pontieri et al., 1996) and gambling (e.g., Breiter, Aharon, Kahneman, Dale, & Shizgal, 2001; Linnet et al., 2010) has found that both are associated with increased dopaminergic neurotransmission. Additionally, there is evidence to suggest that nicotine may influence primary processes related to gambling. In animal models, nicotine has been found to enhance the reinforcement value of lever pressing for a moderately reinforcing visual stimulus (e.g., Chaudhri et al., 2007; Donny et al., 2003; Palmatier et al., 2006). In humans, the acute administration of nicotine has been found to result in greater responsiveness to a card-sorting task among heavy smokers (Dawkins et al., 2006) as well as increased responding for a monetary reward among non-smokers (Barr et al., 2008). While these findings suggest nicotine may influence other reinforcing behaviours, only a select few laboratory studies have investigated its effect on actual gambling. McGrath, Barrett, Stewart, and Schmid (2012) recently examined the effects of acute nicotine administration among regular video lottery terminal (VLT) gamblers who smoke. It was found that nicotine

replacement therapy (NRT) delivered via inhaler reduced subjective craving for cigarettes; however, nicotine did not alter gambling-related cravings or VLT betting behavior (e.g., dollars spent gambling). The available evidence to date is mixed with some studies supporting the reinforcement-enhancing properties of nicotine for other reinforced behavior (e.g., Barr et al., 2008; Dawkins et al., 2006) while other findings suggest that nicotine has little effect on actual gambling behavior (McGrath et al., 2012). While these results do not directly implicate nicotine in the modification of gambling outcomes, they do raise the possibility that nicotine may influence psychological processes associated with gambling.

The cue-reactivity paradigm has become an important framework for investigating the role of cue-induced craving in addiction (Tiffany & Wray, 2009). Cue-reactivity paradigms involve exposing individuals to drug-related stimuli commonly associated with the use of a particular substance. In most cases, behavior, subjective responses, and/or physiological changes following exposure to stimuli are recorded and examined (Carter & Tiffany, 1999). Recent research indicates that laboratory-based cue-reactivity paradigms are also useful for understanding craving for gambling (Kushner et al., 2008). For instance, an exciting gambling video was found to elicit greater urges to gamble among pathological gamblers compared to social gamblers (Sodano & Wulfert, 2010); viewing images of preferred gambling activities elicited greater craving among pathological gamblers than images of non-preferred activities (Wulfert et al., 2009); and gambling imagery scripts were found to elicit higher ratings of excitement than gambling images among student gamblers (Ashrafioun et al., in press). Other studies suggest that gambling-related audio (Blanchard et al., 2000) as well as imagining gambling (Sharpe,

2004) can increase physiological arousal (e.g., heart rate) in problem gamblers compared to social gamblers. Finally, recent neuroimaging investigations with problem gamblers reveal dorsolateral prefrontal activity while watching gambling-related video (Crockford et al., 2005) and fronto-parietal activation following exposure to a blackjack scenario (Miedl et al., 2010) indicating that memory networks associated with gambling are triggered by cues. In a sample of treatment-seeking gamblers exposed to gambling cues, Goudriaan et al. (2010) found increased activity in brain regions implicated in motivation and visual processing, areas also associated with cue-reactivity in other substance dependence including tobacco. Although gambling-focused cue-reactivity research is still in its infancy, the aggregate of these findings suggests that this paradigm reliably induces craving for gambling in experimental settings.

A few studies have also investigated the potential for cue-reactivity paradigms to elicit craving in drug challenge experiments in which nicotine was administered. Specifically, nicotine was found to potentiate cue-induced cocaine craving (Reid et al., 1998) as well as ratings of facial attractiveness (Attwood et al., 2009). These findings indicate that nicotine may potentiate the hedonic value of other visual stimuli that is unrelated to smoking itself. As such, it is feasible that a nicotine challenge may also influence craving ratings for visual cues associated with other behaviors commonly associated with smoking such as gambling. To date, however, no known published reports have investigated the potential of using a laboratory-based gambling cue-reactivity paradigm to elicit craving in a similar drug challenge protocol.

The present study sought to further clarify the relationship between nicotine and gambling using a laboratory-based drug challenge experiment. The study protocol was

designed to accomplish a set of specific goals. First, some evidence suggests that nicotine may influence other reinforcing behaviours in humans (e.g., Barr et al., 2008; Dawkins et al., 2006) while at least one study indicates that this may not be the case for actual gambling behavior (i.e., McGrath et al., 2012). However, a number of limitations in McGrath et al. may have contributed to the negative findings. Specifically, inclusion of regular gamblers (instead of problem), the relatively slow absorption of nicotine from inhalers, and possibly the naturally high reinforcement value of VLT gambling itself may have contributed to the null effects for nicotine on gambling craving. The primary goal of current study was to provide an additional examination of whether acutely administered nicotine can influence gambling craving in gamblers who smoke. Second, the current study was also designed to improve upon potential methodological limitations of the protocol employed in McGrath et al. (2012). Specifically, McGrath et al. recruited smokers who were regular gamblers; however, participants were not required to meet diagnostic criteria for problem or pathological gambling. It is feasible that regular gamblers do not experience intense cravings for gambling in a manner similar to that of problem gamblers. Indeed, results from Sodano and Wulfert (2010) suggest that pathological gamblers report greater urges to gamble following cue exposure than social gamblers. In the current study, the sample was comprised solely of ‘moderate-risk’ or ‘problem’ VLT/slots gamblers as defined by a score of ≥ 3 on the Canadian Problem Gambling Index (Ferris and Wynne, 2001). This selection procedure was designed to exclude individuals who only gamble occasionally or socially. A final goal of the current study was to investigate the potential for using a gambling cue-reactivity paradigm in a nicotine drug challenge experiment. Cue-reactivity paradigms from other domains (e.g.,

cocaine use, facial attractiveness) have successfully induced craving across pharmacological conditions; however, no known studies have directly examined the utility of a gambling cue procedure with similar nicotine protocols. Based on previous literature illustrating the secondary-reinforcement properties of nicotine, it was predicted that relative to placebo, nicotine administration would be associated with elevated subjective gambling craving and heightened response on physiological indices (i.e., average heart rate) following exposure to gambling-cues in this sample of high-risk gamblers. It was also hypothesized that participants in the nicotine condition would be significantly more likely to accept an offer to gamble on a video lottery terminal (VLT) following gambling cue exposure than those in the placebo condition.

Method

Study Recruitment

All individuals were recruited from the Halifax Regional Municipality through Internet bulletin boards. Participants were screened via telephone for the following inclusion criteria: (a) being 19 years of age or older, (b) regular daily smoking for the past 12 months, (c) a score of ≥ 3 on the FTND (Heatherton et al., 1991), (d) have played VLTs at least once a month for the past 6 months, and (e) a score of ≥ 3 on the Canadian Problem Gambling Index (Ferris & Wynne, 2001) indicating ‘moderate-risk’ (between 3 – 7) or ‘problem gambling’ (between 8 – 27). Individuals were excluded if they had ever sought treatment for gambling, were currently trying to quit smoking or gambling, or for females, were currently pregnant or were planning to conceive. The experimental protocol received ethics approval from the Capital District Health Authority Research Ethics Board and was conducted in accordance with the Declaration of Helsinki.

Participants

Participants were 30 (20 males) regular VLT gamblers who smoked daily with a mean age of 32.2 years ($SD = 11.8$). The sample reported smoking an average of 15.5 ($SD = 8.9$) cigarettes per day and a mean FTND (Heatherton et al., 1991) score of 5.7 ($SD = 1.6$). The mean CPGI (Ferris and Wynne, 2001) score was 8.6 ($SD = 4.5$) with 12 being ‘moderate risk’ gamblers and 18 meeting the criteria for ‘problem gambling’.

Procedure

Blinding

To control for demand characteristics, participants were not informed of the specific ingredients they would ingest prior to their participation. Rather, they were told the lozenges ‘may contain some of the ingredients commonly found in cigarettes (e.g., tar, ammonia, carbon monoxide, menthol, nicotine, sucrose, etc.)’. In addition, the experimenter remained blind to both the lozenges administered and the content of the second slideshow viewed by participants. Participants were also asked not to divulge information regarding the lozenges or slideshows to the experimenter.

Test Procedures

For this mixed within/between-subjects design, each experimental session was conducted in a neutral testing room (i.e., undecorated walls and no other visual cues) and took place during mornings only (between 09:00 and noon). Fifteen participants were randomly assigned to a nicotine lozenge (NL) condition and 15 were assigned to a placebo lozenge (PL) condition. Following informed consent, 12-hour overnight tobacco abstinence was verified with a CO expired air reading (< 15 parts per million) and an alcohol analyzer breath sample (0.00 blood-alcohol concentration). The CO cut-off was

chosen for verifying overnight abstinence as the long drug half-life during sleep can result in ratings as high as 30ppm the next morning despite abstaining from smoking overnight (Benowitz et al., 2002). All participants were also asked not to consume caffeine the morning of the session. The first task assigned to participants in both conditions was to complete baseline subjective craving and HR measurements (Time 1). Participants were then provided with a lozenge (nicotine or placebo) and were asked to complete a second set of identical craving measures (Time 2) after 30 minutes from the start of lozenge administration. Next, all participants viewed the neutral cue slideshow (always presented first) and completed the third set of measures (Time 3). Lastly, both groups viewed the gambling cue slideshow (always presented second) in a fixed order and completed the final set of craving measures (Time 4). HR was recorded during both cue slideshow presentations. Neutral cue presentations were always shown before the gambling cue presentation, thereby reducing the chance of carryover effects on craving ratings and minimizing the need for counterbalancing presentations (Sayette, Griffin, & Sayers, 2010). Following completion of the last set of measures, participants were provided with \$10 CAD and the option of keeping the money or using it to play a VLT. Those who chose to gamble were escorted from the neutral testing room to the VLT bar-lab located directly across the hallway. At the end of the session, all participants were compensated with an additional \$30 CAD per session plus any amount won while gambling.

Cue Presentations

The gambling cue presentation consisted of 40 high-resolution electronic gaming-related images (e.g., rows of slot machines, individuals of varying

ages/ethnicities/genders playing slots) paired with an audio soundtrack of background casino noise. The slideshow presentation was two minutes long with each photograph displayed for three seconds. Previous studies indicate that pairing images with sounds can effectively induce craving for gambling (e.g., Sodano & Wulfert, 2010). Images were carefully selected to avoid inclusion of other addictive substances (e.g., tobacco, alcohol, illicit drugs). The neutral cue presentation was designed to be congruent with the gambling slideshow. The presentation consisted of 40 high-resolution dishwasher and washing machine images (e.g., rows of washing machines, individuals of varying ages/ethnicities/genders operating the appliances) paired with an audio soundtrack of washing machine sounds.

Lozenges

Nicotine was administered via NRT mint-flavored quick release lozenges (4 mg of nicotine; NiQuitin, GlaxoSmithKline: United Kingdom). The lozenges are not commercially available in Canada, thus limiting prior participant experience with this NRT. The placebos were comprised of pharmacologically-inert mint-flavored lozenges. In both conditions, participants were instructed to place the lozenge in their mouth, occasionally move it from one side of their mouth to the other (not chew or suck the lozenge), and allow it to dissolve over 30 minutes. Recent evidence indicates that quick release nicotine lozenges are effective in acutely reducing cigarette craving (Barrett & Wagner, 2011) in a time course similar to the present study. Lozenges were chosen as they have been found to produce higher acute blood nicotine levels compared to other forms of NRT including the inhalers administered in the previous study (i.e., McGrath et al., 2012).

Measures

Visual Analog Scales (VAS; Bond & Lader, 1974). VAS items were used to measure 16 subjective mood states: ‘relaxed’, ‘pleasant’, ‘head rush’, ‘stimulated’, ‘jittery’, ‘dizzy’, ‘irritable’, ‘trouble concentrating’, ‘anxious’, ‘satisfied’, ‘high’, ‘alert’, ‘frustrated’, ‘sedated’ ‘crave cigarette’, and ‘crave VLTs/slots’ (the wording of this gambling item was changed from the previous study to better reflect ‘craving’). Each item was rated from 1 = “not at all” to 10 = “extremely”, with participants asked to rate their present feelings.

Gambling Craving Scale (GACS; Young & Wohl, 2009). The GACS is a 9-item self-report scale of current subjective craving for gambling comprised of three factors: ‘anticipation of gambling’, ‘desire for gambling’, and ‘relief of negative affect’. The GACS contains good psychometric properties with alphas ranging from .81 to .85 among its three factors (Young & Wohl, 2009).

Questionnaire of Smoking Urges - Brief (QSU-B; Cox, Tiffany, & Christen, 2001). A 10-item self-report measure used to assess current smoking urges. It contains two factors: ‘intention to smoke’, and ‘withdrawal/negative affect’. The QSU-B has been demonstrated to be psychometrically sound with both factors displaying strong internal consistency ($\alpha = .96$ and $\alpha = .93$ respectively) (Cox et al., 2001).

Behavioural Task

At the end of the experimental session, participants were presented with a choice of either: (a) receiving \$10 to keep and take with them; or (b) receiving \$10 to gamble on a VLT for up to 15 minutes. Participants were free to spend as much of the \$10 as they wished and were paid by the experimenter for any amount they won gambling.

Apparatus

Carbon Monoxide Reader. An expired air carbon monoxide (CO) reader (piCO Smokerlyzer; Bedfont Scientific Ltd, Maidstone, England) was used to confirm smoking abstinence. Alcohol abstinence was also confirmed using a breathalyzer (Alcomate Premium; AK Solutions USA LLC, Palisades Park, New Jersey).

Heart Rate Monitor. A heart rate monitor (Polar Electro Canada Inc., Lachine, QC) was used to measure average heart rate (HR). The average number of beats was recorded over a 2-minute interval for each individual measurement period.

VLTs. As part of the experimental protocol, participants were offered an opportunity to play an authentic video lottery terminal (VLT) provided by the Atlantic Lotto Corporation and the Nova Scotia Gaming Corporation. Gambling took place in a ‘bar-lab’ decorated to resemble a real-world VLT gambling environment (see Stewart et al., 2000 for a description). VLT play was restricted to a spinning reels game (i.e., Royal Spins) to guarantee a similar gambling session for all participants (Ellery et al., 2005).

Data Analyses

All analyses were conducted using SPSS Version 17 (Chicago, Illinois, USA). The dependent variables included: VAS ratings, GACS subscale scores (Young & Wohl, 2009), QSU-B factor scores (Cox et al., 2001), average HR, and ‘choice to play/not play the VLT’. Each dependent variable was analyzed using mixed modeling with pharmacology (NL, PL) and time [baseline (T1), following lozenge administration (T2), following neutral-cue presentation (T3), and following gambling-cue presentation (T4)] entered as fixed and repeated factors, respectively; sex was entered as a fixed factor and pre-lozenge baseline scores (T1) were entered as a time-varying covariate. Covariance

structures were chosen based on model simplicity and the likelihood ratio test (West, 2009). For each dependent variable involving time (i.e., VAS, GACS, QSU-B, average HR), the interaction of pharmacology with time was of primary interest. A chi-square test was conducted for ‘choice to play/not play the VLT’ across NL and PL conditions.

Results

Visual Analog Scales

Out of the 16 VAS items, four were found to have significant pharmacology x time interactions. A significant pharmacology x time interaction was found for ratings of ‘crave cigarette’, $F(3, 45) = 4.33, p = 0.01$. Lower cigarette craving ratings were found for NL relative to PL at T2 (following lozenge) ($p = 0.01$) and T3 ($p = 0.04$) (following neutral-cues) and a marginal effect ($p = 0.07$) at T4 (following gambling-cues) (see Figure 4.1). Significant interactions were found for ‘head rush’ [$F(3, 44) = 4.43, p = 0.01$], ‘alert’ [$F(3, 44) = 2.75, p = 0.05$], and ‘satisfied’ $F(3, 44) = 3.26, p = 0.03$. For ‘head rush’, NL ratings were higher at T2 ($M = 3.90, SE = 0.44$) and T4 ($M = 3.05, SE = 0.44$) than PL at T2 ($M = 1.86, SE = 0.44$) and T4 ($M = 1.66, SE = 0.44$); for ‘alert’ PL ($M = 6.15, SE = 0.49$) ratings were greater than NL ($M = 4.82, SE = 0.49$) at T2; and while there was significant interaction for ‘satisfied’, no differences were found at individual time points. No significant interactions were found for the remaining VAS items. Notably, there was no significant pharmacology x time interaction for the gambling-related VAS item ‘crave VLTs/slots’, $F(3, 44) = 0.85, p = 0.47$ (see Figure 4.2). Finally, post-hoc analyses revealed that the interaction of pharmacology x time x CPGI category for ‘crave VLTs/slots’ was not significant [$F(3, 44) = 1.03, P = 0.39$], suggesting no differences in ratings between ‘moderate risk’ and ‘problem’ gamblers.

