

Developing and Testing the Effectiveness of a Novel Online Integrated Treatment for Problem Gambling and Tobacco Smoking: A Protocol for a Randomized Controlled Trial

Elena Bilevicius

University of Manitoba

Alanna Single

University of Manitoba

Chris Baumgartner

University of Zurich

Van Bui

University of Manitoba

Tyler Kempe

University of Manitoba

Michael Schaub

University of Zurich

Sherry Stewart

Dalhousie University

James MacKillop

McMaster University

David Hodgins

University of Calgary

Jeffrey Wardell

University of Toronto

Roisin O'Connor

Concordia University

Jennifer Read

University at Buffalo

Heather Hadjistavropoulos

University of Regina

Christopher Sundstrom

University of Regina

Matt Keough (✉ keoughmt@yorku.ca)

York University

Study protocol

Keywords: problem gambling, tobacco smoking, integrated treatment, cognitive behavioral therapy, motivational interviewing, online, self-help

Posted Date: July 20th, 2020

DOI: <https://doi.org/10.21203/rs.3.rs-26995/v1>

License:  This work is licensed under a Creative Commons Attribution 4.0 International License.

[Read Full License](#)

Version of Record: A version of this preprint was published on November 19th, 2020. See the published version at <https://doi.org/10.1186/s13063-020-04867-1>.

Abstract

Background: Gambling and tobacco smoking are highly comorbid among North American adults. However, there is a paucity of treatment options that are integrated (i.e., targeting both gambling and tobacco smoking simultaneously), accessible, and evidence based.

Methods: The aim of this two-arm randomized controlled trial is to examine the effectiveness of an online, self-guided integrated treatment for problem gambling and tobacco smoking. A target sample of 214 participants will be recruited and be randomized into either an eight-week integrated or gambling-only control condition. Both conditions will consist of seven online modules following cognitive behavioral therapy and motivational interviewing principles. Our three primary outcomes are (1) number of days gambled, (2) money spent on gambling activities, and (3) time spent in gambling activities. Secondary outcomes include gambling disorder symptoms, cigarette use, and nicotine dependence symptoms. Assessments will be completed at baseline, at completion (i.e., eight-weeks from baseline), and follow-up (i.e., 24-weeks from baseline). Generalized linear mixed modelling will be used to evaluate our primary and secondary outcomes. We expect that participants receiving online integrated treatment will show larger reductions in gambling relative to those receiving a control gambling only intervention. We further hypothesize that reductions in smoking will mediate these group differences.

Discussion: The rates of problem gambling and tobacco smoking are high in North America; yet, the treatment options for both are limited, with no integrated treatments available. If supported, our intervention will be a cost-effective and accessible way to improve treatments for co-occurring problem gambling and tobacco use.

Trial registration: Clinicaltrials.gov; ID NCT03614884. Registered August 3, 2019;

Background

Significance

Problem gambling and tobacco smoking are highly comorbid. Indeed, studies show that tobacco dependence is the most common comorbid disorder among problem gamblers, with prevalence rates ranging from 41–60%.^{1,2,3} According to the World Health Organization, tobacco use kills up to 50% of its users – translating into nearly six million deaths annually.⁴ Tobacco use is also linked to several chronic health conditions, including cancers, respiratory problems, and cardiovascular diseases.⁴ Given their high rates of smoking (relative to the general population)^{1,2,3}, problem gamblers are thus disproportionately affected by the increased morbidity and mortality from tobacco use. Moreover, research to date shows that co-occurring tobacco use compounds gambling-related harms. Problem gamblers who smoke have more severe gambling pathology⁵, experience stronger gambling urges⁶, are more likely to have other mental disorders⁵, tend to bet larger sums of money and spend more time in gambling activities⁷, and have greater financial problems.⁸ Based on this, it has been suggested that daily smoking, a central

trigger for gambling and related cravings, may undermine the treatment of problem gambling.⁹ Accordingly, a priority needs to be placed on integrating the treatment of tobacco smoking into evidence-based interventions for problem gambling. In this study, we aim to design and test a novel online intervention for comorbid problem gambling and tobacco use.

Recent statistics show a clear need for this intervention, as prevalence rates for problem gambling^{10,11} and tobacco smoking^{12,13} and their co-occurrence^{9,14} are high in North America. The proposed intervention will draw on strategies from Cognitive Behavioral Therapy (CBT) and Motivational Interviewing (MI) – both evidence-based psychotherapies for problem gambling¹⁵ and smoking.¹⁶ A main strength is that this intervention will be integrated – meaning that it will use treatments for both problem gambling and tobacco smoking to target the functional relations between each behaviour within the same treatment. This is in contrast to limited traditional approaches, which include treating these problems either one at a time, or simultaneously by two different professionals. The online platform also offers key advantages relative to in-person modalities. First, some provinces across Canada (e.g., Manitoba and Saskatchewan) and states in the United States have significant rural spread, meaning that communities are dispersed throughout the area with little access to major cities. This poses huge challenges for providing equal access to mental health care services for all citizens. In fact, statistics suggest that people living in remote communities struggle most with addictive behaviours and mental health issues but have limited access to treatment facilities.¹⁷ Thus, we will be better able to reach these people with an online treatment. Second, many problem gamblers do not seek traditional forms of treatment due to stigma.¹⁷ Problem gamblers may be more willing to try online interventions due to anonymity and reduced shame.¹⁹ This integrated intervention has the potential to have positive impacts on the health of adult North Americans who struggle with problem gambling and tobacco use.

Evidence for the Association between Problem Gambling and Tobacco Smoking

Based on the epidemiological literature showing very high prevalence rates of tobacco smoking among problem gamblers, researchers have begun to examine the potential reasons for this association. While we still do not know the exact mechanisms underlying the problem gambling-tobacco use comorbidity, neurobiological studies suggest that both addictive behaviours are mediated by similar reward circuits in the brain.⁹ Specifically, neurobiological work shows that drugs of abuse, including nicotine, increase transmission of dopamine in mesocorticolimbic regions.^{20,21} This effect is thought to underlie the reinforcing properties of substance use. Similarly, data suggest that gambling is also associated with increased activity in dopaminergic rich areas of the mesocorticolimbic circuit. For example, in a double-blinded laboratory study²², it was shown that administration of amphetamine (a potent dopamine agonist or releaser) increased motivation to gamble among individuals with gambling problems. It has also been noted that people with Parkinson's disease (caused by disruption of mesocorticolimbic dopamine) can develop problem gambling symptoms.²³ Taken together, tobacco use and problem gambling appear to act on similar neural pathways that underlie addictive, reward-driven behaviours.

Functionally, research shows that nicotine may enhance or augment the reinforcing value of other addictive behaviours.^{9,24} Nicotine has been shown to lead to increased self-administration of alcohol in male smokers²⁵; increased cravings in cocaine-dependent smokers²⁶; and increased self-administration of methadone in opioid-dependent smokers.²⁷ Compared to alcohol and other drugs, very little neurobiological work has been done to show direct functional effects of nicotine on the reinforcing qualities of gambling. Indirect evidence for nicotine's effects on gambling behaviour, however, comes from studies examining the impact of monetary reward on dopaminergic transmission in the brain. Overall, this work shows that when individuals receive uncertain or variable monetary rewards (i.e., those that cannot be predicted by any regularity), they show increased dopaminergic activity in the very same regions associated with tobacco use.^{28,29} In comparison, when monetary rewards are certain or predictable, there is no increased dopaminergic transmission in these brain regions. Given that uncertain or variable reinforcement is hallmark of gambling, one could predict that co-occurring tobacco use could promote or reinforce gambling and gambling-seeking behaviours over time (via nicotine's effects on dopaminergic brain regions in the mesocorticolimbic pathway).

Complementing neurobiological studies, behavioural research demonstrates that nicotine may alter reward-related cognitive processes that increase risk for problem gambling.⁹ To illustrate, nicotine may enhance the salience of short-term rewards from gambling, while detracting focus from gambling's longer-term negative outcomes. This notion is supported by work showing that heavy smokers engage in risky decision making on the Iowa Gambling Task, with response patterns showing preference for short-term gains at the expense of long-term losses.³⁰ Heavy smokers also show steeper discounting of future rewards relative to non-smokers³¹, suggesting that nicotine may reinforce impulsive behaviour – like gambling – where the goal is immediate reward. It is possible that tobacco smoking (via nicotine's effects on learning and reward systems in the brain) strengthens problem gambling, making this behaviour difficult to extinguish especially when repeatedly paired with cigarette use. This may account for the increased clinical severity in heavy smoking (relative to non-smoking) problem gamblers. Moreover, some studies demonstrate that nicotine may enhance cognitive processes, like attention and executive control.³² These momentary effects may be highly desirable to problem gamblers, as they may experience a greater ability to focus and shift attention during gambling episodes (after smoking).

Finally, the literature on cross-cue reactivity shows that tobacco use and problem gambling may become powerful reciprocal triggers for each behaviour.³³ That is, through repeated co-occurrence, stimuli associated with smoking are believed to become conditioned stimuli for gambling and vice versa. For example, over time, smoking cues can come to elicit strong urges to gamble, and conversely, gambling cues can come to promote cravings for tobacco use. While this is a relatively understudied research area, recent data show that gamblers who smoke had greater cross-cue reactivity (compared to gambling and smoking only control groups).³³ Results suggested that smoking gamblers had increased physiological arousal and greater subjective desire to smoke, irrespective of whether cues were smoking- or gambling-related.³³ Accordingly, if tobacco use potentiates gambling – and vice versa – then it would be very challenging for a person to reduce either behaviour in isolation.

