

Effects of Prevention Messages for Electronic Gambling Machines on Behaviours and Cognitions: Protocol for a Two-Arm Stratified Block Randomised Controlled Study

Benjamin Galipeau, Christian Jacques, Serge Sévigny, Isabelle Giroux

Submitted to: JMIR Research Protocols
on: March 27, 2025

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Abstract

Background: Electronic Gambling Machines and online gambling are the reputedly most damaging gambling type from a public health perspective. Pop-up messages are often used as a responsible gambling (RG) measure to prevent harm for these screen-based types of gambling. Despite some evidence of effectiveness in the literature for these messages, limitations persist, among which low ecological validity is of particular concern.

Objective: This study aims to test (1) the potential of pop-up messages as a prevention measure in a gambling setting, and (2) if this potential is moderated by characteristics of people exposed to the messages. Secondary objectives also tackle some fundamental assumptions of gambling studies conducted in a laboratory setting.

Methods: This is a two-arm stratified block randomised controlled study. Eighty participants are recruited under the false pretense of evaluating the realism of a gambling session in a laboratory replicating a bar. Duplicity is also used to make participants believe that they are risking their own money during the experimentation (i.e. winnings and losses are real). Participants are randomised to one of the two arms in a 1:1 ratio: (1) Experimental group (regular gambling session with prevention pop-up messages presented on a fixed schedule); (2) Active control group (regular gambling session). Outcomes measures include behaviours, cognitive and emotional responses to the pop-up-messages. Believability of the gambling session's realism is also evaluated.

Results: Ethical approval was obtained from the Comités d'éthique de la recherche avec des êtres humains de l'Université Laval (CÉRUL; reference no 2020-076 A-1 / 27-05-2024). Recruitment began in February 2024 and was extended to conclude in December 2025. Study completion is expected in February 2026. No results are currently available.

Conclusions: This study will provide new insights on the efficacy of pop-up messages as a prevention measure for gambling. Clinical Trial: ClinicalTrials.gov NCT06341504; <https://clinicaltrials.gov/study/NCT06341504>

(JMIR Preprints 27/03/2025:75068)

DOI: <https://doi.org/10.2196/preprints.75068>

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Electronic Gambling Machines and online gambling are the reputedly most damaging gambling type from a public health perspective. Pop-up messages are often used as a responsible gambling (RG) measure to prevent harm for these screen-based types of gambling. Despite some evidence of effectiveness in the literature for these messages, limitations persist, among which low ecological validity is of particular concern.

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Trial registration:

ClinicalTrials.gov NCT06341504; <https://clinicaltrials.gov/study/NCT06341504>

Keywords

Gambling prevention; Responsible gambling; Harmful gambling; Pop-up messages; EGM; Electronic gambling machine; Primary prevention; Preventive communication

Data availability statement

This is a protocol, so no data are available yet.

Introduction

Background and rationale

Gambling disorder refers to a persistent and recurrent problematic gambling behavior that disrupts

several spheres of an individual's life [1]. Whereas the dichotomous approach of the DSM may be useful in a clinical setting, it can easily lead to problematic sub-clinical behaviors not being considered. From a prevention standpoint, a continuous conceptualisation of problem gambling is more useful. Williams, West [2] use the term 'problem gambling' to encompass the varying degrees of severity and reserve the use of 'pathological gambling' for referring to severe problem gambling. Others like Feris J and Wynne [3] classify people who gamble on a four-steps scale (i.e. non-problem, low risk, moderate risk, problem gambling). Moderate risk gambling is also called at-risk gambling in other classification systems [4]. Finally, recent development in the literature started to shift to focus on counting harms instead of counting people afflicted by them (see the Conceptual Framework of Harmful Gambling for more information [5]).

Data from a recent meta-analysis indicates that the worldwide prevalence of problem gambling is 1.29%, and moderate risk/at-risk gambling is 2.43% in the adult population [6]. The consequences of problem gambling are manifold. Cowlishaw and Kessler [7] found associations between problem gambling and mental health, such as anxiety, neurotic symptoms, substance use problems, and psychosocial maladjustments, like suicidality, financial difficulties, and social support. Langham, Thorne [8] also published a taxonomy of harms that could result from gambling. To limit and prevent these negative effects, a wide range of measures grouped under the term responsible gambling (RG) have been put in place (see Blaszczynski, Collins [9] for a detailed definition of the RG concept; see Williams, West [2] for a review of different RG measures).

Among RG measures are pop-up messages. In the context of RG, pop-ups or dynamic messages are defined as informative messages or warnings that appear on the screen during gambling activities to change gameplay and reduce gambling-related harm [10]. Pop-up messages serve as a tool to deliver RG information to gamblers during play and force a break in gambling [11]. Common content such pop-up messages are factual, descriptive, or normative information, such as details about time and/or monetary expenditure, either for the individual player alone or in comparison with other gamblers [10-12]. Self appraisal content has also been a promising strategy for pop-up messages. It has been suggested that pop-up messages can be an effective and minimally invasive strategy for introducing responsible gambling information and reinforcing responsible gambling behaviors.

The interest in pop-up messages is heightened by the fact that EGMs are regarded as one of the most damaging gambling games from a public health perspective [13-16]. The content of pop-up messages employed as a measure of RG exhibits variability across studies and settings. However, there is a paucity of studies that replicate results for the same measure of RG [2, 10-12]. Additionally, numerous methodological constraints impact many of these studies, including the utilization of self-reported data, limited sample sizes, inadequate control conditions, and reduced ecological validity [2, 10-12]. Thus, it is evident that more rigorous data is necessary to evaluate the effectiveness of RG pop-up messages and their potential moderators.

Of all the limitations listed, ecological validity poses the most complex problem. Indeed, testing the effectiveness of RG messages in a natural environment poses major ethical, organizational, and financial challenges, mainly related to the need to reach an agreement with the gambling operator and issues regarding maintaining researchers' independence and participants' privacy. There are also technical difficulties regarding gambling operators' software that can limit the possibilities of alterations to insert RG messages. It is generally more practical to test RG game features in a laboratory setting, even if this approach has its own set of problems related to ecological validity. Indeed, in a recent systematic review and meta-analysis containing 19 studies on the effect of pop-up messages on gambling behaviors and cognition, 14 studies were conducted in a laboratory environment whereas only five were conducted in a natural setting [11].

In laboratory settings, volunteers are typically invited to gamble by wagering virtual credits [17, 18] or monetary compensation received for their participation in the study [19-24]. Their behavior in that setting is then deemed to resemble that of gamblers in a real gambling environment. Surprisingly, this proposition has received very little scientific verification. Data suggests that gamblers would be

more emotionally engaged in play in a real gambling environment [25, 26] but would take more risks in a laboratory setting [27]. These results could be explained in part by the fact that laboratory research in the field of gambling neglects a fundamental aspect of its definition: the wagering of money or an object of value, a wager which, once placed, cannot be taken back [28]. Thus, no real monetary consequences could reduce people's gambling inhibitions. The absence or reduction of participants' sense of risk while gambling in a laboratory setting raises doubts about the seriousness with which they would take any warning message about the consequences of their actions. Indeed, without any serious motivation to gamble (e.g., desire to win big, desire to make up for a major loss, etc.), it is quite possible that people in laboratory studies are not gambling as they would usually do. These participants who are presented with RG measures may understand that they are being encouraged to moderate their gambling behavior while lacking the incentive to ignore those safety advice. This bias could artificially inflate the effectiveness of certain RG measures when tested in the laboratory. These RG measures may subsequently fail to fulfill their protective role when deployed in the field.

