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Risk gambling in Brazil: National Prevalence and Structural Correlates from the Third Brazilian National Alcohol and Drugs Survey (LENAD III)

Short title: Gambling Harm in Brazil: Data from LENAD III

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Abstract

The rapid expansion of online gambling in Brazil has outpaced the consolidation of regulatory safeguards, raising concerns about gambling-related harm at the population level. The Third Brazilian National Alcohol and Drugs Survey (BNADS/LENAD III) investigated gambling participation and risk gambling, providing nationally representative estimates of the magnitude of the problem and identifying vulnerable groups to inform public policy.

LENAD III is a survey conducted in Brazil in 2022–2023 with 16,608 individuals aged 14 years and older. Gambling participation and risk were assessed using the Problem Gambling Severity Index (PGSI). Weighted prevalence estimates and multivariable logistic regression models were used to examine associations between structural, sociodemographic, behavioural factors, and risk gambling.

Past-year gambling was reported by 17.6% of the population. Overall, 6.6% fell within the PGSI risk spectrum, while 2.8% were classified as moderate- or high-risk. Risk gambling was substantially more frequent among online gamblers. In multivariable models, online gambling remained the strongest correlate of gambling-related harm.

Risk gambling in Brazil is substantial and disproportionately concentrated in online betting. Regulatory responses should prioritize structural measures that address product design, advertising exposure, and access control. Strengthening enforcement and aligning regulation with public health principles are urgent priorities.

Keywords: Gambling, Public Health, Population surveillance, Epidemiologic Studies, Brazil

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Introduction

Gambling disorder is classified as an addictive condition in both the DSM-5 (1) and ICD-11 (2) presenting high rates of comorbid psychiatric conditions (3-5) and resulting in significant socioeconomic harm. This harm extends beyond individual financial loss to encompass adverse psychosocial outcomes, such as severe domestic indebtedness and a measurable decline in the quality of life for

families (6, 7). In the Brazilian context, the escalation of these gambling-related problems is further exacerbated by the country's high levels of social vulnerability (8).

Digital transformation has reshaped the global gambling ecosystem, primarily through the growth of online sports betting, which now constitutes the fastest-growing segment of the international market (9). Structural features such as 24/7 availability, in-play wagering, and algorithmically personalised incentives shorten the feedback loop between wagers and outcomes, impairing self-control and promoting repetitive cycles of loss-chasing (10).

Consequently, studies consistently show that online bettors exhibit significantly higher odds of developing gambling disorder compared to those engaging in land-based modalities (11, 12).

Brazil serves as a primary example of how these technological mechanisms can exploit economic instability. Technical reports from the Central Bank of Brazil (13) highlight that approximately 24 million individuals engaged in online gambling in 2024, generating a monthly turnover of 3 billion for betting firms, with 70% of these bettors being heads of household (13). The commercial appeal of "rapid enrichment" has led to the displacement of essential spending, with 56% of bettors reporting that wagers negatively impact their monthly domestic budget (14).

The resulting strain on the Unified Health System (SUS) is both substantial and measurable. Official data reveal a 104% increase in clinical appointments related to pathological gambling and gambling mania between 2018 and 2025 (8) . This surge places unprecedented pressure on the Public Psychosocial Care Network (RAPS), which is already struggling with limited capacity to address pre-existing mental health demands. Public perception reflects this crisis: according to a survey performed in 2024 by the Brazilian Bank Association (FEBRABAN) (14), 50% of citizens view gambling debt as a public issue affecting the nation, while 47% recognise gambling addiction specifically as a public health crisis. Despite the rapid expansion of gambling in Brazil, contemporary epidemiological evidence to inform regulation and public health responses remains limited, as most available studies were conducted more than a decade ago, before the emergence of the

current digital betting market (8, 15, 16). The Brazilian National Alcohol and Drugs Survey (BNADS/LENAD) can address this critical gap. Drawing on this nationally representative survey, the present study aims to: (a) estimate the prevalence of various gambling modalities; (b) classify levels of risk using the Problem Gambling Severity Index (PGSI); and (c) examine the sociodemographic correlates of these risks within the contemporary Brazilian landscape.

Methods

Ethics

The research protocol was approved by the Ethics Committee of the Federal University of São Paulo (UNIFESP) and the National Commission for Ethics in Research (CONEP; CAAE: 53953121.6.0000.5505). All participants provided written informed consent prior to the interview. In accordance with the World Health Organization's Psychological First Aid guidelines, respondents were offered remote psychological support and referral pathways if they experienced discomfort during or after the interview.

Study design and sampling

LENAD is a nationally representative probabilistic household survey employing a four-stage cluster sampling design. The target population comprises individuals aged 14 years and older living in private, permanent households across Brazil, excluding Indigenous reserves and those with substantial cognitive impairment or language limitations.

The third edition of this survey (LENAD III) was conducted between 2022 and 2023 by IPSOS Public Affairs. Sampling procedures accounted for the selection of 349 municipalities, including 300 sampled with probability proportional to size (PPS) and 49 large municipalities (> 1,014,535 inhabitants) included as self-representing units. Within selected municipalities, 1,340 census tracts (17) were randomly chosen with stratification by geographic region, municipality size, and urbanization level. Households were then randomly selected within each tract, and one eligible individual was randomly selected per household, with no substitution.

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Interview procedures

Face-to-face interviews were conducted by trained professionals using a fully structured questionnaire via Ipsos-iField computer assisted personal interview (CAPI) system. The survey adopted a split questionnaire design, in which respondents were randomly assigned to one of three interview versions in order to keep the average interview duration within a maximum of one hour. The three versions consisted of: V1 – core module only, including indicators comparable across previous survey waves; V2 – core module plus the Addictive Behaviours and Prevention Indicators Module; and V3 – core module plus the Health and Violence Assessment Module. The present study comprises the analysis of the 4,842 individuals who responded to interview version 2, which included the assessment of a range of addictive behaviours, including gambling practices and the Problem Gambling Severity Index (PGSI).