Existing Evidence-based Treatments for Problem Gambling

Existing evidence-based treatment protocols for problem gambling generally combine strategies from two main psychological intervention frameworks: CBT and MI.^{15,34} CBT is a structured and goal-oriented treatment, where individuals acquire skills to reduce problem gambling through modifying thoughts and behaviours in response to internal (e.g., negative emotions) and external (e.g., gambling cues) triggers. During CBT, individuals with gambling problems strengthen coping skills by completing various exercises both in-session and at home between sessions. Complementing CBT, MI strategies are used in gambling treatment to elicit and motivate positive change. MI is a patient-centered and collaborative approach, where the goal is to help patients resolve ambivalence about change and get them to move in a direction that is consistent with personal values. MI is typically a prelude to CBT, but also a style that a therapist can return to if barriers are encountered during CBT. The weight of the evidence demonstrates that the combination of CBT and MI has synergistic beneficial effects on gambling behaviours during treatment.^{15,34} By increasing motivation for change using MI, individuals with problem gambling may be more willing to engage in the effortful activities of CBT (e.g., homework), which in turn, are essential for building better coping skills. Integrated MI may also help to clarify a problem gambler's core values in CBT by creating discrepancy between current and desired behaviour. Thus, from a theoretical perspective, CBT and MI naturally complement each other in the treatment of problem gambling. Supporting this, a recent meta-analysis showed that CBT/MI treatments reduce problem gambling symptoms with medium effect sizes,¹⁵ and online CBT treatments reduce problem gambling amount, frequency, and urges.³⁵

Despite CBT/MI's effectiveness for reducing gambling, there are notable problems with existing approaches. First and foremost, while CBT/MI approaches have been shown to be helpful, effect sizes on short- and long-term gambling outcomes are modest.¹⁵ This suggests that there is a great deal of room to improve interventions for gambling. Second, dropout rates in problem gambling treatment studies are substantial. Specifically, it has been estimated that 14–50% of individuals with problem gambling drop out of active treatment, with the average being about 30% across studies.^{36,37} This suggests that a large portion of treatment-seeking individuals with problem gambling do not complete this efficacious psychological intervention. Third, individuals with problem gambling show marked problems with treatment adherence, as evidenced by poor homework completion and low session attendance.³⁸ Adherence may be especially poor among the 50–70%³⁹ of problem gamblers with co-occurring substance use problems. In turn, poor treatment adherence predicts poor responses to intervention.^{38,40} Finally, similar to people with tobacco use disorders⁴¹ relapse rates among treated problem gamblers remain very high.⁴² As a whole, these issues suggest that we need to find effective ways to augment CBT/MI to improve clinical outcomes for problem gambling.

Based on the neurobiological and behavioural literature discussed above, it is highly possible that comorbid tobacco use is a factor that helps to maintain and reinforce problem gambling behaviours – even after treatment engagement. Despite their best efforts in treatment, individuals with problem gambling who smoke (versus those who do not smoke) may have marked difficulty controlling gambling

urges, forming new non-gambling related associations, and shifting focus to adaptive future (relative to often maladaptive and immediate) goals in therapy.^{9,31,32} These difficulties may contribute to commonly observed poor treatment engagement and completion and the modest success of problem gambling treatment among individuals with problem gambling. Unaddressed daily tobacco use may also be a critical factor in high rates of relapse among treated problem gamblers. As noted earlier, tobacco-related cues are powerful conditioned stimuli that elicit strong cravings among problem gamblers.³³ It follows that even after treatment, individuals with problem gambling who continue to smoke will have to fight against strong urges resulting from their increased cross-cue sensitivity. Thus, a key augmentation to CBT/MI treatments for problem gambling would be to include content to address co-occurring tobacco use.

Integrated Treatment

Research on integrated addiction treatment is relatively new. This is surprising, given that it is common for individuals to present with more than one addictive behaviour.⁴³ Polysubstance use is associated with greater clinical severity and poorer treatment outcomes.⁴⁴ Further, poor treatment outcomes has also been observed for gamblers with substance abuse treatment history compared to gamblers without substance abuse treatment history.⁴⁵ Traditional methods for treating co-occurring addiction/mental disorders are sequential and parallel intervention.⁴³ During a sequential approach, clinicians treat the addiction/disorder viewed as “primary” first, followed by the treatment of the comorbid condition. For example, a person with co-occurring alcohol misuse and problem gambling would likely not be able to work on reducing gambling until they achieve some notable period of abstinence from drinking. Thus, in the sequential model, treatment is provided for one disorder at a time – with the more acute disorder (e.g., alcohol misuse) taking first priority. The sequential model of intervention has been (and still is) the most widely used approach to treating disorder comorbidities. In contrast, the parallel model involves treating co-occurring problems separately by two distinct professionals and/or clinical teams, each with expertise in one of the two problems.⁴⁶ An example of this approach would be a person seeing a family doctor for management of smoking, while working with a psychologist to reduce gambling. Therefore, in the parallel model, an individual receives support for both issues simultaneously, but from distinct professionals.

Although still widely used, sequential and parallel approaches are limited as intervention models for comorbid addictive behaviours.⁴⁶ A sequential approach may be necessary in crisis situations, such as when a person needs hospitalization for alcohol-related seizures. However, in the absence of an emergency warranting the immediate stabilization of one disorder over the other, sequential treatment may impede the treatment of both addictive behaviours.⁴⁶ Sequential treatment does not consider the interconnectedness of addictive behaviours. To illustrate, a person would likely find it very challenging to reduce gambling if their smoking (a main trigger for gambling) remains untouched in treatment. In turn, this person’s smoking (perhaps as a coping mechanism) would likely be worsened by repeated failed attempts to control gambling. In such a scenario, it would be difficult for this person to make major improvements on either problem. Moreover, in a parallel treatment model, there is often little

communication between the professionals independently treating each problem.⁴⁶ This is problematic because professionals often have different case conceptualizations and treatment recommendations. For example, a physician may emphasize the usefulness of medication over psychotherapy, whereas, the reverse may be true for a psychologist. Hence, it is very common for a person to get conflicting advice and feedback in a parallel treatment approach.⁴⁶ Furthermore, it is up to the patient to “integrate” distinct treatment approaches, which is likely difficult due to high rates of cognitive impairment among those with problem gambling.⁴⁷ Finally, another potential problem for the client is the demands of attending two separate treatments (i.e., time, money). The limitations of a parallel approach may lead to adverse patient outcomes, such as frustration, continued mental health challenges, and in the most extreme case, discontinuation of treatment. Overall, attesting to these limitations, the literature shows that sequential and parallel approaches result in poor treatment outcomes in those struggling with addictive behaviours.⁴⁶

The main advantage to an integrated treatment framework is that it recognizes common etiological mechanisms underlying co-occurring addictive behaviours. Hence, from a common mechanism or “transdisease” approach,⁴⁸ one can design a treatment that helps individuals achieve notable improvements on more than one addictive disorder at a time. We posit that combined CBT/MI represents a general framework to target co-occurring problem gambling and tobacco use. CBT/MI therapies have been shown to be effective for smoking cessation across many studies⁴⁹, and these approaches are very similar in content to those used for problem gambling. Overall, CBT/MI therapies help people acquire coping skills to deal with addictive behaviours broadly, including building motivation, improving understanding of triggers (i.e., learning how smoking is a trigger for gambling), avoiding high-risk situations, developing balanced ways of thinking, and creating well-informed relapse prevention plans. Numerous articles support the efficacy of these CBT/MI strategies for the treatment of problem gambling, tobacco use, and addictive behaviours more broadly.^{15,49} Given CBT/MI’s emphasis on general coping skill development, we posit that it is an ideal framework for an integrated intervention for co-occurring problem gambling and tobacco use.

The Current Study

This study will address a notable gap in the literature on problem gambling treatment. It has been known for a long time that a high proportion of gamblers smoke cigarettes,^{1,2} and that daily smoking compounds gambling severity.⁵⁻⁸ However, very little work has been done to systematically address the problem of smoking in treatment for problem gambling. In fact, to our knowledge, no existing treatment protocols have integrated content to help problem gamblers reduce smoking. Using a randomized controlled trial (RCT), we will be the first to design, implement, and test a novel online integrated treatment for problem gambling and comorbid smoking. Relative to traditional face-to-face approaches, there are distinct advantages to an online delivery of integrated treatment in North America. First, online interventions would be able to reach adults from rural and Northern communities across North America. We know from health statistics that the highest rates of addictive behaviours and addiction-related

deaths exist in these communities.^{50, 51} Second, adults with gambling issues may be more willing to engage in a self-help online intervention (relative to in person). This is because an online modality may be associated with reduced shame and stigma – which are known, persistent barriers to seeking treatment among problem gamblers.¹⁹ Finally, online interventions could significantly reduce the burden on mental health care systems in North America. More people with gambling problems would be helped for much less cost relative to hospital treatments. Data show that cost-effective, online psychosocial interventions reduce problem gambling⁵² and tobacco use⁵³, separately. Therefore, the literature supports the online modality as a means to delivery our proposed integrated intervention.