Aims and objectives

This study aims to test (1) the potential of pop-up messages as a prevention measure in a gambling setting, and (2) if this potential is moderated by characteristics of people exposed to the messages. Secondary aims also tackle some fundamental assumptions of gambling studies conducted in a laboratory setting.

Specifically, the main objectives are to test to what extent do prevention pop-up messages affect participant's:

1. gambling behavior (e.g. money betted, gambling session length, gambling intensity, etc.).
2. cognitions (e.g. thoughts elicited by messages, perceived effectiveness of message, etc.).
3. emotions (e.g. enjoyment of gambling, emotional response to messages, etc.).

Secondary objectives are:

4. to test to what extent are the main effects moderated by participants' characteristics (e.g., gender, age, education, PGSI category, etc.) moderate the main effects found in objectives 1–3.
5. to examine the feasibility of studies conducted in a laboratory setting with the use of real money (or using deception to make the participants believe they are gambling their own money). This objective is accomplished with the use of five research questions:
 - 5.1. Is it possible to recruit enough participants for the study to conduct meaningful statistical analysis (i.e. does the novel approach of risking one's own money in a study without guaranteed compensation deter too many people from participating)?
 - 5.2. Does the laboratory bar replicate adequately the overall "vibe" of a typical gambling venue with EGMs?
 - 5.3. Do the participants find their actual gambling activity in the bar replica as realistic as a real one?
 - 5.4. Do the participants believe they are gambling their own money during the study (i.e. to what extent does the deception worked)?
 - 5.5. Do outcomes, both self-reported (past 12 months) and measured in the laboratory, differ from each other?

Methods

Study Design

This is a two-arm stratified block randomised controlled study. Participants are randomised to one of

the two arms in a 1:1 ratio:

- Experimental group: Regular gambling session with prevention pop-up messages presented on a fixed schedule.
- Active control group: Regular gambling session.

There are three assessment phases in this study (Figure 1). Recruitment began in February 2024 and is expected to conclude in August 2025. Study completion is expected in December 2025. Study outcomes will be reported in line with the Consolidated Standards of Reporting Trials guidelines and the extension for social and psychological interventions trials (CONSORT-SPI) [29].

Sample size considerations

Using G*Power, we estimated the required sample size for an α level of 5% and β level of 80% for a two-tailed t -test for a range of effect sizes (Table 1). This was done both for testing difference on outcomes between two independent groups and for repeated measures.

Table 1. Required sample size for a range of effect sizes

Effect size (g)	n (per group)	n (total)
0.2	394	788
0.3	176	352
0.4	100	200
0.5	64	128
0.6	45	90
0.7	34	68
0.8	26	52
0.9	16	32

Note. Calculated for an α level of 5% and β level of 80% for a two-tailed t -test

A recent meta-analysis by Bjørseth, Simensen [11] on the effects of RG pop-up messages on gambling behaviours and cognitions reports effect sizes respectively of $g = 0.616$ (95% CI = 0.359–0.872 and $g = 0.578$ (95% CI = 0.325–0.830) when adjusting for publication bias. Based on those values, total sample size would be between 86 and 96. Note that sample size requirements for one-way ANCOVAs and repeated measures analyses would be equal or smaller. Considering the potential difficulty to recruit participants accepting to play with their own money, we aimed at a sample size of 80. Therefore, we can expect a power range from 72,34% to 77,66% with effect sizes comparable to what is reported by Bjørseth, Simensen [11].

Participants and eligibility criteria

We aim to recruit 80 participants in total. While many may refuse to participate when presented with the study's specifics, we do not anticipate a significant number of dropouts after consent is obtained. Inclusion criteria are:

- Age at least 18 years old. This is the legal age to gamble where the study is conducted (Quebec, Canada).
- Functional literacy in French. This study is conducted in French and requires being able to read and understand simple texts in that language. Questions are also asked and answered in French.
- Having played EGMs at least once every two weeks for the past 12 months. Note that this criterion was subsequently lowered to having played EGMs at least 6 times in the past 12 months to expand the recruiting pool. This change was done on May 27th, 2024.

The rationale for a floor limit on play frequency is that prevention pop-up messages are expected to produce a small effect that becomes more impactful when cumulated over multiple sessions. Therefore, these messages are thought to be more suited to people who gamble on a regular basis. Moreover, regular EGMs gamblers are more likely to feel compelled by a message warning about the dangers of excessive gambling than people who gamble very sporadically.

Exclusion criteria are:

- Classified as a probable pathological gambler (score ≥ 8 on the PGSI).
- Currently receiving treatment for problem gambling or trying to achieve or maintain abstinence from gambling.
- Currently under self-exclusion from a gambling venue or website.

The rationale for the exclusion criteria are ethical considerations. The first criterion is mandated by the ethics committee to prevent possible adverse effect on the most vulnerable gamblers. The other two criteria aim to not interfere with someone's recovering process or wishes to stop gambling.

Recruitment

The study is advertised online via social media, our research team's website, our university's mailing list and online ads targeted at people geolocated at gambling venues. An email was also sent to participants from a previous study who agreed to be contacted again. Finally, the study is advertised offline via ads in a local newspaper and posters in gambling venues near our university.

Pre-experimentation phase

Screening

Screening and following interview for the pre-experimentation phase are done over the phone. Participants are asked questions to determine if they satisfy the inclusion/exclusion criteria. Not all criteria are communicated on the recruitment ads and neither are participants told beforehand what answer would disqualify them. Screening interview ends with the Problem Gambling Severity Index (PGSI) which is a subscale of the Canadian Problem Gambling Index [3]. This instrument is designed to determine problem gambling severity and is the actual gold standard for problem gambling screening in the general population. The instrument is composed of nine items scored on a four-points Likert scale. Scores range from 0-27 and classify gamblers in four categories: (1) Non-problem (score of 0); (2) Low risk (score of 1-2); (3) Moderate risk (score of 3-7); (4) Problem gambling (score of 8+).

Presentation of the study and verbal consent

After satisfying the screening criteria, participants are presented with the details of the study. Participants are recruited for a single gambling session in a bar replica equipped with EGMs. Recruitment is done under the false pretense of evaluating the realism of a gambling session in a laboratory replicating a bar. The main points communicated to the participants during the presentation of the study are:

- Gambling is done with your own money. You must bring the amount they wish to gamble the day of the experiment.
- Winnings are paid up to \$500 more than the total amount inserted in the EGM over the course of the gambling session (e.g. if you insert \$60 in the EGM during your session, you could be paid up to \$560). In turn, losses are real. There is no baseline compensation for participating in the study. The only compensation for participation are the potential winnings made while gambling. Overall, it is possible to end the study with less money than at the beginning, even

to lose it all.

- The EGMs used in this study are of the same model currently in operation in Quebec, Canada. Their payout rate is the same (92 %).
- You are free to gamble as much and for as long as you like.
- You are allowed to take breaks.
- Snacks and non-alcoholic beverages can be purchased with real money during the study via cash or electronic transactions.

