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ORIGINAL ARTICLE

Examining the Gambling-Related Harms, Gambling Disorder, and Player Characteristics of Jogo do Bicho (an Illegal National Lottery) in a Representative Sample of Brazilian Lottery Players

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Abstract

We investigated the demographics, gambling-related harms, and risk for gambling disorder (GD) associated with an illegal national lottery-type game called Jogo do Bicho that is culturally unique to Brazil in a sample of 5407 representative Brazilian lottery players. Participants reported on demographics, gambling behaviors, gambling-related harms, and GD. A total of 27.0% of the participants reported playing Jogo do Bicho in the past year. Jogo do Bicho was associated with greater risk of GD with 5.7% of current Jogo do Bicho players meeting diagnostic criteria. Jogo do Bicho was also associated with greater gambling-related harms. Older participants, males, individuals who self-identified as Black, and who were widowed were more likely to be current Jogo do Bicho players. Jogo do Bicho is a popular activity among legal lottery players in Brazil despite its illegal status and is associated with greater harms and increased risk of GD.

Keywords Lotteries · Jogo do Bicho · Brazilian animal game · Gambling disorder · Complex sample analyses

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Pathological gambling was first introduced as a mental health disorder in the 1980s with the publication of the 3rd edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM-3; Griffiths, 1996; Petry et al., 2014). In the DSM-3, pathological gambling was classified as an impulse control disorder not otherwise classified with kleptomania, trichotillomania, intermittent explosive disorder, and pyromania (Petry et al., 2014). In 2013, pathological gambling was renamed gambling disorder (GD) and officially recognized as a behavioral addiction with the publication of the 5th edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM-5; American Psychological Association, 2013). The reclassification of GD from an impulse control disorder to an addiction occurred due to decades of research suggesting gambling disorder shared many neurobiological and clinical similarities to substance use disorders (Clark & Limbrick-Oldfield, 2013; Mann et al., 2016; Petry, 2006).

According to the DSM-5, GD is characterized by a persistent and continued gambling behavior despite negative consequences as a result of the gambling (American Psychiatric Association, 2013). To be diagnosed with gambling disorder, an individual needs to meet four of the following nine symptoms in a 12-month period: loss of control over one's gambling, tolerance, withdrawal, preoccupation, using gambling to cope with negative emotions, chasing losses, concealing the extent of one's gambling, risking relationships/employment, and borrowing money from others (American Psychiatric Association, 2013). GD is relatively common with worldwide prevalence rates between 0.12 and 5.8% (Calado & Griffiths, 2016).

Several theories have been proposed that may help explain why some people may develop GD, while majority of people who gamble do so without developing an addiction. For example, the biopsychosocial model of problem gambling posits that there are biological, psychological, and social factors, which interact to increase the risk of GD for individuals (Sharpe, 2002). Biological factors may include a genetic predisposition (Walters, 2001), while impulsivity has been found to be a robust psychological risk factor (Ioannidis et al., 2019). Furthermore, the availability of gambling, which is a social factor, has also been implicated with GD (Sharpe, 2002). In addition to the biopsychosocial model, several theories of GD have been proposed, with the pathways model of problem and pathological gambling (Blaszczynski & Nower, 2002) perhaps being the most influential.

The pathways model proposes three pathways to GD. The first pathway includes those who are behaviorally conditioned to gambling through classical and operant conditioning principles. Of importance to the present research, previous studies have found that structural characteristics of a gambling activity itself may increase the risk of GD. For example, gambling activities that offer a continuous rate of reinforcement such as electronic gaming machines have a higher risk of developing GD compared to other forms of gambling such as horse racing (Delfabbro et al., 2020). The second pathway consists of individuals who have an emotional vulnerability such as depression and anxiety and may use gambling to cope with their distress. Providing support for the emotional vulnerability pathway, recent longitudinal studies suggest that mental health problems precede the development of GD (Dowling et al., 2019). The third pathway consists of individuals with greatest severity of GD and presents with not only emotional vulnerabilities but is distinguished from the second pathway by the presence of impulsivity and features of antisocial personality disorder (Blaszczynski & Nower, 2002).