Informed by the literature, our primary aim will be to examine if integrating treatment of comorbid tobacco smoking improves gambling outcomes among North Americans with problem gambling relative to a focus on problem gambling alone. Our second aim will be to test if reduced smoking explains (or mediates) the beneficial effects of the integrated treatment on gambling. We expect that participants receiving online integrated treatment will show larger reductions in gambling relative to those receiving a control gambling only intervention. We further hypothesize that reductions in smoking will mediate these group differences.

Methods/design

Design

This project will consist of a two-arm RCT (see Figs. 1 and 2 for an overview). Dr. Keough and his research team will collect the data in Canada and the United States. Participants will be randomly assigned into one of two conditions. In the experimental condition, participants will receive an 8-week online integrated intervention for problem gambling and smoking. In the control condition, participants will receive a similar eight-week online intervention for problem gambling without treatment content to address smoking. Online assessments will occur before randomization (T0; baseline), at eight-weeks since baseline (T1; treatment end), and at 24-weeks since baseline (T2; follow up; see Table 1). The timeline of these assessments, including the longer-term follow-up, is consistent with previous RCTs examining technology-based interventions for problem gambling and those for smoking cessation.^{54,55} Participants will be compensated based on the following schedule: \$20 per assessment, a bonus of \$20 for completing all three assessments, and \$20 for completing at least five of the treatment modules (max compensation per participant = \$100). For ethical reasons, participants will be compensated in the form of gift cards to Amazon.ca. This RCT is registered with ClinicalTrials.gov for transparency and to avoid publication bias. Prior to the initiation of the study, we obtained ethical approval from the Research Ethics Board (REB) at the University of Manitoba and York University.

Table 1
Schedule of Assessments for Measures

Self-Report Measures	Baseline (T0)	8-weeks (T1)	24-weeks (T2)
1. Demographics (e.g., age, gender, treatment history, psychiatric/medical history)	X		
2. Alcohol Use Disorders Identification Test (AUDIT)	X		
3. Drug Abuse Screening Test-10 (DAST-10)	X		
4. Timeline Followback (TLFB) for Gambling, Smoking, Alcohol, and Substance Use	X	X	X
5. Gambling Symptom Assessment Scale (G-SAS)	X	X	X
6. Problem Gambling Severity Index (PGSI)	X	X	X
7. Fagerstrom Test for Nicotine Dependence	X	X	X
8. P4 Suicide Screener	X	X	X
9. Withdrawal scale	X	X	X
10. NIDA-ASSIST	X	X	X

Recruitment

A target sample size of $N = 300$ will be recruited (see Power Analysis section below). Dr. Keough's research team will collect data. A variety of methods will be used to recruit potential participants. Dr. Keough will also recruit from cities across Canada and the United States using online ads (e.g., Google Ads, Craigslist, Kijiji, and local news websites), local avenues (i.e., newspapers), and governmental organizations (i.e., Manitoba Liquor and Lotteries). Given the high rates of problem gambling and tobacco smoking in Canada and the United States,¹⁻⁴ it should be feasible to recruit the required sample size.

Another very important issue will be to recruit a sufficient number of women to be able to examine gender differences in treatment effects. Based on the literature, about one-third of individuals with problem gambling from the community will be women.⁵⁶ We will make every effort to ensure that at least one-third of our final sample is comprised of women, although we will aim for a higher percentage during the recruitment process. Inclusive recruitment will ensure that both genders equally contribute to and benefit from the intervention. This is very important, since data show that women are drastically underrepresented in gambling treatment settings. To illustrate, only 2–7% of those who attend Gambler's Anonymous are women.⁵⁷ We aim to greatly improve these numbers for our trial.

Inclusion/exclusion criteria

There has been a shift to include heterogeneous samples in RCTs to improve the generalizability of findings. Thus, inclusion/exclusion criteria will be kept to a minimum. Our main target demographic will be adults with moderate levels of gambling problems who identify as daily smokers. Inclusion criteria will include: (1) ages 19+; (2) problem gambling status based on reporting a score of > 3 on the Problem Gambling Severity Index (PGSI); (3) reporting current daily smoking; (4) fluency in English; and (5) have weekly Internet access.

Exclusion criteria will include

(1) self-reported current engagement in other psychosocial treatments for problem gambling and/or smoking; (2) elevated suicidality (scoring greater than “minimal risk” on a screener⁵⁸); (3) past-90-day psychosis or mania; and (4) presence of a severe substance use disorder (SUD). SUD severity will be determined based on established cut-offs on widely used and validated screening measures for alcohol and other drug use. For alcohol, individuals with a score of > 20 on the Alcohol Use Disorder Identification Test (AUDIT)⁵⁹ will be excluded from the study. For other substance use, individuals with a score of > 5 on the Drug Abuse Screening Test-10 (DAST-10)⁶⁰ will be excluded. The rationale for excluding those with severe SUDs is based on the large literature showing that these individuals need intensive residential treatments (with corresponding medical supervision)⁶¹ and hence, would not benefit from self-guided online interventions, such as the one to be provided in the current study. We will provide a list of local addiction and financial resources for those with severe AUD and SUD symptoms.

Primary outcomes

Gambling Behaviour

There will be three primary outcomes to capture intervention-related change in gambling behaviour. Specifically, participants will be asked about their past-30-day gambling frequency (# of days gambled), money spent on gambling activities (in dollars), and time spent engaged in gambling activities (# of minutes). These primary indices were selected because they are common outcomes in RCT studies examining CBT/MI approaches to the treatment of problem gambling.^{15,62} The Timeline Followback (TLFB) procedure will be used to collect data for the primary outcomes.⁶³ Anchoring gambling to specific calendar dates helps to improve the accuracy of self-reported involvement in these activities. The TLFB procedure has also been shown to produce relatively accurate estimates of addictive behaviour involvement when participants are ensured anonymity.⁶⁴ Furthermore, recent data shows that a self-report web-delivered version of the TLFB (like the one to be used in this study) produces reliable and valid estimates of addictive behaviours.⁶⁵

Secondary outcomes

Gambling Symptom Assessment Scale (G-SAS)

The G-SAS is a 12-item self-report questionnaire that was designed specifically to capture change in gambling symptoms following treatment.⁶⁶ The G-SAS has a unidimensional structure and psychometric work shows that G-SAS total scores have good reliability and good convergent validity with clinician-rated measures of gambling symptom change during treatment, such as the Yale-Brown Obsessive Compulsive Scale modified for Pathological Gambling.⁶⁶ The main advantage of using the G-SAS as a secondary measure of gambling symptom change is that it includes several questions about gambling urges. While urges are expected to decrease with intervention, existing widely used measures (e.g., Problem Gambling Severity Index [PGSI]) do not include items to assess urge change during treatment. The G-SAS also includes items to assess changes in gambling harms during treatment (e.g., reductions in emotional distress). In the present study, the total G-SAS score will serve as a secondary measure of gambling change after intervention.

Problem Gambling Severity Index (PGSI)

The PGSI is the most widely used self-report measure of gambling harms in the literature.⁶⁷ The PGSI contains nine items that assess a broad array of problems experienced by individuals who engage in problem gambling (e.g., guilt, financial problems etc.). Previous work supports the PGSI's good reliability and validity.⁶⁷ The total PGSI score will be used in this study to capture changes in gambling harms following intervention.

Cigarette Use

The TLFB procedure will also be used to collect information about past-30-day cigarette use. A sum score will be used to reflect total smoking behaviour at each assessment. This secondary outcome will be used to capture intervention-related change in smoking behaviour. As noted above for gambling, recent data show that a self-report web-delivered TLFB provides valid estimates of cigarette use.⁶⁵ In addition to collecting information on cigarette use, we will also use the TLFB procedure to code for episodes of co-occurring gambling and smoking. That is, participants will be asked to denote the days in which they smoked while gambling (e.g., leaving a bar with VLTs momentarily to smoke, then resume playing). This variable may be used for secondary analyses, depending on the variability in the data.

Nicotine Dependence Symptoms

The Fagerstrom Test of Nicotine Dependence is a six-item self-report measure that captures the severity of nicotine dependence symptoms.⁶⁸ The Fagerstrom total score will be calculated at each time point

and will be used to assess intervention-related changes in nicotine dependence symptoms. Previous work shows that the Fagerstrom has good reliability and validity⁶⁸ and is sensitive to treatment-induced change.⁶⁹

Informed Consent and Randomization

Participants will first read the study rationale and then will be told the following during informed consent: (1) the inclusion/exclusion criteria; (2) the potential risks/benefits; (3) the safety arrangements during and after the study; (4) the program is self-guided; (5) the circumstances under which they should contact a medical professional from an emergency list that will be accessible at all times via the menu item “Help Me” on the intervention website; and (6) participation is voluntary. Participants endorsing significant suicide ideation and/or plans will be told to visit a hospital for support. For ethical reasons, individuals with clinically-elevated SUD/AUD symptoms (i.e., those who score above the cut-offs on our screening tools) will be given access to the integrated intervention, and will be given the contact information for mental health professionals in their area. However, they will be excluded from the study. Following informed consent, participants will register on the intervention website. Inclusion/exclusion criteria will be assessed, and eligible participants will be invited to complete a baseline assessment. After completion of the baseline measures, a computer program will be used to randomize eligible participants to the treatment conditions.