Participants who give their verbal consent proceed with the intake interview.

Duplicity

Four aspects of this study are hidden from participants to emulate a realistic level of personal risk and prevent demand characteristics.

The main objectives are hidden from participants

The main objectives of this study, namely “Evaluating the effect of prevention pop-up messages on behaviours and cognitions”, are hidden from the participants. Instead, they are told that this study is about evaluating the bar replica (i.e., the ambiance, look, functionality, etc.) and the gambling session’s realism. They are also told that this information will be used to inform future studies using the same bar replica.

To prevent participants mistaking the prevention pop-up messages for a bug or becoming sceptical about the study’s true objectives, they are told that some characteristics of the EGMs could differ slightly from their typical experience. It is also specified that these differences are not guaranteed to be present (to account for participants in the control group). The explanation given to participants for potential differences is that our research team is conducting multiple parallel studies with the same EGMs and that it would not be practical to tinker with the EGMs between each participant. These potential differences are kept vague and presented to the participants as minor modifications, mostly affecting the user’s interface (e.g. change in fonts to improve readability) and never affecting the games’ mechanics and payout rates.

Participants cannot lose their own money

All money inserted in the EGMs during the gambling session is given back at the end of the study, though winnings are paid as advertised (Table 2). Also, participants that incur net losses or winnings less than \$30 are reimbursed their money and given exactly \$30. This ensures a floor limit on the compensation for participating in the study.

Table 2. Examples of payments made to participants under different scenarios

Money inserted in the EGM during the gambling session	Credits left on the EGM at the end of the gambling session	Net gains	Amount paid to participant ^a	Total money given to participant at the end of the gambling session
60	120	+60	60	120
60	800	+740	500	560
60	65	+5	30	90
60	0	-60	30	90

Note. All units are in \$

^a Money inserted in the EGM (\$60 in all examples) is returned to participants in addition to the amount listed in this column.

The gambling session's duration is limited to 2 hours

The gambling session's duration is limited to 2 hours long. The gambling session starts when the participant insert money for the first time in the EGM. Breaks during gambling session are permitted (e.g. using the restroom, buying snacks from the bartender/barmaid, etc.) but are included in the 2 hours time limit. If participants have not yet ended their gambling session upon reaching the 2 hours time limit, they are offered to take a short brake to answer some questions. They then proceed to the post-experiment phase. If the participant insists to keep playing or try to quit hastily (e.g. because they are angry about losing money), they are prematurely debriefed before proceeding with the post-experiment phase.

Participants' gambling behaviours are monitored

Unbeknown to them, participants are monitored through a secret camera hidden in the ceiling during their gambling session. Their gambling behaviour is also recorded from the EGM they play on.

Intake interview

The intake interview collects information on basic sociodemographic factors, gambling behaviours on EGMs (past 12 months), general level of fun while playing EGMs (past 12 months) and perceived self-control while playing EGMs. Participants then schedule a gambling session to be done in our laboratory on the university's campus. While free to choose any date and time they wish, participants are incited to select a moment that fits their usual gambling habits. There is no maximum or minimum time limit between the intake interview and the gambling session in the laboratory. Sessions are usually scheduled days to weeks after the intake interview.

Experimentation phase

Randomisation

Blocks are size 4 and strata are divided on problem gambling severity using PGSI categories. Randomisation was done using RANDOM.ORG's list randomizer tool. The list within each block, "1, 1, 0, 0" (where "1" is experimental condition and "0" is control), was randomized 20 times for each PGSI categories, excluding the probable pathological gambling category (Figure 2). This arrangement of 80 places for the three lowest PGSI categories allows for any combination of levels of problem gambling among recruited participants while preventing major imbalance between the two groups on this characteristic.

Allocation is done just before the participant arrive at the laboratory, on the day of the experiment. Participants are allocated to the first available spot from the top of the randomised list corresponding to their PGSI category (Figure 3). Participants who complete the intake interview but don't show up at the scheduled appointment vacate their spot on the list. They then may be reassigned depending on whether they reschedule another gambling session. Meanwhile, the vacated spot becomes available for another participant who fits the same profile. The moment participants present themselves to the laboratory, their spot on the list cannot be reallocated, even if they desist latter in the process.

Concealment of allocation and blinding

While participants in the experimental group should notice the novel prevention pop-up messages, for all they know before debriefing, there are no "assignment" per se. This is because the study is presented as an opinion survey about the realism of the bar replica and the gambling session in it. No

instruction suggests any type of comparison between conditions. Therefore, participants would not be aware that there are two different groups, nor that this study tests the effects of prevention pop-up messages.

Note that masking becomes “open label” after debriefing. Indeed, after being informed of the true goals of this study, participants are easily able to determine in which group they were allocated based on what occurred during their gambling session. Regardless, gambling behaviours are recorded before debriefing and won't be affected by unmasking. There is no functional way to mask group assignment to the research team. However, the randomization procedure assures that allocation is purely random.

Gambling session in the laboratory

There is only one participant at a time in the laboratory for the gambling session. Each participant arrives at the lab at a scheduled appointment. Then, a research assistant greets the participant and proceeds to refresh their memory about the important aspects of the study. The participant is then brought to a room replicating a typical bar with EGMs (e.g. subdued light, music, bar paraphernalia, fake liquor on display, etc.; Figures 4–5; Multimedia Appendix 1 for additional images).

Upon entering the bar, the participant is greeted by another member of our research team who plays the role of bartender operating the cash register and ensuring the general safety of the session. The addition of this bartender is done to improve the general realism of the gambling setting. The bar replica has three EGMs, but only one can be played on and used to show the prevention pop-up messages. The other two EGMs are turned on for ambiance purposes, but their money collector is disabled. Limiting play to only one EGM eases the recording of gambling behaviours and proper showing of the prevention messages. The participant is told the two “unusable” EGMs are awaiting to be serviced because of their money collector malfunction.

The participants are free to do as they please (e.g. play EGMs, buy chips and non-alcoholic beverages, relax in the bar, etc.). They are allowed to leave the bar if they need to go to the bathroom or smoke. They are accompanied by the bartender if they elect to do so. The reference timepoint of the experiment (i.e. T+00:00:00) starts when the participant insert money for the first time in the EGM. Note that breaks in play, no matter the motive, does not stop the experiment timer regarding the duration limit.

While the participant is in the bar, a second research assistant observe from an adjacent room and is responsible for recording all gambling behaviours using a computer connected to the EGM and operating the pop-up messages presentation schedule (Figure 6). A live feed spy camera disguised as a smoke detector is used to observe gambling related behaviours that cannot be recorded by the EGM's computer (e.g. taking a break).

The session ends when one of the two following conditions is met: (1) The participant expresses, without ambiguity, that they wish to end the experiment; (2) T+02:00:00 (two hours) is reached. Procedure may slightly vary depending on how the gambling session ends.

Normal scenario

The participant ends their session by themselves, before reaching the T+02:00:00 time limit. In this scenario, the procedure continues normally, as described in the Post-experimentation phase section.

Alternative scenario 1

The participant reaches the T+02:00:00 time limit and continues to play. The member of the research team playing the role of bartender interrupt the participants and suggest taking a pause to answer some questions. If the participant agrees, the procedure continues normally, as described in the Post-experimentation phase section. Unbeknown to them, they will not be allowed to resume gambling after said questions.

