Brazilian Journal of Psychiatry
bjp
Revista Brasileira de Psiquiatria
Brazilian Psychiatric Association
Fully open access
No APCs

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(article published as accepted)

Original Article

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http://doi.org/10.47626/1516-4446-2025-4662

Submitted: 21-Oct-2025

Accepted: 18-Jun-2026

This is a preliminary, unedited version of a manuscript that has been accepted for publication in the Brazilian Journal of Psychiatry. As a service to our readers, we are providing this early version of the manuscript. The manuscript will still undergo copyediting, typesetting, and review of the resulting proof before it is published in final form. The final version may present slight differences in relation to the present version.

# Gambling disorder and problem gambling in Brazil: The development of a brief screening scale

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## Abstract

**Background**: Brief, accurate, and context-sensitive screening tools are essential for detecting gambling-related problems, but most existing instruments are not validated for on-site gambling.

**Objectives**: This study aimed to estimate the prevalence and patterns of Gambling Disorder (GD) and problem gambling among Brazilian lottery players and to develop and test a concise screening tool optimized for this on-site context.

**Methods**: A multistage, stratified sampling design recruited 5,407 adult gamblers at 494 lottery kiosks. Participants completed a version of the NODS adapted to DSM-5 criteria. Using an exhaustive combinatorial approach, all 2–4-item subsets from the NODS were tested for sensitivity and specificity.

**Results**: Three combinations emerged as optimal. A three-item version (control, coping, chasing) showed the best balance for detecting problematic gambling (sensitivity = 96.5%), while a four-item version reached high specificity for GD (96.2%). All combinations outperformed the widely used NODS-CLiP.
**Conclusions**: The study introduces the “3-Cs screener,” a novel, ultra-brief tool for on-site lottery players. Its high diagnostic accuracy makes it a promising candidate for prevention and intervention strategies, though further validation in clinical and digital settings is warranted.

## Introduction

Gambling is a widespread and culturally ingrained activity, with most people gambling at least once in their lifetime[1]. Beyond those who meet clinical criteria for Gambling Disorder (GD), a larger group experiences persistent gambling-related harms that do not reach the GD threshold, commonly referred to as problem gambling. This subthreshold group is more prevalent and represents a key target for prevention and early intervention[2]. Therefore, early identification of individuals at risk is crucial, which makes brief screening tools essential in real-world settings. Nonetheless, most existing instruments were developed for general population surveys and have not been validated for on-site use among active gamblers. Moreover, some of these instruments fail to adequately differentiate between problem gambling and GD, underscoring the need for brief, accurate, and context-sensitive screening[3]. For the sake of conceptual clarity, this report will use the terms "problem gambling" and "problem gamblers" to refer to individuals who experience persistent gambling issues but do not meet the criteria for GD. The term "problematic gambling" will be used to address a broader category that includes both individuals who meet some or all the criteria for GD, encompassing both problem gamblers and those with GD[4].

Since 2018, Brazil has permitted fixed-odds betting, defined by predetermined returns on real or virtual events. In 2023, the regulatory framework was expanded to explicitly include online games (“online casinos”), producing the peculiar legal configuration in which online casino betting is permitted, whereas land-based gambling remains prohibited, with the exception of state lotteries. Poker tournaments and poker houses have operated under an

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ambiguous legal framework that neither explicitly criminalizes nor regulates the activity. Consequently, lottery products remain the predominant form of land-based gambling in Brazil, both in terms of user engagement and revenue [5] Legal lotteries are operated primarily by the federal bank CAIXA, which holds nearly 95% of the national lottery market, estimated at approximately US$5.1 billion in revenue in 2024. CAIXA's portfolio includes large-scale jackpot draws (e.g., Mega-Sena, drawn twice weekly), daily draws (e.g., Quina), and instant-win scratch tickets, which had been out of operation for nearly a decade due to legal and administrative challenges but have only recently returned to the market [6]. With ticket prices starting as low as US$ 1.00, these games are highly accessible to all socioeconomic groups. These products are sold through an expansive network of retail kiosks known as "CAIXA's Lottery Kiosks" (CLKs) located in nearly all municipalities. Since these kiosks are operated as correspondents for the federal bank, they offer not only gambling products but also a wide array of essential banking and payment services. This dual function results in a ubiquitous, high-traffic environment that is deeply integrated into Brazilian daily life, making these units a strategic setting for prevention and screening initiatives. However, little is known about the prevalence and profile of GD and problem gambling specifically among Brazilian lottery players. A survey in the general population estimated lifetime prevalence of GD and problem gambling at 1.0% and 1.3%[7]. Yet, studies indicate that even when lotteries are not the preferred gambling form, they remain common among individuals seeking treatment for GD in Brazil[8]. Moreover, international data confirm that lotteries are the most favored form of gambling worldwide, with participation rates of 7.8% among adults and 10.3% among adolescents[9]. Within the Brazilian context, the federal lottery network represents a unique convergence point through which frequent gamblers can be reached for both preventive interventions and the assessment and referral of individuals with gambling-related problems.