Prior to starting the intervention, an intervention support person will contact all participants to confirm eligibility and willingness to participate. It is important to note that the intervention support person does not have any formal training in clinical psychological treatment to ensure that participants were not inadvertently receiving psychotherapy. The role of the intervention support person is to strictly answer participant-initiated questions about the website and intervention.

Integrated Treatment (Experimental Condition)

Participants in this condition will have access to seven treatment modules over eight weeks (see Fig. 3 for overview of module interface). The specific gambling content will be adapted from a self-help intervention developed by Dr. Hodgins (a Co-Investigator on the proposed project; see Table 2 for module content). This intervention has been validated in several trials^{34,62}, and has been successfully adapted for online delivery.^{49,70} Smoking content will be adapted from existing evidence-based CBT/MI protocols, including the most widely used best practice guidelines from both Abrams et al. (2005) and Fiore and colleagues (2008).^{49,71} One standard care guideline for smoking cessation interventions is the combined use of nicotine replacement therapy (NRT) and psychosocial support (CBT/MI).^{49,71} Accordingly, in the first module, participants in the integrated treatment arm will be provided with an extensive fact sheet on NRT use – including the strong evidence supporting its use in conjunction with psychosocial treatment for smoking cessation. Participants will be (1) encouraged to use NRT patches for the eight weeks of

active treatment, (2) advised that NRT patches are available over the counter at any local pharmacy, (3) provided with NRT patches for the duration of treatment, and (4) advised to consult with their family physician should they have any medical questions related to NRT patches. As noted in best practice guidelines⁷¹, the dosage schedule of NRT patches will be the following: 24 mg for four weeks then 14 mg for two weeks and finally 7 mg for remaining two weeks. NRT will be mailed out to each participant at the outset of their registration to ensure that they have it for the duration of the intervention. NRT usage will be tracked weekly during the active intervention and also at each follow-up assessment.

The psychosocial integrated treatment content is fully summarized in Table 2. As noted earlier, all components of the intervention come from well-established CBT/MI protocols for problem gambling and smoking cessation.^{15,49} Integrated content will allow participants to understand the links between gambling and smoking; identify and set goals related to gambling and smoking, as well as make goals for increasing involvement in pleasurable and positive activities; learn to identify and plan for “high risk” situations related to smoking and gambling; develop strategies to cope with gambling and smoking urges; learn to challenge and/or alter thoughts that promote gambling and smoking; and learn how to prevent relapse of each behavior. Participants will have immediate access to all modules, and it will be recommended that they work through the modules sequentially. However, any order is possible. An adult might, for example, jump ahead to a module on craving, if they are having strong urges to smoke in a given week. Participants will be encouraged to complete the modules as many times as needed, and their progress will be visible on a digital progress bar. If participants leave a module and revisit it later, they will restart where they left off. Participants will be asked to track both gambling and smoking behaviours each week. On the “dashboard” intervention page, participants will be able to see a graph depicting their individualized treatment progress for their gambling and smoking behaviour. The website will automatically adapt for use on smartphones and tablets.

Gambling Only Treatment (Control Condition)

The control group will receive a similar eight-week online intervention for gambling only. The gambling content will be the same as in the experimental condition, but there will be no treatment content about smoking and no integrated content. The complete module content for the gambling only arm is summarized in Table 3.

Table 2
Module Content for Integrated Intervention

Module number and Title	Module Content
M1: Introduction	<ul style="list-style-type: none"> • Introduction to the intervention and website • Psychoeducation about the links between gambling and cigarette smoking, including a rationale for working on both in treatment together • Motivational enhancement (i.e., identifying reasons for change, and pros and cons of gambling/not gambling, and smoking/not smoking) • Psychoeducational fact sheet on nicotine replacement therapy (NRT), including a strong recommendation for using NRT during the intervention • Self-monitoring gambling and smoking behaviours, including frequency of co-occurrence
M2: Goal setting	<ul style="list-style-type: none"> • Determine personal goals related to gambling and smoking (i.e., abstinence versus harm reduction) • Develop SMART (specific, measurable, achievable, realistic, and timely) goals for gambling and smoking reduction
M3: Risk situations	<ul style="list-style-type: none"> • Resisting gambling in specific situations (e.g., situations involving negative emotions) • Developing personal strategies to reduce/abstain from harmful gambling and to control access to money • Introduce need for pleasurable activity scheduling (i.e., behavioural activation) • SMART goal setting for pleasurable, low-risk, and healthy activities (e.g., activities that are incompatible with gambling and smoking)
M4: Identifying triggers	<ul style="list-style-type: none"> • Strategies for avoiding triggering situations related to smoking • Identify strategies for refusing smoking and gambling
M5: Unhelpful thinking	<ul style="list-style-type: none"> • Review common thinking errors related to gambling (or “gambling traps”) and smoking • Psychoeducation about games of chance • Identify how misperceptions about gambling odds impact one’s inner dialogue or thoughts • Psychoeducation about thinking traps related to smoking

Module number and Title	Module Content
M6: Cravings	<ul style="list-style-type: none"> • Psychoeducation about craving • Introduce self-monitoring of craving • New ways to effectively cope with cravings (e.g., distraction, urge surfing, and recalling the negative outcomes of gambling) • Identifying the similarities and differences between gambling and smoking cravings
M7: Dealing with slips	<ul style="list-style-type: none"> • Define a “slip” versus a full-blown relapse • Introduce ways to cope with slip in meeting gambling and smoking goals • Introduce relapse prevention planning • Create personalized relapse prevention plan • Identify three coping strategies for preventing gambling and smoking

Table 3
Module Content for Gambling-only (control) Intervention

Module number and Title	Module Content
M1: Introduction	<ul style="list-style-type: none"> • Introduction to the intervention and website • Motivational enhancement (i.e., identifying reasons for change, and pros and cons of gambling and not gambling) • Self-monitoring gambling behaviours
M2: Goal setting	<ul style="list-style-type: none"> • Determine personal goals related to gambling (i.e., abstinence versus harm-reduction) • Develop SMART (specific, measurable, achievable, realistic, and timely) goals for gambling reduction
M3: Risk situations	<ul style="list-style-type: none"> • Resisting gambling in specific situations (e.g., situations involving negative emotions) • Developing personal strategies to reduce/abstain from harmful gambling and to control access to money • Introduce need for pleasurable activity scheduling (i.e., behavioural activation) • SMART goal setting for pleasurable, low-risk, and healthy activities (e.g., activities that are incompatible with gambling)
M4: Cravings	<ul style="list-style-type: none"> • Psychoeducation about craving • Introduce self-monitoring of craving • New ways to effectively cope with cravings (e.g., distraction, urge surfing, and recalling the negative outcomes of gambling)
M5: Unhelpful thinking	<ul style="list-style-type: none"> • Review common thinking errors related to gambling (or “gambling traps”) • Psychoeducation about games of chance • Identify how misperceptions about gambling odds impact one’s inner dialogue or thoughts • Introduce the thought record as a way to see associations between situations, automatic thoughts, behaviours, and gambling consequences • Help foster identification of “gambling traps” and strategies to challenge them
M6: Dealing with slips	<ul style="list-style-type: none"> • Define a “slip” versus a full-blown relapse • Introduce ways to cope with slip in gambling • Introduce relapse prevention planning

Module number and Title	Module Content
M7: Preserve your success	<ul style="list-style-type: none"> • Identify “early warning signs” for slip/relapse • Create personalized relapse prevention plan • Discuss ways to cope with relapse • Identify top five coping strategies for preventing gambling • How to know if more treatment is needed (with corresponding recommendations)

Sample-Size Justification and Statistical Plan

A meta-analysis showed that CBT/MI (relative to control) treatments have medium effects on gambling.¹⁵ However, we will be comparing two active treatments, which may result in smaller effect sizes. Accordingly, we used G*Power to calculate the sample size needed to detect a small effect size for our primary outcome. We used a 2 (between subjects; treatment condition) by 3 (within subjects; time) mixed design. Assuming a power rate of .80, an α of .05, and a correlation of .50 between repeated measures, the required sample size to detect a small effect size is $N= 164$. Given an average attrition rate of 30% in gambling treatment studies¹⁵, our final adjusted sample size is $N= 214$. Generalized mixed modelling will be used to evaluate the main hypothesis that integrated online treatment will result in the larger reductions in gambling than the gambling only treatment. Primary and secondary outcomes will be tested sequentially. We will include all randomized participants in analyses (i.e., intent-to-treat). Missing data will be accounted for using full information maximum likelihood estimation. We will include some covariates in our models if needed. Of particular relevance, we expect variability in adherence to NRT; therefore, we will explore whether NRT use (e.g., # of days patch was used during treatment) affects primary/secondary treatment outcomes.