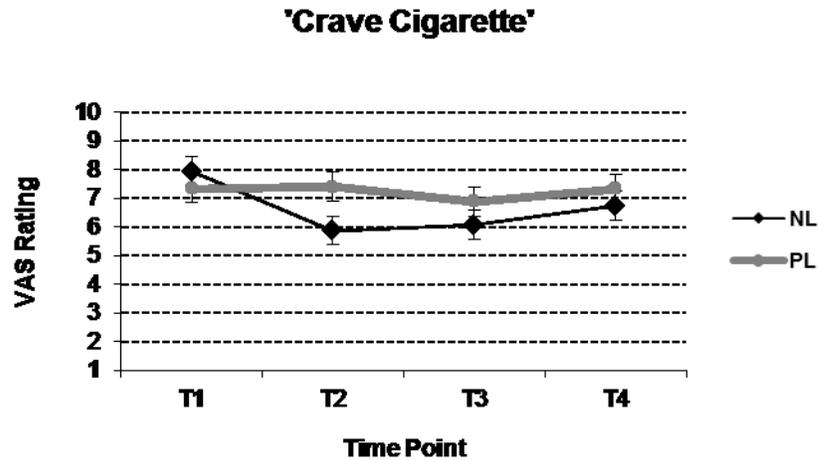


Figure 4.1. Unadjusted mean ratings for VAS item ‘crave cigarette’ for nicotine lozenge (NL) and placebo lozenge (PL) conditions at: baseline (T1); following lozenge administration (T2); following neutral-cue presentation (T3); and following gambling-cue presentation (T4) in Experiment 2. Baseline values were fixed as time-varying covariates in the analyses. NL significantly reduced ratings for ‘crave cigarette’ at T2, T3, and marginally at T4 relative to PL. There was also a main effect of time for ‘crave cigarette’ with mean ratings at T4 being significantly higher than those at T2 and T3. Note: Bars represent standard errors (SE).

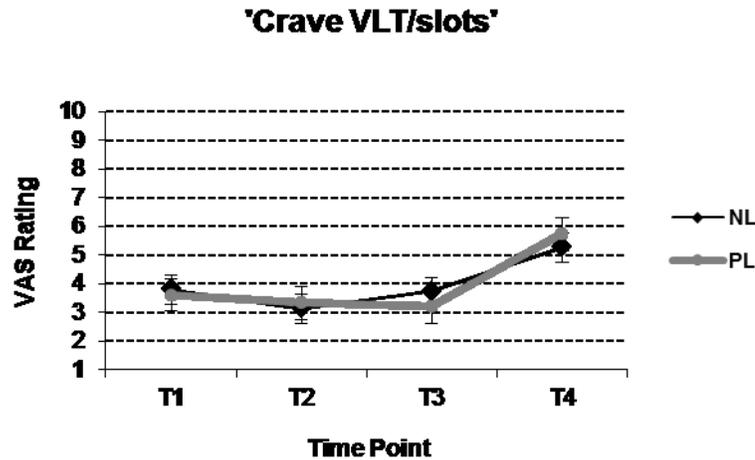


Figure 4.2. Unadjusted mean ratings for VAS item ‘crave VLTs/slots’ for nicotine lozenge (NL) and placebo lozenge (PL) conditions at: baseline (T1); following lozenge administration (T2); following neutral-cue presentation (T3); and following gambling-cue presentation (T4) in Experiment 2. Baseline values were fixed as time-varying covariates in the analyses. No differences were observed between NL and PL for any time point on ratings for ‘crave VLTs/slots’. Note: Bars represent standard errors (SE).

However, there was a main effect of time [$F(2, 58) = 22.60, p = 0.01$], with mean ratings at T4 ($M = 5.48, SE = 0.40$) being significantly higher than those at T2 ($M = 3.05, SE = 0.40$) and T3 ($M = 3.35, SE = 0.40$) suggesting higher overall cravings following presentation of gambling cues (see Figure 4.3). No differences were found between T2 and T3 ($p = 0.37$). There were no significant interactions involving sex.

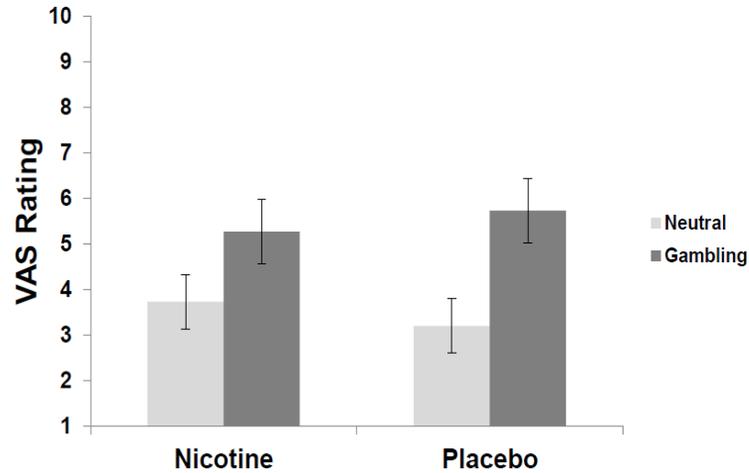


Figure 4.3. Unadjusted mean ratings for VAS item ‘crave VLTs/slots’ for nicotine lozenge (NL) and placebo lozenge (PL) conditions at: following neutral-cue presentation (T3) and following gambling-cue presentation (T4). There was a main effect of time for ‘crave VLTs/slots’ with ratings being significantly greater at T4 compared to T3 in the NL and PL conditions. Note: Bars represent standard errors (SE).

Gambling Craving Scale (GACS; Young & Wohl, 2009)

NL and PL conditions were compared across the three GACS factors. No differences were found between NL and PL on the ‘anticipation of gambling’ scale, [$F(3, 44) = 0.58, p = 0.63$], the ‘desire for gambling’ scale, [$F(3, 44) = 0.63, p = 0.60$], or the ‘relief of negative affect’ scale, $F(3, 45) = 0.56, p = 0.64$ (see Figure 4.4a through 4.4c). However, as seen with ‘crave VLTs/slots’, significant main effects for time were found for ‘anticipation of gambling’, [$F(2, 58) = 14.17, p = 0.01$], ‘desire for gambling’, [$F(2, 60) = 17.29, p = 0.01$], and ‘relief of negative affect’, $F(2, 59) = 8.84, p = 0.01$. In each case, total T4 ratings were higher than those for T2 and T3 (see Figure 4.4a thru 4.4c). No interaction effects of sex were observed for any of the indices.

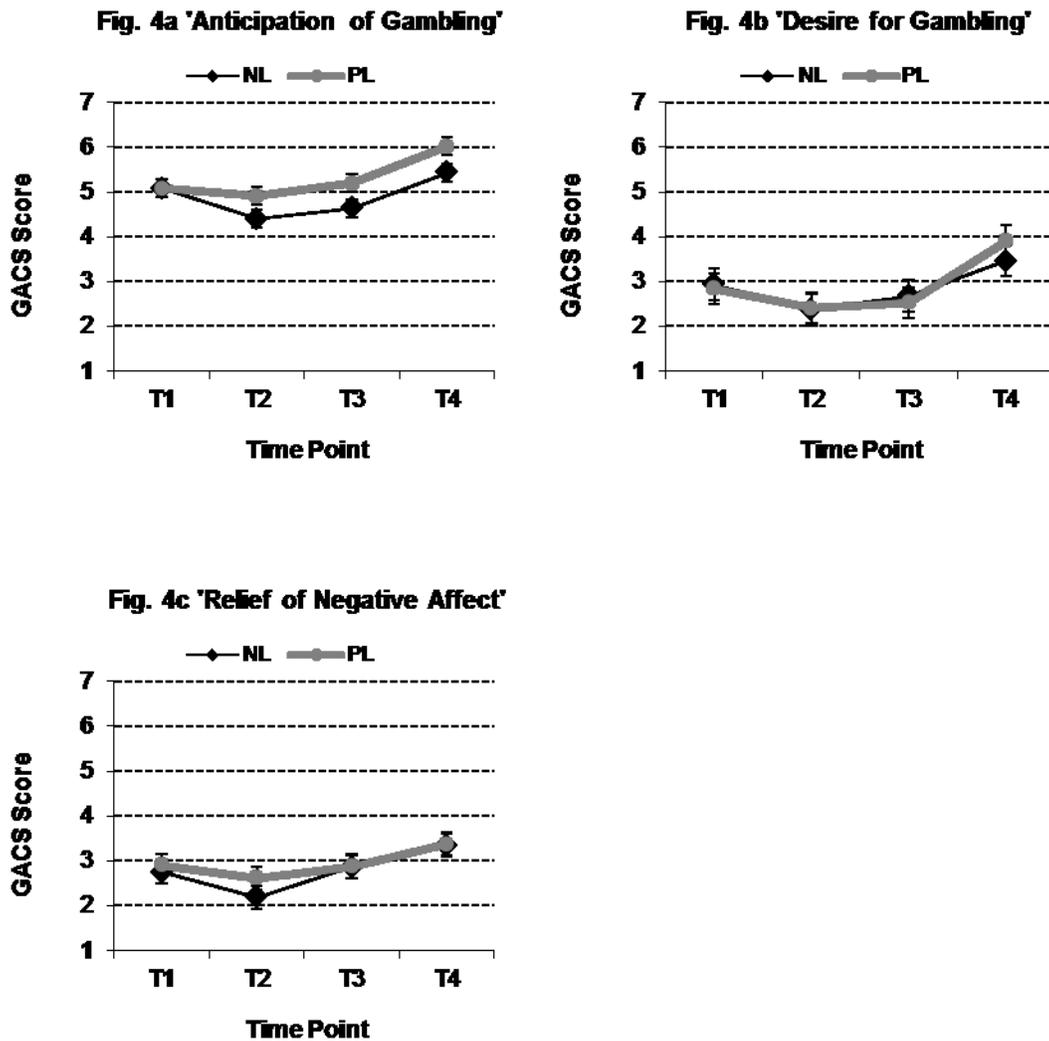


Figure 4.4. Unadjusted mean ratings for GACS (Young & Wohl, 2009) factors ‘anticipation of gambling’, ‘desire for gambling’, and ‘relief of negative affect’ for nicotine lozenge (NL) and placebo lozenge (PL) conditions at: baseline (T1); following lozenge administration (T2); following neutral-cue presentation (T3); and following gambling-cue presentation (T4) in Experiment 2. Baseline values were fixed as time-varying covariates in the analyses. No differences were observed between NL and PL for

any time point on ratings for any of the GACS factors. There was a main effect of time for ‘anticipation of gambling’, ‘desire for gambling’, and ‘relief of negative affect’ with mean ratings at T4 being significantly higher than those at T2 and T3 for all three factors.

Note: Bars represent standard errors (SE).

Questionnaire of Smoking Urges - Brief (QSU-B; Cox et al., 2001)

NL and PL conditions were compared across the two QSU-B factors. There was a significant interaction of pharmacology x time for ratings on ‘intention to smoke’, $F(3, 46) = 4.44, p = 0.01$. NL ratings were significantly lower at T2 ($M = 21.01, SE = 1.73$) and T3 ($M = 22.91, SE = 1.73$) than PL at T2 ($M = 29.81, SE = 1.76$) and T3 ($M = 29.06, SE = 1.76$). No differences were found at T4. No differences were found between NL and PL as a function of time on the ‘withdrawal/negative affect’ scale, $F(3, 46) = 1.02, p = 0.39$. There were no significant interactions involving sex.

Behavioral Task

For the decision to play or not play the VLT, no differences were found between the number of participants in NL ($N = 9$) and PL ($N = 13$) conditions who chose to play the VLT, $\chi^2(1, N = 30) = 2.73, p = 0.10$. In both cells, the majority chose to play the VLT (22/30) regardless of pharmacology condition.

Heart Rate

There was a significant interaction of pharmacology x time for average HR, $F(3, 43) = 5.64, p = 0.01$. Average HR was found to be higher in the NL than the PL condition at T2 (following lozenge) [$M = 76.34 (SE = 1.32)$ vs. $M = 69.03 (SE = 1.30), p = 0.01$], T3 (following neutral-cues) [$M = 71.66 (SE = 1.32)$ vs. $M = 67.39 (SE = 1.36), p = 0.03$],

and T4 (following gambling-cues) [$M = 73.33$ ($SE = 1.32$) vs. $M = 67.28$ ($SE = 1.30$), $p = 0.01$]. No interaction effects of sex were observed.

Assessment of Cue Carryover Effects

Although steps were taken to minimize the potential for carryover effects, additional analyses were conducted to rule out the possibility that the order of cue presentations (i.e., neutral cues followed by gambling cues) influenced craving ratings. An additional group of participants was recruited for the purpose of assessing possible cue carryover effects. These participants were tested in the same manner as the main sample with the exception being they received neutral cues twice (i.e., neutral-neutral) instead of gambling cues (i.e., neutral-gambling). The second sample consisted of eight (seven males) VLT gamblers who smoked daily with a mean age of 28.1 years ($SD = 8.9$). Average age, [$t(36) = 0.90$, $p = .37$], mean FTND score of 6.1 ($SD = 2.0$), [$t(36) = 0.65$, $p = .52$], and mean CPGI score ($M = 9.3$, $SD = 4.4$), [$t(36) = 0.38$, $p = .70$], of this sample did not significantly differ from that of the main sample.

The potential influence of time on gambling craving ratings within this subset of participants was then examined in a second set of analyses. Gambling-related subjective measures (i.e., ‘crave VLTs/slots’, GACS factors) were examined, with the main effect of ‘time’ being of primary interest. No significant main effects of time were found for ‘crave VLTs/slots’, [$F(2, 16) = 0.57$, $p = 0.58$], the GACS ‘anticipation of gambling’ scale, [$F(2, 15) = 2.23$, $p = 0.14$], the GACS ‘desire for gambling’ scale, [$F(2, 15) = 1.67$, $p = 0.22$], or the GACS ‘relief of negative affect’ scale, [$F(2, 15) = 0.50$, $p = 0.62$]. These findings suggest that gambling-related craving was not influenced by prior exposure to neutral cues; however, given the small number of participants in this analysis

(i.e., eight in total), recruitment of a larger sub-sample may be required to adequately detect potential effects.

Discussion

The present study investigated the potential for acutely administered nicotine to augment cue-induced gambling cravings in VLT gamblers who smoke. No significant pharmacology x time interactions were found on gambling-related subjective measures including 'crave VLTs/slots' or GACS (Young & Wohl, 2009) subscales 'anticipation of gambling', 'desire for gambling', and 'relief of negative affect'. There were, however, significant main effects for time indicating that overall gambling craving ratings were higher following gambling-cues than at any other point. This suggests that gambling cues elicited greater overall gambling-related craving than neutral cues. Furthermore, no differences between NL and PL conditions were detected for the behavioral measure 'decision to play VLT'. In contrast to previous studies (e.g., Attwood et al., 2009; Reid et al., 1998) which found that nicotine enhanced ratings of other positive/hedonic cues, nicotine did not influence gambling craving following exposure to gambling-related cues in the present study. These findings are in line with those of McGrath et al. (2012) and suggest that acute administration of nicotine does not appear to influence VLT gambling-related craving.