The first widely used screening instrument for problem gambling was the South Oaks Gambling Screen (SOGS), originally developed to assess gambling problems among treatment-seeking individuals with substance use disorders. However, SOGS lacks the brevity required for rapid screening and has been shown to overestimate the prevalence of GD when applied to general

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population samples[10]. In response to these limitations, more recent screening tools have been developed, typically consisting of two to four items and designed for use in population-based settings[3]. However, a remaining challenge in this context is that the prevalence of gambling-related problems among regular lottery bettors is likely higher than in the general population, which may require recalibration of screening thresholds to accurately identify both GD and subsyndromal presentations[11].

Aiming to address this gap, the present study pursued two main objectives: first, to develop a brief screening tool specifically optimized for the on-site identification of both problematic gambling and GD within this unique context; and second, to estimate the prevalence of gambling-related problems in a large, nationally representative sample of adult lottery customers recruited at CLKs.

## Methods

The study was a cross-sectional population based multi-stage interview of a representative sample of visitors to CLKs in Brazil. There are approximately 13,500 CLKs throughout the country[6]. Prior to initiating the fieldwork, we first conducted four pilot tests consisting of 149 interviews to estimate the average length and to identify potential concerns regarding the phrasing of the questions. After each pilot test, the survey was revised to make it as succinct and clear as possible in order to increase participation and minimize participant drop-out. All interviews were conducted by third party company specializing in large scale surveys. To ensure inter-rater consistency across the 494 locations, we employed a tiered training model in which a core group trained the rest of the field team using a standardized protocol. Furthermore, as a quality control measure, a random subsample of 100 interviews was audited via telephone follow-up, demonstrating an acceptable concordance index with the original on-site reports. Participant flow is summarized in Figure 1.

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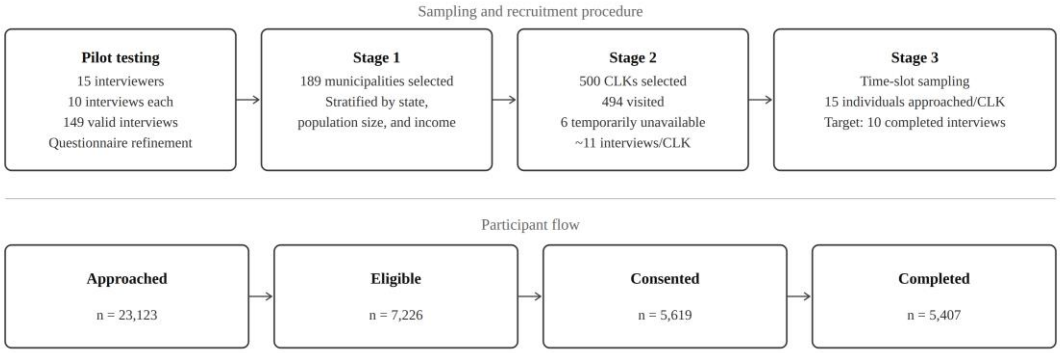



**Figure 1.** Study design and participant flow.
*CLK = CAIXA's Lottery Kiosk.*

Figure 1 Study design and participant flow. CLK = CAIXA's lottery kiosk.

## Sampling Design

The sampling strategy was designed to ensure a representative sample of the Brazilian population, 18 years old or older, both men and women who normally gamble on lotteries from all regions of Brazil. The sample was structured by stratified conglomerates and was selected in three stages, following the pattern of probabilistic selection[12]. The first stage consisted of a stratified selection of municipalities with at least one CLK. These municipalities were then explicitly segmented by state, population size, and implicitly by income, before a systematic selection was conducted, where the first municipality was selected randomly. The implicit stratification was achieved by sorting municipalities by income within the explicit strata, resulting in the selection of 189 municipalities. Within the 189 municipalities, CLKs were then selected systematically, with random selection of the first CLK, which was implicitly stratified by the revenue related to the most popular lottery game in the previous month. By using the revenue from a standard month as a proxy, the sampling design ensured that the selection reflected the typical operational flow of the kiosks, effectively capturing regular gamblers and minimizing the influence of seasonal outliers or atypical lottery events. Data collection was deliberately conducted on weekdays preceding lottery draws without jackpot rollovers, in order to minimize the inclusion of occasional or atypical bettors.

Within each municipality, which were the primary sampling units (PSU), the number of CLKs selected was proportional to the number of CLKs in the municipality with a minimum of two CLKs per municipality to allow for variance

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estimations. In cases where the municipality only had one CLK, the PSU for analysis was considered to be a grouping of two municipalities closest in the sampling frame (i.e., similar region and size).

**Sample Size and Selection of Gamblers**

The sample size target was calculated with the goal of representing all lottery players who purchased at least one lottery ticket at CLKs during the period of data collection. Furthermore, the sample size was calculated to achieve +/-2% error on estimating the prevalence of GD, using a 95% confidence interval. To this end, a prevalence of 10% of GD was assumed based on the only epidemiological study of gambling in Brazil that was available when the study was being conducted[7]. This resulted in a targeted sample of 1,000 individuals. However, an adjustment to the sample size was necessary to account for the inflation in the variance caused by the sample clustering, known as design effect. In a previous unpublished household survey of lottery players, using a three-stage sample (municipalities, neighborhoods and respondents), the effect of the sample design over binary variables with frequencies around 10% was estimated to be around 4. That said, we considered a sample design effect of 5 as the present study used CLKs instead of neighborhoods as the intermediary stage. This resulted in an increase in sample size target from 1,000 to 5,000 participants.