Measures

Sociodemographic variables included sex (female/male), age, race/colour, stable relationship status, education level, current studying status, employment status, personal income, household income, welfare receipt, main income provider status, and region of residence. For descriptive analyses, age was categorized as adolescents (14–17 years) and adults (18+ years), whereas continuous age was used in regression models to preserve statistical power. Ethnicity (race/skin colour) was self-reported using the system adopted by the Brazilian Institute of Geography and Statistics (IBGE), which includes White, Black, Brown ("*Pardo*"), Yellow (Asian) and Indigenous. Black and Brown categories were combined in the variable labelled Black (official definition of “população negra” in Brazilian demographic statistics). Due to sample size limitations, Yellow and Indigenous categories were also aggregated and only the two most prevalent groups (White and Black) were retained for multivariable logistic regression models. Income variables were categorized according to the Brazilian minimum wage in effect at the time of data collection.

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Gambling was defined as the act of wagering money or other valuables on events with uncertain outcomes, with the primary intention of obtaining monetary gain. Past-year gambling was defined as participation in any gambling activity during the previous 12 months. Gambling modalities were assessed using a structured not mutually exclusive checklist covering the main forms of gambling available in Brazil, including lotteries, scratch cards ("*raspadinhas"*), "*Jogo do Bicho*", an illegal but widely practised lottery-like betting system in the country and land-based casino machines. These modalities were aggregated into a composite variable labelled "traditional gambling" for analysis purposes. Online gambling was defined as participation in internet-based gambling platforms, including sports betting websites and virtual casino games.

Risk gambling was assessed using the Problem Gambling Severity Index (PGSI) (8), a nine-item instrument evaluating gambling behaviours and related consequences over the preceding 12 months. Total scores range from 0 to 27. Respondents were classified according to the original PGSI severity categories. Individuals who did not report gambling in the previous year were classified as non-gamblers. Among past-year gamblers, scores were categorized as non-risk gambling (score = 0), low-risk gambling (scores 1–2), moderate-risk gambling (scores 3–7), and problem gambling (scores ≥8) (18-20).

Statistical Analysis

Sampling weights incorporated unequal probabilities of selection and non-response adjustments and were post-stratification calibrated to official population totals from the 2023 National Household Sample Survey (17), ensuring national representativeness of Brazilians aged 14 years and older. Prevalence estimates and corresponding 95% confidence intervals (95%CI) were calculated for gambling practices in the total sample and for risk gambling among past-year gamblers. To estimate absolute population counts, weighted prevalence estimates were extrapolated to the total Brazilian population aged 14 years and older based on PNAD 2023 population totals. Descriptive analyses examined gambling practices and risk gambling according to sociodemographic characteristics and by gambling

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modality. Analyses were restricted to participants who reported gambling in the previous 12 months and completed the Problem Gambling Severity Index (PGSI) module (N=674) in fully adjusted models due to complete-case analysis. For analytical purposes, PGSI categories were aggregated to improve statistical power and model stability. A binary variable representing “any risk gambling” (PGSI ≥ 1) was created for stratified and multivariable analyses, and moderate-risk and problem gambling were combined (PGSI ≥ 3) to allow international comparability. Differences between groups were assessed using Rao–Scott adjusted chi-square tests, with second-order corrections converted to design-based F statistics. Odds ratios (ORs) and 95% confidence intervals were estimated in hierarchical models. Model 1 included structural socioeconomic variables (household income and Brazilian region). Model 2 additionally adjusted for sex (Female vs Male), age (continuous), and Ethnicity (White vs Black). Model 3 further included a gambling modality (traditional vs online). Odds ratios (OR) and 95%CI were estimated, and model fit was assessed using likelihood ratio tests and pseudo R^2 statistics. Statistical significance was set at $p < 0.05$. As a sensitivity analysis, associations were also examined using ordinal regression across the full spectrum of gambling risk categories (no risk, low risk, moderate risk, and problem gambling), applying the same sequential adjustment strategy across all three models.

Results

In the total sample, 17.6% of individuals reported gambling in the previous 12 months (Table 1). When extrapolated to the Brazilian population aged 14 years and older, based on PNAD 2023 population estimates, this corresponds to approximately 30 million individuals who engaged in gambling in the past year. Gambling participation was approximately twice as frequent among males compared with females, for both traditional and online modalities.

Online gambling corresponded to a prevalence of 5.6%, representing nearly 10 million Brazilians participating in digital betting platforms. Although overall gambling participation was higher among adults, online gambling was disproportionately

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concentrated among adolescents, with roughly 1 million minors engaged in online gambling in the previous year.

Table 1 Prevalence rates of gambling practices in the Brazilian population according to sociodemographic characteristics