Another goal of the current study was to examine the potential utility of gambling cue-reactivity paradigms for drug challenge experiments. Previous work has established that the presentation of gambling-related visual and auditory cues can successfully induce craving in gamblers (e.g., Wulfert et al., 2009). However, no known studies have directly compared cue-induced craving for gambling between pharmacological conditions in a

drug challenge protocol. Despite the lack of predicted interaction effects of nicotine on subjective craving for gambling, the results of this study do suggest that meaningful differences on craving can be detected between neutral and gambling cues in both drug and placebo conditions. Validation of this type of laboratory-based gambling cue paradigm may have benefits for future drug challenge experiments involving other substances frequently co-used with electronic gambling (e.g., alcohol, illicit drugs, etc.).

Although gambling craving was unaffected by nicotine, subjective measures of cigarette craving were, as would be suspected, significantly lower in the NL condition. Ratings for the VAS item ‘crave cigarette’ in the NL group were lower than those in the PL condition at each time point (i.e., directly following lozenge, following neutral-cues, following gambling-cues) after lozenge administration. Similarly, ratings for the QSU-B (Cox et al., 2001) factor ‘intention to smoke’ were lower in the NL condition following lozenge administration and following the neutral-cues. However, the interaction for the other QSU-B factor ‘withdrawal/negative affect’ was not significant. These results suggest that acute NRT used in the current study lowered cigarette craving but did not provide relief of the negative affect associated with tobacco abstinence. Lastly, significantly higher average HR was recorded at each time point following lozenge administration in the NL condition indicating that the nicotine dose received resulted in a predictable increase in cardiovascular activity (e.g., Najem et al., 2006).

There are a number of potential explanations for nicotine’s failure to enhance gambling craving in the current study. It is possible that some of the gamblers recruited do not normally report gambling-related craving. For instance, ‘moderate risk’ gamblers may qualitatively differ from those with severe gambling problems and may experience

fewer gambling urges. However, post-hoc analyses comparing ‘moderate-risk’ and ‘problem gamblers’ in the current sample failed to find any significant interactions involving gambling status for ‘crave VLTs/slots’ or GACS factors (Young & Wohl, 2009). Also, significant main effects were found for subjective measures of gambling craving, indicating an overall increase in gambling craving following gambling cues but not following neutral cues. Regardless, future studies may want to consider including only individuals with a history of severe gambling in order to rule out this possibility. It is also feasible that the moderate levels of nicotine dependence reported by this sample contributed to the null findings. While all participants were daily smokers, the sample reported smoking an average of only 15.5 ($SD = 8.9$) cigarettes per day with a mean FTND score (Heatherton et al., 1991) of 5.7 ($SD = 1.6$). It is conceivable that nicotine may exacerbate gambling-related craving among heavily dependent smokers to a greater extent than among light/moderate smokers. Finally, it is possible that difference in the pharmacokinetic properties of tobacco and nicotine lozenges contributed to the negative findings. For instance, both the maximum concentration of nicotine (C_{max}) and the time to achieve these concentrations (T_{max}) are shorter with cigarettes than with NRT (Hukkanen et al., 2005). As such, it’s possible that these shorter timeframes result in a greater stimulatory effect for tobacco compared to NRT, which may influence the reinforcement enhancing properties of nicotine.

This study does have limitations. First, women comprised only one-third of the sample. There are number of established gender differences in smoking and NRT use. For instance, women have been found to have lower quit rates with nicotine patches than men (Perkins & Scott, 2008) and are more responsive to smoking-related cues (Perkins,

Donny, & Caggiula, 1999). Although no interaction effects involving sex were found in the current study, it is conceivable that a sample that includes more women would result in different conclusions. Second, despite overnight smoking abstinence, participants in the current study may still have been under the influence of the chronic effects of tobacco. Achieving complete nicotine elimination can take several days (Matta et al., 2007); as such, it is difficult to determine the extent to which chronic nicotine tolerance may have influenced participants. Also, nicotine lozenges are designed for long-term use to achieve smoking cessation. In the present study, lozenges were administered acutely and more research is needed to fully understand their long-term use on gambling craving following exposure to environmental cues. Finally, for the behavioural task in which participants were given the opportunity to gamble on a VLT, it is possible that the \$10 offered was not a salient enough reward. That is, among ‘moderate risk’ and ‘problem’ gamblers who have substantial experience playing VLTs, having only \$10 to gamble with may be deemed as being insufficient to result in a likely gambling win. Participants were not asked to express their views on the dollar amount given; future studies may want to consider exploring this possibility or increasing the available reward to gamble.

In conclusion, contrary to initial predictions, acute nicotine administration did not enhance cue-induced craving for gambling following exposure to gambling-related cues. However, nicotine was found to significantly reduce subjective tobacco-related craving and to increase average HR throughout the experiment. Future investigations should focus on the extent to which longer-term use of NRT affects gambling craving in environments where gambling cues are commonly found. The findings of this study offer

further support to the suggestion that NRTs may be an appropriate option for VLT gamblers who wish to quit smoking (McGrath et al., 2012).

CHAPTER FIVE: GENERAL DISCUSSION AND CONCLUSION

Over the past two decades, Canada has experienced an unprecedented increase in the availability of legal gambling opportunities with total annual revenues derived from gambling surpassing \$13.8 billion CAD in 2009 (Marshall, 2010). Unfortunately, coinciding with the expansion of gambling has been an increase in rates of PG (Cox et al., 1999). It has been suggested that EGMs are an especially troublesome form of gambling for those who suffer from a gambling problem (Afifi et al., 2010b; Holtgraves, 2009). Moreover, in at least two of the Atlantic provinces of Canada, VLTs have been identified as being a particularly common form of electronic gambling associated with problematic gambling (Doiron, 2006; Focal Research, 2007). Prior to implementation of a smoking ban, there was also evidence to suggest that among individuals who regularly participate in VLT gambling, most report using tobacco while they gamble (Focal Research, 1998; Stewart et al., 2002). Indeed, rates of tobacco use among gamblers, especially PGs, have been found to far exceed those of non-gamblers (Cunningham-Williams et al., 1998; Lorains et al., 2011; Petry et al., 2005). Despite the common co-occurrence of tobacco smoking and gambling, there is a paucity of research dedicated to disentangling this association. The overarching goal of the present dissertation was to further explore the smoking – gambling relationship from both epidemiological and experimental perspectives. First, a secondary data analysis was conducted using a dataset provided from a gambling prevalence survey conducted in the province of Newfoundland and Labrador. The purpose of this analysis was to further investigate potentially important associations between smoking and gambling (e.g., motives for gambling among smokers) that have been overlooked in previous epidemiological work. Next, a

laboratory experiment was conducted to directly test the effects of acute doses of nicotine (via nicotine inhaler) on subjective and behavioural responses on VLT gambling in regular gamblers who smoke. Finally, a second laboratory experiment was completed to examine the extent to which acute doses of nicotine (via nicotine lozenge) affected gambling cue-induced subjective, physiological, and behavioural indices among at-risk gamblers who smoke. The laboratory experiments allowed for a direct examination of the effects of nicotine on actual gambling outcomes following interactions with either a real-world gambling task or images (and audio) of commonly witnessed gambling scenarios. It is believed that this dissertation represents the first attempt to experimentally test outcomes for actual gambling under nicotine and placebo pharmacological conditions. It is hoped that the collective results of this work will further our understanding of the smoking - gambling relationship and provide potentially valuable evidence to clinicians, policy makers, and researchers on the implications of NRT use among gamblers who smoke.

Each of the studies included in this dissertation provides novel findings that make important individual contributions to the literature on co-morbid smoking and gambling. In the secondary data analysis (Chapter Two), current tobacco use was found to be associated with increased PGSI scores (Ferris & Wynne, 2001), using alcohol/drugs while gambling, spending more money gambling, and VLT participation. These results corroborate findings from previous epidemiological (e.g., Cunningham-Williams et al., 1998; Lorains et al., 2011; Petry et al., 2005) and clinically-based studies (e.g., Grant et al., 2008; Petry & Oncken, 2002; Potenza et al., 2004) of smoking and gambling. However, unlike previous reports that have specifically investigated smoking and

gambling, the sample used in this analysis was drawn from a general population of gamblers rather than gamblers seeking treatment. Probability sampling from a broad base of gamblers is a noted strength of this study. In contrast to past research, this analysis allowed for the comparison of gambling-related variables in smokers and non-smokers across the entire spectrum of tobacco and gambling dependence. In this respect, these findings could be considered to be more representative than past work. Another important contribution of this analysis pertains to the inclusion of motives for gambling among smokers. Again, this is the first known study to specifically compare motives for gambling among smokers and non-smokers. The study revealed that gambling motives related to positive reinforcement/reward and negative reinforcement/relief were associated with tobacco use. This finding not only indicates that smokers and non-smokers gamble for different reasons, but that smokers may gamble as a means for either decreasing negative affect (i.e., ‘escape’) or increasing positive affect (i.e., ‘excitement’) (Stewart & Zack, 2008; Stewart et al., 2008). Differentiating smokers and non-smokers on the basis of their gambling motivations may at some point prove useful for identifying individuals at-risk for developing problematic gambling.

Lastly, a final strength of the secondary data analysis was the use of Canadian-based epidemiological data. Most of the large-scale epidemiological reports on smoking and gambling previously described in this dissertation have been conducted in the United States (e.g., Cunningham-Williams et al., 1998; Petry et al., 2005). Access to gambling opportunities, the forms of gambling available, and laws surrounding gambling as well as tobacco use are highly variable across jurisdictions. More so than previous work, the current analysis allows for an examination of smoking and gambling that is more

representative of the Atlantic Canadian context before smoking was banned in gaming venues. However, the extent to which these findings would generalize to the relationship between smoking and gambling after the implementation of the smoking ban is unknown.

In chapters 3 (Experiment 1) and 4 (Experiment 2), the extent to which acute nicotine administration (compared to placebo) affected subjective and behavioural responses following VLT gambling and gambling-related cues was examined. Combined, these studies revealed a number of novel and potentially important findings. First, it was found that nicotine administered either via inhaler or lozenge significantly reduced scores on subjective ‘cigarette craving’ indices. More specifically, in both experiments, the nicotine condition experienced decreased VAS ratings (Bond & Lader, 1974) on smoking-related items following the administration of nicotine relative to placebo. Additionally, ratings on the QSU-B (Cox et al., 2001) factor ‘intention to smoke’ were also lower for the nicotine condition in Experiment 2 at the two time points directly following drug administration. These results indicate that participants received a pharmacologically active dose of nicotine, and that the NRT reduced cravings following short-term tobacco abstinence. However, the primary hypotheses that nicotine would augment gambling craving and VLT betting patterns in gamblers who smoke were not supported in either experiment. Receiving nicotine (compared to placebo) did not increase scores on the VAS item ‘want to play VLT’ or scores on the post-VLT questionnaire items ‘enjoy the VLT game’, ‘the VLT was exciting’, or ‘playing the VLT reduced tensions/worries’ at any point before, during, or after VLT play in Experiment 1. Similarly, no differences were found between nicotine and placebo on scores for the VAS item ‘crave VLTs/slots’ or GACS (Young & Wohl, 2009) subscales ‘anticipation of

gambling’, ‘desire for gambling’, and ‘relief of negative affect’ following the presentation of gambling-related cues. Combined, these findings suggest that acute nicotine administration does not directly influence craving for gambling in a laboratory setting. The results of the behavioural outcomes (e.g., betting patterns) for both experiments were also found to be contrary to initial predictions. Nicotine did not affect behavioural outcomes including ‘average number of bets per minute’, ‘amount spent’, ‘average bet-size’, and ‘number of maximum bets’ in Experiment 1, nor did nicotine influence the ‘decision to play VLT’ following gambling-cue exposure in Experiment 2. The aggregate of these findings offer potentially important insight into smoking cessation attempts based on the use of NRT. Acutely administered nicotine was successful at reducing cravings for tobacco while not augmenting craving for gambling in both experiments. This suggests that NRT may be a safe and efficacious treatment option for smoking cessation efforts among regular and at-risk/problem gamblers who smoke. However, further research exploring the long-term use of NRT in this population is warranted before more conclusive treatment recommendations can be made.

The two laboratory experiments conducted for this dissertation contain a number of improvements over previous studies of nicotine/tobacco and gambling. In Experiment 1, the extent to which nicotine influences craving and actual VLT gambling was examined. A noted strength of this study was the behavioural assay employed. Previous experiments examining the enhancing properties of nicotine in humans have used tasks that may simulate the properties of gambling but were not externally valid forms of gambling normally found in gaming venues. Examples of these “gambling like” tasks were employed by Businelle et al. (2009) in their comparison of non-smokers and heavy

smokers on the Gambling Task (GT; Bechara et al., 1994; Bechara et al., 2000) as well as by Al-Adawi and Powell (1997) and Powell et al. (2002), who each compared overnight tobacco-abstinent and non-abstinent smokers' performance on card-sorting tests which were paired with a financial incentive. Similarly, in the studies conducted to date which contained NRT and placebo conditions, none reported using a real-world gambling task. Dawkins et al. (2006) also examined performance on a card-sorting task, while others have compared nicotine and placebo conditions on responding for rewarding stimuli such as monetary rewards (Barr et al., 2008; Perkins et al., 2009), music, or removal of an aversive stimulus (Perkins et al., 2009). Although these tasks may have served as useful behavioural assays in an experimental setting, their structural characteristics fundamentally differ from real-world electronic gambling. Experiment 1 is the first known direct investigation of acute nicotine administration on VLT gambling behaviour. While the extent to which the results of Experiment 1 generalize to real-world VLT play is unclear, it has been suggested that lab-based gambling can serve as useful analogue for real gambling when the laboratory setting resembles an actual gambling environment (Stewart & Jefferson, 2007). Similarly, the stimuli used in Experiment 2 to investigate nicotine's effects on gambling cue-reactivity can also be considered a strength. Although previous investigations have employed visual cues to induce gambling-related craving (e.g., Crockford et al., 2005; Sodano & Wulfert, 2010), no known studies have examined cue-induced craving for gambling using VLT/slot specific gambling cues and audio. The gambling cue presentation used in the Experiment 2 was found to elicit higher ratings than the matched neutral cue presentation, suggesting that the gambling cues did induce greater overall craving for gambling as predicted. Another noted strength of the design of

the two experiments was the combined use of both subjective and behavioural outcomes. Subjective measures used in Experiment 1 included several VAS items (Bond & Lader, 1974) and post-VLT play questions. Experiment 2 also contained VAS items; however, other standardized measures of both cigarette (i.e., QSU-B; Cox et al., 2001) and gambling craving (i.e., GACS; Young & Wohl, 2009) were also used. The inclusion of additional subjective measures allowed for a more nuanced assessment of craving at each time point and also helped to corroborate the findings for cigarette and gambling focused VAS items. For instance, scores for cigarette items related to craving (i.e., VAS item, the QSU-B ‘intention to smoke’) were reduced but not the QSU-B factor ‘withdrawal/negative affect’. These findings may indicate the nicotine lozenges were effective in reducing craving, but not the removal of negative affect associated with tobacco abstinence. Also, the behavioural components of the experiments enhanced the validity of the results. In both experiments, nicotine was not found to affect actual VLT gambling-related outcomes. This behavioural component further corroborates each of the experiment’s subjective findings and enhances the overall generalizability of these results to real-world gambling experiences. Finally, the two experiments in this dissertation included different commercially available forms of NRT (i.e., inhalers in Experiment 1 and lozenges in Experiment 2). Regardless of the method of administration, nicotine was not found to influence gambling craving and betting patterns. However, in both cases, nicotine was found to reduce subjective craving for cigarettes. The congruency of these findings indicates that the pharmacological manipulation in both experiments successfully distinguished nicotine from placebo.

Despite the noted strengths of the methodologies employed, the results of Experiment 1 & 2 contradicted initial predictions that nicotine would directly affect gambling behaviour or cue-induced craving for gambling. The lack of influence on gambling-related craving, despite the reduction in cigarette craving in nicotine conditions, was unexpected. This is surprising given the high rates of co-occurring tobacco use amongst gamblers (e.g., Cunningham-Williams et al., 1998; Lorains et al., 2011; Petry et al., 2005; Smart & Ferris, 1996) and evidence indicating poorer psychosocial outcomes among PGs who smoke (Grant & Potenza, 2005; Petry & Oncken, 2002; Potenza et al., 2004). There are a number of reasons exist why nicotine had no effect on gambling in the two laboratory experiments.