Based on the above sample size calculation, 500 CLKs were selected with the goal of 10 completed responses per CLK. Generally, the selection of interviewees in this type of scenario occurs in a systematic way with a defined skip. However, this was not possible for the present research as the total number of gamblers who visit CLKs was not known. Therefore, we chose to conduct the interviews at pre-defined times of the day. Specifically, the first lottery player to enter the CLKs after a predetermined time (i.e., 8:10, 8:40, 9:10, 9:40 etc.) were interviewed. These schedules were pre-defined according to the hours of operation of each CLK. In order to ensure 10 completed responses,15 lottery players were selected per CLK, based on a non-response rate of 30%, which was estimated from our pilot interviews. If the individual was not eligible, the next lottery customer was interviewed. Exclusion criteria were difficulty in understanding the questionnaire, difficulties with communication

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(individuals with speech and/or hearing problems), or unwilling to be part of the research by not signing the informed consent form. As the sample was probabilistic, cases of refusal were considered as a valid selection with no response and there was no substitution. To obtain a precise demographic profile of eligible participants, the interviewers were instructed to complete a nonresponse questionnaire for individuals who refused, recording perceived gender, estimated age, ethnicity, time and date of refusal and CLKs for post-hoc adjustments.

**Procedure**

Since the lottery kiosks are owned by the Federal Bank, they offer not only betting services, but also a variety of banking services. Thus, in approaching potential participants, the interviewer made sure that the person waiting in line was there to purchase a lottery ticket using the following standardized script: "Good morning / Good afternoon, if you are here today to buy a lottery ticket, we would like to invite you to be part of a research conducted by the University of São Paulo in partnership with CAIXA, assessing gambling behaviors. If you agree to participate, you will not have to stand in line. We will take you directly to the register after the interview. The duration of the interview is 15 minutes on average. You do not have to identify yourself and your answers are confidential". Lottery players who agreed to participate in the present study were taken to a private area to complete the interview. Importantly, no financial or material incentives were offered to respondents, and participation was entirely voluntary, with no impact on their ability to place bets or on their relationship with the lottery unit.

**Ethics**

The present research was funded by CAIXAs responsible gambling initiative to the senior author (H.T.). CAIXA had no role in the development of the survey and the University of São Paulo is the sole owner of the data and holds unrestrained reporting rights without previous consultation or interference from CAIXA. Ethical approval was obtained from the Faculty of Medicine University of São Paulo Research Ethics Board.

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## Measures

### Demographics

Data were collected regarding participants' demographic characteristics, including, gender, age, marital status, education, and employment status.

### Gambling assessment

The Brazilian adaptation of the National Opinion Research Center Diagnostic Screen for Gambling Problems (NODS) was used to classify participants using the DSM-5 criteria. The original NODS was developed by Gerstein et al.[13] as a screening tool to identify GD according to the DSM-IV criteria, with the aim of being used in clinical and population research. The NODS includes 17 items that are used to score the DSM-IV criteria and was selected in this study due to its specific methodological advantages. Other widely used alternatives, such as the SOGS, were developed prior to the DSM-IV and do not align with current diagnostic thresholds. Similarly, while the Problem Gambling Severity Index (PGSI) is a common choice for population surveys, it does not translate as automatically into the specific DSM-5 symptomatic criteria for GD as the NODS does.

Moreover, using the full item pool of the NODS, Toce-Gerstein and colleagues (2009) developed the Control, Lying, and Preoccupation gambling screen (NODS-CLiP)[14]. The authors evaluated combinations of two, three, and four NODS items in a community sample. A three-item combination assessing loss of control, lying, and preoccupation demonstrated the highest sensitivity (0.99) and specificity (0.88) for identifying pathological gambling, as defined by DSM-IV criteria, when compared with the full NODS. Accordingly, by adopting the NODS as the reference instrument, we were able to directly compare the performance of the newly developed screening tool with that of the NODS-CLiP.

In the present research lottery players were classified in the following categories based on the number of DSM-5 symptoms reported for each period: social (0), at risk (1), problem (2-3), and disordered (4+) gamblers. The prevalence for these categories were then estimated by calculating the weighted proportion of individuals who met the criteria for these categories within two time-frames: lifetime and past-year (based upon GD symptoms experienced in the last 12 months)[1].