Context of Gambling in Brazil: Jogo do Bicho

Although the past several decades have witnessed a significant expansion of commercial gambling activities worldwide (Winters & Smith, 2019), gambling remains a partially prohibited activity in Brazil. With the exception of state-run lotteries, bingo, and a few electronic gambling machines (EGMs), all other forms of gambling are illegal (Tavares, 2014). Yet, gambling is a popular recreational activity with 12% of Brazilian adults engaging in gambling on a monthly basis and 1% of people experiencing gambling disorder (GD) (Tavares et al., 2010).

These rates of gambling are similar to other jurisdictions with legalized gambling (Williams et al., 2012), which may be due in part that despite its prohibited status, gambling activities are relatively common and easy to access. For example, illegal EGMs are commonly found in bars, restaurants, and clubs (Spritzer et al., 2009). One form of illegal gambling that is immensely popular is "Jogo do Bicho" (Brazilian Animal Game), a lottery-like gambling game that is available throughout Brazil. Speaking to its popularity, it is estimated that Jogo do Bicho generates 60% more revenue than state-run legal lotteries (Medeiros et al., 2016), making it the largest clandestine form of gambling in the world (Freire, 2019).

The origins of Jogo do Bicho date back to 1892 in Rio de Janeiro (Freire, 2019; Tavares, 2014). In its earliest iteration, the owner of the city zoo, Baron Joao Batista Viana Drummond, offered a special promotion to increase zoo attendance. Each admission ticket contained a stamp of one of twenty-five animals. At the end of the day, the zoo staff would unveil a picture of a randomly chosen animal, and those with the corresponding stamp would win 20 times their entrance fee. The modern version of Jogo do Bicho, which evolved from its humble beginnings at the zoo, can be played all across Brazil through a widely distributed network of illegal kiosks. These kiosks are found near hospitals, businesses, as well as legal lottery venues. In Jogo do Bicho, players can either place a bet on numbers ranging from 0 to 100 or place bets on pictures of animals, which represent a group of four numbers. For example, players can place bets on the dog (animal #5) representing numbers 17 through 20 or bet on a combination of 4 numbers. Placing the bet on the correct animal pays 18 times the original bet, whereas correctly picking the combination of 4 numbers will pay out 3000 times the original wager.

Although similar to legal lotteries, the unique structural characteristics of Jogo do Bicho may increase the risk of gambling-related harms and GD. In contrast to the most frequent legal lotteries in which the draws occur six times per week, the draws for the winning numbers for Jogo do Bicho take place up to 6 times per day. In other words, Jogo do Bicho offers players 42 opportunities to win each week, compared to only six opportunities to win in legal lotteries. Unfortunately, as previously mentioned, the continued rate of reinforcement and the increased speed of play in Jogo do Bicho may result in greater gambling-related harms and increased risk for GD (Harris & Griffiths, 2018), which is in line with behaviorally conditioned pathways in the pathways model (Blaszczynski & Nower, 2002). Furthermore, the presence of illegal kiosks may increase the availability of Jogo do Bicho, increasing the potential risk of GD. Additionally, there is no standard cost per bet in Jogo do Bicho, and players can risk as much money as they choose, which engenders greater financial risk for players.

Relatively few studies have investigated Jogo do Bicho despite the popularity and increased risk to players. To our knowledge, there have been only two empirical investigations of Jogo do Bicho (Mathias et al., 2009; Medeiros et al., 2016). Mathias et al.