Alternative scenario 2

This is the same as Alternative scenario 1, but the participant refuses and insists on continuing to play, debriefing is done on the spot to end the play session. All questionnaires presented in the Post-experimentation phase section are done, but contrary to the normal scenario, evaluation of participant's perception of the realism of the bar replica and of the gambling session is done after debriefing.

Alternative scenario 3

In this scenario, the participants try to hastily quit the laboratory before we get a chance to debrief them (e.g. because they are angry about losing a lot of money and do not wish to participate any longer). In this case debriefing is done early to prevent them quitting without receiving all the information to make an informed decision about their participation. All questionnaires presented in the Post-experimentation phase section are done, but contrary to the normal scenario, evaluation of participant's perception of the realism of the bar replica and of the gambling session is done after debriefing.

Active control group: Regular gambling session

This condition is designed to closely replicate a typical gambling session in a natural setting.

EGMs

Gambling is done on fully functional and unaltered EGMs, model IGT GL20. This is the model currently in use in Quebec, Canada, the location where this study is conducted. Wins/losses sequence is fully randomized and not determined beforehand. The payout rate is the same as what is prescribed by law (92 %). These machines come equipped with basics responsible gambling features, the two main ones being a mandatory time limit reminder and a submenu containing responsible gambling information.

Mandatory time limit reminder

The mandatory time limit reminder is activated either when (1) the previous time limit is up; or (2) the player bank meter reaches \$0. When the previous time limit is up, a pop-up takes up the upper third of the play screen and requires the player to set a new time limit using one of five choice buttons (four first buttons: 15, 30, 45 or 60 minutes; fifth button: cash out, which prints a receipt and ends the gambling session; Figure 7). As the EGM cannot track who is playing, there are no limits on consecutive gambling sessions. When the player's bank meter reaches \$0, the pop-up described above appears as soon as new money is inserted in the EGM, no matter if the previous time limit is up or not.

Responsible gambling information

A submenu accessed through a button on the main touch screen opens a window which contains basic information on randomness and a responsible gambling advice. The information is presented in small white font on a black background (Figure 8 for an example; Multimedia Appendix 2 for a complete overview).

Food purchases and money withdrawals

A payment terminal allows for buying non-alcoholic beverages (soft drinks or coffee) and chips during the experimentation. This is done to enhance the realism of the bar setting. It also allows for real cash withdrawal from bank account during a gambling session. Quebec's code of conduct for EGMs commercialization prohibits retailers from having an ATM near their EGMs. It also prohibits them from lending money to consumers or withdrawing cash for them to gamble. However, this rule

is not always easy to enforce in practice. For this study, participants are allowed to withdraw from their bank account if they ask by themselves. This option is not communicated upfront to them.

Experimental group: Regular gambling session with prevention pop-up messages

This condition is the same as the active control group with the addition of prevention pop-up messages delivered during the gambling session on a fixed presentation schedule.

Prevention pop-up messages

Messages are shown full screen on the EGM's play screen on a fixed presentation schedule from the moment the participant insert money for the first time in the EGM (i.e. T+00:00:00). The first message is shown at T+00:10:00. The second to fourth messages are shown at 30 minutes intervals from then on. Messages block the play screen for 15 seconds before automatically closing. Up to 4 different messages are presented during the gambling session. Order is determined by sortition without replacement.

Messages all follow the same template (Textbox 1; Figure 9 for an example; Multimedia Appendix 3 for every message).

Textbox 1. Prevention pop-up messages template

- Message is written in a white box over a blue background. Pattern on the background direct the eye toward the message
- Warning heading "Caution!" with pictogram (yellow triangle containing an exclamation mark)
- First information is time spent gambling from beginning of the session
- Second is a warning that gambling could lead to serious monetary loss
- Third is a self-appraisal question about current gambling behaviour. This is the only part of the message that change across versions. There are four different possibilities for this element.
- Fourth is an advice to the participant that a break could help choose what is best for them
- Just below the message is a countdown indicating time left before the message closes itself
- The province's Health department logo is shown in the lower right corner as a more "neutral" endorsement of the messages.

Note that due to hardware limitations on the EGMs' part, the prevention messages presented only alter what is shown on the play screen (they fill the screen completely, hiding the game), but can't pause the game per se. The EGMs' buttons, sound, and music are still operational while the message is shown.

Post-experimentation phase

The participant is brought in a separate office after the end of the gambling session for a series of questionnaires (Tables 4–5) which are, in order:

- Evaluation of participant's perception of the realism of the bar replica and of the gambling session.
- Evaluation of participant's ability to recall prevention pop-up messages. This includes multiple tasks of free (e.g. describing the pop-up messages from memory) and cued recall (e.g. selecting from a list the pop-up messages that were seen during the gambling session).
- Evaluation of participant's cognitive and emotional response to prevention pop-up messages.
- Evaluation of protocol credibility (i.e. if participant really believed they were gambling their

own money and were really risking their own money).

These questionnaires are comprised of Likert scales, multiple choices and open-ended questions. Contrary to more standard qualitative designs, open-ended questions responses are not recorded in an audio format nor are they transcribed verbatim [30]. Instead, the interviewer takes note which the participant can see on a computer screen. Participants are then asked to confirm that the interviewer's notes accurately reflect their opinion. It has been suggested that that note-taking is superior to audio recording for obtaining qualitative data [31].

Debriefing about the true goals of the study and final validation of consent to participate in the study are done between Evaluation of participant's perception of the realism and Evaluation of participant's ability to recall prevention pop-up messages.

Outcome assessments

Primary Outcome Measures

Table 3. Primary outcome measures

	Outcome n°	Outcome	Description	Measurement time points
Gambling behaviour – Money				
	1	Money betted (physical)	Cumulative amount of money physically inserted in the EGM during the gambling session.	Assessed at following timepoints from start of gambling session in the laboratory: [0] T+00:00:00 [1] T+00:10:00 [2] T+00:40:00 [3] T+01:10:00 [4] T+01:40:00 [5] end of gambling session (max T+02:00:00)
	2	Change in money betted (physical)	Change between self reported measure (past 12 months) and observed data in the laboratory	Past 12 months; end of gambling session
Gambling behaviour – Time				
	3	Gambling session's total duration	Time elapsed between the first time the participant puts money in the EGM (T+00:00:00)	Assessed at the end to the gambling session

			to the end of the gambling session. Session's duration is left for the participant to decide. While the participant is told they can play for as long as they like, there is a 2 hrs limit on the session duration. This limit is hidden from the participant. Session's duration includes any breaks taken from gambling on the EGM.	
	4	Total time effectively spent gambling	Time elapsed between the first time the participant puts money in the EGM (T+00:00:00) to the end of the gambling session, minus breaks taken from gambling on the EGM.	Assessed at the end to the gambling session
	5	Change in total time effectively spent gambling	Change between self reported measure (past 12 months) and observed data in the laboratory	Past 12 months; end of gambling session
Gambling behaviour Breaks	–			
	6	Number of breaks taken	Number of breaks taken from gambling on the EGM during the gambling session.	Assessed at the end to the gambling session
	7	Mean breaks' duration	Average duration of breaks' taken from gambling on the EGM over the gambling session's	Assessed at the end to the gambling session