First, it is possible that tobacco itself influences gambling behavior and craving, but that the nicotine challenges used in the two experiments do not. Nicotine administered via tobacco smoke differs from nicotine delivered via inhaler and lozenge in a number of ways. One potentially important difference between tobacco and NRT is the pharmacokinetic properties of nicotine delivery. It has been clearly established that inhalation of tobacco smoke results in more rapid absorption of nicotine than other methods of nicotine administration (Benowitz, 2009). For instance, smoking a single cigarette over a 5 minute period results in absorption of approximately 2mg of nicotine with an average venous blood nicotine concentration between 15-30ng/ml (Hukkanen et al., 2005). Comparatively, rates of nicotine absorption from all forms of NRT have been found to be substantially slower. Administering a nicotine inhaler with a 10mg cartridge over 20 consecutive minutes results in 4mg of nicotine with an average blood nicotine concentration of 8.1ng/ml. Similarly, administration of a 4mg nicotine lozenge over 20-

30 consecutive minutes results in an average blood nicotine concentration of 10.8ng/ml (Hukkanen et al., 2005). Unfortunately, information on the nicotine absorption pharmacokinetics of the 4mg quick release lozenges employed in Experiment 2 appears to be currently unavailable. The pharmacokinetics of the NRT used in Experiments 1 and 2 may have contributed to the lack of influence of nicotine on gambling craving and behavior. All NRT modalities are designed to deliver a dose of nicotine over a set period of time with the intention of curbing cravings as opposed to delivering a stimulatory dose of nicotine. As such, the prolonged nicotine absorption of both inhalers and lozenges, along with the relatively short timeframe of the experimental sessions, may have reduced the length of time that participants were actively under the influence of nicotine during VLT play or gambling cue presentation. The maximum concentration of nicotine (C_{max}) received via cigarette smoking is higher and the time to achieve said concentration (T_{max}) is shorter than with NRT formulations (Hukkanen et al., 2005). Therefore, the nicotine delivered via cigarette smoking could be considered more stimulatory than NRT and may have a unique influence on other addictive behaviors such as VLT gambling.

Second, it is also conceivable that the pharmacodynamic properties of tobacco, in addition to nicotine, may influence gambling behavior and craving. While nicotine is commonly considered to be the primary addictive component of tobacco (e.g. US Department of Health and Human Services, 1988), increasing evidence suggests that other non-nicotine constituents may contribute to the additive properties of tobacco (Rose, 2006). For instance, acetaldehyde, a major component of tobacco smoke, has been found to produce reinforcing effects in rodents synergistically with nicotine. Specifically, acetaldehyde condensation products (i.e., harman and salsolinol) have been

found to inhibit monoamine oxidase (MAO) (Talhout, Opperhuizen, & van Amsterdam, 2007). Inhibition of MAO enzymes is believed to be implicated in the reinforcement of tobacco smoking as well as having an antidepressant effect (Guillem et al., 2005; Villégier, Lotfipour, McQuown, Belluzzi, & Leslie, 2007).

In addition, laboratory administration of both nicotine containing and denicotinized cigarettes has been found to reduce tobacco craving and delay the onset of tobacco self-administration relative to nicotine inhalers in light smokers (Barrett, 2010). The aggregate of these findings suggests that non-nicotine tobacco constituents may play an important role in the addictive properties of cigarette smoke. In terms of Experiments 1 & 2, it appears that the effects of nicotine in the absence of tobacco did not enhance gambling behaviour. Given previous research indicating that nicotine-containing and denicotinized cigarettes influence craving to a greater extent than NRT (e.g., Barrett, 2010), it is conceivable that other tobacco constituents play a role in craving and reinforcement. Inclusion of nicotine-containing and denicotinized tobacco conditions would allow for a more detailed examination of the potential influence of nicotine as well as other tobacco components on gambling behaviour and craving. However, the inclusion of denicotinized tobacco may be subject to potential expectancy effects associated with receiving tobacco (Barrett & Darredeau, 2012). As such, care would need to be taken in terms of instructions given to participants regarding the content of the cigarettes (e.g., nicotine) prior to administration.

Third, it also feasible that the nicotine dosage regimen employed in Experiments 1 & 2 was inadequate to properly evaluate the gambling-related hypotheses. In both experiments, inhalers and lozenges were administered acutely to participants (i.e. single

use administered over a 20 minute period). However, when used for the purposes of smoking cessation, the duration of use for all forms of NRT typically lasts for a period of weeks to months. For instance, in a recent review of the effectiveness of NRT, the clinical studies meeting the inclusion criteria supplied NRT to participants for periods ranging from 6 to 26 weeks (Walsh, 2008). Given the intended purpose of NRT (i.e., to suppress cigarette cravings) as well as the typical duration of use, it is possible that the acute administration of NRT in Experiments 1 & 2 did not accomplish its intended purpose of supplying a stimulatory dose of nicotine to participants. As such, more prolonged use of NRT may be required to adequately examine the potential influence of nicotine on gambling behaviour.

It is also conceivable that withdrawal effects due to tobacco abstinence influenced the findings of both laboratory experiments. Recent evidence indicates that the withdrawal effects of nicotine may result in the removal of its reinforcement enhancing properties. For instance, Perkins, Karelitz, Jao, and Stratton (2012) compared bupropion versus placebo conditions on responsiveness to a simple computer task paired with a brief music reward. In both conditions, participants were required to abstain from tobacco for 24 hours and the average number of responses was compared to an ad lib smoking baseline session. It was found that responding decreased by 50% in the abstinent placebo group compared to the baseline smoking session, suggesting that withdrawal negatively impacted performance on the task. In Experiments 1 and 2, all participants were required to abstain from smoking overnight which was verified with CO readings at the beginning of each testing session. It is feasible that withdrawal symptoms following acute abstinence reduced nicotine's reinforcement enhancing effects, and that the NRT

employed in both experiments was insufficient to reverse withdrawal effects.

Unfortunately, neither study included specific assessments of withdrawal effects among participants beyond subject mood ratings (e.g., VAS items). Future studies may want to include both abstinent and satiated conditions to fully explore the potential blunting of nicotine's reinforcement enhancing effects during withdrawal.

Finally, another potential explanation for the negative findings of Experiments 1 and 2 could be that the relationship between smoking and gambling is correlational rather than causal in nature. For instance, to date, the majority of studies examining smoking and gambling have been epidemiological reports that have only identified associations between these addictive behaviours (e.g., Cunningham-Williams et al., 1998; Lorains et al., 2011; Petry et al., 2005; Smart & Ferris, 1996). Although some studies have investigated the causal influence of nicotine on 'gambling-like' behaviours (e.g., Barr et al., 2008; Dawkins et al., 2006; Perkins et al., 2009), no known previous experimental work has explored direct causal relations between nicotine and gambling. While the aggregate findings of these studies suggest otherwise, it is conceivable that tobacco smoking and gambling are only correlated and are influenced by a possible third variable.

The findings of this dissertation may have important implications for smoking and gambling policy as well as for the treatment of these co-morbid addictive behaviours. The jurisdictions from which the data used in this dissertation originated (i.e., Newfoundland and Labrador, and Nova Scotia) have both implemented bans on smoking in public places, which include gaming establishments. The stated goals of these smoking bans are to discourage the initiation of smoking, to help encourage current smokers to quit, and to protect the public from the dangers associated with second-hand smoke (Room, 2005). In

licensed gambling establishments such as casinos, it is possible that some patrons will use NRT while gambling. Some smokers may be attempting to quit/cut back on their smoking while others could be using NRT as a method for suppressing their smoking cravings while they gamble. The results of this dissertation suggest that NRT could be used successfully to manage nicotine withdrawal symptoms while not simultaneously augmenting craving for VLT gambling. For treatment providers, the findings of Experiments 1 and 2 suggest that NRT may be a safe and effective option for clients who are attempting to quit smoking but may also be at-risk for problematic gambling. However, these findings are tentative and are in need of further replication before more concrete conclusions can be drawn. Lastly, the secondary data analysis identified an association between smoking and motives for gambling centered on positive reinforcement/reward as well as negative reinforcement/relief. Subtyping tobacco users based on their reasons for gambling may have clinical utility for the treatment of co-morbid smoking and pathological gambling. For instance, it may be feasible to identify smokers at risk for developing co-morbid pathological gambling based on their preferred reasons (e.g., coping-based) for gambling.

Prior to the experiments conducted for this dissertation, little research had been devoted to examining the effects of nicotine on gambling behaviour and craving. The results from the secondary data analysis as well as Experiments 1 and 2 provide new insight into how tobacco use and nicotine interact with gambling. Despite the negative findings of the experiments included in this dissertation, further research examining the potential influence of nicotine on gambling is warranted. For instance, laboratory research investigating the effects of nicotine-containing and denicotinized cigarettes on

gambling may help to disentangle the potential effects of nicotine from other tobacco constituents. Also, as nicotine was acutely administered in this dissertation, future work examining the effects of longer-term use of NRT is needed before conclusions can be drawn regarding the nicotine-gambling relationship. Finally, treatment research of co-morbid smoking and gambling is sorely lacking; future studies could investigate the outcomes of tobacco dependent patients presenting for treatment with a gambling problem.

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Appendix A: Government of Newfoundland and Labrador-Gambling Prevalence Study
Final- August 30, 2005

INTRODUCTION

Hello, my name is _____ and I am calling from Market Quest Research, a professional survey research firm. We are conducting a survey on behalf of the Department of Health and Community Services, Government of Newfoundland and Labrador. Today/Tonight we are conducting a research survey on the gambling activities and attitudes of residents of Newfoundland and Labrador and we would like to include your views.

Your response will help researchers better understand gambling behaviour and develop programs and services for Newfoundlanders and Labradorians with a gambling problem. First of all, can you tell me how many adults 19 years of age or older live in this household?

(Record the number).

99 Refused (Terminate call and thank them for their time)

INTERVIEWER: If no one 19 or older in household, terminate interview.
If only one person 19 years or older in household say:

I would like to speak to that person--would that be you?

INTERVIEWER: If more than one person 19 years or older in household say:

I would like to speak to the person in your household 19 years of age or older who has the next birthday—would that be you?

INTERVIEWER: If no, ask to speak to that person.
If the person is not available, arrange call-back.

Great! I would like to interview you and I'm hoping that now is a good time for you. The interview will take about 20 minutes, depending on how many of the questions apply to you.

Before we start, I'd like to assure you that your participation is voluntary and that any information you provide will be kept completely confidential. If there are any questions that you do not wish to answer, please feel free to point these out to me and I'll go on to the next question. You have the right to terminate the interview at any time. If you have any questions about the survey, you can phone Market Quest Research at 1-800-560-1360 for further information.

INTERVIEWER: If the person never gambles, doesn't believe in it, etc. say:

We understand that not everyone gambles, but your opinions are still very important to us.

1. Agreed to do interview (Thank them and go to Q.1)
2. Refused to do interview (Terminate and thank them for their time)

GAMBLING INVOLVEMENT AND ACTIVITIES

First, we'd like to ask some questions about gambling activities you may participate in. People spend money and gamble on many different things including buying lottery tickets, playing bingo, or card games with their friends. I am going to list some activities that you might have bet or spent money on.

1. In the past 12 months, have you bet or spent money on (_____)? READ LIST

1. Lottery tickets such as Lotto 649, Super 7, Atlantic 49, Atlantic Payday or Keno
2. Breakopen, Pull Tab or Nevada Strips
3. Scratch tickets such as Crossword, Bingo or Lucky 7
4. Raffles or fundraising tickets
5. Horse Races, either live at the track or off track
6. Bingo
7. Video lottery terminals (VLT machines)
8. Pro-Line or Over/Under
9. Sports Pools or the outcome of sporting events (through a bookie, charity, with friends or at work)
10. Cards (not including poker) or board games at home, friends home or at work
11. Poker, either at home, friends home, at work or on the Internet
12. Games of Skill such as pool, bowling, golf or darts
13. Arcade or Video Games
14. Gambling on the Internet (not including poker)
15. Short Term Speculative Stock or Commodity Purchases such as day trading, not including longterm investments such as mutual funds or RRSPs
16. Gambling at Casinos out of province

1b. Have you participated in any other forms of gambling? (Please Specify)

INTERVIEWER: If respondent does not say "Yes" to any activity, or says "I do not gamble" twice, go to Q13.

INTERVIEWER: Repeat Q2 to Q5 for all activities selected in Q1

2. In the past 12 months, how often did you bet or spend money on [INSERT ACTIVITY FROM Q1]? READ LIST

- Daily 01
- 2 to 6 times per week 02
- About once per week 03

- 2 to 3 times per month 04
- About once per month 05
- Between 6-11 times per year 06
- Between 1-5 times per year 07
- Don't Know 98
- Refused 99

3. On a typical occasion when you spend money on [INSERT ACTIVITY FROM Q1], how much money do you spend, not including winnings? ENTER NUMBER OF DOLLARS- ROUND UP TO NEAREST DOLLAR.

- \$ _____
- Don't Know 98
- Refused 99

INTERVIEWER: If asked for clarification, we mean spending that is out of pocket, and doesn't include money won and THEN spent.

4. On a typical occasion when you spend money on [INSERT ACTIVITY FROM Q1], how much money do you win? ENTER NUMBER OF DOLLARS- ROUND UP TO NEAREST DOLLAR.

- \$ _____
- Don't Know 98
- Refused 99

5. On a typical occasion when you spend money on [INSERT ACTIVITY FROM Q1], how much money do you lose? ENTER NUMBER OF DOLLARS- ROUND UP TO NEAREST DOLLAR.

- \$ _____
- Don't Know 98
- Refused 99

Next, I would like you to think about all of the gambling activities we discussed.

6. During a typical month, how much time do you spend gambling? Please give the total amount of time spent gambling in a typical month. USE MINUTES/HOURS TO RECORD EXACT TIME SPECIFIED BY RESPONDENT.

- _____ Minutes
- _____ Hours
- Don't Know 98
- Refused 99

7. In the past 12 months, how much money have you spent gambling, not including winnings? ENTER NUMBER OF DOLLARS- ROUND UP TO NEAREST DOLLAR.

- \$ _____
- Don't Know 98
- Refused 99

8. In the past 12 months, how much money have you won gambling? ENTER NUMBER OF DOLLARS- ROUND UP TO NEAREST DOLLAR.

\$ _____

Don't Know 98

Refused 99

9. In the past 12 months, how much money have you lost gambling? ENTER NUMBER OF DOLLARS- ROUND UP TO NEAREST DOLLAR.

\$ _____

Don't Know 98

Refused 99

10. What are the main reasons why you gamble? IF NECESSARY READ TO PROMPT, ACCEPT ALL ANSWERS

It's an opportunity to socialize 01

I can forget about my problems 02

It is exciting/fun 03

It decreases my boredom 04

I can win money 05

It's a hobby 06

To support worthy causes/charities 07

Out of curiosity 08

To be alone 09

Because I am good at it 10

Other: (Please Specify) 90

Don't Know 98

Refused 99

PROBLEM GAMBLING BEHAVIOUR AND ADVERSE CONSEQUENCES

The next questions are part of a standard measurement scale that was recently developed in Canada for use in gambling surveys similar to this one. Some of these questions may not apply to you but please try to answer as accurately as possible. Remember that all of your answers are strictly confidential.

11. Thinking about the past

	Never	Sometime s	Most of the time	Almost Always	Don't Know	Refused
Bet more than you could really afford to lose	00	01	02	03	98	99
Needed to gamble with larger amounts of money to get the	00	01	02	03	98	99

same feeling of excitement						
Went back another day to try and win back the money you lost	00	01	02	03	98	99
Borrowed money or sold anything to get money to gamble	00	01	02	03	98	99
Felt that you might have a problem with gambling	00	01	02	03	98	99
Felt gambling has caused you any health problems including stress or anxiety	00	01	02	03	98	99
Had people criticize your betting or tell you that you have a gambling problem regardless of whether or not you think it is true	00	01	02	03	98	99
Felt your gambling has caused financial problems for you or your household	00	01	02	03	98	99
Felt guilty about the way you gamble or what happens when you gamble	00	01	02	03	98	99

12. Which, if any, of the following problems have you experienced from gambling?

READ LIST, CIRCLE ALL THAT APPLY

- Income loss/debt 01
- Relationship problems 02
- Physical health problems 03
- Mental health problems 04
- Work problems 05
- Loneliness/Increased isolation 06
- Other: Please Specify 90
- None 96
- Don't Know 98
- Refused 99

PROBLEM GAMBLING CORRELATES

The next questions explore some of your gambling experiences, beliefs, alcohol and drug use, and health related issues. Once again, all your answers will be kept strictly confidential.