Sociodemographic (N=4.842; missing = 28)	Past-year gambling % (95%CI)	Gambling modality % (95%CI)	
		Traditional	Online
Whole sample	17.63% (15.99;19.39)	12.00% (10.84;13.28)	5.62% (4.58;6.90)***
Sex			
Male	23.76% (20.82;26.98)	15.01% (12.96;17.32)	8.76% (6.82;11.17)***
Female	11.94% (10.36;13.73)	9.22% (7.86;10.79)	2.72% (2.09;3.55)***
Age			
Adolescent (14-17)	10.52% (7.87;13.95)	2.39% (1.43;3.97)	8.13% (5.73;11.42) ***
Adult (18+)	18.14% (16.44;19.98)	12.70% (11.46;14.05)	5.44% (4.36;6.78) ***
Ethnicity			
White	17.06% (14.89;19.47)	12.93% (10.96;15.18)	4.13% (3.04;5.60) ***
Black	18.49% (16.09;21.15)	11.71% (10.04;13.61)	6.78% (5.22;8.76) ***
Yellow/Indigenous	9.89% (5.89;16.15)	7.19% (3.84;13.07)	2.71% (1.03;6.92)
In a stable relationship			
No	17.80% (15.72;20.08)	10.77% (9.41;12.31)	7.02% (5.47;8.98)*
Yes	17.38% (14.98;20.08)	13.81% (11.60;16.36)	3.57% (2.58;4.93) ***
Education Level			
Illiterate/ Primary School	13.12% (11.08;15.48)	10.35% (8.72;12.24)	2.78% (1.73;4.43) ***
Secondary School	20.17% (17.72;22.86)	11.45% (9.66;13.51)	8.72% (7.04;10.75)
College/Higher Education	21.73% (17.85;26.18)	16.09% (12.91;19.88)	5.64% (3.71;8.48) ***
Current studying			
No	17.55% (15.82;19.44)	12.84% (11.53;14.28)	4.71% (3.76;5.90) ***
Yes	17.99% (14.60;21.97)	7.97% (5.93;10.62)	10.03% (7.41;13.43)
In employment			
No	12.69% (10.80;14.85)	10.13% (8.43;12.12)	2.56% (1.83;3.57) ***
Yes	20.67% (18.43;23.10)	13.16% (11.43;15.10)	7.51% (6.04;9.31) ***
Personal Income			
Up to 1 MS†	16.68% (14.22;19.46)	10.12% (8.67;11.77)	6.56% (4.80;8.91)*
1 to 2 MS	19.15% (16.06;22.68)	13.30% (10.76;16.34)	5.85% (4.15;8.18) ***
2 MS plus	23.86% (19.69;28.60)	18.70% (15.09;22.93)	5.16% (3.01;8.71) ***

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Household Income			
Up to 1 MS	13.94% (11.74;16.48)	10.52% (8.71;12.65)	3.43% (2.26;5.16) ***
1 to 2 MS	14.50% (11.47;18.16)	9.00% (7.03;11.46)	5.50% (3.62;8.26)
2 MS plus	23.14% (20.34;26.20)	15.68% (13.40;18.26)	7.47% (5.90;9.40) ***
Welfare recipient			
No	19.51% (17.33;21.89)	12.21% (10.64;13.98)	7.30% (5.86;9.05) ***
Yes	15.04% (12.34;18.22)	10.86% (8.63;13.59)	4.18% (2.83;6.14) ***
Main income provider			
No	17.39% (15.28;19.73)	10.74% (9.09;12.65)	6.65% (5.13;8.59)*
Yes	17.90% (15.64;20.41)	13.48% (11.61;15.59)	4.42% (3.14;6.20) ***
Region			
North	16.54% (11.78;22.73)	10.69% (8.00;14.15)	5.85% (3.07;10.86)
Northeast	16.25% (13.80;19.05)	10.69% (8.86;12.84)	5.57% (3.99;7.71) ***
Central-West	17.63% (14.90;20.72)	11.70% (9.83;13.87)	5.92% (4.12;8.46) ***
Southeast	20.37% (17.17;24.00)	15.00% (12.35;18.11)	5.37% (3.69;7.75) ***
South	18.73% (11.46;29.09)	14.55% (8.60;23.54)	4.19% (2.26;7.64)

Notes: Estimates are based on a nationally representative sample of the Brazilian population aged ≥14 years (N = 4,842).

Prevalence rates and 95% confidence intervals (95%CI) account for the complex survey design (stratification, clustering, and sampling weights). Group differences were tested using Rao–Scott adjusted chi-square tests. *p < 0.05; **p < 0.01; ***p < 0.001.

† Minimum Wage = R$1.212 00

Participation in any gambling modality increased with educational attainment and income. Individuals with secondary or higher education reported higher participation than those with primary education or less. Traditional gambling was more concentrated in higher education and income strata, while online gambling showed stronger variation by age and sex. Online gambling showed smaller variation across income levels. With regards to ethnicity, rates of participation were similar across groups, although online gambling was more frequent among Black individuals. Relationship status showed little difference in overall participation, but traditional gambling was more frequent among individuals in a stable relationship, while online gambling was more common among those not in one. Individuals in employment presented higher rates of participation in both modalities. Regional

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variation in gambling participation was modest, with the highest levels observed in the Southeast and broadly comparable patterns across the remaining regions.

Complementary modality-specific distributions among past-year gamblers are presented in the Supplementary Table S1, showing lotteries were the most frequently reported form of gambling, mentioned by 71.3% of past-year gamblers. Nearly one third reported using online gambling platforms ("bets"), including sports betting websites (32.1%), a prevalence that exceeded the traditional "*jogo do bicho*" (28.9%). Scratch cards were reported by 18.8% of gamblers and land-based casino games by 12.4% (Supplementary Table S1).

Table 2: Distribution of risk gambling categories according to the Problem Gambling Severity Index Scale in the Brazilian population and past-year gamblers, by gambling modality.

		Past-year gamblers % (95% CI)		
			Modality	
PGSI classification	**Total population % (95% CI)**	**Any gambling**	**Traditional Gambling**	**Online Gambling**
No gambling	82.82 (81.04–84.46)	-	-	-
Gambling with no-risk	10.59 (9.43–11.88)	62.0 (56.70 - 66.31)	75.03 (69.95–79.50)	33.33 (26.19–41.33)
Any risk	6.59 (5.51–7.88)	38.37 (33.65 - 43.32)	24.97 (20.50–30.05)	66.67 (58.67,73.81)
Low risk	3.78 (3.02–4.73)	22.0 (18.12 - 26.51)	15.79 (12.43–19.85)	35.13 (27.64–43.44)
Moderate risk	2.18 (1.59–2.96)	12.7 (9.40 - 16.81)	6.60 (4.21–10.21)	25.46 (17.96–34.75)
Problem gambling	0.64 (0.40–1.02)	4.0 (2.31 - 5.92)	2.58 (1.36–4.83)	6.08 (3.16–11.40)

Notes: Prevalence rates and 95% CI calculated accounting for stratification, clustering, and sampling weights.
Estimates represent the Brazilian population aged 14 years and older: total population N = 4,842; Gamblers N= 674, missing = 28. Gambling risk was assessed using the PGSI. Any risk corresponds to PGSI score ≥1; Low risk to scores 1–2; moderate risk to scores 3–7; problem gambling to scores ≥8. Gambling risk classification was assessed among past-year gamblers (N=674) using the PGSI and subsequently integrated with the category of non-gamblers to estimate the overall population distribution. The distribution of PGSI categories differed significantly according to modality (Rao–Scott adjusted F test, $p < 0.001$).