			total duration.	
	8	Total breaks duration	Sum of breaks' duration taken from gambling on the EGM over the gambling session's total duration.	Assessed at the end to the gambling session
	9	Mean time elapsed between breaks	Average time separating any two breaks taken from gambling on the EGM over the gambling session's total duration.	Assessed at the end to the gambling session
Gambling behaviour – Risk taking				
	10	Number of bets placed	Number of bets placed on the EGM during the gambling session.	Assessed at following timepoints from start of gambling session in the laboratory: [0] T+00:00:00 [1] T+00:10:00 [2] T+00:40:00 [3] T+01:10:00 [4] T+01:40:00 [5] end of gambling session (max T+02:00:00)
	11	Gambling speed	Number of bets placed on the EGM during the gambling session over a given amount of time (i.e. bets/min).	Assessed at following timepoints from start of gambling session in the laboratory: [0] T+00:00:00 [1] T+00:10:00 [2] T+00:40:00 [3] T+01:10:00 [4] T+01:40:00 [5] end of gambling session (max T+02:00:00)
	12	Gambling intensity (physical)	Money physically inserted in the EGM during the gambling session	Assessed at following timepoints from start of gambling

			over a given amount of time (i.e. \$/min).	session in the laboratory: [0] T+00:00:00 [1] T+00:10:00 [2] T+00:40:00 [3] T+01:10:00 [4] T+01:40:00 [5] end of gambling session (max T+02:00:00)
	13	Gambling intensity (all)	Money betted on the EGM during the gambling session over a given amount of time (i.e. \$/min). This is money used to "buy rounds on the EGM", whether it's money physically inserted in the EGM or money won while gambling and betted again.	Assessed at following timepoints from start of gambling session in the laboratory: [0] T+00:00:00 [1] T+00:10:00 [2] T+00:40:00 [3] T+01:10:00 [4] T+01:40:00 [5] end of gambling session (max T+02:00:00)
Cognitions				
	14	Perceived self-control while gambling on EGMs	Participant's perceived ability to control their gambling behaviour (e.g. sticking to their predetermined limits) over the gambling session's total duration. Evaluated with a 7-points Likert scale (1 = "I never had control" to 7 = "I always had control").	Assessed at the end to the gambling session
	15	Change in perceived self-control while gambling on EGMs	Change between self reported measure (past 12 months) and observed data in the laboratory	Past 12 months; end of gambling session
	16	Perceived behavioural	Participant's perceived	Assessed at the end to the gambling

		effectiveness of prevention pop-up messages	effectiveness of prevention pop-up messages on modifying their gambling behaviour during the gambling session. Evaluated with two 7-points Likert scale about the perceived effects of the prevention pop-up messages on money betted and time spent during the gambling session (1 = "lowered gambling behaviour a lot" to 7 = "heightened gambling behaviour a lot").	session
Emotions				
	17	General level of fun while gambling on EGMs	Participant's general enjoyment of gambling on EGMs over the gambling session's total duration. Evaluated with a 7-points Likert scale (1 = "I hated it" to 7 = "I loved it").	Assessed at the end to the gambling session
	18	Change in general level of fun while gambling on EGMs	Change between self reported measure (past 12 months) and observed data in the laboratory	Past 12 months; end of gambling session
	19	Psychological reactance to prevention pop-up messages (between group)	Evaluated based on the Dillard & Shen (2005) method: (a) Induction check (4 items, 7-points Likert scale, 1 = "Strongly disagree, 7 = "Strongly agree"); (b) Anger (4 items, 7-points	Assessed at the end to the gambling session

			Likert scale, 1 = "Strongly disagree, 7 = "Strongly agree"); (c) Cognitive response (count of negative thoughts in relation to the pop-up messages); (d) Attitude (7 word pairs, 7-points semantic differential scale).	
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Secondary Outcome

Table 4. Secondary outcome measures

	Outcome n°	Outcome	Description	Measurement time points
Feasibility Recruitment potential –				
	20	Volunteers	Number of people that answered the recruitment ad and wanted to either participate or get more information on the study.	NA
	21	Recruited	Number of people that qualified and agreed to participate in the study.	NA
	22	Rejected	Number of people that volunteered to participate but didn't qualify according to the inclusion/exclusion criteria.	NA
	23	Refusal	Number of people that qualified for participation in the study but refused to do so after hearing the details of it.	NA

	24	Refusal reasons		NA
	25	Attrition	Number of people that qualified and agreed to participate in the study but desisted during their participation.	NA
	26	Attrition vs previous study	Conversion from recruitment list from a previous study	NA
Feasibility – Perceived realism				
	27	Gambling location type most resembling the session in the laboratory	Among a predetermined list of gambling location type (e.g. bar/restaurant, casino, etc.), participant choose which the gambling session in the laboratory resembled the most.	Assessed at the end to the gambling session
	28	Session in the laboratory VS gambling on EGMs in a bar/restaurant	Level on resemblance between a gambling session on EGMs in a bar/restaurant and the gambling session in the laboratory. Evaluated with a 7-points Likert scale (1 = "Almost 100 % different" to 7 = "Almost 100 % the same").	Assessed at the end to the gambling session
	29	Similarities between session in the laboratory VS gambling on EGMs in a bar/restaurant	Things that were the same or very alike when comparing a gambling session on EGMs in a bar/restaurant and the gambling session in the laboratory.	Assessed at the end to the gambling session

			Participant lists all resemblances that come to their mind.	
	30	Differences between session in the laboratory VS gambling on EGMs in a bar/restaurant	Things that were not the same or very not alike when comparing a gambling session on EGMs in a bar/restaurant and the gambling session in the laboratory. Participant lists all differences that come to their mind.	Assessed at the end to the gambling session
	31	What could be done to heighten realism of the session in the laboratory	Things or aspects of the study that be changed in order for the gambling session in the laboratory to be more alike a real gambling session on EGMs in a bar/restaurant. Participant lists all that come to their mind.	Assessed at the end to the gambling session
	32	Effect of using one own money on realism	Effect of gambling one own money in this study on the level of realism. Evaluated with a 7-points Likert scale (1 = "It lessened the realism a lot" to 7 = " It heighten the realism a lot ").	Assessed at the end to the gambling session
	33	Effect of using one own money on realism (open-ended)	Effect of gambling one own money in this study on the level of realism. Participant freely explain their perception of said effect.	Assessed at the end to the gambling session
	34	Perceived correspondence	Participant's perception of how	Assessed at the end to the gambling

		between habitual gambling behaviour and gambling behaviour during the session in the laboratory	much their gambling behaviour during their gambling session in the laboratory was representative (i.e. how much it was the same) of their gambling behaviour on EGMs in the past 12 months. Evaluated with a 7-points Likert scale (1 = "Almost 100 % different" to 7 = "Almost 100 % the same").	session
	35	Perceived correspondence between habitual gambling behaviour and gambling behaviour during the session in the laboratory (open-ended)	Participant's perception of how much their gambling behaviour during their gambling session in the laboratory was representative (i.e. how much it was the same) of their gambling behaviour on EGMs in the past 12 months. Participant freely explain their perception.	Assessed at the end to the gambling session
Feasibility Duplicity check	–			
	36	Protocol credibility	Participant's level of certitude they were betting their own money and that they could lose money for real during the study. Evaluated with a 7-points Likert scale (1 = "Almost 100 % certain they were going to get their money back at the end of the study" to 7 = "Almost 100 %	Assessed at the end to the gambling session

			certain winnings and losses were real").	
	37	Protocol credibility (open-ended)	Participant comment freely on their level of certitude that they were betting their own money and that they could lose money for real during the study.	Assessed at the end to the gambling session