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**Data Analytic Plan**

Prior to analysis, the data were weighted with the inverse of the selection probability for each respondent. The selection probability of an individual in a CLK is given by the number of individuals selected divided by the total number of individuals that entered the CLK to buy a lottery ticket during the day of the field work. The total number of individuals was estimated by the number of tickets sold in the CLK divided by the estimate of average number of tickets per individual, where, to decrease variability, we estimated the average number of tickets over the region where the CLK was located. The selection probability of the individual within the CLK was then multiplied by the probability of the selection of the CLKs within the municipality, and of the municipality within the strata. A post-hoc sensitivity analysis confirmed that the number of tickets purchased was not significantly associated with gambling severity, supporting the validity of the weighting proxy used. In another post-hoc sensitivity analysis, we did not find a statistically significant association between gambling status (i.e. social, at-risk, problem and disordered gambling according to the NODS) and time of arrival at the CLKs. Thus, we did not apply a specific weight to adjust for the time of day for completed interviews. An additional non-response post-stratification layer of weights were considered to determine whether demographic differences existed between lottery players who refused to participate in the study compared to those participated. The analyses found that the two groups did not differ, and thus a decision was made not to apply post stratification weights to adjust for interview refusal. Missing data for the NODS items were negligible, and only complete cases were included in the final analysis.

Weighted prevalence estimates for at-risk, problem, and disordered gambling were calculated as the proportion of participants meeting the respective DSM-5 criteria thresholds within both the past-year and lifetime timeframes.

The data analysis for the development of a brief screener was based on the same methodology used to develop the NODS-CLiP[14], using the full 17-item NODS (DSM-5 version). We evaluated all unique 2–4-item subsets from the NODS and, across outcomes/timeframes/decision rules, conducted 19,176 screening-rule evaluations to compare sensitivity, specificity, and the Youden

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Index. While multivariate techniques such as linear discriminant analysis or logistic regression can identify informative items, we prioritized an exhaustive combinatorial approach to ensure the final tool maintained the binary (yes/no) scoring format essential for rapid on-site screening, while directly optimizing for the highest possible sensitivity to identify problematic gambling. The analytic procedure used for screener development is summarized in Figure 2.

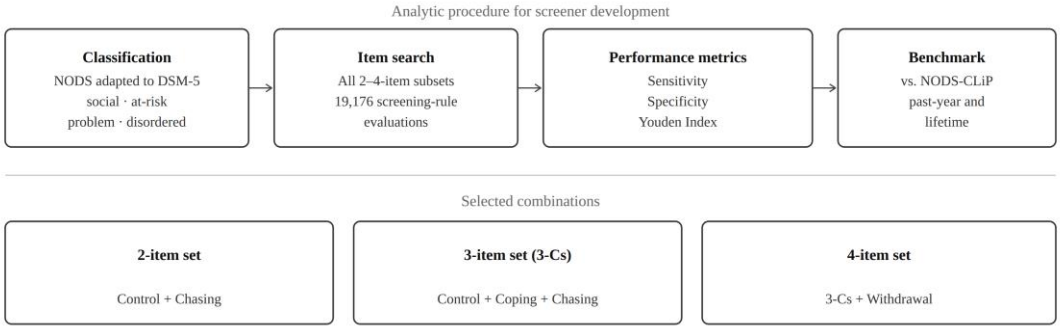



**Figure 2.** Analytic procedure for screener development.
*GD = Gambling Disorder. NODS-CLiP = Control, Lying and Preoccupation scale.*

**Figure 2** Analytic procedure for screener development. GD = gaming disorder; NODS-CLiP = Control, Lying, and Preoccupation scale.

We also tested problematic gambling as sub-threshold levels of GD (i.e., problem gambling) given its importance to researchers and clinicians[15]. As the aim of the screening instrument was to identify people who may be currently experiencing problematic gambling, we selected combinations of two, three and four items with the highest sensitivity for identifying GD diagnosis in the past-year. Next, we selected the item combinations with the highest specificity for GD in past-year. If a tie remained, then we would choose the combination that performed better on the identification of lifetime GD. Finally, we calculated the Youden Index (sensitivity+specificity-1) of all the selected combinations to compare the balance between sensitivity and specificity and the general performance of the item combinations[16],[17]. As a further investigation into the gambling classification from the DSM-IV to the DSM-5, we checked the frequency of endorsement to NODS item addressing the illegal acts criterion.

For weighted prevalence estimates, we used the R statistical environment, which calculates variances through Taylor series linearization under the

assumption of sampling with replacement[18]. For the remaining unweighted analyses, we used GNU PSPP, a free and open-source alternative to IBM SPSS Statistics[19].

## Results

In total, 23,123 individuals were approached, of whom 7,226 were eligible (i.e., they were at CLKs primarily to gamble on lotteries). Of the 7,226 eligible individuals, 5,619 agreed to participate and 5,407 completed the interview, resulting in a refusal rate of 25.2%. Of the 500 CLKs initially chosen, data were collected from 494. The six CLKs in which interviews were not completed were temporarily unavailable (e.g., closed on the interview day), yielding an average of 11 completed interviews per CLK (see Figure 1 for the participant flow and sampling/recruitment overview).