Approximately 11.3 million individuals (6.6%) reported experiencing gambling-related harm at some level according to the PGSI risk spectrum (PGSI ≥1). Within

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this continuum, moderate and problem gambling combined (PGSI ≥3) affected 2.8% of the population, representing an estimated 4.8 million individuals nationwide. Problem gambling (PGSI ≥8), the most severe category, accounted for 0.6% of the population, equivalent to approximately 1.1 million individuals.

Among past-year gamblers who completed the PGSI (N=674), more than one-third (38.4%) were at some level of risk (Table 2). Online bettors were substantially more concentrated in higher PGSI categories, whereas non-online participants were predominantly classified within the non-risk range. The distribution of PGSI categories differed markedly according to online betting participation (Rao–Scott adjusted F (3.7, 1149.6) = 268.8, p < 0.001). Additional stratified analyses indicated higher prevalence among males than females, and over half of the adolescent gamblers (55.2%; 95% CI: 38.96–70.44) met criteria for gambling-related risk (Supplementary Table S2).

Broader sociodemographic stratification of risk gambling among gamblers is presented in Supplementary Table S2.

Table 3: Risk gambling among past-year gamblers: prevalence and hierarchical logistic regression models

Variable	Risk gambling prevalence % (95% CI)†	Model 1 OR (95% CI)	Model 2 OR (95% CI)	Model 3 OR (95% CI)
Gambling modality				
Traditional betting	24.97 (20.52–30.04)	—	—	1.00
Online betting	66.67 (58.69–73.79)	—	—	**3.61 (2.29–5.69)*** **
Sex	—	—	**1.77 (1.25–2.51)****	**1.55 (1.08–2.23)***
Age	—	—	**0.98 (0.97–0.99)*** **	1.00 (0.98–1.01)
Ethnicity	—	—	1.18 (0.80–1.76)	1.14 (0.76–1.71)
Household income				
≤1 minimum wage	—	1.35 (0.91–2.00)	**1.69 (1.11–2.57)***	**1.73 (1.12–2.66)***
1–2 minimum wages	—	1.50 (0.98–2.29)	**1.59 (1.02–2.49)***	1.45 (0.91–2.31)

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Variable	Risk gambling prevalence % (95% CI)†	Model 1 OR (95% CI)	Model 2 OR (95% CI)	Model 3 OR (95% CI)
Region				
North	—	**2.06 (1.05–4.05)***	1.44 (0.68–3.02)	1.54 (0.72–3.30)
Northeast	—	**2.15 (1.29–3.57)****	**1.76 (1.00–3.09)***	**1.85 (1.04–3.29)***
Southeast	—	1.30 (0.80–2.12)	1.15 (0.68–1.95)	1.13 (0.66–1.95)
Central-West	—	1.26 (0.63–2.53)	0.99 (0.47–2.13)	1.14 (0.52–2.49)

Notes: Prevalence calculated among past-year gamblers who completed the PGSI module (N = 674).
Analyses restricted to past-year gamblers with complete data (Model 1: N = 644; Models 2 and 3: N = 620). Differences in sample size reflect complete-case analysis. Outcome defined as risk gambling (PGSI ≥1), corresponding to any level of risk (low, moderate, or problem gambling) according to the Problem Gambling Severity Index.
Model 1: Structural adjustment for household income and region.
Model 2: Sociodemographic, additionally adjusted for sex (male x female), age (continuous), and ethnicity (Black vs White).
Model 3 additionally adjusted for gambling modality (online vs traditional).
Reference categories: household income = ≥ 2 minimum wage; region = South; sex = female; race/colour = White; gambling modality = traditional betting. Model fit statistics (Pseudo R^2): 0.025 (Model 1), 0.066 (Model 2), and 0.105 (Model 3).
*p < 0.05; ** p < 0.01; *** p < 0.001.

Table 3 presents the hierarchical logistic regression models for risk gambling (PGSI ≥1) among past-year gamblers, alongside the unadjusted prevalence of risk gambling by gambling modality. In the descriptive component of Model 3, risk gambling affected about one-quarter of traditional bettors, whereas roughly two-thirds of those who reported online betting met criteria for risk gambling, highlighting a marked modality gradient.

In Model 1 (Structural), which included household income and region (reference: South), individuals residing in the North and Northeast showed higher odds of risk gambling compared to the South, while household income was not significantly associated with the outcome at this stage. In Model 2 (+ Sociodemographic), after additional adjustment for sex, age, and race/colour (Black/Brown vs White), male sex was associated with higher odds of risk gambling, and increasing age was associated with reduced odds. Individuals in lower income categories showed elevated odds compared to those with higher

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income, and regional differences were attenuated, although the Northeast remained associated with increased risk.

In Model 3 (Behavioural), which additionally adjusted for gambling modality, online betting emerged as the strongest correlate of risk gambling, with nearly fourfold higher odds compared to traditional betting. Male sex and lower household income remained associated with increased odds. In the fully adjusted model, residents of the Northeast continued to show higher odds of risk gambling relative to the South, whereas the North, Southeast, and Central-West did not differ significantly. Age and race/colour were not significantly associated in the final model outcome. Findings from the sensitivity analyses using ordinal regression across the full range of gambling risk categories were consistent with the primary analyses (see Supplementary Table S3), supporting the stability of the observed associations across risk levels of gambling.