Other outcomes

Table 5. Other outcome measures

	Outcome n°	Outcome	Description	Measurement time points
Recall				
	38	Free recall (Y/N)	Participant is asked if they saw any prevention pop-up messages during their gambling session in the laboratory. This is a Yes/No question.	Assessed at the end to the gambling session
	39	Free recall (number)	If participant declared they saw prevention pop-up messages during their gambling session in the laboratory, they are asked how many there were. The same message presented twice count as "2".	Assessed at the end to the gambling session
	40	Free recall (content)	If participant declared they saw prevention pop-up messages during their gambling session in the laboratory, they are asked to freely	Assessed at the end to the gambling session

			describe them (i.e. content, graphical appearance, etc.).	
	41	Cued recall (Y/N)	Participant is presented with a list of prevention pop-up messages that could have been shown during the study. For each of them, they are asked to identify if they saw it or no.	Assessed at the end to the gambling session
	42	Cued recall (number)	If participant declared they saw prevention pop-up messages during their gambling session in the laboratory, they are asked how many there were. The same message presented twice count as "2". This is different from Outcome 39 because, participant might recognize a message they had forgotten about or a message they saw but didn't considered it a "prevention message".	Assessed at the end to the gambling session

Statistical methods

Sociodemographic variables, past 12 months gambling related variables and PGSI category will be presented in a table with appropriate central tendency estimates. This table will be divided by assignation group.

Three statistical models will be used to analyse the outcomes presented in Tables 3–4. All these models will control for the gains/losses ratio and will test the moderation effect of the following variables: Gender (M, F); Age (continuous); Education (five categories); PGSI category (non-problem, low risk, moderate risk). Holm-Bonferroni correction [32] will be used to counteract the family-wise error rate due to multiple comparisons whenever required.

The first model uses ANCOVAs to examine the differences between the two groups at the end of the gambling session on outcome variables 1, 3, 4, 6–9, 14, 16, 17, 19 separately.

The second model uses repeated measures ANCOVAs to examine the differences between the two groups at specific time points during the experiment corresponding to the presentation of the prevention pop-up messages in the experimental group. This model is computed on outcome variables 1, 10–13 separately.

The third model uses repeated measures ANCOVAs to examine the differences between self-reported measures (past 12 months) and the observed behaviours during the experiment. This model is computed on outcome variables 2, 5, 15, 18 separately.

Secondary and other outcomes will be documented but not statistically compared. Descriptive estimates will be provided for each quantitative variable. Open-ended questions will be analysed in a manner inspired by the thematic analysis method (Textbox 2) [33].

Textbox 2. Five steps in analysis of open-ended questions

1. Interviewer's notes are regrouped in a Microsoft Word document.
2. Raw data is carefully read, both by main author and another member of the research team, to extract categories of similar content.
3. Categories are refined by both coders
4. Raw data is independently categorised in appropriate categories by both coders
5. Inter-coder agreement is calculated on all the categorisation to ensure reliability.

Discussion

Ethic considerations

This study does not expose participants to a higher level of risk than what they already do by themselves. Participants regularly engage in gambling on EGMs in their everyday lives. In the context of the study, participants are provided with the same incentives to gamble, but nothing is done to exacerbate these behaviours (e.g. altering the EGMs' payout rate, offering loans to gamble, etc.). On the contrary, 50% of the participants are provided with prevention messages and any money lost while gambling is reimbursed at the end of the session. Also, because this study is conducted in a psychology laboratory, people on site can provide crisis support should a participant feel unwell after a significant loss. This kind of support is not usually available where EGMs are situated. Finally, we chose to not recruit particularly vulnerable gamblers (i.e. people trying to reach or maintain abstinence). Nevertheless, those protections, the ethics committee felt that probable pathological gamblers should also be excluded from the study.

Study Strengths and Limitations

This study's main strengths are the use of a highly realistic setting for the gambling session and the use of duplicity to make participants believe that they are risking their own money. Moreover, the maximal possible gain (\$500) is sufficiently high to elicit an incentive to gamble seriously even though the (perceived) level of risk. This level of realism has seldom been achieved in a laboratory setting.

Another strength is the diversity of outcomes observed. More specifically, the use of open-ended questions on multiple aspects heightens the chance to be able to interpret unexpected results.

On the other hand, limitations include potential difficulties in recruiting enough participants. For one, regular EGMs gamblers do not constitute a relatively small population where this study is conducted. Moreover, being a regular EGM player significantly overlap with probable pathological gambling [34, 35], which the ethics committee prohibits us to recruit.

Another limitation is the impossibility of programming the same sequence of gains and losses for all participants. This is due to hardware limitations on the EGM. While randomness should provide balance between both groups, there is always the possibility that one group is significantly "luckier"

than the other, which could limit the ability to observe an effect.

Finally, it is possible that the protection effect from pop-up messages is best observed over repeated exposition over multiple sessions. A single gambling session might not be enough to observe the full effect.

Conclusion

This study will provide new insights on the efficacy of pop-up messages as a prevention measure for gambling.

Acknowledgments

Authors' Contributions

This study is realised in the context of BG's doctoral thesis. BG designed the trial, formed the assistants and supervised data collection. IG and SV are BG's supervisor and provided significant input at every step of the study. CJ also provided significant input at every step of the study. All the authors discussed, read, and revised the manuscript. The final manuscript for this protocol was approved by all authors.

Ethical approval

This study was approved by the Comités d'éthique de la recherche avec des êtres humains de l'Université Laval (CÉRUL; reference n° 2020-076 A-1 / 27-05-2024).

Funding

Funding for the study was mainly provided by the Fonds pour la prévention et le traitement du jeu de l'Université Laval. The fund's mission is to promote and financially support clinical and research activities of the Centre québécois d'excellence pour la prévention et le traitement du jeu (CQEPTJ) to which all authors are affiliated. The Fonds de recherche du Québec - Société et culture also contributed to funding via a research team grant (Soutien aux équipes de recherche / Universitaire – renouvellement; Title: Jeux de hasard et d'argent: Mieux comprendre pour mieux intervenir) for the 2020/4 – 2024/3 period. Isabelle Giroux is the lead investigator for this grant and Serge Sévigny is among the co-researchers.

Constraints on publishing

The authors declare no constraints on publishing.

Competing interests

Benjamin Galipeau was awarded a three-year scholarship as a doctoral student from the Fonds de Recherche du Québec – Société et culture for 2018-2020 (Actions concertées – Bourse doctorale sur le jeu responsable).

Isabelle Giroux has received research funding from: Centre Dollard-Cormier - Institut universitaire sur les dépendances (Québec, Canada); Conseil de Recherches en Sciences Humaines du Canada (Canada); Fonds de recherche du Québec - Société et culture (Québec, Canada); Fonds pour la prévention et le traitement du jeu de l'Université Laval (Québec, Canada); Ministère de la Santé et des Services sociaux (Québec, Canada); Santé Canada (Canada).