### Gambling rates among Brazilian lottery players

The past-year prevalence of at-risk gambling, problem gambling, and GD were 17.7% (SE = 0.9%), 10.7% (SE = 0.8%), and 4.1% (SE = 0.5%), respectively. Lifetime prevalence rates were 19.4% (SE = 1.0%) for at-risk gambling, 13.1% (SE = 0.8%) for problem gambling, and 6.8% (SE = 0.7%) for GD. Ninety-five percent confidence intervals (95% CIs) for all prevalence estimates and symptom frequencies are provided in Table 1. Additionally, 39.2% (SE = 1.6%) of lottery players reported at least one DSM-5 diagnostic criterion in their lifetime, and 32.6% (SE = 1.6%) in the past-year. The most frequently endorsed symptom of GD was preoccupation with gambling (18.8%), followed by gambling to cope with negative emotions (12.2%) and chasing (8.4%). The least endorsed symptoms were interpersonal harms (0.7%), financial consequences (1.5%), and tolerance (3.7%). Among players meeting criteria for GD, the most endorsed symptoms were gambling to escape negative emotions (85.7%), followed by preoccupation (79.9%) and chasing (75.3%) (see Table 1).

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**Table 1.** Weighted prevalence of at-risk gambling, problem gambling, and gambling disorder (GD), and endorsement of DSM-5 symptoms among Brazilian lottery players (n = 5,407). *Values are weighted % (SE) with 95% confidence intervals (CIs) in brackets.*

| DSM-5 criteria | % of endorsement by gambling category (SE) | | | |
|---|---|---|---|---|
| | **At Risk Gambler** | **Problem Gambler** | **Gambling Disorder** | **Total Sample** |
| Tolerance | 10.0% (1.6) | 13.6% (2.8%) | 11.4% (3.5%) | 3.7% (0.5%) |
| Withdrawal | 7.7% (2.1) | 26.4% (4.1%) | 69.1% (5.2%) | 7.0% (1.0%) |
| Loss control over gambling | 4.9% (1.2) | 24.2% (3.3%) | 63.7% (5.8%) | 6.10% (0.8%) |
| Preoccupation | 46.9% (3.1) | 66.8% (2.7%) | 79.9% (3.9%) | 18.8% (1.3%) |
| Gambling to escape negative emotions | 17.7% (3.0) | 51.2% (3.3%) | 85.7% (3.5%) | 12.2% (1.1%) |
| Chasing losses while gambling | 8.2% (1.4) | 36.3% (2.9%) | 75.3% (3.9%) | 8.4% (0.7%) |
| Lying to conceal gambling | 4.0% (0.8) | 13.9% (1.9%) | 43.3% (6.3%) | 4.0% (0.5%) |
| Relationships jeopardized by gambling | 0.3% (0.2) | 1.5% (0.6%) | 12.8% (2.7%) | 0.7% (0.2%) |
| Indebtedness caused by gambling | 0.4% (0.2) | 3.5% (1.00%) | 26.1% (3.8%) | 1.5% (0.2%) |

**Note.** Estimates account for the complex multistage sample design using Taylor series linearization (Complex Samples). DSM-5 categories: social (0), at-risk (1), problem (2–3), disordered (≥4) symptoms. Abbreviations: GD = Gambling Disorder; SE = standard error; CI = confidence interval.

Regarding illegal acts, 0.9% (SE = 0.5%) of lottery players with problem gambling and 4.0% (SE = 1.5%) of those with GD endorsed the illegal-acts criterion in their lifetime, while 0.4% (SE = 0.4%) of players with problem gambling and 2.1% (SE = 0.8%) of those with GD endorsed it in the past-year. Corresponding 95% CIs are reported in Table 1.

## Development of a brief screening instrument

Three combinations consisting of two, three, and four items were identified as best for identifying lottery players with current GD. The analytic workflow leading to the selection of these combinations is summarized in Figure 2. The two-item set included lack of control (#4) and chasing (#10), while the three-item set added coping (#8). The four-item set comprised withdrawal (#5); control (item #7, contingent upon #4); coping (#9); and chasing (#10). Full operating characteristics (sensitivity, specificity, and Youden Index) are shown in Table 2.

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**Table 2.** Operating characteristics of brief screening combinations versus NODS-CLiP for identifying GD and problematic gambling (problem gambling + GD), past-year and lifetime frames.

| Items from NODS | | NODS-CLiP[a,b] | | Youden Index | Best 4-item combination[c] | | Youden Index | Best 3-item combination[d] | | Youden Index | Best 2-item combination[e] | | Youden Index |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Sens. | Spec. | | Sens. | Spec. | | Sens. | Spec. | | Sens. | Spec. | |
| Past-year | Gambling Disorder | 97.3% | 70.6% | 0.68 | 100% | 88.9% | 0.89 | 100% | 72.9% | 0.73 | 99.0% | 77.0% | 0.76 |
| | Problematic Gambling (problem + disordered gambling) | 90.2% | 77.9% | 0.68 | 77.7% | 96.2% | 0.74 | 96.5% | 73.9 | 0.70 | 83.0% | 83.8% | 0.67 |
| Lifetime | Gambling Disorder | 100% | 63.3% | 0.63 | 100% | 84.8% | 0.85 | 100% | 66.1% | 0.66 | 99.1% | 70.3% | 0.69 |
| | Problematic Gambling (problem + disordered gambling) | 95.2% | 70.5% | 0.66 | 80.7% | 92.1% | 0.73 | 95.2% | 70.5% | 0.74 | 87.0% | 77.0% | 0.64 |

[a] Control, Lying & Preoccupation scale
[b] NODS Items: #1, #4 and #11
[c] NODS Items: #5, #7, #9, #10
[d] NODS Items: #4, #8, #10
[e] NODS Items: #4, #10

Preoccupation: #1 – "Have there ever been periods lasting two weeks, or longer, when you spent a lot of time thinking about your gambling experiences or planning out future gambling ventures or bets?"