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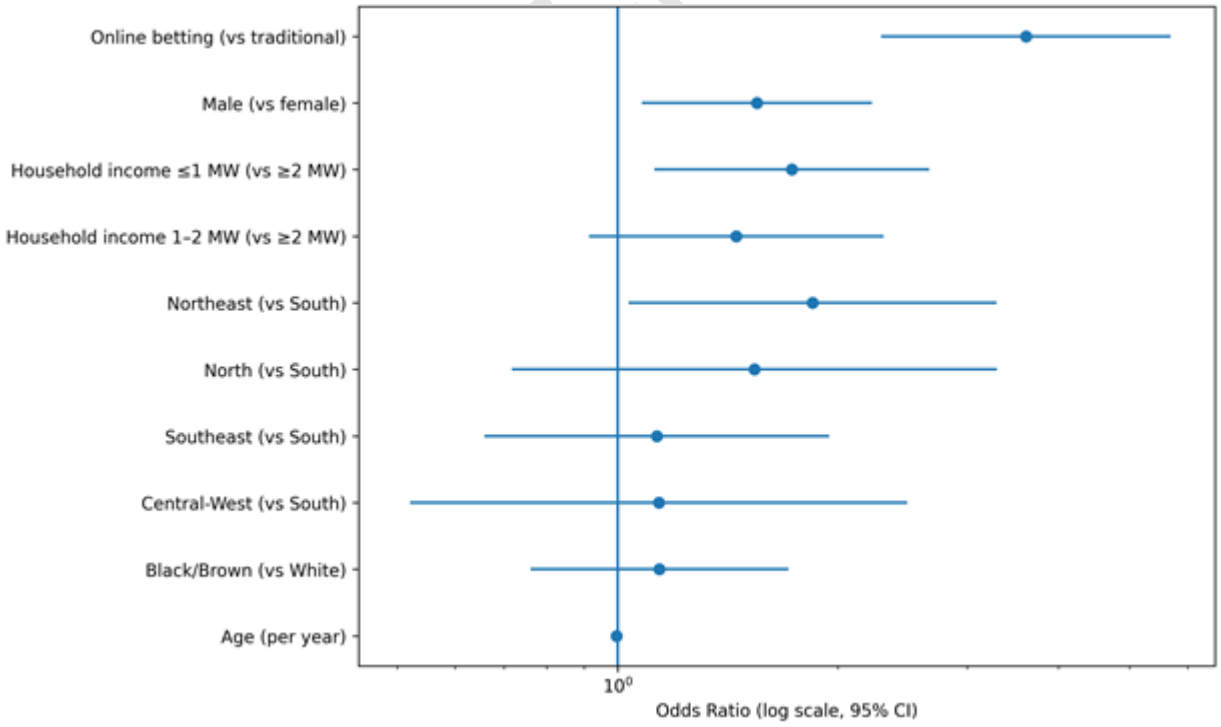


Figure 1: Forest plot of adjusted odds ratios for risk gambling among past-year gamblers in the fully adjusted model. Model 3 (Fully adjusted model) adjusted for household income,

region, sex, age (continuous), race/colour (White), and gambling modality. Reference categories: female, ≥2 MW household income, South region, White, traditional betting. Odds ratios are presented on a logarithmic scale; the vertical reference line indicates OR = 1.0. Estimates account for the complex survey design. Outcome defined as risk gambling (PGSI ≥1), corresponding to any level of risk (low-, moderate-, or high-risk) according to the Problem Gambling Severity Index. Analyses restricted to past-year gamblers who completed the PGSI module (complete-case analysis; N = 620).

In an additional analysis using age group to specifically examine adolescents (14–17 years), adolescents presented more than a two-fold increase in the odds of risk gambling compared to adults (OR = 2.42; 95% CI: 1.42–4.11) in the sociodemographic model. However, this association was attenuated and no longer statistically significant after adjustment for gambling modality in the behavioural model (OR = 1.38; 95% CI: 0.78–2.46).

Model fit improved across the hierarchical steps, with the pseudo R^2 increasing from 0.025 in Model 1 to 0.066 in Model 2 and 0.106 in Model 3. The magnitude and precision of the final adjusted estimates are illustrated in Figure 1.

Discussion

The third edition of the Brazilian National Alcohol and Drugs Survey (LENAD III) recently released the most up-to-date nationally representative estimates of gambling participation and risk gambling in Brazil. The findings shed light on the scale of gambling involvement as well as the unequal distribution of gambling risk across sociodemographic groups, with online betting emerging as the strongest predictor of risk. Results show that approximately 30 million individuals aged 14 years and older reported past-year gambling participation in Brazil between 2022 and 2023, positioning the activity as a widespread behavioural phenomenon rather than a niche activity. Of these, almost 10 million engaged in online gambling, which was disproportionately concentrated among underaged adolescents, with an estimated one million minors involved in digital gambling platforms. These figures reflect the rapid expansion of high-intensity digital betting in a country that historically maintained restrictions on land-based gambling (21).

While gambling participation per se cannot be equated with pathological or harmful behaviour, the magnitude of exposure translates into a substantial burden

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of possible gambling-related harm at the population level. In fact, 6.6% of the population scored within the Problem Gambling Severity Index (PGSI) risk spectrum, indicating patterns of gambling associated with clinically relevant behavioural symptoms and/or adverse consequences. When extrapolated to the national population, this corresponds to more than 11 million individuals potentially experiencing varying levels of risky gambling. An estimated 1.1 million individuals actually met criteria for problem gambling (PGSI ≥8), a threshold widely considered indicative of probable gambling disorder and shown to correspond closely with diagnostic criteria for gambling disorder as defined in the DSM-5 (1). When moderate and problem gambling were combined (PGSI ≥3), 2.8% of the population, an estimated 4.8 million individuals fell within this higher-risk range. These figures position gambling related harm as one of the leading addictive conditions in Brazil in terms of the number of individuals affected. Indeed, when compared with other addictive behaviours assessed in the same survey, risk gambling affects more individuals nationwide than heavy smoking consumption of all illicit drugs combined, including cannabis. Only alcohol use disorder accounts for a higher number of affected individuals (22). Together, these comparisons underscore the scale of risk gambling within the spectrum of addictive conditions in Brazil.