Serge Sévigny has received research funding from: Fonds de recherche du Québec - Société et culture (Québec, Canada); Ministère de la Santé et des Services sociaux (Québec, Canada); Santé Canada (Canada).

Christian Jacques has no conflicts of completing interests to declare.

While not directly related to this manuscript, Loto-Québec (LQ), the state-owned gambling operator

for the province of Québec (Canada) is lending, free of charges, EGMs to use in laboratory studies at the Centre québécois d'excellence pour la prévention et le traitement du jeu (CQEPTJ) to which all authors are affiliated. LQ also provides technical support for the EGMs through Moneris, a third-party provider. This loan is made without any scrutiny rights from LQ. LQ can not and does not: (1) suggest study designs or research ideas; (2) intervene in or comment on ongoing studies; (3) intervene in or comment on manuscripts; (4) get a firsthand look on pre-print manuscripts; (5) get privileged access to research results. All talks with Moneris have always been strictly about the technical side of using the EGMs in the laboratory (e.g., maintenance on broken modules, tutorial on usage of the EGMs utilities, etc.).

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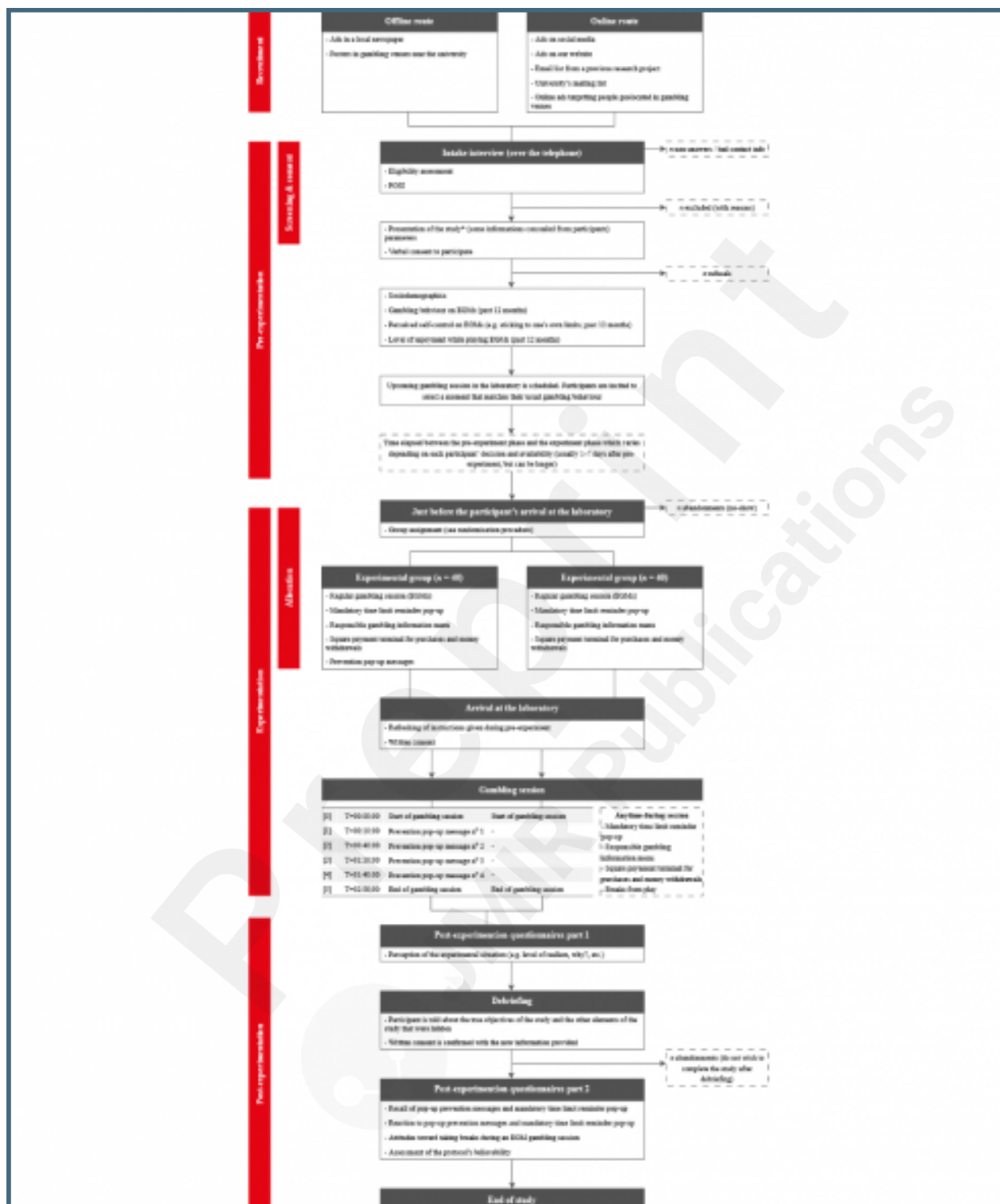
Available from: <https://hdl.handle.net/10133/3641>.