13. How old were you when you first gambled for money? (If “never tried gambling,” SKIP to Q17)

ENTER AGE IN YEARS

Never tried gambling 95

Don't Know 98

Refused 99

14. What type of gambling activity did you first try? DO NOT READ LIST, ACCEPT ONLY ONE ANSWER

Lottery tickets (e.g. Lotto 649, Super 7, Atlantic 49, Atlantic Payday, or Keno) 01

Breakopen, pull tabs or Nevada strips 02

Scratch tickets like Crossword, Bingo or Lucky 7 03

Raffles or Fundraising Tickets 04

Horse races (either live at the track or off track) 05

Bingo 06

Video Lottery Terminals (VLT's) 07

Pro Line or Over/Under 08

Sports pools/Outcome of sporting events (through a bookie, charity, with friends or at work) 09

Cards or board games (excluding poker) 10

Poker 11

Games of skill such as pool, bowling, darts or golf 12

Arcade or video games 13

Gambling on the internet (excluding poker) 14

Short-term speculative stock or commodity purchases such as day trading, not including long-term investments such as mutual funds or RRSPs 15

Casinos out of province 16

Other (Please Specify) 90

Don't Know 98

Refused 99

15. Do you remember a big WIN when you first started gambling?

Yes 01

No 02

Don't Know 98

Refused 99

16. Do you remember a big LOSS when you first started gambling?

Yes 01

No 02

Don't Know 98
Refused 99

17. Please tell me if you strongly agree, agree, disagree, or strongly disagree with the following statement: "While gambling, after losing many times in a row, you are more likely to win."

Strongly Agree 01
Agree 02
Disagree 03
Strongly Disagree 04
Don't Know 98
Refused 99

18. Please tell me if you strongly agree, agree, disagree, or strongly disagree with the following statement: "While gambling, you could win more if you used a certain system or strategy."

Strongly Agree 01
Agree 02
Disagree 03
Strongly Disagree 04
Don't Know 98
Refused 99

(If "non gambler" (Do not say "yes" to any activity in q1) or "never tried gambling" (q13=95), SKIP to Q26)

20. In the past 12 months, have you used alcohol or drugs while gambling?

Yes 01
No 02
Don't Know 98
Refused 99

21. In the past 12 months, have you gambled while drunk or high?

Yes 01
No 02
Don't Know 98
Refused 99

22. In the past 12 months, if something painful happened in your life, did you have the urge to gamble?

Yes (includes doing as well as having the urge) 01
No 02
Don't Know 98
Refused

23. In the past 12 months, have you engaged in petty crime or other criminal activities to support your gambling?

- Yes 01
- No 02
- Don't Know 98
- Refused 99

24. In the past 12 months, have you seriously thought about suicide as a result of your gambling?

- Yes 01
- No 02
- Don't Know 98
- Refused 99

25. In the past 12 months, have you attempted suicide as a result of your gambling?

- Yes 01
- No 02
- Don't Know 98
- Refused 99

Next, I would like to ask you some questions about cigarette smoking.

26. Have you EVER smoked cigarettes?

- Yes 01
- No 02 GO TO Q30
- Don't Know 98 GO TO Q30
- Refused 99 GO TO Q30

27. Have you smoked at least 100 cigarettes in your life?

- Yes 01
- No 02
- Don't Know 98
- Refused 99

28. At the present time, do you smoke cigarettes daily, occasionally or not at all?

- Daily 01
- Occasionally 02
- Not at all 03 GO TO Q30
- Refused 99 GO TO Q30

29. During a typical day, how many cigarettes do you smoke (1 pack=20 cigarettes)

- RECORD NUMBER OF CIGARETTES
-
- Less than one cigarette a day 97
 - Don't Know 98
 - Refused 99

Now, I would like to ask you some questions about drinking alcohol. In these questions, when I use the word “drink”, it means one 12 ounce bottle of beer, glass of draft, or cooler, one 5 ounce glass of wine or one straight or mixed drink with one and a half ounces of hard liquor.

30. Have you EVER had a drink of any alcoholic beverage?

- Yes 01
- No 02 GO TO Q35
- Don't Know 98
- Refused 99

31. In the past 12 months, have you had a drink of any alcoholic beverage?

- Yes 01
- No 02 GO TO Q35
- Don't Know 98 GO TO Q35
- Refused 99 GO TO Q35

32. In the past 12 months, how often did you drink alcoholic beverages. Would you say you drank alcoholic beverages.. READ LIST

- More than once a day 01
- 6 to 7 times a week 02
- 4 to 5 times a week 03
- 2 to 3 times a week 04
- Once a week 05
- 2 to 3 times a month 06
- Once a month 07
- Less than once a month 08
- Don't Know 98
- Refused 99

33. On a typical day when you have a drink of alcoholic beverage, approximately how many drinks do you consume?

RECORD NUMBER OF DRINKS

- Less than one drink 97
- Don't Know 98
- Refused 99

34. In the past 12 months, how often did you have 5 or more drinks at the same sitting or occasion, would you say it was.. READ LIST

- More than once a day 01
- 6 to 7 times a week 02
- 4 to 5 times a week 03
- 2 to 3 times a week 04
- Once a week 05
- 2 to 3 times a month 06
- Once a month 07

Less than once a month 08
 Never in the past year 09
 Don't Know 98
 Refused 99

The next few questions deal with drug use. Some people use drugs in private, with friends or in other types of situations.

35. Have you EVER used...

	Yes	No	Don't Know	Refused
Marijuana or hash	01	02	98	99
Cocaine	01	02	98	99
Crystal Methamphetamine, otherwise known as crystal meth	01	02	98	99
Heroin	01	02	98	99
Ecstasy	01	02	98	99

36. In the past 12 months, have you used [INSERT DRUG FROM Q35]?

Yes 01
 No 02
 Don't Know 98
 Refused 99

37. In the past 12 months, how often have you used [INSERT DRUG FROM Q35] ?

Would you say you have used it.. READ LIST

More than once a day 01
 6 to 7 times a week 02
 4 to 5 times a week 03
 2 to 3 times a week 04
 Once a week 05
 2 to 3 times a month 06
 Once a month 07
 Less than once a month 08
 Don't Know 98
 Refused 99

38. Some people use the drug Oxycontin, more commonly known as "oxies" or "hillbilly heroine", in ways other than those prescribed by a physician. Have you EVER used Oxycontin in ways other than those prescribed by a physician?

Yes 01
 No 02 GO TO Q41
 Don't Know 98

Refused 99

39. In the past 12 months, have you used Oxycontin?

Yes 01

No 02 GO TO Q41

Don't Know 98 GO TO Q41

Refused 99 GO TO Q41

40. In the past 12 months, how often have you used Oxycontin? Would you say you have used it.. READ LIST

More than once a day 01

6 to 7 times a week 02

4 to 5 times a week 03

2 to 3 times a week 04

Once a week 05

2 to 3 times a month 06

Once a month 07

Less than once a month 08

Don't Know 98

Refused 99

The next few questions deal with your mental and physical health...

41. How would you rate your current physical health? Would you say it is...READ LIST

Very Good 01

Good 02

Fair 03

Poor 04

Very Poor 05

Don't Know 98

Refused 99

42. How would you rate your current mental health? Would you say it is...READ LIST

Very Good 01

Good 02

Fair 03

Poor 04

Very Poor 05

Don't Know 98

Refused 99

43. Have you EVER felt you might have an alcohol or drug problem?

Yes 01

No 02

Don't Know 98

Refused 99

44. Has anyone in your family EVER had an alcohol or drug problem?

Yes 01

No 02

Don't Know 98

Refused 99

45. In the past 12 months, if something painful happened in your life, did you have the urge to have a drink of alcohol?

Yes 01

No 02

Don't Know 98

Refused 99

46. In the past 12 months, if something painful happened in your life, did you have the urge to use drugs or medication?

Yes 01

No 02

Don't Know 98

Refused 99

47. In the past 12 months, have you been under a doctor's care because of physical or emotional problems brought on by stress?

Yes 01

No 02

Don't Know 98

Refused 99

48. In the past 12 months, have you felt seriously depressed?

Yes 01

No 02

Don't Know 98

Refused 99

49. How many people, if any, could you turn to for support or help if you had a serious personal problem?

_____ RECORD NUMBER OF PEOPLE

Don't Know 98

Refused 99

The next questions deal with problem gambling.

50. Has anyone in your family EVER had a gambling problem?

Yes 01

No 02

Don't Know 98

Refused 99

51. Have you EVER experienced problems as a result of someone else's gambling?

Yes 01

No 02

Don't Know 98

Refused 99

52. If you or someone close to you had a gambling problem, whom might you go to for help? READ LIST AND CIRCLE ALL THAT APPLY.

Family 01

Friend 02

Family Doctor 03

Minister/Priest/Rabbi 04

Social Worker/Psychologist/Psychiatrist 05

Addictions Counsellor 06

Gamblers Anonymous 07

Instructor/Teacher 08

Employees/Family Assistance Program 09

Law Enforcement Official 10

Pharmacist 11

Any other? (Please Specify) 90

None 96

Don't Know 98

Refused 99

53. Are you aware that there is a toll free crisis help line for problem gamblers in Newfoundland and Labrador?

Yes 01

No 02

Don't Know 98

Refused 99

54. Are you aware that there is a detox center available for problem gamblers in Newfoundland and Labrador called the Recovery Centre?

Yes 01

No 02

Don't Know 98

Refused 99

55. Are you aware that there is a provincial treatment center for problem gamblers in Newfoundland and Labrador called Humberwood?

Yes 01

No 02

Don't Know 98

Refused 99

56. To your knowledge, are there gambling counseling services available in your community?

- Yes 01
- No 02
- Don't Know 98
- Refused 99

Finally, I would like to ask you some demographic questions. All answers you provide to these questions will be kept strictly confidential.

57. Into which of the following age categories do you fall...READ LIST

- 19-24 01
- 25-34 02
- 35-44 03
- 45-54 04
- 55-64 05
- 65 or older 06
- Refused 99

58. Which of the following best describes your marital status...READ LIST

- Married 01
- Common Law/Living with Partner 02
- Single (never married and not living with partner) 03
- Widowed (not remarried) 04
- Divorced or separated (not remarried) 05
- Refused 99

59. Which of the following best describes the highest level of education you have completed? READ LIST

- Some high school/junior high or less 01
- Completed high school 02
- Some post secondary school 03
- Completed post secondary school 04
- Completed post graduate education 05
- Don't Know 98
- Refused 99

60. Which of the following best describes your present job status? Are you... READ LIST

- Employed full time (30 or more hours/week) 01
- Employed part time (Less than 30 hours/week) 02
- Unemployed 03 GO TO Q62
- Student 04 GO TO Q62
- Retired 05 GO TO Q62
- Homemaker 06 GO TO Q62
- Don't Know 98 GO TO Q62

Refused 99 GO TO Q62

61. What type of work do you do? Probe: What is your occupation? RECORD RESPONSE

62. Which of the following broad categories best describes how much income you and other members of your household received in the year ending December 31, 2004? Please include income from all sources such as savings, pensions, rent and employment insurance, as well as wages. READ LIST

- \$20,000 or less 01
- \$20,001 to \$30,000 02
- \$30,001 to \$40,000 03
- \$40,001 to \$50,000 04
- \$50,001 to \$60,000 05
- \$60,001 to \$70,000 06
- \$70,001 to \$80,000 07
- \$80,001 to \$90,000 08
- \$90,001 to \$100,000 09
- More than \$100,000 10
- Don't Know 98
- Refused 99

62. How many people under the age of 18 live in your household? _____
RECORD RESPONSE

63. To what ethnic or cultural group did you or your ancestors belong on first coming to this country? IF RESPONDENT IS NOT CLEAR SAY "Are you Scottish, Chinese, Irish or something else?" IF RESPONDENT SAYS CANADIAN ASK "In addition to being Canadian, to what ethnic or cultural group did you or your ancestors belong on first coming to this country?" DO NOT READ LIST, CIRCLE ALL THAT APPLY

- Innu 01
- Inuit 02
- Bangladeshi 03
- Black/African 04
- English/British 05
- Canadian 06
- Chinese 07
- East Indian 08
- French 09
- German 10
- Greek 11
- Irish 12
- Italian 13
- Japanese 14
- Jewish 15
- Korean 16

Metis 17
Pakistani 18
Polish 19
Scottish 20
Sikh 21
Sri Lankin 22
Welsh 23
Other: (Please Specify) 90
Don't Know 98
Refused 99

64. How important is religion in your life? Would you say it is... READ LIST

Very Important 01
Somewhat Important 02
Not Very Important 03
Not at all Important 04
Don't Know 98
Refused 99

65. What are the first three digits of your postal code? _____ RECORD
RESPONSE

Thank you for your time! Have a great day/evening!

Record Gender:

Male 01
Female 02

Appendix B: Study 1 Informed Consent

Title of Study:

The Effects of Nicotine and Smoking on Video Lottery Terminal (VLT) Gambling Behaviour

Local Principal Investigators:

Daniel S. McGrath, MSc., Ph.D. Student, Department of Psychology, Dalhousie University, Life Sciences Centre, 1355 Oxford Street, Halifax, Nova Scotia, Canada, B3H 4J1. Phone: 902-494-2956; E-mail: daniel.mcgrath@dal.ca

Dr. Sean P. Barrett, Ph.D., Assistant Professor, Department of Psychology, Dalhousie University, Life Sciences Centre, 1355 Oxford Street, Halifax, Nova Scotia, Canada, B3H 4J1. Phone: 902-494-2956; Fax: 902-494-6585; E-mail: Sean.Barrett@dal.ca.

Dr. Sherry H. Stewart, Ph.D., Associate Professor, Departments of Psychology and Psychiatry, Dalhousie University, Life Sciences Centre, 1355 Oxford Street, Halifax, Nova Scotia, Canada, B3H 4J1. Phone: 902-494-3793; Fax: 902-494-6585; E-mail: sstewart@dal.ca.

Dr. Raymond M. Klein, Ph.D., Professor, Departments of Psychology, Dalhousie University, Life Sciences Centre, 1355 Oxford Street, Halifax, Nova Scotia, Canada, B3H 4J1. Phone: 902-494-6551; E-mail: Ray.Klein@dal.ca.

Contact Person:

Lyndsay Bozec, Research Assistant. Department of Psychology, Dalhousie Gambling Lab, Dalhousie University, Life Sciences Centre, 1355 Oxford Street, Halifax, Nova Scotia, Canada, B3H 4J1. Phone: 902-494-6488; Fax: 902-494-6585; E-mail: gamble@dal.ca.

Introduction:

We invite you to take part in a research study being conducted by Daniel McGrath who is a graduate student at Dalhousie University, as part of his PhD in Experimental Psychology. Your participation in this study is voluntary and you may withdraw from the study at any time. The study is described below. This description tells you about the risks, inconvenience, or discomfort that you might experience. Participating in the study might not benefit you, but we might learn things that will benefit others. You should discuss any questions you have about this study with Daniel McGrath or Lyndsay Bozec.

Purpose of the Study:

The purpose of the study is to examine the effects of nicotine and tobacco on a variety of different aspects of gambling behavior in regular VLT players.

Study Design:

This is a study to investigate how nicotine and tobacco smoking will affect gambling. We will study this over the course of two study sessions, which will each be two and a half

hours in length. We also want to learn what is rewarding about smoking and gambling to people. We will be looking at the body's physical responses to these activities. Approximately 40 participants will take part and all testing sessions will take place in Dr. Barrett's Smoking Laboratory (Room 2404 of the Dalhousie Psychology Department).