When compared with international estimates derived from studies using the same screening instrument (PGSI), a striking pattern emerges. Although overall gambling participation in Brazil is lower than in several middle- and high- income countries, where participation often approaches half of the adult population — the prevalence of moderate and high risk gambling is comparatively high (23-26). This raises important questions about how gambling-related risk is distributed within the Brazilian population and what factors account for this concentration.

Socioeconomic and regional inequalities provide part of the explanation. While overall gambling participation was more frequent among individuals in higher income strata, risk gambling was more prevalent among those with lower income, indicating a dissociation between participation and vulnerability. Higher levels of risk were also observed among males and individuals with lower educational

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attainment, patterns also documented in Australia, New Zealand, Canada, and Great Britain (23, 25-28), as well as among residents of the North and Northeast regions of Brazil.

The hierarchical models provide some insights into how these layers of risk might interact. Structural vulnerabilities—particularly lower household income and regional inequalities—were associated with higher odds of risk gambling, indicating that risk is embedded within broader social and economic contexts. Sociodemographic factors, including male sex and younger age, further shaped differential exposure and vulnerability. However, once behavioural factors were introduced, engagement in online betting emerged as the strongest and most consistent correlate of risk gambling. Online betting remained associated with substantially higher odds of risk independent of income, region, sex, age, and race/colour, with effect sizes exceeding those observed for structural variables. Age-specific analyses further illustrate this dynamic. Adolescents initially showed elevated odds of risk gambling, but this association was attenuated after adjustment for gambling modality, indicating that their heightened vulnerability was associated with involvement in online betting. In fully adjusted models, ethnicity was not independently associated with risk gambling, suggesting that observed disparities are more likely attributable to structural inequalities and differential exposure to high-risk modalities rather than intrinsic racial effects (2).

Taken together, these findings suggest that risk may operate through multiple interconnected layers. Structural inequalities, sociodemographic characteristics, and gambling modality were all associated with variations in risk gambling, indicating that these factors may interact in shaping patterns of vulnerability and exposure. In particular, modality-specific structural characteristics of online betting such as continuous accessibility, rapid betting cycles, and frictionless digital payment systems may contribute to higher levels of engagement and potentially greater risk intensity compared with traditional formats(11, 13, 21).

In a context marked by pronounced socioeconomic inequality and uneven access to mental health care and social protection systems, a similar proportional prevalence may translate into greater functional impairment and more severe

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downstream social consequences, potentially increasing gambling-related harms. In such settings, gambling-related harm is likely to intersect with socioeconomic vulnerabilities, amplifying both its broader social consequences and overall public health impact (11, 13, 16, 21). Recent financial, educational, and social protection data in Brazil have signalled rising indebtedness, pressures on household resource allocation, and potential strain on income-transfer beneficiaries associated with betting expenditures (13, 14, 29). The growing visibility of these socioeconomic impacts has already prompted governmental initiatives to strengthen the training of professionals within the public mental health care system to better identify and manage gambling-related problems (8).

The national estimates of risk gambling and the identification of high-risk groups presented here should serve as an urgent signal for strengthening regulatory safeguards in Brazil. Although our data collection overlapped with the enactment of Federal Law No. 14.790/2023 (30), which established the regulatory framework for fixed-odds betting in Brazil and explicitly prohibited participation by individuals under 18 years of age, much remains to be implemented and enforced. The substantial adolescent engagement identified in this survey reflects a market dynamic that preceded the initial stages of enforcement, capturing the consequences of a regulatory gap in which rapid market expansion outpaced the consolidation of oversight mechanisms. International experience shows that phases of gambling market liberalisation not accompanied by fully operational safeguards are often marked by a concentration of harm among young people, socioeconomically disadvantaged groups, and individuals with pre-existing vulnerabilities (31-34), patterns that are consistent with the Brazilian case.

In this context, the evidence generated by LENAD III is already supporting the development of structured public health recommendations aimed at strengthening regulatory safeguards, protecting vulnerable populations, and reframing gambling as a collective health concern rather than solely an issue of personal responsibility (35). The regulatory framework remains limited in scope and enforcement capacity. Core structural measures – particularly robust age-verification systems, broader and more effective restrictions on advertising exposure and enforceable harm-

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minimisation requirements must be urgently strengthened and fully operationalised (35). The national dissemination of these recommendations has contributed to broader public and institutional debate, increasing pressure for more robust and health-oriented regulatory measures in Brazil.

The LENAD was the first nationally representative survey in Brazil to investigate gambling at the population level. Gambling-related behaviours were already assessed in the first wave conducted in 2006 using validated instruments. In the current wave (LENAD III), gambling was reassessed using the Problem Gambling Severity Index (PGSI), a tool widely used in epidemiological studies across multiple countries, the findings allow for direct comparison with international estimates and situate Brazil within the broader global literature on gambling harm. Nevertheless, several limitations should be acknowledged.

First, gambling participation and PGSI items were self-reported and therefore susceptible to recall error, social desirability bias, and misunderstanding of survey questions, which may lead to measurement error and misclassification across PGSI categories.

Second, while the PGSI is a validated screening instrument capturing behavioural symptoms and adverse consequences along a continuum of risk, it does not provide a clinical diagnosis. The threshold for problem gambling is widely used as an indicator of probable gambling disorder, but structured diagnostic assessments were not conducted. Certain dimensions of harm, particularly long-term financial or family consequences, may not be fully captured.