Discussion

Possible Challenges and Mitigation Plan

Adherence to Treatment

The literature shows that adherence to treatment tends to be suboptimal in addictive behaviour intervention studies, including both in-person and online modalities.⁷² To address this potential challenge, the proposed intervention will have features aimed at improving adherence, including automatic reminders to complete modules and assessments. Inclusion of these strategies within this intervention was based on literature showing that frequent automatic and specific feedback improves adherence to self-guided behavioural change interventions.⁷³

Recruitment

As noted in the methodology section, Dr. Keough and his research team will make every effort to recruit adults across North America. Online advertisements (e.g., Google Ads) and local avenues will help to increase recruitment in each province. However, it is possible that issues with suboptimal recruitment will occur. Recruitment rates will be monitored on an ongoing basis (e.g., % completing screening relative to % meeting criteria to participate).

Attrition

Intervention studies show substantial variability in attrition rates, depending on treatment orientation, clinical severity, and so forth.¹⁵ Generally, drop-out rates are high in populations with behavioural and substance use addictions – ranging from 21–80%.⁷⁴ We are aware of this possible influence on attrition. Regular contact with an intervention support person will likely provide personalized support that is not typical of online interventions. This may reduce drop-out. Finally, we will offer participants the possibility to receive a personalized feedback report at the end of the study. This report will contain information about their treatment progress. The combined use of the strategies above will help reduce attrition rate.

Ethical Considerations

The intervention will be designed to adhere to the ethical principles of the Declaration of Helsinki. Ethics approval will be obtained from the REB at the University of Manitoba and York University before study initiation. Participant data will be kept confidential. To achieve this, we will be using arbitrary identifiers (e.g., numerical IDs) for participants. These identifiers will be used to link data over time, but the data set will not contain personal information. We will keep a master list of participant contact information in a separate password-protected master list. We are also aware of the increased risks associated with recruiting adults with clinically-elevated gambling problems, considering the high rates of comorbid mental health problems with disordered gambling.⁷⁵ We would expect higher base rates of suicidality and self-harming behaviours in these individuals relative to those without these substance use and behavioural addiction concerns. Accordingly, we will have safeguards to minimize risk of harm. Adults who report significant suicide ideation and/or plans during screening will be given a recommendation to visit their local medical professional (GP or hospital) for support. They will also be given access to the integrated intervention, but their data will not be analyzed. We will also be monitoring changes in suicidality at each assessment, and will direct participants to emergency services if needed. Participants will also have full time access to a list of mental health services, including community resources, public and private psychologists, hospitals, and helplines. Dr. Keough will be available to speak with participants if serious issues arise (i.e., increase in suicidal ideation) and will make sure a safe course of action is followed. For ethical reasons, people with clinically-elevated AUD/SUD symptoms will be provided with access to the integrated treatment instead of being denied access should they require the intervention as a resource for their problem gambling and/or smoking behaviours. However, their data will not be

included in the study. Finally, participants in the gambling only control condition will be given access to the active integrated treatment after the final assessment (6-months) should they wish. They will receive all elements of the integrated arm, including NRT.

Implications of the Proposed Intervention

High rates of problem gambling and tobacco use in North America demonstrate a clear need for more mental health services in the country around this crucial issue. Some provinces and states also have significant rural spread, meaning that several communities are dispersed throughout the province with little access to major city centers. This poses a huge challenge for providing equal access to mental health care services for all North Americans. In fact, statistics suggest that people living in remote communities are at a significant disadvantage.^{1,2} They seem to be struggling most with addiction and related problems, but have limited access to treatment facilities. Thus, the proposed study has the potential to substantially improve the health and well-being of adults living across the continent. Furthermore, if supported, the proposed intervention would be a cost-effective method (relative to traditional in person treatments) of improving gambling addiction care delivery to North Americans. Online interventions have the potential to save the government thousands of dollars via the reduced burden on the health care system.

Abbreviations

RCT

randomized controlled trial

CBT

cognitive behavioral therapy

MI

motivational interviewing

REB

research ethics board

MGRP

Manitoba Gambling Research Program

AUDIT

Alcohol use disorder identification test

DAST-10

Drug abuse screening test-10

AUD

Alcohol use disorders

SUD

Substance use disorders

G-SAS

Gambling symptom assessment scale

TLFB

Timeline followback

PGSI

problem gambling severity index

NIDA-ASSIST

National institute on drug abuse – alcohol, smoking and substance involvement screening test

FIML

full information maximum likelihood

NRT

nicotine replacement therapy

Declarations

Ethics approval and consent to participate

This study has received ethical approval from the Research Ethics Boards at the University of Manitoba and York University, which adhere to the Declaration of Helsinki. All participants will provide informed consent prior to participation.

Consent for publication

Not applicable.

Availability of data and material

The datasets generated and/or analyzed during the current study are not publicly available due to ongoing data collection, but are available from the corresponding author on reasonable request. Results will be published in open-access journals.

Competing interests

None.

Trial Status

To ensure transparency, the current study has been registered on the clinicaltrials.gov website (Clinicaltrials.gov ID NCT03614884). Any protocol modifications will be updated on clinicaltrials.gov and on the consent form located on the online intervention website.

Protocol version number: NCT03614884

Date trial was registered: August 3, 2018

Date recruitment began: May 2, 2019

Last update posted: September 25, 2019

Estimated date when recruitment will be completed: December 31, 2020

Funding

This research was funded by the Manitoba Gambling Research Program of Manitoba Liquor & Lotteries; however, the findings and conclusions of this paper are those solely of the author(s) and do not necessarily represent the views of Manitoba Liquor & Lotteries.

Authors' Contributions

MTK and MPS are the principle investigators of the project, who devised and wrote the grant. MTK is supervising the data collection and project at the University of Manitoba. SHS, JM, JW, RO, JR, HH, & CS are co-investigators that contributed to the development of the project and continue to provide on-going support throughout the project. CB is providing the expertise for the programming of the online interface. DH provided existing module content for the gambling program. EB and AS are the study coordinators at the University of Manitoba. VB and TK are intervention support personnel that are assisting with recruitment. All authors read and approved the final manuscript.

References

1. Smart RG, Ferris J. Alcohol, drugs and gambling in the Ontario adult population, 1994. *The Canadian Journal of Psychiatry*. 1996;41:36–45.
2. McGrath DS, Barrett SP, Stewart SH, McGrath PR. A comparison of gambling behavior, problem gambling indices, and reasons for gambling among smokers and nonsmokers who gamble: Evidence from a provincial gambling prevalence study. *Nicotine Tobacco Research*. 2012;14(7):833–9.
3. Grant JE, Desai RA, Potenza MN. Relationship of nicotine dependence, subsyndromal and pathological gambling, and other psychiatric disorders: Data from the National Epidemiologic Survey on Alcohol and Related Conditions. *J Clin Psychiatry*. 2009;70:334–43.
4. World Health Organization. Global status report on alcohol and health-2014. World Health Organization. 2014.

5. Grant JE, Kim S, Odlaug BL, Potenza MN. Daily tobacco smoking in treatment-seeking pathological gamblers: Clinical correlates and co-occurring psychiatric disorders. *Journal of Addiction Medicine*. 2008;2:178–84.
6. Grant JE, Potenza MN. Tobacco use and pathological gambling. *Ann Clin Psychiatry*. 2005;17:237–41.
7. Petry NM, Oncken C. Cigarette smoking is associated with increased severity of gambling problems in treatment-seeking gamblers. *Addiction*. 2002;97:745–53.
8. Potenza MN, Steinberg MA, Mclaughlin SD, Wu R, Rounsaville BJ, Krishnan-Sarin S, et al. Characteristics of tobacco-smoking problem gamblers calling a gambling helpline. *The American Journal on Addictions*. 2004;13:471–93.
9. McGrath DS, Barrett SP. The comorbidity of tobacco smoking and gambling. A review of the literature. *Drug Alcohol Rev*. 2009;28(6):676–81.
10. Wood RT, Williams RJ. Internet gambling: Prevalence, patterns, problems, and policy options. Ontario: Final report for the Ontario Problem Gambling Research Centre; Guelph; 2009. January.
11. Welte J, Barnes G, Tidwell M, Hoffman J, Wieczorek W. Gambling and problem gambling in the United States: Changes between 1999 and 2013. *J Gambl Stud*. 2015;31:695–715.
12. Statistics Canada. (2014): <http://www.statcan.gc.ca/tables-tableaux/sum-som/l01/cst01/health74beng.htm>.
13. Substance Abuse and Mental Health Services Administration. National household survey on drug abuse. Available at: <http://www.samhsa.gov/oas/NHSDA=2kNHSDA=chapter4.htm>. Accessed 3/17/2020.
14. Grant BF, Hasin DS, Chou SP, Stinson FS, Dawson DA. Nicotine dependence and psychiatric disorders in the United States: Results from the national epidemiologic survey on alcohol and related conditions. *Arch Gen Psychiatry*. 2004;61:1107–15.
15. Gooding P, Tarrier N. A Systematic Review and Meta-Analysis of Cognitive-Behavioural Interventions to Reduce Problem Gambling: Hedging Our Bets? *Behav Res Ther*. 2009;47(7):592–607.
16. Hetta JE, Hendricks PS. Motivational Interviewing for Smoking Cessation: A Meta-Analytic Review. *J Consult Clin Psychol*. 2010;78(6):868–84.
17. Manitoba Health. (2015). Annual Statistics 2014–2015.
18. Hodgins DC, El-Guebaly N. Natural and treatment-assisted recovery from gambling problems: a comparison of resolved and active gamblers. *Addiction*. 2000;95:777–89.
19. van der Maas M, Shi J, Elton-Marshall T, Hodgins DC, Sanchez S, Lobo DSS, Hagopian S, Turner NE. Internet-based interventions for problem gambling: Scoping review. *JMIR Ment Health*. 2019;6(1):e65.
20. Di Chiara G, Imperato A. Drugs abused by humans preferentially increase synaptic dopamine concentrations in the mesolimbic system of freely moving rats. *Proceedings of the National Academy of Science*. 1988;85:5274–5278.