Loss of Control: #4 – "Have you ever tried to stop, cut-down, or control your gambling?"
#7 – "If so, have this happened three or more times?"

Withdrawal: #5 – "On one or more of the times when you tried to stop, cut down, or control your gambling, were you restless or irritable?"

Coping: #8 – "Have you ever gambled to relieve uncomfortable feelings such as guilt, anxiety, helplessness, or depression?"
#9 – "Have you ever gambled as a way to escape from personal problems?"

Chasing: #10 – "Has there ever been a period when, if you lost money gambling one day, you would often return another day to get even?"

Lying: #11 – "Have you ever lied to family members, friends, or others about how much you gamble or how much money you lost on gambling?

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Given that the combinations identified here differed from the original NODS-CLiP, we conducted additional analyses comparing our selected items with the NODS-CLiP to identify problem gambling and GD. Within the past-year timeframe, the two-, three-, and four-item sets exceeded the NODS-CLiP for GD screening. Within the lifetime timeframe, the NODS-CLiP was exceeded by the four- and three-item sets, while the two-item set performed similarly, all with higher Youden indices (see Table 2). For screening problematic gambling (problem gambling + GD), the three-item set had higher sensitivity for the past-year (96.5%) than all selected combinations, including the NODS-CLiP (90%). Lifetime performance of the three-item set was also high and similar to the NODS-CLiP (95.2%). Hence, the three-item set (control, coping, chasing) showed the best overall performance across combinations and outperformed the NODS-CLiP.

## Discussion

The main objective of this study was to develop a brief, context-sensitive screening tool and to estimate the prevalence of GD and problem gambling among Brazilian lottery players. Our results revealed prevalence rates of 4.1% for GD and 10.7% for problem gambling in the past-year. These figures are higher than those typically observed in household surveys but align more closely with studies conducted in gambling venues and online environments[20,21]. This discrepancy is largely explained by sampling differences; by approaching gamblers directly at lottery kiosks, we captured a population with significantly higher gambling involvement than the general public.

However, the 4.1% prevalence of GD is notably high when compared to other studies specifically involving lottery players, a group often characterized in the literature as being at lower risk for gambling-related harm. This suggests that the strategic location of lottery kiosks in Brazil, often doubling as banking service centers, may capture a unique profile of high-frequency players whose level of harm has been previously underestimated.

International research has shown that prevalence estimates vary substantially according to recruitment method and gambling type. Studies conducted in general population surveys usually report low prevalence, while

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samples drawn from gambling sites tend to detect higher proportions of problematic gamblers[15]. Our findings therefore highlight the importance of sampling location when interpreting prevalence data, and suggest that lottery kiosks may represent a strategic venue for identifying vulnerable individuals.

An additional cultural factor that may contribute to the higher prevalence of gambling-related problems in our sample is the widespread presence of *jogo do bicho*, an illegal but socially normalized gambling activity in Brazil. Unlike state lotteries, *jogo do bicho* offers multiple daily draws, accepts very small stakes, and is easily accessible through an extensive informal betting network[8]. These features increase betting frequency and opportunity for repeated engagement, which may in turn elevate gambling-related risk. Therefore, individuals recruited at lottery kiosks in Brazil may be embedded in a gambling ecosystem that is more intensive and accessible than that described in lottery-based studies from other countries. This contextual difference may partially explain why rates of problem gambling and GD were higher in our sample. For international readers, these findings underscore the importance of interpreting prevalence estimates within their local cultural and regulatory context.

When analyzing DSM-5 diagnostic criteria, our results showed that “preoccupation” was the most frequently endorsed symptom, including among at-risk gamblers, which limits its discriminative value. Conversely, harm-based criteria such as relationship problems or indebtedness were rarely endorsed, even among individuals meeting full GD criteria. This pattern suggests that harm-based indicators emerge later in the disorder trajectory and may not be ideal for screening purposes[3]. Instead, criteria reflecting subjective loss of control and the use of gambling to cope with negative emotions appear to be more useful as early markers. These findings are consistent with evidence from screening tools for substance use disorders, such as the Cut down, Annoyed, Guilty, and Eye-opener screen (CAGE) and the Alcohol Use Disorders Identification Test (AUDIT), which prioritize dimensions of loss of control and coping motives[22,23].