Who Can Participate in the Study:

You may take part in this study if you are 19 years of age or older, if you are a regular smoker (i.e., at least five cigarettes per day), if you are a regular VLT player (i.e., play VLT's at least once per month for the past 6 months), and you are willing to participate over a two-week period. Also if you are pregnant, planning to get pregnant or if you are unsure, you should not participate in the study.

Those individuals who are currently or have previously been treated for a gambling problem cannot participate in the study. Also, people who are abstaining from smoking or gambling cannot participate in the study.

Who will be Conducting the Research:

Daniel McGrath MSc., Dr. Sean P. Barrett, Ph.D. Dr. Sherry H. Stewart, Ph.D. and Dr. Raymond Klein, Ph.D. are the Principle Investigators of this study. Lyndsay Bozec is a technical research assistant who will be actively involved in conducting the research.

What you will be asked to do:

The following information outlines what you will be asked to do during both study sessions:

- As a participant, you will first be asked to provide a breath sample using a breath carbon monoxide analyzer to ensure that you have abstained from smoking for 12 hours.
- Next you will be required to fill out a number of psychological questionnaires about personal characteristics (e.g., your age, gender), your habits and behaviors associated with gambling, your goals and motivations, your normal smoking habits, as well as your responses to smoking the cigarettes and playing the VLT, and your current mood. For several of these questionnaires, you will be asked to complete them more than once during the experiment.
- A measuring device will be secured to your chest to measure heart rate and this information will be transmitted to a wrist receptor held by the experimenter. The experimenter will record your heart rate for 3 minutes from this device while you relax.
- Next you will be asked to puff an inhaler. The inhaler may include substances typically found in cigarettes including nicotine. Your heart rate will be measured for another 3 minutes while you use the inhaler.
- You will then be asked to play a commercially-available spinning reels game for two 15 minute sessions on a standard VLT in the lab, which is similar to those in use

throughout the province of Nova Scotia. The odds of winning and losing will be exactly the same as on standard machines you have played before. For the total session, you will receive \$60 to gamble with. You may gamble as little or as much money as you desire. You are allowed to keep any amount that remains from the \$60 you were given to gamble with. Any amount of money you win under \$200 will be paid in cash and any amount over \$200 will be paid by cheque at the end of the session. You will not be reimbursed for any money you lose while gambling. Also, you are NOT permitted to use any of your own money that you have brought with you to the testing session for gambling. Any money you lose by playing the VLT will be returned to the study budget. Please note, your VLT play for each session will be video recorded for the purposes of data collection, however, your face will not appear on any video recording and your identity will remain strictly confidential.

- You will also be asked to fill out questionnaires and give a breath sample using the carbon monoxide analyzer breathalyzer at the end of the experiment. The experimenter will be sampling your heart rate continuously while you play the VLT. Each session of the experiment takes approximately 2 hours and 10 minutes.

Possible Risks and Discomforts:

For this experiment, you will be asked to puff an inhaler. Some people have reported mild irritation of the mouth or throat and cough from using inhalers. In addition, some people may feel discomfort in discussing their gambling habits, but you understand that you are not required to answer any questions, and you may withdraw from the study at any point. You should also be aware of the possibility that participating in gambling tasks may stimulate urges to gamble for some individuals.

Should you wish to seek professional assistance for any issues with gambling, please contact the Problem Gambling Helpline at 1-888-347-8888.

Should you wish to seek professional assistance for smoking, please contact the Canadian Cancer Society's Smoker's Helpline at 1-877-513-5333 or the Capital Health Tobacco Intervention Program at 902-424-2025.

Possible Benefits:

There are no direct personal benefits to you for participating in this study.

Compensation:

You will receive \$60 before each gambling session begins. You do not have to gamble any money if you do not wish to, and you may stop gambling at any time. You may gamble as much or as little money as you wish. You may keep any winnings and any money remaining that you may have at the end of each session. You will receive an additional \$20 at the completion of each testing session. You understand that you will receive this money to cover your expenses in traveling to the laboratory and as compensation for spending time here.

Confidentiality & Anonymity:

All information obtained during the study will remain confidential, unless otherwise required by law and/or the Dalhousie Research Ethics Board. Your data will be identified only with a code number and not your name, and your records will be kept in a locked filing cabinet. Only the principal investigators (Daniel McGrath, Dr. S.P. Barrett, Dr. S.H. Stewart and Dr. R.M. Klein) and their research assistant (Lyndsay Bozec) will be able to know which records are yours. In any published report or presentation about the results of this project, your name will never be mentioned, nor will any information that could identify you. Your data may be re-analyzed in future studies conducted by the research team over the next 5 years. All data will be retained for 5 years post-publication and then destroyed.

Questions:

You will be contacted by a member of the research team should any new information become available that might affect your decision to participate in the study. Should you have any questions regarding the study or your participation in it, please contact Daniel McGrath at: 902-494-2956 or by E-mail: daniel.mcgrath@dal.ca or Dr. Sean Barrett at 902-494-2956.

Termination:

The researcher reserves the right to terminate your participation in the study at any time. Participation will be terminated if your health or the health of a member of the research team could be jeopardized. Termination should not be confused with your right to withdraw from the study at any time.

Problems or Concerns:

If you have any difficulties with, or wish to voice concern about, any aspect of your participation in this study, you may contact Patricia Lindley, Director of Dalhousie University's Office of Human Research Ethics Administration for assistance, (902) 494-1462, patricia.lindley@dal.ca.

Title of Study:

The Effects of Nicotine and Smoking on Video Lottery Terminal (VLT) Gambling Behaviour

Signature:

Please sign the following page to confirm that you have read the explanation of the study entitled "The Effects of Nicotine and Smoking on Video Lottery Terminal (VLT) Gambling Behaviour", and that you had any questions answered to your satisfaction. You will receive a copy of this consent form for your records. Feel free to address any question you may wish to the investigators either now or after you have participated.

I have read the explanation about this study, I have been given the opportunity to discuss it and my questions have been answered to my satisfaction. I hereby consent to take part in this study. However, I realize that my participation is voluntary and that I am free to withdraw from this study at any time.

Participant's Signature: _____

Date: _____

Investigator's Signature: _____

Date: _____

I understand that my VLT play will be video recorded for data collection purposes and that no identifying information will be seen on the recordings. I hereby consent to the video recording of my VLT play as part of this study.

Participant's Signature: _____

Date: _____

Investigator's Signature: _____

Date: _____

Appendix C: Study 1 Telephone Screen and FTND

Name _____ ID # _____

Interviewer to read to potential participant: Hello, this is _____ calling from the Dalhousie Gambling Lab with regards to a study that you recently inquired about. The study will take place during two 2.5-hour sessions over a two-week period. In the two sessions you will be asked to administer an inhaler with varying nicotine amounts and play a video lottery terminal (VLT). We will provide the money that you will use to play the machine and will compensate you with \$20 for each session for your time commitment. Would you be interested in participating? If yes, I will need to ask you several questions to make sure that you are eligible to participate in this study. This will take about 10 minutes to complete. Is this okay? (If yes, proceed).

Exclusion Criteria

1. Do any of the following statements apply to you?

- I am under the age of 19
- I am currently abstaining or trying to abstain from gambling
- I am currently in treatment for or have previously sought treatment for a gambling problem
- I do not play VLTs
- I have played VLTs less than once a month over the past 6 months
- I never play spinning reels VLT games
- I am currently abstaining or trying to abstain from smoking
- I am not a daily smoker
- I smoke less than 5 or more than 20 cigarettes per day
- I have allergies to menthol or peppermint
- I have any one of these conditions: heart problems (heart attack, irregular beat, heart pain), stomach problems or ulcers, overactive thyroid, high blood pressure, allergies to drugs, diabetes requiring insulin, kidney or liver disease, asthma or chronic lung problems, accelerated hypertension, treatment for poor circulation, or treatment for circulation disorders of the brain
- I take one of the following medications or supplements: clozapine (aka Clozaril, Gen-Clozapine), memantine (aka Ebixa), adenosine (aka Adenocard), cimetidine (aka Nu-Cimet), niacin (aka Advicor, Ni-odan, Niaspan), or lobelia

If the participant answers 'yes' to any of the above, then explain that:

“Unfortunately, we cannot allow you to participate in this study because _____ (state the criteria that disqualifies them). Thank you very much for your interest in the study.”

2. Administer the Fagerstrom Test for Nicotine Dependence.

If the participant scores less than 2 or greater than 20, explain that:

“Unfortunately, we cannot allow you to participate as your level of smoking is not sufficient for the study. Thank you very much for your interest in the study.”

3. (For females only) “We know that smoking during pregnancy can be unhealthy for babies before they are born. If you are pregnant, planning to get pregnant, or are nursing, you should not be in the study. We also cannot have anyone in the study who feels that there may be a chance they are pregnant (i.e., if they are sexually active and have not taken appropriate birth control measures).

- Do you fall into any of these categories? (reject if yes)
- Are you currently pregnant, planning to get pregnant, or nursing a baby at this time? (reject if yes)

If the participant answers ‘yes’ to any of the above, then explain that:

“For the reasons I just outlined, we cannot allow you to participate in this study because the study involves smoking. Thank you very much for your interest in the study.”

FAGERSTROM TEST FOR NICOTINE DEPENDENCE

The following questions assess your dependence on nicotine. Please answer each question; each answer gets a set amount of points. Add up the points and check out the score indicator below:

Questions	Answers	Points
1. How soon after you wake up do you smoke your first cigarette	Within 5 minutes	3
	6 to 30 minutes	2
	31-60 minutes	1
	After 60 minutes	0
2. Do you find it difficult to refrain from smoking in places where it is forbidden such as church, the library, or movie theatres?	Yes	1
	No	0
3. Which cigarette would you hate most to give up?	The first one in the morning	1
	Any others	0
4. How many cigarettes do you smoke each day? (20 cigarettes are in a pack)	10 or less	0
	11-20	1
	21-30	2
	31 or more	3
5. Do you smoke more frequently during the first hours after waking than the rest of the day?	Yes	1
	No	0
6. Do you smoke if you are so ill that you are in	Yes	1

bed most of the day?	No	0
----------------------	----	---

Total (Add items 1 to 6) = _____

Closing Remarks:

To participate in the study, you must abstain from using alcohol and/or drugs for 24 hours prior to your appointment. Also, please abstain from smoking for 12 hours prior to our appointment. We will administer a smoke analyzer to verify abstinence.

Appendix D: Study 1 Measures Administered

Information Sheet

Subject ID:

Date:

Gender: M
(circle one)

F

Age:

years

Handedness: right / left

Date of Birth:

Occupation:

Education Level

Highest grade completed:

Trade School: _____

Community college:

University: _____

Other: _____

Diploma/Degree Obtained:

Total number of years of schooling:

Annual Family Income (circle one):

1. up to \$30,000

2. \$31,000 to \$40,000

3. \$41,000 to \$50,000

4. \$51,000 to \$60,000

5. \$61,000 to \$70,000

6. \$71,000 to \$80,000

7. more than \$80,000

Marital Status

Single (never married) _____

Married or cohabitating _____

Separated/divorced _____

Widowed _____

Tobacco Use:

Did you usually smoke while gambling before the public smoking ban was introduced in Nova Scotia? By usually, we mean at least half the time you gamble you smoke as well.

Yes No

Currently, do you usually smoke while gambling? Again, by usually, we mean at least half the time you gamble you smoke as well. Yes No

If yes, how many cigarettes would you typically have while gambling? _____

How many cigarettes do you smoke per day? _____

South Oaks Gambling Screen

1. Please indicate which of the following types of gambling you have done in your lifetime. For each type, mark one answer: "not at all," "less than once a week," or "once a week or more."

- | | <i>not
at
all</i> | <i>less
than
once
a week</i> | <i>once
a week
or more</i> | |
|----|---------------------------|--|------------------------------------|---|
| a. | _____ | _____ | _____ | play cards for money |
| b. | _____ | _____ | _____ | bet on horses, dogs or other animals (at OTB, the track or with a bookie) |
| c. | _____ | _____ | _____ | bet on sports (parlay cards, with a bookie, or at Jai Alai) |
| d. | _____ | _____ | _____ | played dice games (including craps, over and under or other dice games) for money |
| e. | _____ | _____ | _____ | gambled in a casino (legal or otherwise) |
| f. | _____ | _____ | _____ | played the numbers or bet on lotteries |
| g. | _____ | _____ | _____ | played bingo for money |
| h. | _____ | _____ | _____ | played the stock, options and/or commodities market |
| i. | _____ | _____ | _____ | played slot machines |
| j. | _____ | _____ | _____ | played VLT machines |
| k. | _____ | _____ | _____ | bowled, shot pool, played golf or some other game of skill for money |
| l. | _____ | _____ | _____ | pull tabs or "paper" games other than lotteries |
| m. | _____ | _____ | _____ | some form of gambling not listed above (please specify) |

2. What is the largest amount of money you have ever gambled with on any one day?

- | | <i>not
at
all</i> | <i>less
than
once
a week</i> | <i>once
a week
or more</i> | |
|----|---------------------------|--|------------------------------------|---|
| a. | _____ | _____ | _____ | play cards for money |
| b. | _____ | _____ | _____ | bet on horses, dogs or other animals (at OTB, the track or with a bookie) |
| c. | _____ | _____ | _____ | bet on sports (parlay cards, with a bookie, or at Jai Alai) |
| d. | _____ | _____ | _____ | played dice games (including craps, over and under or other dice games) for money |
| e. | _____ | _____ | _____ | gambled in a casino (legal or otherwise) |
| f. | _____ | _____ | _____ | played the numbers or bet on lotteries |
| g. | _____ | _____ | _____ | played bingo for money |

- h. _____ played the stock, options and/or commodities market
- i. _____ played slot machines
- j. _____ played VLT machines
- k. _____ bowled, shot pool, played golf or some other game of skill for money
- l. _____ pull tabs or "paper" games other than lotteries
- m. _____ some form of gambling not listed above (please specify)

3. Check which of the following people in your life has (or had) a gambling

- _____ never have gambled
- _____ \$1 or less
- _____ more than \$1 up to \$10
- _____ more than \$10 up to \$100
- _____ more than \$100 up to \$1,000
- _____ more than \$1,000 up to \$10,000
- _____ more than \$10,000

4. When you gamble, how often do you go back another day to win back money you lost?

- _____ father
- _____ mother
- _____ brother or sister
- _____ grandparent
- _____ my spouse/partner
- _____ my child(ren)
- _____ another relative
- _____ a friend or someone else important in my life

5. Have you ever claimed to be winning money gambling but weren't really? In fact, you lost?

- _____ never
- _____ some of the time (less than half the time I lost)
- _____ most of the time I lost
- _____ every time I lost

6. Do you feel you have ever had a problem with betting money or gambling?

- _____ never (or never gamble)
- _____ yes, less than half the time I lost
- _____ yes, most of the time

7. Did you ever gamble more than you intend to? _____ yes _____ no

8. Have people criticised your betting or told you that you had a gambling problem, regardless of whether or not you thought it was true? _____ yes _____ no

9. Have you ever felt guilty about the way you gamble or what happens when you gamble? _____ yes _____ no

10. Have you ever felt like you would like to stop betting money or gambling but didn't think you could? _____ yes _____ no

11. Have you ever hidden betting slips, lottery tickets, gambling money, I.O.U.s or other signs of betting or gambling from your spouse, children, or other important people in your life? _____ yes _____ no

12. Have you ever argued with people you live with over how you handle money? _____ yes _____ no

13. (If you answered yes to question 12): Have money arguments ever centred on your gambling? _____ yes _____ no

14. Have you ever borrowed from someone and not paid them back as a result of your gambling? _____ yes _____ no

15. Have you ever lost time from work (or school) due to betting money or gambling? _____ yes _____ no

16. If you borrowed money to gamble or to pay gambling debts, who or where did you borrow from? (check "yes" or "no" for each)

	<i>no</i>	<i>yes</i>
a. from household money	()	()
b. from your spouse	()	()
c. from other relatives or in-laws	()	()
d. from banks, loan companies or credit unions	()	()
e. from credit cards	()	()
f. from loan sharks	()	()
g. you cashed in stocks, bonds or other securities	()	()
h. you sold personal or family property	()	()
i. you borrowed on your checking account	()	()
j. you have (had) a credit line with a bookie	()	()
k. you have (had) a credit line with a casino	()	()

Visual Analog Scales

SUBJECT ID: _____

For each of the following, please choose the number that best describes how you are feeling **RIGHT NOW**.