21. Effects of nicotine on the nucleus
Pontieri FE, Tanda G, Orzi F, Di Chiara G. Effects of nicotine on the nucleus.
22. accumbens and similarity to those of addictive drugs. *Nature*. 1996;382:255–257.
23. Zack M, Poulos CX. Amphetamine primes motivation to gamble and gambling-related semantic networks in problem gamblers. *Neuropsychopharmacology*. 2004;2:195–207.
24. Avanzi M, Baratti M, Cabrini S, Uber E, Brighetti G, Bonfa F. Prevalence of pathological gambling in patients with Parkinson's disease. *Mov Disord*. 2006;21:2068–72.
25. McGrath DS, Barrett SP, Stewart SH, Schmid EA. The effects of acute doses of nicotine on video lottery terminal gambling in daily smokers. *Psychopharmacology*. 2012;220:155–61.
26. Barrett SP, Tichauer M, Leyton M, Pihl RO. Nicotine increases alcohol self-administration in non-dependent male smokers. *Drug Alcohol Depend*. 2006;81:197–204.
27. Reid MS, Mickalian JD, Delucchi KL, Hall SM, Berger SP. An acute dose of nicotine enhances cue-induced cocaine craving. *Drug Alcohol Depend*. 1998;49:95–104.
28. Spiga R, Schmitz J 2nd, Day J. Effects of nicotine on methadone self-administration in humans. *Drug Alcohol Depend*. 1998;50:157–65.
29. The hedonic response to
Barrett SP, Boileau I, Okker J, Pihl RO, Dagher A. The hedonic response to.
30. cigarette smoking is. proportional to dopamine release in the human striatum as measured by.
31. positron emission tomography. and [11C]raclopride. *Synapse*. 2004;54:65–71.
32. Zald DH, Boileau I, El-Dearedy W, et al. Dopamine transmission in the human striatum during monetary reward tasks. *J Neurosci*. 2004;24:4105–12.
33. Businelle MS, Kendzor DE, Rash CJ, Patterson SM, Coffey SF, Copeland AL. Heavy smokers perform more poorly than nonsmokers on a simulated task of gambling. *Subst Use Misuse*. 2009;44:905–14.
34. Bickel WK, Odum AL, Madden GJ. Impulsivity and cigarette smoking: delay discounting in current, never, and ex-smokers. *Psychopharmacology*. 1999;146:447–454.
35. Mooney ME, Odlang BL, Kim SW, Grant JE. Cigarette smoking status in pathological gamblers: Association with Impulsivity and Cognitive Flexibility. *Drug Alcohol Depend*. 2011;117(1):74–7.
36. Wulfert E, Harris K, Broussard J. The role of Cross-Cue Reactivity in Coexisting Smoking and Gambling Habits. *Journal of Gambling Issues*. 2016;32:28–43.
37. Hodgins DC, Currie SR, el-Guebaly N. Motivational enhancement and self-help treatments for problem gambling. *J Consult Clin Psychol*. 2001;69(1):50–7.
38. Casey LM, Oei TPS, Raylu N, Horrigan K, Day J, Ireland M, Clough BA. Internet-based delivery of cognitive behaviour therapy compared to monitoring, feedback and support for problem gambling: A randomised controlled trial. *J Gambli Stud*. 2017;33:993–1010.
39. Tolchard B, Battersby M. Treatment Completion in a Cognitive Behaviour Therapy Service for Problem Gamblers: Clinical Outcome Study. *Journal of Addiction Research Therapy*. 2013;4:165.

40. Melville KM, Casey LM, Kavanagh DJ. Psychological treatment dropout among pathological gamblers. *Clin Psychol Rev.* 2007;27(8):944–58.
41. Petry NM, Ammerman Y, Bohl J, Doersch A, Gay H, Kadden R, Molina C, Steinberg K. Cognitive-behavioural therapy for pathological gamblers. *J Consult Clin Psychol.* 2006;74(3):555–67.
42. Toneatto T, Brennan J. Pathological gambling in treatment-seeking substance abusers. *Addict Behav.* 2002;27:465–9.
43. Simpson HB, Maher MJ, Wang Y, Bao Y, Foa EB, Franklin M. Patient adherence predicts outcome from cognitive behavioural therapy in obsessive-compulsive disorder. *J Consult Clin Psychol.* 2011;79(2):247–52.
44. Koçak ND, Eren A, Boğa S, Aktürk Ü, Öztürk Ü, Arınç S, Şengül A. Relapse rates and factors related to relapse in a 1-year follow-up of subjects participating in a smoking cessation program. *Respir Care.* 2015;60(12):1796–803.
45. Smith DP, Battersby MW, Pols RG, Harvey PW, Oakes JE, Baigent MF. Predictors of relapse in problem gambling: a prospective cohort study. *J Gambl Stud.* 2015;31(1):299–313.
46. Barrett SP, Darredeau C, Pihl RO. Patterns of simultaneous polysubstance use in drug using university students. *Hum Psychopharmacol.* 2006;21:255–63.
47. Dutra L, et al. A Meta-Analytic Review of Psychological Interventions for Substance Use Disorders. *Am J Psychiatry.* 2008;165(2):179–87.
48. Ladd GT, Petry NM. A comparison of pathological gamblers with and without substance abuse treatment histories. *Experimental Clinical Psychopharmacology.* 2003;11(3):202–9.
49. Mueser KT, Noordsy DL, Drake RE, Fox L. *Integrated treatment for dual disorders: A guide to effective practice.* New York: Guilford Press; 2003.
50. Goudriaan AE, Oosterlaan J, De Beurs E, Brink WVD. Neurocognitive functions in pathological gambling: a comparison with alcohol dependence, Tourette syndrome, and normal controls. *Addiction.* 2006;101(4):534–47.
51. Bickel WK, Mueller TE. Toward the study of trans-disease processes: A novel approach with special reference to a study of co-morbidity. *Journal of Dual Diagnosis.* 2009;5(2):131–8.
52. Abrams DB, Niaura R, Brown RA, Emmons KM, Goldstein MG, Monti PM. *The tobacco dependence treatment handbook: A guide to best practices.* New York: Guilford; 2003.
53. Manitoba Health. Seniors, and Active Living: Information Management and Analytics. Annual Statistics 2017–2018. Retrieved from <https://www.gov.mb.ca/health/annstats/as1718.pdf>.
54. Center for Behavioral Health Statistics and Quality. 2018 Surveillance report of drug-related risks and outcomes. <https://www.cdc.gov/drugoverdose/pdf/pubs/2018-cdc-drug-surveillance-report.pdf>. Accessed March 17, 2020.
55. Gainsbury S, Blaszczynski A. Online self-guided interventions for the treatment of problem gambling. *Int Gambl Stud.* 2011;11(3):289–308.

56. Cunningham JA, et al. Online interventions for problem gamblers with and without co-occurring mental health symptoms: Protocol for a randomized controlled trial. *BMC Public Health*. 2016;16:624. DOI:10.1186/s12889-016-3291-7.
57. Haug S, Schaub MP, Venzin V, Meyer C, John U. Efficacy of a text message-based smoking cessation intervention for young people: A cluster randomized controlled trial. *Journal of Medical Internet Research*. 2013;15(8):e171.
58. Wiebe J, Mun P, Kaufman N. *Gambling and Problem Gambling in Ontario*. Responsible Gambling Council: Canada; 2006.
59. Mark ME, Lesieur HR. A feminist critique of problem gambling research. *Br J Addict*. 1992;87:549–65.
60. American Psychiatric Association. *Diagnostic and statistical manual of mental disorders*. 5th ed. Arlington: American Psychiatric Publishing; 2013.
61. Dube P, Kurt K, Bair MJ, Theobald D, Williams LS. The P4 screener: Evaluation of a brief measure for assessing potential suicide risk in 2 randomized effectiveness trials of primary care and oncology patients. *Prim care Companion J Clin Psychiatry*. 2010;12(6):10 m00978.
62. Saunders JB, Aasland OG, Babor TF, de la Fuente JR, Grant M. Development of the Alcohol Use Disorders Identification Test (AUDIT): WHO Collaborative Project on Early Detection of Persons with Harmful Alcohol Consumption—II. *Addiction*. 1993;88:791–803.
63. Skinner HA. The Drug Abuse Screening Test. *Addict Behav*. 1982;7(4):363–71.
64. Tiet QQ, Ilgen MA, Byrnes HF, Harris AHS, Finney JW. Treatment setting and baseline substance use severity interact to predict patients' outcomes. *Addiction*. 2007;102(3):432–40.
65. Hodgins DC, Currie SR, Currie G, Fick GH. Randomized trial of brief motivational treatments for pathological gamblers: More is not necessarily better. *J Consult Clin Psychol*. 2009;77(5):950–60.
66. Sobell LC, Sobell M. Timeline followback: A technique for assessing self-reported ethanol consumption. *Measuring alcohol consumption: Psychosocial and biological methods*; 1992.
67. Weinstock J, Whelan JP, Meyers AW. Behavioral Assessment of gambling: an application of the timeline followback method. *Psychol Assess*. 2004;16(1):72–80.
68. Rueger SY, Trela CJ, Palmeri M, King AC. Self-Administered Web-Based Timeline Followback Procedure for Drinking and Smoking Behaviours in Young Adults. *Journal of Studies on Drugs Alcohol*. 2012;73(5):829–33.
69. Kim S-K, Grant JE, Potenza MN, Blanco C, Hollander E. The Gambling Symptom Assessment Scale (G-SAS): A reliability and validity study. *Psychiatry Res*. 2009;166(1):76–84.
70. Ferris J, Wynne H. *The Canadian problem gambling index: Final report*. Submitted for the Canadian Centre on Substance Abuse; 2001.
71. Heatheron TF, Kozlowski LT, Frecker RC, Fagerström K. The Fagerstrom test for nicotine dependence: a revision of the Fagerstrom tolerance questionnaire. *Br J Addict*. 1991;86:1119–27.