Another central finding was the consistent importance of “chasing losses.” Unlike loss of control and coping, which are transdiagnostic across addictions, chasing is a gambling specific behavior reflecting distorted cognitions and compulsive attempts to recover losses. International studies confirm its strong

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diagnostic specificity and its role in distinguishing problematic gamblers from non-problematic ones[24]. Together, these results support the selection of “control,” “coping,” and “chasing” as the most informative core items for brief screening.

The proposed three-item screener, the “3-Cs,” identified over 95% of individuals with past-year problem gambling. Adding a fourth item addressing withdrawal symptoms (“Cut”) increased specificity for GD to above 95%. Thus, a pragmatic approach would be to use the 3-Cs as a first-line screen, followed by the fourth question when diagnostic precision for GD is required. Both versions outperformed the NODS-CLiP in our analyses, suggesting superior balance between sensitivity and specificity.

Despite the promising results, some limitations should be noted. First, the study relied on self-report, which is susceptible to recall and social desirability biases. Second, recruitment occurred exclusively at land-based lottery kiosks, limiting generalizability to online players. Recent research suggests that online lottery gambling is associated with distinct patterns of risk and financial harm[25]. As gambling increasingly shifts to digital platforms, future studies should examine whether brief screeners perform consistently across modalities. Third, while the sample design ensured representativeness of kiosk patrons, it may not capture occasional players who purchase tickets elsewhere.

Nonetheless, this study has several strengths. It is the first large-scale, probabilistic survey of Brazilian lottery gamblers, covering multiple regions and socioeconomic groups. The sampling strategy ensured inclusion of both urban and rural settings, increasing external validity. Moreover, by systematically testing all possible subsets of NODS items, the study identified item combinations with strong empirical support rather than relying on theory alone. Finally, the proposed screener is brief, easy to administer, and specifically tailored to a highly prevalent form of gambling in Brazil.

In conclusion, our findings challenge the perception that lottery gambling is inherently low risk. Instead, they reveal a substantial subgroup of lottery players who experience significant gambling-related problems. By identifying a concise set of criteria with high diagnostic accuracy, this study provides a practical tool for early detection and prevention.

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## Conclusion

Our results challenge the widespread popular assumption that lottery gambling is necessarily low risk and that lottery players rarely experience gambling-related problems. Furthermore, rather than defining risk by the type of game, these findings reveal a subpopulation of problematic gamblers that is often overlooked, based upon core problematic gambling behaviors. While the current investigation cannot determine which specific type of game is primarily responsible for harm within this subgroup of problematic gamblers, it raises the possibility that lottery products may pose greater risks than previously assumed. By identifying a brief yet diagnostically powerful set of screening items, this study highlights the urgency of refining public health strategies to better detect and address gambling-related harms across different communities. Lottery kiosks, given their ubiquity and accessibility, emerge as strategic venues for implementing responsible gambling initiatives. Future research should validate the 3-Cs screener in clinical and online settings, and assess its predictive value in longitudinal designs.

We have no known conflict of interest to disclose.

**Funding:** Caixa Econômica Federal, (Grant / Award Number: )

**Edited by:** Thiago Henrique Roza

## References

1. Wardle, H., Degenhardt, L., Marionneau, V., Reith, G., Livingstone, C., Sparrow, M., Tran, L. T., Biggar, B., Bunn, C., Farrell, M., Kesaite, V., Poznyak, V., Quan, J., Rehm, J., Rintoul, A., Sharma, M., Shiffman, J., Siste, K., Ukhova, D., ... Saxena, S. (2024). The Lancet Public Health Commission on gambling. The Lancet Public Health. Advance online publication. https://doi.org/10.1016/S2468-2667(24)00167-1
2. Browne, M., & Rockloff, M. J. (2018). Prevalence of gambling-related harm provides evidence for the prevention paradox. Journal of Behavioral Addictions, 7(2), 410–422. https://doi.org/10.1556/2006.7.2018.41.

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3. Dowling, N. A., Merkouris, S. S., Dias, S., Rodda, S. N., Manning, V., Youssef, G. J., Lubman, D. I., & Volberg, R. A. (2019). The diagnostic accuracy of brief screening instruments for problem gambling: A systematic review and metaanalysis. Clinical Psychology Review, 74, 101784. https://doi.org/10.1016/j.cpr.2019.101784.
4. Calado F, Griffiths MD. Problem gambling worldwide: an update and systematic review of empirical research (2000-2015). J Behav Addict. 2016;5(4):592-613.
5. Cantusio MP, Couto R, Moscardini C. STAR: Impact of online gambling on Brazilian economy and sectors (Santander Thematic Alpha Research) [Internet]. Banco Santander; 2024 Out 22 [cited 2026 Feb 02]. Available at: https://bnldata.com.br/wp-content/uploads/2024/10/gambling-report.pdf.
6. CAIXA Loterias S.A. Relatório de administração e demonstrações contábeis: exercício 2024 [Internet]. Brasília: Caixa Econômica Federal; 2025 [cited 2026 Fev 02]. Disponível em: https://www.caixa.gov.br/Downloads/caixa-loterias-sa/Demonstracoes-Contabeis-2024.pdf.
7. Tavares, H., Carneiro, E., Sanches, M., Pinsky, I., Caetano, R., Zaleski, M., & Laranjeira, R. (2010). Gambling in Brazil: Lifetime prevalences and socio-demographic correlates. Psychiatry Research, 180(1), 35–41. https://doi.org/10.1016/j.psychres.2010.04.014.
8. Medeiros, G., Grant, J. E., & Tavares, H. (2016). Gambling disorder due to Brazilian animal game (“jogo do bicho”): Gambling behavior and psychopathology. Journal of Gambling Studies, 32(1), 231–241. https://doi.org/10.1007/s10899-015-9527-0.
9. Tran, L. T., Wardle, H., Colledge-Frisby, S., Taylor, S., Lynch, M., Rehm, J., Volberg, R., Marionneau, V., Saxena, S., Bunn, C., Farrell, M., & Degenhardt, L. (2024). The prevalence of gambling and problematic gambling: A systematic review and meta-analysis. The Lancet Public Health, 9(8), e594–e613. https://doi.org/10.1016/S2468-2667(24)00126-9.