Confident	Not at all	<u>1 2 3 4 5 6 7 8 9 10</u>	Extremely
Intoxicated	Not at all	<u>1 2 3 4 5 6 7 8 9 10</u>	Extremely
Bored	Not at all	<u>1 2 3 4 5 6 7 8 9 10</u>	Extremely
High	Not at all	<u>1 2 3 4 5 6 7 8 9 10</u>	Extremely
Unsure	Not at all	<u>1 2 3 4 5 6 7 8 9 10</u>	Extremely
Crave Cigarette	Not at all	<u>1 2 3 4 5 6 7 8 9 10</u>	Extremely
Want to Play VLT	Not at all	<u>1 2 3 4 5 6 7 8 9 10</u>	Extremely

Post-VLT Play Questionnaire

1. Did you enjoy the game you just played?

Not at all 1 2 3 4 5 6 7 Absolutely

2. Did you find that the VLT was exciting?

Not at all 1 2 3 4 5 6 7 Absolutely

3. Did playing the VLT reduce your tensions/worries?

Not at all 1 2 3 4 5 6 7 Absolutely

Debriefing Form

Initially, we told you that you would be administering an inhaler of varying nicotine amounts while playing a video lottery terminal (VLT) for each study session.

In actuality, in one of the sessions you were given inhalers that contained nicotine and in the other session the inhaler contained 0 mg of nicotine. These are called placebos.

It was necessary to hide these truths about the purpose of this study in order to control for what we call “expectancy effects”. In other words, people who expect they have been given nicotine may react as if they really have been given nicotine. These are normal reactions, and it lets us separate the psychological effects of smoking cigarettes or inhalers with nicotine from other effects.

Due to the fact that we did not fully disclose the true purpose of this study, at this time we wish to give you the opportunity to withdraw your data from the study.

We also wish at this time to tell you not to share the nature of this study with anyone as it may make the study’s results invalid if others were to participate while knowing what the study is really about.

Appendix E: Study 2 Informed Consent Form

Consent Form

STUDY TITLE: Image Perceptions among Regular VLT Players Who Smoke

**PRINCIPAL
OR QUALIFIED
INVESTIGATOR** Dr. Sean Barrett
Department of Psychology
Life Sciences Centre
Dalhousie University
1355 Oxford Street
Halifax, Nova Scotia
Canada (B3H 4H6)
Telephone: (902) 494-2956

**ASSOCIATE
INVESTIGATORS:** Mr. Daniel McGrath
Dr. Sherry Stewart

STUDY SPONSOR: Dalhousie University Department of Psychiatry

PART A.

Non-Clinical Trial Studies – General Information

1. Introduction

You have been invited to take part in a research study. Taking part in this study is voluntary. It is up to you to decide whether to be in the study or not. Before you decide, you need to understand what the study is for, what risks you might take and what benefits you might receive. This consent form explains the study.

Please read this carefully. Take as much time as you like. If you like, take it home to think about for a while. Mark anything you don't understand, or want explained better. After you have read it, please ask questions about anything that is not clear.

The researchers will:

- Discuss the study with you
- Answer your questions
- Keep confidential any information which could identify you personally
- Be available during the study to deal with problems and answer questions

We do not know if taking part in this study will help you. You may feel better. On the other hand it might not help you at all. It might even make you feel worse. We cannot

always predict these things. We will always give you the best possible care no matter what happens.

If you decide not to take part or if you leave the study early, your usual health care will not be affected.

PART B.

EXPLAINING THE STUDY

2. Why Is This Study Being Done?

We are conducting this study to find out whether ingredients normally found in cigarettes can impact perceptions after watching different images. The results of this study may help to clarify how different cigarette ingredients can affect other behaviours. Answers to this type of question can only be fully understood using research experiments conducted in a laboratory setting. We hope to gain knowledge from this study that may be used to develop better treatment programs to help people who want to quit smoking or gambling.

3. Why Am I Being Asked To Join This Study?

You have been asked to join this study because at present: you are a regular VLT player (e.g. have wagered on VLTs at least “once per month” for at least the past 6 months) and you smoke at least “five (5) cigarettes” per week.

4. How Long Will I Be In The Study?

The study involves one (1) session at the Dalhousie Tobacco and Addictions Laboratory. The session will take approximately one-and-a-half (1.5) hours to complete. The total estimated time commitment is one-and-a-half (1.5) hours.

5. How Many People Will Take Part In This Study?

This study will be conducted in Halifax Nova Scotia only. We expect that approximately eighty (80) participants will be recruited from the local community. It is expected that the current study will take about six (6) months to complete.

6. How Is The Study Being Done?

You will be required to attend one (1) session at the Dalhousie Tobacco and Addictions Laboratory. Over the course of the study, you may receive lozenges that differ from one another according to ingredients that are normally found in regular cigarettes (e.g. tar, ammonia, menthol, nicotine, sucrose, etc.). Additionally, you will be asked to watch slideshows that may or may not contain scenes of VLT gambling. This study is being done to examine the effects of cigarette ingredients on subjective responses (e.g.

satisfaction, sedation, stimulation, craving) on questionnaires and behavioural responses (gambling behaviour) following the presentation of different images.

7. What Will Happen If I Take Part In This Study?

TELEPHONE SCREENING

If you want to be in this study and sign this consent form, you must have consented to and successfully completed a telephone interview. This is called screening. The telephone screening was done to ensure that you have met all the eligibility criteria to participate. More specifically, you indicated that you are nineteen (19) years of age or older, you have gambled on VLTs at least once (1) per month for the last six (6) months, and you smoke at least five (5) cigarettes per week. You have also indicated that you are not currently trying to quit smoking or plan to do so in the next sixty (60) days and are not currently using nicotine-replacement therapy (NRT) for any reason. You have also indicated that you are not currently trying to quit gambling or plan to do so in the next sixty (60) days. Also, if you are a female, you have indicated that you are not currently pregnant, and are not currently planning to conceive or are nursing.

STUDY

Testing Session:

Upon successful completion of the phone screen, you will be scheduled for the session which will take place in the morning. **You will not be able to smoke tobacco or marijuana cigarettes or drink alcohol twelve (12) hours prior to the session.** During the session, after having the experiment explained to you, your tobacco abstinence will be verified by collecting a breath and saliva sample; your alcohol abstinence will also be verified using a breath sample. Following this, you will complete several questionnaires that indicate your perceptions and mood. Next, a measuring device will be secured to your chest to measure heart rate and this information will be transmitted to a wrist receptor held by the experimenter. The experimenter will record your heart rate for up to 180 seconds from this device while you relax. You will then complete a series of self-report questionnaires that look at various aspects of your lifestyle and personality and will be asked about your tobacco use and gambling.

Next, the experiment will begin. Prior to the testing session, you will be placed into one of two groups at random. Randomization is much like “the flip of a coin”, where you have an equal chance of being placed into one of the two groups. One group will receive a lozenge which may contain ingredients normally found in regular cigarettes (e.g. tar, ammonia, menthol, nicotine, sucrose, etc.), whereas the other group will receive a placebo lozenge, which contains an inactive substance. Both you and the researcher will be blinded during testing; meaning neither of you will not know whether you are receiving the study drug or the inactive substance.

You will then be asked to consume the assigned lozenge steadily for thirty (30) minutes. Afterwards, your heart rate will be measured for another 180 seconds and you will

complete the same questionnaires you completed at the beginning of the session regarding your perceptions and mood. Once this task is complete, you will be presented slideshows played on a laptop computer. You are asked to watch slideshows and focus on their content. The slideshows will last approximately 2-minutes each. During the slideshow presentation, your heart rate will be measured for another 180 seconds and you will again complete the same questionnaires you completed at the beginning of the session. Lastly, the researcher will give you the opportunity to play a VLT; however, the decision to play is entirely yours.

After completing the session, you will be compensated with a minimum of \$40 and will be allowed to leave. In total, the experimental session is expected to last one-and-a-half (1.5) hours. You will be free to leave at any time to take bathroom breaks. You are also free to completely withdraw from the study at any time without losing compensation.

Lastly, you will have the option to provide a saliva sample by spitting into a small container. All saliva samples will then be sent to a lab, with only a study code assigned to them. No information that could possibly identify you will be kept with the sample; however, the research staff will have access to a file that indicates which code is matched with your name. These records will be kept for seven (7) years in a secure area such as a locked file cabinet. Therefore, only the research staff will have access to them, and know your name. You can also contact the Principal Investigator (Dr. Sean Barrett) at any time to make arrangements to have your sample destroyed.

8. Are There Risks To The Study?

There are risks with this, or any study. To give you the most complete information available, we have listed some *possible* risks. We want to make sure that if you decide to try the study, you have had a chance to think about the risks carefully. Please be aware that there may be risks that we don't yet know about.

STUDY RISKS

Ingredients normally found in cigarettes have some side effects associated with them. There is a small risk (less than 10%) of headache, coughing, hiccups, nausea, vomiting, and irritation in the mouth and throat and nasal congestion.

In addition, as you will be asked not to smoke the night prior (12 hours prior to testing) to your first experimental session, you may experience withdrawal symptoms. These symptoms may be physical (i.e. dizziness) and/or mental (i.e. feelings of frustration and/or anger).

Symptoms can include any of the following:

- dizziness
- feelings of frustration and/or anger
- irritability
- cravings

- trouble concentrating
- restlessness
- headache
- tiredness

You should also be aware of the possibility that participating in gambling tasks may stimulate urges to gamble for some individuals. You will be exposed to gambling scenarios, gambling questionnaires, and potential opportunities to gamble throughout the course of the study. Some people may feel discomfort in discussing their gambling habits, but you understand that you are not required to answer any questions, and if you become uncomfortable you may withdraw from the study at any point.

SALIVA SAMPLES

The saliva samples that are being collected during the experimental sessions will be used to examine the concentration of certain tobacco ingredients (e.g. tar, ammonia, menthol, nicotine, sucrose) in your saliva. They will not be used for any other reason, including genetic analyses. To protect your identity/information, we will not keep your name or other information that may identify you with the sample; only a code number. Files that link your name to the code number will be kept in a locked cabinet and only the study staff will be allowed to look at them. Although no one can absolutely guarantee confidentiality, using a code number greatly reduces the chance that someone other than the research staff or other authorized persons (discussed later in the consent form) will ever be able to link your name to your sample or to any test results.

You may find that providing saliva samples throughout the study is uncomfortable and/or embarrassing. You do not have to provide the saliva samples if they make you feel uncomfortable.

QUESTIONNAIRES

You may find the questionnaires you receive during the course of the study upsetting or distressing. You may not like all the questions that you will be asked. You do not have to answer those questions you find distressing.

All of the previously listed potential risks are those which could be anticipated prior to the beginning of the study; however, the possibility remains for other unforeseen risks to arise during the course of this study. Should you be concerned with any other aspects of the study, you are asked to bring these concerns to the attention of the research team.

9. What Happens at the End of the Study?

Once the study is complete, you may request to be contacted by phone and told about the results of the study. Please note that only combined group results, and not your own individual scores, will be available following completion of the study.

10. What Are My Responsibilities?

As a study participant you will be expected to:

- Follow the directions of the Principal Investigator;
- Report any changes in your health status;
- Report any serious adverse events that have occurred as soon as possible

11. Can I Be Taken Out Of The Study Without My Consent?

Yes. You may be taken out of the study at any time, if:

- You can't tolerate the side effects.
- There is new information that shows that being in this study is not in your best interests.
- Dalhousie University, the Capital Health Research Ethics Board or the Principal Investigator decides to stop the study.
- You do not follow the directions of the Principal Investigator.
- You become pregnant.

You will be told about the reasons why you might need to be taken out of the study.

12. What About New Information?

It is possible (but unlikely) that new information may become available while you are in the study that might affect your health, welfare, or willingness to stay in the study. If this happens, you will be informed in a timely manner and will be asked whether you wish to continue taking part in the study or not.

13. Will It Cost Me Anything?

a) Compensation

You will not be paid to be in the study. You will get a small amount of money (**i.e. forty (40) dollars**) to cover your time, gas mileage, and parking for your session at the Dalhousie Tobacco and Addiction Laboratory. This will be awarded in order to compensate you for the time that your normal activities were disrupted.

Research Related Injury

If you become ill or injured as a direct result of participating in this study, necessary medical treatment will be available at no additional cost to you. Your signature on this form only indicates that you have understood to your satisfaction the information regarding your participation in the study and agree to participate as a subject. In no way does this waive your legal rights nor release the Principal Investigator, the research staff,

the study sponsor or involved institutions from their legal and professional responsibilities.

14. What About My Right To Privacy?

Protecting your privacy is an important part of this study. A copy of this consent will be put in your health record.

When you sign this consent form you give us permission to:

- Collect information from you
- Share information with the people conducting the study
- Share information with the people responsible for protecting your safety

Access to records

The Principal Investigator and members of the research team will see health and study records that identify you by name.

Other people may need to look at the health and study records that identify you by name. These might include:

- Dalhousie University
- The CDHA Research Ethics Board and Research Quality Associate

Use of records

The research team will collect and use only the information they need to complete the Study. This information will only be used for the purposes of this study.

This information will include your:

- date of birth
- sex
- medical conditions
- medications
- saliva samples
- information from study interviews and questionnaires

Your name and contact information will be kept secure by the research team at Dalhousie University in Halifax, Nova Scotia. It will not be shared with others without your permission. Your name will not appear in any report or article published as a result of this study. Information collected for this study will be kept as long as required by law. This could be 7 years or more.

If you decide to withdraw from the study, the information collected up to that time will continue to be used by the research team. It may not be removed.

After your part in this study ends, we may continue to review your study records. We may want to follow your progress and to check that the information we collected is correct.

Information collected and used by the research team will be stored at the Dalhousie Tobacco and Addictions Laboratory. The Principal Investigator is the person responsible for keeping it secure.

You may also be contacted personally by Research Auditors for quality assurance purposes.

Your access to records

You may ask the study doctor to see the information that has been collected about you. As the study is 'blinded', you cannot see this information until the study ends. This is to prevent either you or the researchers from knowing which study arm you participated in.

15. What If I Want To Quit The Study?

If you chose to participate and later change your mind, you can say no and stop the research at any time. If you wish to withdraw your consent please inform the Principal Investigator. All data collected up to the date you withdraw your consent will remain in the study records, to be included in study related analyses. If you are a Dalhousie student, a decision to stop being in the study will not affect your grades.

16. What Will Happen To My Sample After The Study Is Over?

After this study is over, we will dispose of all the saliva samples we collected as part of the study by burning them.

17. Declaration of Financial Interest

The sponsor is paying the Principal Investigator and/or the Principal Investigator's institution to conduct this study. The amount of this payment is sufficient to cover the costs of conducting the study. The Principal Investigator has no financial interests in conducting this research study.

18. What About Questions or Problems?

For further information about the study call **Dr. Sean Barrett**. Dr. Barrett is in charge of this study at this institution (Principal Investigator). Dr. Barrett's work telephone number is (902) 494-2956.

If you experience any symptoms or possible side effects or other medical problems, please let the Principal Investigator know immediately.

The Principal Investigator is **Dr. Sean Barrett.**

Telephone: (902) 494-2956

Your Research Coordinator is **Mr. Daniel McGrath**

Telephone: (902) 240-1243

19. What Are My Rights?

After you have signed this consent form you will be given a copy.

If you have any questions about your rights as a research participant, contact the **Patient Representative** at **(902) 473-2133.**

In the next part you will be asked if you agree (consent) to join this study. If the answer is “yes”, you will need to sign the form.

PART C.

20. Consent Form Signature Page

I have reviewed all of the information in this consent form related to the study called:

Image Perceptions among Regular VLT Players Who Smoke

I have been given the opportunity to discuss this study. All of my questions have been answered to my satisfaction.