Third, estimates among past-year gamblers rely on a smaller subsample, limiting precision for subgroup analyses, especially among adolescents and modality-specific strata. Some modality groupings are heterogeneous and may mask variation across specific gambling products, such as “*Jogo do Bicho*”. Fourth, other known risk factors cannot be excluded. Although LENAD III assessed a wide range of psychiatric and substance-use comorbidities, the present analyses focused on structural, sociodemographic, and behavioural factors, and did not incorporate the full spectrum of clinical correlates into the multivariable models. More comprehensive analyses integrating comorbid mental health conditions and

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substance use patterns will be explored in subsequent publications. In addition, certain environmental and contextual exposures such as the exposure to gambling advertising and marketing, social media promotion, and the temporal coincidence of major sporting events were not measured in sufficient detail. A further limitation relates to the complete-case approach used in the regression analyses. The final models included 620 of the 674 past-year gamblers, with 54 participants (approximately 8%) excluded because of missing data across one or more variables. Although the proportion of missing data was relatively small, it is possible that excluded participants may have differed from those retained in the analyses, including potentially representing more socially or economically vulnerable groups. As such, some degree of selection bias cannot be ruled out. Finally, because the findings reflect the market and regulatory context of 2022–2023, subsequent increases in advertising and market penetration may mean that current levels of exposure and risk exceed those captured in this survey. At the same time, regulatory measures—including age-verification requirements and restrictions aimed at limiting access by minors—have begun to be implemented. As enforcement and market dynamics continue to evolve, ongoing surveillance will be necessary to assess how these changes influence future patterns of risk gambling.

Conclusions

LENAD's findings provide robust epidemiological evidence to inform balanced regulatory, preventive, and clinical strategies grounded in a public health approach. The results indicate that the burden of risk gambling already exceeds that observed for tobacco dependence and all illicit drugs combined in absolute numbers. While gambling risk is socially patterned and influenced by socioeconomic and regional inequalities, engagement in online gambling emerged as the strongest predictor of risk gambling. The magnitude and independence of this association suggest that modality-specific structural characteristics play a central role in shaping risk. Consequently, if modality-specific risk exceeds that attributable to sociodemographic factors, regulatory strategies must address product design and market structure rather than focusing exclusively on individual-

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level prevention (6, 10, 21, 34, 36). As Brazil consolidates its regulatory framework for fixed-odds betting, policies that address the structural features of high-intensity digital gambling platforms will be essential to mitigate harm and protect vulnerable populations. Regulatory measures aligned with these findings have already been proposed (35, 37) and remain urgently needed.

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Supplementary Table S1 Gambling modalities reported by past-year gamblers

Gambling modality (past-year gamblers)	% (95% CI)
Lottery	71.3 (36.6–75.6)
Online betting platforms (“bets”)	32.1 (127.5–37.0)
“Jogo do bicho”	28.9 (24.9–33.2)
Scratch cards	18.8 (15.4–22.8)
Land-based casino games	12.4 (9.7-15.7)

Gambling modality categories were not mutually exclusive. Prevalence rates weighted to represent the Brazilian population aged 14 years and older and calculated among past-year gamblers (N = 674), missings = 28.

Supplementary Table S2 Distribution of risk gambling categories according to the Problem Gambling Severity Index Scale among past-year gamblers, by sex

PGSI classification	Total % (95% CI)	Male % (95% CI)	Female % (95% CI)
No gambling	82.82 (81.04–84.46)	76.98 (73.72–79.95)	88.18 (86.41–89.74)
Non-risk	10.59 (9.43–11.88)	12.97 (10.99–15.25)	8.40 (7.17–9.83)
Any risk*	6.59 (5.51–7.88)	10.05 (7.91–12.67)	3.42 (2.65–4.41)
Low risk	3.78 (3.02–4.73)	5.52 (4.13–7.35)	2.18 (1.61–2.96)
Moderate risk	2.18 (1.59–2.96)	3.61 (2.46–5.27)	0.86 (0.56–1.32)
Problem gambling	0.64 (0.40–1.02)	0.92 (0.53–1.59)	0.38 (0.15–0.94)

Prevalence rates weighted to represent the Brazilian population aged 14 years and older (N = 4,842; missing = 28). Gambling severity was assessed among past-year gamblers using the Problem Gambling Severity Index (PGSI) and subsequently integrated with the category of non-gamblers to estimate the overall population distribution.

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Low risk corresponds to PGSI scores 1–2; moderate risk to scores 3–7; problem gambling to scores ≥8. Any risk corresponds to PGSI scores ≥1 (low, moderate, or problem gambling).

* Sex differences were statistically significant (design-based F test for: F(3.68, 1145.71) = 17.07; p < 0.001).

Estimates account for the complex survey design (stratification, clustering, and sampling weights).

Supplementary Table S3 Prevalence rates of any risk gambling among gambler's according to sociodemographic characteristics