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10. Stinchfield, R. (2002). Reliability, validity, and classification accuracy of the South Oaks Gambling Screen (SOGS). Addictive Behaviors, 27(1), 1–19. https://doi.org/10.1016/S0306-4603(00)00158-1.
11. Delfabbro, P., & King, D. L. (2020). The prevalence of loyalty program use and its association with higher risk gambling in Australia. Journal of Behavioral Addictions, 9(4), 1093–1097. https://doi.org/10.1556/2006.2020.00082.
12. Hansen, M. H., Hurwitz, W. N., & Madow, W. G. (1953). Sample survey methods and theory (Vols. 1–2). John Wiley & Sons..
13. Gerstein, D. R., Volberg, R. A., Toce, M. T., Harwood, H., Johnson, R. A., Buie, T., & Christiansen, E. M. (1999). Gambling Impact and Behavior Study: Report to the National Gambling Impact Study Commission. NORC at the University of Chicago.
14. Toce-Gerstein, M., Gerstein, D. R., & Volberg, R. A. (2009). The NODS-CLiP: A rapid screen for adult pathological and problem gambling. Journal of Gambling Studies, 25(4), 541–555. https://doi.org/10.1007/s10899-009-9135-y.
15. Toce-Gerstein, M., Gerstein, D. R., & Volberg, R. A. (2003). A hierarchy of gambling disorders in the community. Addiction, 98(12), 1661–1672. https://doi.org/10.1111/j.1360-0443.2003.00545.x
16. Fluss, R., Faraggi, D., & Reiser, B. (2005). Estimation of the Youden Index and its associated cut-off point. Biometrical Journal, 47(4), 458–472. https://doi.org/10.1002/bimj.200410135.
17. Youden, W. J. (1950). Index for rating diagnostic tests. Cancer, 3(1), 32–35. https://doi.org/10.1002/1097-0142(1950)3:1<32::AID-CNCR2820030106>3.0.CO;2-3.
18. R Core Team. (2025). R: A language and environment for statistical computing [Computer software]. R Foundation for Statistical Computing. https://www.rproject.org/.
19. GNU Project. (2025). PSPP (Version 2.0.0) [Computer software]. Free Software Foundation. https://www.gnu.org/software/pspp/
20. Welte, J. W., Barnes, G. M., Tidwell, M.-C. O., & Hoffman, J. H. (2008). The prevalence of problem gambling among U.S. adolescents and young

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adults: Results from a national survey. Journal of Gambling Studies, 24(2), 119–133. https://doi.org/10.1007/s10899-007-9086-0.

21. Gainsbury, S. M., Russell, A., Hing, N., Wood, R., Lubman, D. I., & Blaszczynski, A. (2014). The prevalence and determinants of problem gambling in Australia: Assessing the impact of interactive gambling and new technologies.Psychology of Addictive Behaviors, 28(3), 769–779. https://doi.org/10.1037/a0036207.
22. Ewing, J. A. (1984). Detecting alcoholism: The CAGE questionnaire. JAMA, 252(14), 1905–1907. https://doi.org/10.1001/jama.252.14.1905.
23. Babor TF, Higgins-Biddle JC, Saunders JB, Monteiro MG. The Alcohol Use Disorders Identification Test (AUDIT): guidelines for use in primary care. 2nd ed. Geneva: World Health Organization; 2001.
24. Ciccarelli, M., Cosenza, M., Griffiths, M. D., D'Olimpio, F., & Nigro, G. (2019). The interplay between chasing behavior, time perspective, and gambling severity: An experimental study. Journal of Behavioral Addictions, 8(2), 259–267. https://doi.org/10.1556/2006.8.2019.29.
25. Challet-Bouju G, Hardouin JB, Thiabaud E, Saillard A, Donnio Y, Grall-Bronnec M, Perrot B. Modeling Early Gambling Behavior Using Indicators from Online Lottery Gambling Tracking Data: Longitudinal Analysis. J Med Internet Res 2020;22(8):e17675. https://doi.org/10.2196/17675.

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