(2009) found that Jogo do Bicho was among the most common types of gambling activities among people seeking treatment for substance use disorders with a comorbid gambling disorder. The rates of Jogo do Bicho was even greater than slot machines in this sample, which speaks to the potential increased risk of Jogo do Bicho and gambling disorder. Medeiros et al. (2016) found that participants who were in treatment due to Jogo do Bicho were older, male, financially dependent, less educated, and less likely to be single than individuals in treatment due to other forms of gambling. Jogo do Bicho players were also more likely to report unsuccessful efforts to cut down their gambling, which is an indicator of greater severity of gambling problems. Taken together, these results provide preliminary support that Jogo do Bicho players may represent a unique subgroup of individuals who gamble.

While informative, a limitation of the existing research is that the samples consisted of people seeking treatment, which provides an important but restricted perspective on individuals who play Jogo do Bicho. This is because the small minority of people who seek treatment for GD are significantly different than those who do not in terms of severity and length of problem (Evans & Delfabbro, 2005; Pulford et al., 2009; Suurvali et al., 2008). In addition, GD and gambling harms are related but distinct constructs with the former including dependence-related symptoms such as preoccupation and the latter being more specific to negative consequences as a result of one's gambling (Dowling et al., 2021). Gambling-related harms are also not limited to individuals with GD or those seeking treatment and are experienced across the population of individuals who gamble (Browne & Rockloff, 2018). As such, investigating Jogo do Bicho among a non-treatment seeking sample would provide valuable insights into this culturally unique form of gambling, including its associated harms and risk of GD.

In the present research, we aimed to extend the previous findings of Jogo do Bicho by investigating the prevalence, playing habits, demographic, gambling-related harms, and GD associated with Jogo do Bicho in a sample of current lottery players recruited from a representative sample of lottery kiosks all across Brazil. Based on the limited extant literature, we expected Jogo do Bicho players compared with non-Jogo do Bicho players to be more likely to be male, older, to report gambling-related harms, and to meet criteria for GD using the 5th edition of the Diagnostic and Statistical Manual Disorders criteria (American Psychiatric Association, 2013).

Method

Participants and Procedure

Current lottery players were recruited from legal lottery kiosks across all regions of Brazil. The sampling strategy was designed to ensure a representative sample of the Brazilian population who normally gamble on lotteries, 18 years old or older, from all regions of Brazil. The sampling strategy was chosen in order to develop a profile of representative lottery players in Brazil. The sample was collected using a three-stage stratified cluster design. The first stage consisted of selecting communities with lottery kiosks in Brazil. We obtained list of all cities that contained lottery kiosks provided by Caixa Econômica Federal. In the first stage, 189 municipalities were selected with stratification by State, population size, average income of the municipality, and number of lottery players, which was estimated by number of bets placed on Megasena (a legal lottery game) in the previous month. Municipalities

were selected with the probability proportional to the revenue of lottery shops. In the second stage, five hundred lottery shops were selected within each municipality with the probability proportional to their revenue. Within selected lottery shops, the third stage selected individuals systematically as they arrived and lined up to purchase their lottery tickets. The selection of individuals was based on the experience from our pilot study. A new individual was to be selected who first arrived at the shop, 30 min after a previous individual refused to participate, or 1 h after a complete interview, until 15 interviews were completed or the shop closed. Data on total revenue of the selected lottery shops was collected for the weight calculation, with the number of individuals in a day estimated based on average number of tickets per lottery player and revenue that day.

The interviewers approached potential participants who were in line waiting to purchase a lottery ticket using a standardized script: "Good morning / Good afternoon, we are inviting 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 min 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. Trained interviewers conducted a total of 5407 interviews, and informed consent was obtained from all participants. The sampling error was set as 2%, for a confidence interval of 95%. Weights were attributed to account for the stages of sample selection, interview refusal, variations in lottery prizes throughout weeks of the data collection period, day of the week in which bets are placed (i.e., further or closer to the day of the draw), amount of money wagered, and the number of bets placed in the lottery shops selected for the study.

Measures

Demographics

Participants, age, gender (male/female), marital status (single, married/co-living, widowed, divorced), and ethnicity (White, Black, Mixed, Other) were collected.