N=674	**Total**	**Male**	**Female**
	% (95%CI)	**% (95%CI)**	**% (95%CI)**
Risk gambling*	**38.37% (33.65;43.32)**	**43.65% (36.93;50.60)**	**28.94% (23.41;35.16)**
Age group			
Adolescent (14-17)	55.22% (38.96;70.44)	47.36% (28.17;67.37)	69.33% (47.65;84.88)
Adult (18+)	37.66% (32.75;42.82)	43.49% (36.80;50.42)	27.22% (21.84;33.35)
Race/Colour			
White	31.35% (24.41;39.22)	38.65% (28.70;49.65)	19.68% (12.81;29.01)
Black/Brown	42.19% (35.80;48.86)	46.17% (38.22;54.31)	34.19% (26.19;43.19)
Yellow/Indigenous	58.02% (32.02;80.21)	69.63% (29.06;92.77)	51.62% (27.47;75.05)
In a stable relationship			
No	43.21% (37.09;49.55)	51.26% (43.63;58.83)	27.89% (21.59;35.20)
Yes	31.18% (24.09;39.27)	31.68% (22.90;42.00)	30.35% (21.07;41.55)
Education Level			
Illiterate/ Primary School	44.65% (35.94;53.69)	47.66% (36.96;58.57)	36.66% (24.84;50.33)
Secondary School	44.68% (37.63;51.95)	49.39% (40.22;58.60)	36.17% (27.54;45.80)
College/Higher Education	21.78% (13.89;32.46)	27.38% (15.01;44.60)	15.00% (7.74;27.06)
In employment			
No	31.42% (24.89;38.78)	37.20% (27.90;47.55)	25.67% (18.52;34.42)
Yes	40.90% (35.03;47.03)	45.33% (37.72;53.16)	30.87% (23.14;39.85)
Personal Income			
Up to 1 MS	52.82% (46.00;59.54)	63.34% (53.64;72.07)	36.84% (28.57;45.96)

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1 to 2 MS	31.20% (23.66;39.87)	32.63% (23.33;43.52)	28.62% (18.33;41.74)
2 MS plus	21.14% (13.50;31.53)	23.66% (13.83;37.42)	15.12% (6.64;30.82)
Household Income			
Up to 1 MS	49.81% (41.46;58.17)	62.81% (51.53;72.85)	30.00% (20.86;41.06)
1 to 2 MS	47.84% (37.53;58.34)	50.14% (36.88;63.39)	44.09% (30.10;59.08)
2 MS plus	30.06% (23.99;36.92)	33.93% (26.19;42.64)	22.60% (15.65;31.48)
Welfare recipient			
No	40.13% (34.20;46.36)	46.06% (38.42;53.90)	26.45% (19.36;35.01)
Yes	40.57% (32.57;49.09)	41.31% (29.47;54.25)	39.93% (29.72;51.10)
Main income provider			
No	39.96% (32.52;47.89)	50.18% (40.05;60.29)	25.55% (19.40;32.86)
Yes	36.59% (29.36;44.48)	37.54% (28.61;47.41)	34.31% (25.29;44.63)
Region			
North	46.23% (24.62;69.35)	47.32% (21.47;74.68)	43.70% (19.48;71.35)
Northeast	52.23% (41.76;62.51)	56.51% (43.08;69.05)	42.48% (33.33;52.17)
Central-West	29.82% (18.54;44.23)	46.69% (27.09;67.36)	14.62% (9.04;22.77)
Southeast	34.74% (27.83;42.36)	39.90% (31.51;48.93)	24.14% (15.38;35.78)
South	28.01% (20.70;36.69)	28.14% (17.04;42.73)	27.86% (17.94;40.55)
Gambling modality			
Traditional gambling	24.97% (20.52;30.04)	26.54%	22.68% (17.36;29.06)
Online gambling	66.67% (58.69;73.79)	72.51%	49.81% (35.43;64.22)

Notes: Prevalence rates weighted to represent the Brazilian population aged 14 years and older and calculated among past-year gamblers who completed the PGSI module (N = 674, missing = 28). Outcome defined as risk gambling (PGSI ≥1), corresponding to any level of risk (low-, moderate-, or problem gambling) according to the Problem Gambling Severity Index.

Supplementary Table S3 Risk gambling among past-year gamblers: prevalence and hierarchical ordinal regression models

Variable	Model 1 OR (95% CI)	Model 2 OR (95% CI)	Model 3 OR (95% CI)
Gambling modality			
Traditional betting	—	—	1.00

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Variable	Model 1 OR (95% CI)	Model 2 OR (95% CI)	Model 3 OR (95% CI)
Online betting	—	—	**3.22 (2.06–5.03)*** **
Gender	—	**1.74 (1.26–2.43)***	**1.54 (1.09–2.17)***
Age	—	**0.98 (0.97–0.99)*** **	1.00 (0.98–1.01)
Ethnicity	—	1.37(0.98–1.91)	1.39 (0.99–1.97)
Household income			
≤1 minimum wage	1.15 (0.91–2.00)	**1.40 (1.11–2.03)***	**1.49 (1.01–2.19)***
1–2 minimum wages	1.20 (0.98–2.29)	**1.23 (1.02–1.92)***	1.18 (0.74–1.87)
Region			
North	**1.93 (1.01–3.70)***	1.27 (0.64–2.53)	1.48 (0.71–3.08)
Northeast	**2.19 (1.34–3.59)***	**1.70 (1.00–2.89)***	**1.69 (1.00–2.93)***
Southeast	1.33 (0.82–2.15)	1.17 (0.71–1.95)	1.14 (0.68–1.92)
Central-West	1.16 (0.82–2.15)	0.91 (0.44–1.85)	0.98 (0.47–2.04)

Notes: Prevalence calculated among past-year gamblers who completed the PGSI module (N = 674).

Analyses restricted to past-year gamblers with complete data (Model 1: N = 644; Models 2 and 3: N = 620). Differences in sample size reflect complete-case analysis. Outcome defined as risk gambling categories (no risk, low risk, moderate risk, and problem gambling according to the Problem Gambling Severity Index.

Model 1: Structural adjustment for household income and region.

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Model 2: Sociodemographic, additionally adjusted for sex (male x female), age (continuous), and ethnicity (Black vs White).

Model 3 additionally adjusted for gambling modality (online vs traditional).

Reference categories: household income = ≥ 2 minimum wage; region = South; gender = female; race/colour = White; gambling modality = traditional betting. Model fit statistics (Pseudo R^2): 0.012 (Model 1), 0.042 (Model 2), and 0.068 (Model 3).

*p < 0.05; ** p < 0.01; *** p < 0.001.

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