I agree to allow the people described in this consent form to have access to my study information.

This signature on this consent form means that I agree to take part in this study. I understand that I am free to withdraw at any time.

Signature of Participant

_____/_____/_____
Name (Printed) Year Month Day*

Witness to Participant's
Signature

_____/_____/_____
Name (Printed) Year Month Day*

Signature of Investigator _____ _____ / _____ / _____
Name (Printed) Year Month Day*

Signature of Person Conducting
Consent Discussion _____ _____ / _____ / _____
Name (Printed) Year Month Day*

I Will Be Given A Signed Copy Of This Consent Form
Thank you for your time and patience!

Appendix F: Study 2 Telephone Screen, FTND, & PGSI

Telephone Screen (+Fagerstrom Test for Nicotine Dependence and Problem Gambling Severity Index)

ID# _____

Interviewer to read to potential participant: Hello, this is _____ calling from the Dalhousie Tobacco and Addictions Laboratory with regards to a study that you recently inquired about. First, I will tell you a little about the study and then I will ask you a few questions regarding your smoking, gambling, and drinking habits. The purpose of the study is to evaluate whether ingredients normally found in cigarettes can impact responses on questionnaires after watching different types of video.

The study will take place during 1 session at Dalhousie University. You will be required to abstain from smoking and drinking alcohol 12 hours before you arrive at the lab and this will be verified by two breath samples and a saliva sample at the beginning of the session. We also ask that you refrain from drinking any caffeinated beverages 2 hours before you arrive at the lab. During the session, you may be asked to use/consume different types of substances. These include different types of lozenges that may vary according to ingredients normally found in cigarettes(e.g. menthol, sucrose, ammonia, nicotine, carbon monoxide,etc.). You will also complete a series of questionnaires about your mood and cravings. The session is expected to take about 1 and a half hours. You will be compensated with \$30 for the session. In addition to the hourly compensation, you will be awarded an extra \$10 at the completion of each session. The study session will be booked on a morning that is convenient for you and the researchers.

Are you interested in participating in this study? If yes, I will need to ask you several questions to make sure that you are eligible to participate in the study. This will take about 10 minutes to complete. Is this okay?

Question	Response	Interviewer Response
<p>Medications that are contraindicated with nicotine replacement therapy</p> <p>Are you taking any of the following medications?</p> <ul style="list-style-type: none"> • Champix (varenicline) • bupropion • amitriptyline • clozapine (aka Clozaril, Gen-Clozapine), • memantine (aka Ebixa), • adenosine (aka Adenocard), • cimetidine (aka Nu-Cimet), • niacin (aka Advicor, Ni-odan, Niaspan), • or lobelia 	<input type="checkbox"/> Yes Specify _____ <input type="checkbox"/> No	Reject if Yes
<p>Have you EVER suffered from any of the following medical conditions:</p> <ul style="list-style-type: none"> • allergies to nicotine, • heart problems (heart attack, irregular beat, heart pain), • active tempo-mandibular joint disease (TPJ) • stomach problems or ulcers, • overactive thyroid, • high blood pressure, • allergies to drugs, • diabetes requiring insulin, • kidney or liver disease, • adrenal disease, • asthma or chronic lung problems, • accelerated hypertension, • treatment for poor circulation, • or treatment for circulation disorders of the brain 	<input type="checkbox"/> Yes Specify _____ <input type="checkbox"/> No	Reject if Yes

Question	Response	Interviewer Response
----------	----------	----------------------

1. How old are you?		Reject if under 19
2. What is your birthday		
3. Have you been a smoker for at least the past year?	<input type="checkbox"/> Yes <input type="checkbox"/> No	Reject if No
4. How many cigarettes do you smoke per week?		Reject if under 5 Cigarettes per week
5. Are you a daily smoker?	<input type="checkbox"/> Yes <input type="checkbox"/> No	Reject if No
6. Are you currently trying to quit smoking or do you intend to do so within the next sixty days?	<input type="checkbox"/> Yes <input type="checkbox"/> No	Reject if Yes
7. Are you currently using Nicotine Replacement Therapy (i.e. patch, gum, inhalers)?	<input type="checkbox"/> Yes <input type="checkbox"/> No	Reject if Yes
8. Do you regularly play VLTs/Slot machines	<input type="checkbox"/> Yes <input type="checkbox"/> No	Reject if No
9. Have you played VLTs at least once a month for the past 6 months?	<input type="checkbox"/> Yes <input type="checkbox"/> No	Reject if No
10. Are you currently trying to quit gambling or do you intend to do so within the next sixty days?	<input type="checkbox"/> Yes <input type="checkbox"/> No	Reject if Yes
11. Are you currently in treatment for or have you previously sought treatment for a gambling problem?	<input type="checkbox"/> Yes <input type="checkbox"/> No	Reject if Yes

Pregnancy FEMALES: “We know that cigarette consumption pregnancy can be unhealthy for babies before they are born. If you are pregnant, planning to get pregnant, or are you should not be in the study. If you have engaged in sexual activity that could lead to pregnancy and are using effective birth control we recommend that you get a pregnancy test before enrolling in this study.”		
(a) Are you currently pregnant, planning to get pregnant, or nursing a baby at this time?	<input type="checkbox"/> Yes <input type="checkbox"/> No	Reject if Yes If No, go to (b)

(b) Are you currently engaging in sexual activity that Lead to pregnancy?	<input type="checkbox"/> Yes <input type="checkbox"/> No	If Yes, go to (c) If No, go to FTND
(c) Are you using effective means of birth control?	<input type="checkbox"/> Yes <input type="checkbox"/> No	If Yes, go to FTND Reject if No

FAGERSTROM TEST FOR NICOTINE DEPENDENCE (FTND)

The following questions assess your dependence on nicotine. Please answer each question; each answer gets a set amount of points. Add up the points and check out the score indicator below:

Questions	Answers	Points
1. How soon after you wake up do you smoke your first cigarette	Within 5 minutes 6 to 30 minutes 31-60 minutes After 60 minutes	3 2 1 0
2. Do you find it difficult to refrain from smoking in places where it is forbidden such as church, the library, or movie theatres?	Yes No	1 0
3. Which cigarette would you hate most to give up?	The first one in the morning Any others	1 0
4. How many cigarettes do you smoke each day? (20 cigarettes are in a pack)	10 or less 11-20 21-30 31 or more	0 1 2 3
5. Do you smoke more frequently during the first hours after waking than the rest of the day?	Yes No	1 0
6. Do you smoke if you are so ill that you are in bed most of the day?	Yes No	1 0

Total (Add items 1 to 6) = _____

Reject if total score is 2 or less

CPGI (PGSI)

Some of the next questions may not apply to you, but please try to be as accurate as possible. THINKING ABOUT THE LAST 12 MONTHS...

1. Have you bet more than you could really afford to lose?

- <a> Never
- Sometimes
- <c> Most of the time
- <c> Almost always
- <d> Don't know

2. Still thinking about the last 12 months, have you needed to gamble with larger amounts of money to get the same feeling of excitement?

- <a> Never
- Sometimes
- <c> Most of the time
- <c> Almost always
- <d> Don't know

3. When you gambled, did you go back another day to try to win back the money you lost?

- <a> Never
- Sometimes
- <c> Most of the time
- <c> Almost always
- <d> Don't know

4. Have you borrowed money or sold anything to get money to gamble?

- <a> Never
- Sometimes
- <c> Most of the time
- <c> Almost always
- <d> Don't know

5. Have you felt that you might have a problem with gambling?

- <a> Never
- Sometimes
- <c> Most of the time
- <c> Almost always

<d> Don't know

6. Has gambling caused you any health problems, including stress or anxiety?

<a> Never

 Sometimes

<c> Most of the time

<c> Almost always

<d> Don't know

7. Have people criticized your betting or told you that you had a gambling problem, regardless of whether or not you thought it was true?

<a> Never

 Sometimes

<c> Most of the time

<c> Almost always

<d> Don't know

8. Has your gambling caused any financial problems for you or your household?

<a> Never

 Sometimes

<c> Most of the time

<c> Almost always

<d> Don't know

9. Have you felt guilty about the way you gamble or what happens when you gamble?

<a> Never

 Sometimes

<c> Most of the time

<c> Almost always

<d> Don't know

Total (Add items) = _____

Reject if total score is 2 or less

IF THEY MEET REQUIREMENTS:

Based on your answers to the questions we asked, you are eligible to participate in the study.

Would you still like to participate? Yes No

If yes, book the first session with the participant. Provide the following information:

- First session will be scheduled during a morning following overnight tobacco and alcohol abstinence (THIS WILL BE CHECKED WITH A BREATHALYZER)
- You will have the option to provide a saliva sample by spitting into a small container.
- Ensure them that all information will remain strictly confidential and can be accessed only by the researchers

- Directions to find the lab at Dalhousie
- Information on parking
- Contact information for the researcher should they need to contact us

IF THEY DO NOT MEET REQUIREMENTS:

Currently you are not eligible to participate in the study, however because the requirements may change it is possible the you may be eligible at a later time. Is it okay if I keep you name in a database to be contacted regarding this study in the future?

PARTICIPANT INFO:

PHONE NUMBER: _____
SESSION DATE & TIME: _____

LAB INFO:

PHONE NUMBER: 494-4596
EMAIL: vltstudy@dal.ca

Appendix G: Study 2 Measures Administered



Capital Health

Demographics and Smoking/Gambling History Questionnaire

SUBJECT ID _____

Below you will find some questions about your smoking/gambling history. Although you are not required to answer any questions that make you uncomfortable, it is important to remember that all of your answers are completely confidential and anonymous.

1. How old are you? _____
2. Please indicate your sex: (Male) (Female)
3. Please indicate your marital status:
(Single) (Common-Law) (Married) (Separated) (Divorced) (Widowed)
4. Please indicate your ethnicity? _____
(Aboriginal) (Asian) (Black) (Hispanic) (Caucasian) (Other)
5. Please indicate your highest level of education completed:
(Some High School) (High School Diploma) (Some College/University)
(College/University Degree) (Other (Please specify): _____)
6. Are you currently enrolled in a post-secondary institution? (Yes/No)
7. Which of the following best describes your present job status? (circle one)
 - a. Employed full-time
 - b. Employed part-time
 - c. Unemployed
 - d. Student
 - e. Retired
 - f. Other _____
8. At what age did you first try smoking? _____
9. How many cigarettes do you smoke, on average, per day? _____
10. What brand do you normally smoke? _____

11. How long has it been since you had your last cigarette? (in hours) _____

12. How many times have you made a serious attempt to quit smoking? _____

The last time you tried, how long were you able to give up smoking?

___ Years ___ Months ___ Weeks ___ Days ___ Hours

13. At what age did you first try VLTs/Slot machines? _____

14. How many **days** in an average *month* do you play VLTs/Slot machines? _____

15. How much **time** on average do you play VLTs/Slot machines in a single session?
(please specify minutes and hours) _____

16. How much **money** on average do you spend on VLTs/Slot machines in a single session? (please specify amount in dollars) _____

17. Do you have a preferred VLT/Slot machine game (e.g. spinning reels, poker, etc.)? (Yes/No)

If yes, please specify your favorite _____

Visual Analog Scales



Capital Health

SUBJECT ID: _____

For each of the following, please choose the number that best describes how you are feeling **RIGHT NOW**.

Relaxed	Not at all	<u>1 2 3 4 5 6 7 8 9 10</u>	Extremely
Pleasant	Not at all	<u>1 2 3 4 5 6 7 8 9 10</u>	Extremely
Head Rush	Not at all	<u>1 2 3 4 5 6 7 8 9 10</u>	Extremely
Stimulated	Not at all	<u>1 2 3 4 5 6 7 8 9 10</u>	Extremely
Jittery	Not at all	<u>1 2 3 4 5 6 7 8 9 10</u>	Extremely
Dizzy	Not at all	<u>1 2 3 4 5 6 7 8 9 10</u>	Extremely
Irritable	Not at all	<u>1 2 3 4 5 6 7 8 9 10</u>	Extremely
Trouble Concentrating	Not at all	<u>1 2 3 4 5 6 7 8 9 10</u>	Extremely
Anxious	Not at all	<u>1 2 3 4 5 6 7 8 9 10</u>	Extremely
Satisfied	Not at all	<u>1 2 3 4 5 6 7 8 9 10</u>	Extremely
High	Not at all	<u>1 2 3 4 5 6 7 8 9 10</u>	Extremely
Alert	Not at all	<u>1 2 3 4 5 6 7 8 9 10</u>	Extremely
Frustrated	Not at all	<u>1 2 3 4 5 6 7 8 9 10</u>	Extremely
Sedated	Not at all	<u>1 2 3 4 5 6 7 8 9 10</u>	Extremely
Crave Cigarette	Not at all	<u>1 2 3 4 5 6 7 8 9 10</u>	Extremely
Crave VLTs/Slots	Not at all	<u>1 2 3 4 5 6 7 8 9 10</u>	Extremely

The Gambling Craving Scale



Capital Health

SUBJECT ID: _____

Please indicate your agreement or disagreement to the following statements by circling the appropriate response

	Strongly disagree		Neutral			Strongly agree	
1. If I had an opportunity to gamble right now I would probably take it.	1	2	3	4	5	6	7
2. If I were gambling right now I could think more clearly.	1	2	3	4	5	6	7
3. I could control things better right now if I could gamble.	1	2	3	4	5	6	7
4. Gambling would be fun right now.	1	2	3	4	5	6	7
5. I crave gambling right now.	1	2	3	4	5	6	7
6. I need to gamble now.	1	2	3	4	5	6	7
7. I would not enjoy gambling right now.	1	2	3	4	5	6	7
8. I have an urge to gamble.	1	2	3	4	5	6	7
9. Gambling would make me less depressed.	1	2	3	4	5	6	7

Questionnaire Smoking Urges - Brief



Capital Health

For each of the following, please choose the number that best describes how you are feeling RIGHT NOW.

	Strongly disagree		Neutral			Strongly agree	
1. I have a desire for a cigarette right now.	1	2	3	4	5	6	7
2. Nothing would be better than smoking a cigarette right now.	1	2	3	4	5	6	7
3. If it were possible, I probably would smoke right now.	1	2	3	4	5	6	7
4. I could control things better right now if I could smoke.	1	2	3	4	5	6	7
5. All I want right now is a cigarette.	1	2	3	4	5	6	7
6. I have an urge for a cigarette.	1	2	3	4	5	6	7
7. A cigarette would taste good right now	1	2	3	4	5	6	7
8. I would do almost anything for a cigarette right now.	1	2	3	4	5	6	7
9. Smoking would make me less depressed.	1	2	3	4	5	6	7
10. I am going to smoke as soon as possible.	1	2	3	4	5	6	7

Study Debrief



Capital Health

The purpose of this experiment is to examine whether or not nicotine can influence craving for gambling cues. Cues are stimuli (e.g. images in a video) that can enhance how much a person rates their craving for a substance or an activity such as gambling. In this study, you watched a video that contained ‘neutral cues’ (washing machines and dishwashers). During the second session, you watched either the same slideshow again or a slideshow that contained “gambling-related cues” (people gambling on slot machines/VLTs). We wanted to see whether your heart rate and ratings for the video were affected by the type of video you watched and the type of lozenge you received.

Initially, we told you that you would be ingesting a lozenge that may vary according to ingredients normally found in cigarettes (e.g. tar, ammonia, nicotine, menthol, etc.). In actuality, you were randomly placed into one of two groups which received different lozenges. One group of participants was given lozenges that contained 4mg of nicotine, while the other group received lozenges that contained 0 mg of nicotine. These are called placebos.

It was necessary to hide these truths about the purpose of this study in order to control for what we call “expectancy effects”. In other words, people who expect they have been given nicotine may react as if they really have been given nicotine. These are normal reactions, and it lets us separate the psychological effects of smoking cigarettes or ingesting lozenges with nicotine from other effects.

Due to the fact that we did not fully disclose the true purpose of this study, at this time we wish to give you the opportunity to withdraw your data from the study.

We also wish at this time to tell you not to share the nature of this study with anyone as it may make the study’s results invalid if others were to participate while knowing what the study is really about.

Appendix H: Copyright Release Letters

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