72. Rohsenow DJ, Martin RA, Tidey JW, Monti PM, Colby SM. Comparison of the Cigarette Dependence Scale with four other measures of nicotine involvement: Correlations with smoking history and smoking treatment outcome in smokers with substance use disorders. *Addict Behav.* 2013;38(8):2409–13.
73. Hodgins DC, Fick GH, Murray R, Cunningham JA. Internet-based interventions for disordered gamblers: study protocol for a randomized controlled trials of online self-directed cognitive behavioural motivational therapy. *BMC Public Health.* 2013;13:10. DOI:10.1186/1471-2458-13-10.
74. Fiore MC, Jaén CR, Baker TB, et al. Treating Tobacco Use and Dependence: 2008 Update. Clinical Practice Guideline. Rockville: U.S. Department of Health and Human Services. Public Health Service; 2008.
75. Murray E, White IR, Varagunam M, Godfrey C, Khadjesari Z, McCambridge J. Attrition Revisited: Adherence and Retention in a Web-Based Alcohol Trial. *Journal of Medical Internet Research.* 2013;15(8):e162.
76. Mohr DC, Cuijpers P, Lehman K. Supportive accountability: a model for providing human support to enhance adherence to eHealth interventions. *Journal of Medical Internet Research.* 2011;13:e30.
77. Brorson HH, Arnevik EA, Rand-Hendriksen K, Duckert F. Drop-out from addiction treatment: a systematic review of risk factors. *Clin Psychol Rev.* 2013;33:1010–24.
78. Karlsson A, Hakansson A. Gambling disorder, increased mortality, suicidality, and associated comorbidity: A longitudinal nationwide register study. *Journal of Behavioral Addictions.* 2018;7(4):1091–9.

Appendix A

Informed Consent Form

Study Name: Developing and testing the effectiveness of a novel online integrated treatment for problem gambling and tobacco smoking: A randomized controlled trial

Researchers: Dr. Matthew Keough, Department of Psychology, 4700 Keele St, York University, North York ON, M3J 1P3; keoughmt@yorku.ca

Purpose of the Research: This research is being conducted to study the effectiveness of an online, self-help integrated treatment for problem gambling. You may also be asked to work on changing smoking behaviours, depending on which condition you are in. You are being asked to take part in this because you expressed interest to the advertised study.

Research has shown that problem gambling and tobacco smoking are highly comorbid. Problem gamblers who smoke tend to: have more severe gambling problems, experience stronger gambling urges, have other mental disorders, bet larger sums of money, spend more time in gambling activities, and have greater financial problems. Accordingly, it might be helpful to reduce your smoking as well, while you are trying to get a grip on your gambling.

Previous studies have treated gambling on its own or tobacco smoking on its own. To date, there has not been a treatment that has targeted treating both at the same time. Considering how often these conditions occur together, it is important to see if combining their treatment results in beneficial outcomes. In the current research, the researchers aim to design and test an online, self-help intervention for co-occurring problem gambling and tobacco smoking. It will draw on strategies from Cognitive Behavioural Therapy (CBT) and Motivational Interviewing (MI) – both which have been shown to be successful in treating problem gambling and tobacco smoking. These outcomes will be compared to a group that receives treatment for problem gambling only. The online format will provide benefits like easier accessibility and the ability to reach communities that are dispersed throughout the province. This research will provide insight into a potential new intervention for treating two highly co-occurring conditions. Part of the integrated treatment will be us advertising you to use nicotine replacement therapy (NRT) in the form of nicotine patch. If you are in the integrated treatment, we will provide vouchers so you can use nicotine patches during the course of treatment.

The researchers are hoping to recruit 300 participants for this study. Half (150) of these individuals will receive the integrated treatment, where both gambling and smoking behaviours will be addressed, and the other half (150) will receive the problem gambling treatment only.

What You Will Be Asked to Do in the Research: If you consent to participate in the research, you will need to register on the study website and verify your account. You can do this via a link you will be sent over e-mail. You will need to verify your account as well as create a username and password in order to access the treatment website. You will use this information for all log-ins throughout the study.

Once you have provided informed consent and are registered on the treatment website, you will be asked to complete a baseline assessment in order to determine whether you are eligible to participate. Eligible participants will be those that: are aged 19 years old+, have at least moderate levels of gambling, report current daily smoking, are fluent in English, and have weekly internet access.

If you consent to participate in this research, you will be “randomized” into one of two study groups described below. “Randomized” means that you are put into a group by chance, like flipping a coin. The two groups are the study treatment group (treatment for both gambling and smoking) and the gambling only (i.e., control) condition. You will have a one in two chance of being placed in the study treatment group (integrated problem gambling and tobacco smoking) and a one in two chance of being placed in the gambling only group. Importantly, the participants assigned to the gambling only group will receive immediate access to an empirical, gambling only treatment. At the conclusion of the study, they will receive access to the integrated gambling and smoking treatment, including vouchers for NRT.

If you take part in this study, you go through the following steps:

- 1) After completing your consent form, you will complete a series of brief questionnaires. Following the completion of these forms and if deemed eligible, you will be randomly assigned a group. You will receive an active link to access the treatment, either the study treatment group or the gambling-only group.
- 2) You will need to create a username and password in order to access the treatment website. All the details will be provided for this.
- 3) After creating an account, study personnel will contact you by phone to ensure that your account is verified. Depending on which condition you are placed in, you may be asked to provide your mailing address in order to be mailed NRT for the duration of the program. In order to initiate your participation in this trial, we need to have a phone call with you.
- 4) Once the link is available, you will participate in the online, self-help 8-week treatment. At the end of the program, you will be asked to complete the same brief questionnaires. You will have 8-weeks to work through seven modules at your own pace. Throughout the modules, there will also be exercises that require additional practice. Overall, you should be prepared to commit approximately 1-3 hours/week.
- 5) Six months following the completion of the online program, you will be asked to complete the same series of brief questionnaires. We may contact you by phone to complete the follow-up questionnaires.

You can stop participating at any time. However, if you decide to stop participating in the study, we encourage you to talk to the study staff first. Although there are no serious consequences of a sudden withdrawal from the study, it is helpful for the study staff to understand why you are withdrawing or in what ways we could have made your participation more comfortable, as this may inform future studies.

It is important to know that this program is meant to be mainly self-guided – meaning that you work through the program at your own pace. However, you will be interacting occasionally with an intervention support person by email, who is an individual with training in clinical psychology. They will send you tips and feedback every so often, and will answer your questions as you go through the program. The function of the intervention support person is help you stay on course during the self-help program, and therefore, the intervention support person is not meant to be a therapist. If at any point you notice a sudden change in your wellbeing and feel you need more intensive support (e.g., in person counselling) please see the “Help Me” tab on the intervention website for resources in your area.

If you are interested in receiving the results of this study, please provide the research team with your contact information in the space provided at the end of this form. You will receive an email summary of the study once it has been completed. Please provide your email in the space provided at the end of this form if you are interested.

As a token of appreciation for your participation in the study, you will be given a \$20 Amazon.ca gift card per assessment. A bonus of \$20 for completing all three assessments, and \$20 for completing at least five of the treatment modules (max compensation per participant = \$100).

Risks and Discomforts: Although there are no known risks of participating in a combined CBT and MI intervention, it is possible that you may find some of the content during treatment difficult. Some individuals who have difficulty with emotions sometimes get thoughts of wanting to harm themselves. If you report significant thoughts of harming yourself and/or plans at the beginning, you will be given a recommendation to visit your local doctor or hospital for support as soon as possible. You will also be provided with ongoing supports via the menu item “Help Me” on the intervention website. This will include a list of mental health services, including community resources, public and private psychologists, hospitals, and helplines. You will have access to these resources and may use them at any time. Dr. Matthew Keough, a clinical psychologist (supervised practice) will also be available to speak with you should serious issues arise and will make sure a safe course of action is followed. If you feel uncomfortable at any time during treatment, you are free to stop participating at any time.

There are some potential risks of using over-the-counter NRT nicotine patches. These can include skin irritation, headache, dizziness, etc. It is important to read the packaging of the patches and speak with the pharmacist if you have further questions.