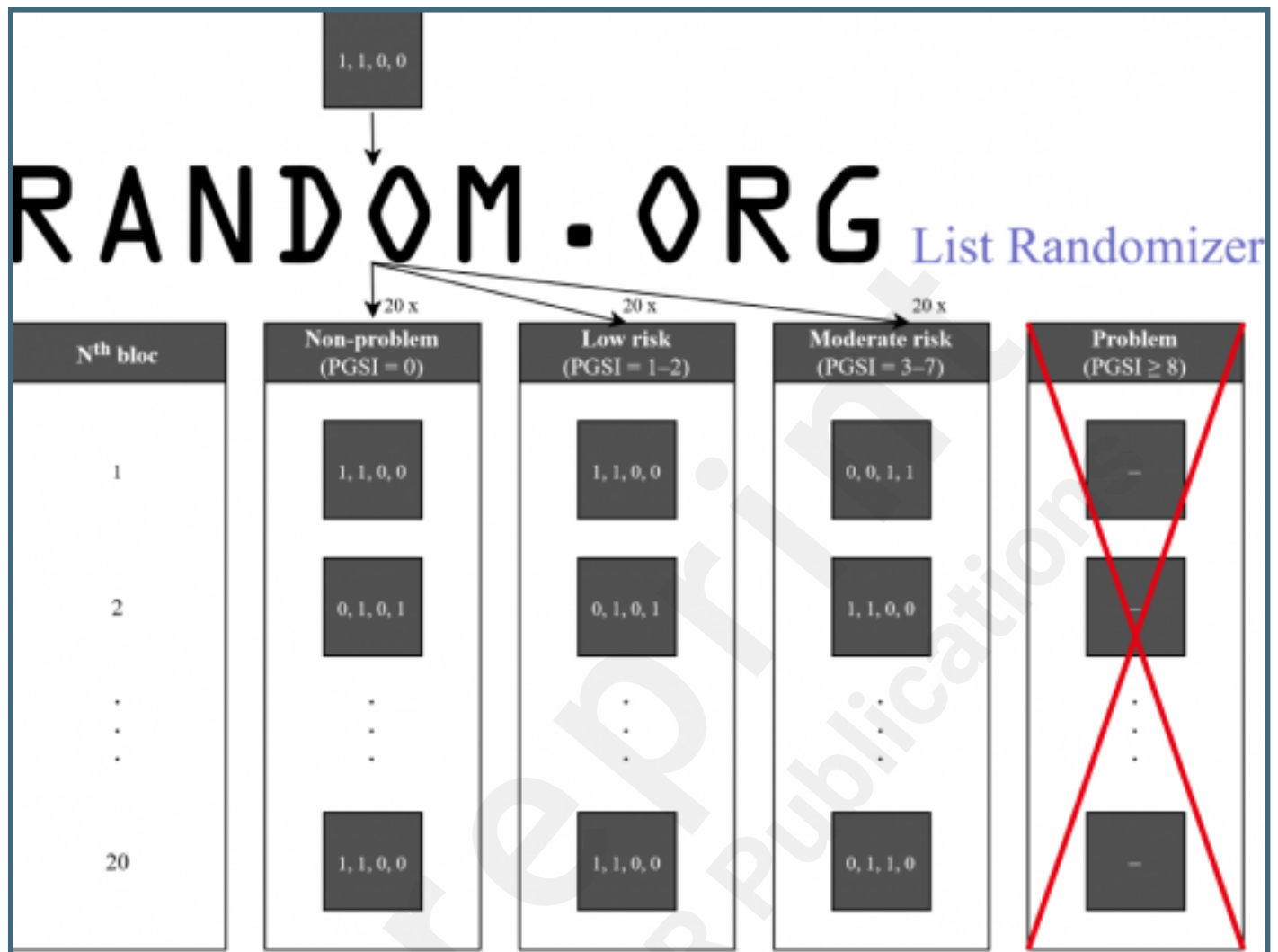
Supplementary Files

Figures

Schematic overview of the two-arm stratified block randomised controlled trial.



Randomisation procedure.



Allocation procedure.

	Non-problem gamblers (PGSI = 0)		Low risk gamblers (PGSI = 1–2)	
N th bloc	Condition ^a	Participant	Condition ^a	Participant id
1	1	10659	1	10547
	1	10855	0	10889
	0	10222	0	
	0	10987	1	
2	0		1	
	1		0	
	1		1	
	0		0	

 - 1st non-problem participant to visit the laboratory was assigned to the experimental condition

 - 2nd low risk participant to visit the laboratory was assigned to the control condition

 - Next low risk participant to visit the laboratory will be assigned to the next available spot (control condition)

 - Bloc n° 1 is full
 - Filling of bloc n° 2 starts for non-problem participants
 - Next non-problem participant to visit the laboratory will be assigned to the next available spot (control condition)

Bar environnement – Electronic gambling machines and lounge.



Bar environnement – Bar paraphernalia and music TV.



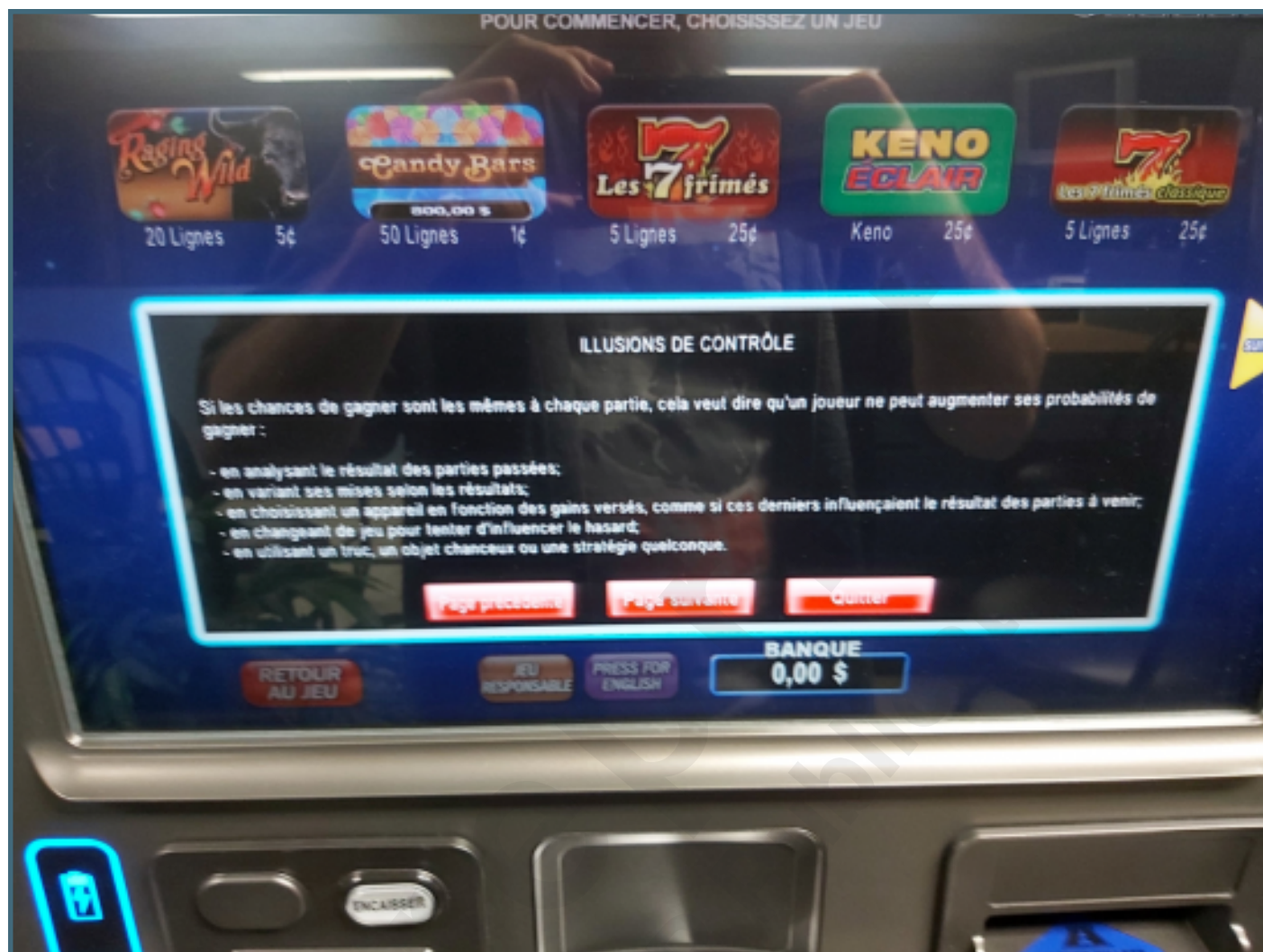
Observation post.



Mandatory time limit reminder.



Responsible gambling information.



Prevention pop-up message as displayed on the EGM.



Multimedia Appendixes

Bar environment.

URL: <http://asset.jmir.pub/assets/08c33e14bf3df1d66c8ec92e6a1579b5.pdf>

Responsible gambling information.

URL: <http://asset.jmir.pub/assets/a4207ffc0b1ede7cfd44821c36e6f524.pdf>

Prevention pop-up messages.

URL: <http://asset.jmir.pub/assets/7ae5eeb86879f46b2351a7bd3b1f5b3e.pdf>