If you become uncomfortable during this training, you are free to immediately stop participating.

Benefits of the Research and Benefits to You: There are also a number of potential benefits of the current study. First, you will be given skills to cope with both problem gambling and/or tobacco smoking. As a result, you may experience an improvement in your overall mental and physical health. We also hope that by offering the program online, we will be able to reach as many people as possible who otherwise may not have had access to treatment. We hope that the information in this study can be used to benefit other individuals struggling with problem gambling and smoking in the future. The results of this study may also be used by future researchers and professionals in order to continue improving the health and well-being of individuals struggling with mental health issues. There are also a number of benefits of using NRT nicotine patches, including reducing smoking and curbing cravings. Finally, the program is being offered free of charge, when standard rates of therapy in the province are as high as \$225/hour.

Voluntary Participation and Withdrawal: Your participation in the study is completely voluntary and you may choose to stop participating at any time. You have the right to withdraw at any time without penalty, financial or otherwise. Your decision not to volunteer, to stop participating, or to refuse to answer particular questions will not influence the nature of your relationship with York University either now, or in the future. Should you wish to withdraw after the study, you will have the option to also withdraw your data up until the analysis is complete.

Confidentiality: All information you supply during the research will be held in confidence and unless you specifically indicate your consent, your name will not appear in any report or publication of the research. Information gathered in this research study may be published or presented in public forums such as research conferences; however, any identifying information will not be used or revealed. All participants will be assigned a de-identifying ("subject ID") so that all identifying information (e.g., email) can be removed from individual data sets, and the key linking subjects to their identifiers will be kept on a password-protected document kept separate from the data. However, despite our best efforts to keep your personal information confidential, absolute confidentiality cannot be guaranteed. All information obtained during the study will be held in strict confidence. You will be identified with a study number only. Your data will be safely stored in a password-protected document on a cloud-based server (e.g., Google drive) and only research team members will have access to this information. We will destroy the identifying information once data collection is completed and all NRT has been mailed. We will delete the online document where this information is housed. The de-identified data will be retained indefinitely so we can continue to analyze the data for future research. Confidentiality will be provided to the fullest extent possible by law.

The researcher(s) acknowledge that the host of the online survey (e.g., Qualtrics, Survey Monkey etc.) may automatically collect participant data without their knowledge (i.e., IP addresses.) Although this information may be provided or made accessible to the researchers, it will not be used or saved without participant's consent on the researchers' system. Further, "Because this project employs e-based collection techniques, data may be subject to access by third parties as a result of various security legislation now in place in many countries and thus the confidentiality and privacy of data cannot be guaranteed during web-based transmission.

Questions About the Research? If you have questions about the research in general or about your role in the study, please feel free to contact Dr. Keough either by telephone at 416-736-2100 ext. 33415 or by e-mail (keoughmt@yorku.ca). This research has received ethics review and approval by the Human Participants Review Sub-Committee, York University's Ethics Review Board and conforms to the standards of the Canadian Tri-Council Research Ethics guidelines. If you have any questions about this process, or about your rights as a participant in the study, please contact the Sr. Manager & Policy Advisor for the Office of Research Ethics, 5th Floor, Kaneff Tower, York University (telephone 416-736-5914 or e-mail ore@yorku.ca).

Legal Rights and Signatures:

I consent to participate in "Developing and testing the effectiveness of a novel online integrated treatment for problem gambling and tobacco smoking: A randomized controlled trial" conducted by Dr. Keough. I have understood the nature of this project and wish to participate. I am not waiving any of my legal rights by signing this form. My signature below indicates my consent.

Signature _____

Date _____

Participant

Principal Investigator

Figures

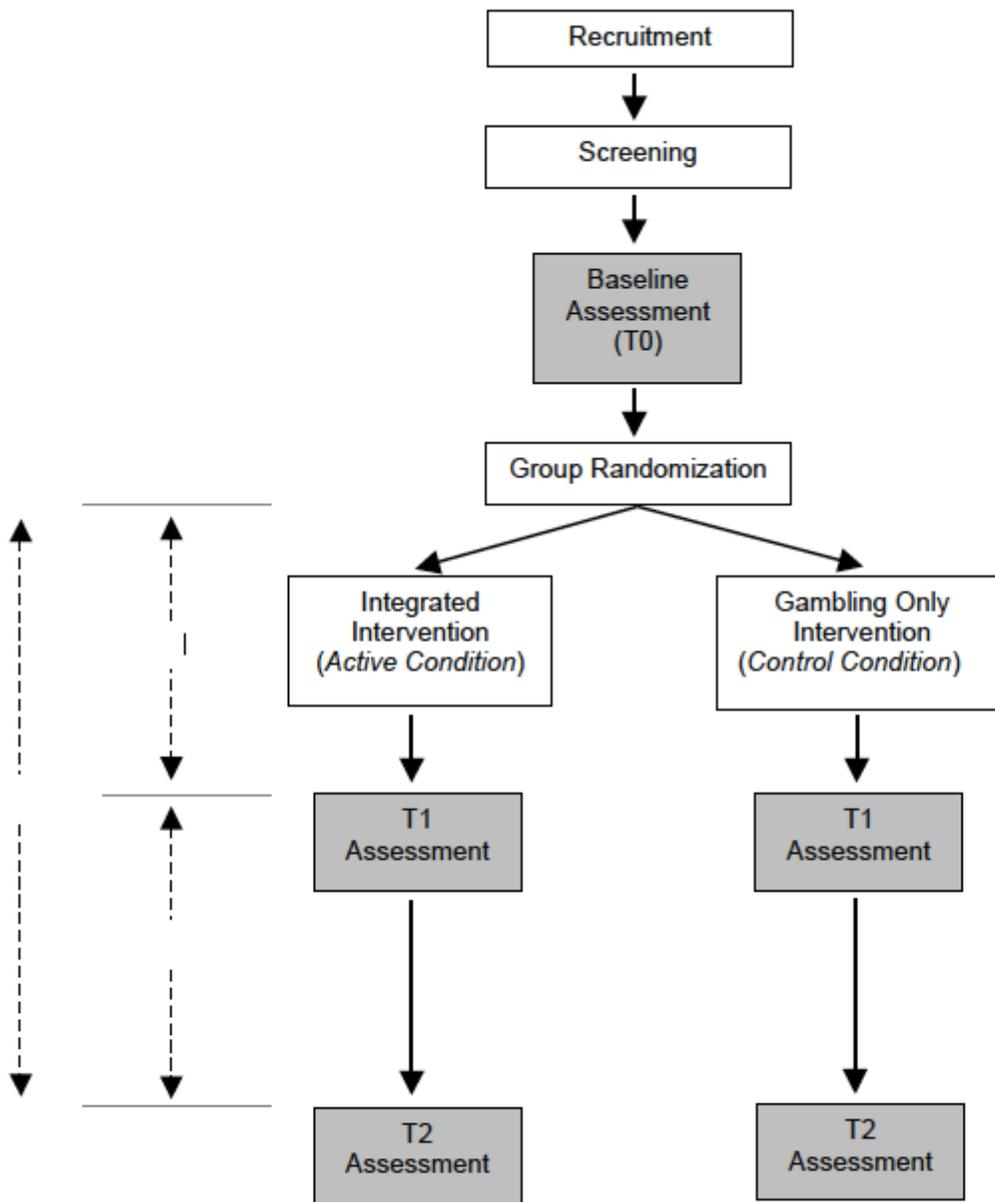


Figure 1. Schematic of the Proposed RCT

Figure 1

Schematic of the randomized controlled trial methodology.

	STUDY PERIOD				
	Enrolment	Allocation	Post-allocation		
	<i>-t1</i>	0	<i>t0</i>	<i>t1</i>	<i>t2</i>
ENROLMENT:					
Eligibility screen	X				
Informed consent	X				
Allocation		X			
INTERVENTIONS:					
<i>Integrated Condition</i>			X	X	X
<i>Gambling-only Condition</i>			X	X	X
ASSESSMENTS:					
<i>Demographics, AUDIT, DAST-10, TLFB Gambling, TLFB Smoking, TLFB Alcohol, TLFB Substance use, PGSI, Fagerstrom Test, P4</i>			X		
<i>Primary outcome: Gambling behaviour (TLFB)</i>			X	X	X
<i>Secondary outcome: G-SAS, PGSI, TLFB smoking, Fagerstrom Test, withdrawal scale, NIDA-ASSIST</i>			X	X	X

Figure 2

Schedule of enrolment, interventions, and assessments. -t1, enrolment to determine eligibility; t0, baseline (at outset of intervention); t1, 8-weeks (at completion of intervention); t2, 24-week (at 4-months following completion of intervention); AUDIT, alcohol use disorder identification test; DAST-10, drug abuse screening test-10; TLFB, Timeline Followback; G-SAS, Gambling symptom assessment scale; GACS, PGSI, problem gambling severity index; P4, suicide screener.

Module overview

Here you see an overview of all modules. We recommend that you will work through 1-2 modules each week, preferably in this order. Your current progress is indicated by a red bar on the bottom of each module which turns green when finished. When you click on a module, you will continue on the page you left the module.



Figure 3

Main menu of intervention modules.

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- [SPIRITChecklist.doc](#)