Jogo do Bicho

Face valid items assessed whether participants have played Jogo do Bicho in the past year or in their lifetime; "have you gambled on Jogo do Bicho in the past 12 months?", "have you ever played Jogo do Bicho?" (Y/N). Participants were categorized as current Jogo do Bicho players if they engaged in Jogo do Bicho in the past 12 months. Participants who had engaged in Jogo do Bicho in the past but not in the past 12 months were categorized as lifetime players. Lastly, participants who reported *never* having engaged in Jogo do Bicho were classified as non-players.

Participants who indicated engaging in Jogo do Bicho in the past year were asked how many days in the past 30 days they played Jogo do Bicho and the average amount of money bet when playing Jogo do Bicho. Participants were also asked if Jogo do Bicho was their most preferred form of gambling, "Of all the games you have played in your life, is Jogo do Bicho your favorite?" and whether Jogo do Bicho was the gambling activity they had bet the most in their lifetime, "Is Jogo do Bicho the game you had bet the most in your life?".

Other Gambling Behaviors

In addition to Jogo do Bicho, participants were asked about their frequency of engagement in other gambling activities, including slot machines, bingo, scratch cards, cards, sports betting, and others, "How often have you played the following gambling activities below in the past 12 months." The response options were 0, 1 time, 2–10 times, 11–20 times, or more than 20 times and were collapsed to 0 (none) and 1 (1–20).

Gambling Disorder

A Brazilian-Portuguese version of the NORC Diagnostic Screen for Gambling Problems (NODS; Tavares et al., 2010) was included to provide DSM-5 criteria for GD. Participants reporting 4 or more symptoms were classified as having GD. The NODS has demonstrated strong psychometric properties including internal consistency ($\alpha = 0.88$) and test–retest reliability (ICC = 0.84) (Brazeau & Hodgins, 2022). The NODS also demonstrates convergent validity with other measures of problem gambling as well as strong sensitivity (84%) and specificity (83%) when compared with the Problem Gambling Severity Index (Brazeau & Hodgins, 2022). The internal consistency of the NODS from the present sample was 0.78.

Gambling-Related Harms

Gambling-related harms were asked using face-valid items, "Has gambling caused the following problems in your life?" The specific gambling-related harms assessed included work, family, friends, neighbors, or acquaintances, financial, law, emotional, well-being, and accidents (e.g., car) due to excessive tiredness. Harms related specifically to Jogo do Bicho were also assessed; "Has gambling on Jogo do Bicho caused the following problems in your life" were assessed with Y/N response options.

Analytic Plan

SPSS Complex Samples module was used to account for the weighted data. The municipalities were specified as primary sampling units of the first stage, with states and municipality revenue ranges as strata. Descriptive statistics were used to examine the prevalence and playing habits of Jogo do Bicho players. Chi-square analyses were conducted to examine the demographic, gambling-related harms, and risk of GD associated with Jogo do Bicho for categorical variables. Next, we conducted binary logistic regression analyses between current Jogo do Bicho, past Jogo do Bicho, and non-players on DSM-5 symptoms and gambling-related harms controlling for demographic variables (age, gender, ethnicity, education, and marital status). General linear models were used for continuous variables, and custom contrasts were used for pairwise comparison when significant differences were observed. Additionally, general linear models were used to control for engagement of other gambling activities to provide further support for the association between Jogo do Bicho and gambling harms as well as risk of gambling disorder. List-wise deletion was used to handle missing data given that less than 1% of the data was missing.

Ethics

Ethics approval was obtained from the local ethics committee and the regional health authority (The State of São Paulo Regional Medical Council) and is registered at the national research website (Plataforma Brazil). The data were part of a larger study examining responsible gambling funded by CAIXA, the state-run operators of gambling activities in Brazil to the senior author. The data are the property of the Department of Psychiatry of University of São Paulo, which holds *unrestrained* reporting rights without previous consultation or interference from the funding source.

Results

Demographics

Of the 7226 eligible individuals, 5619 agreed to participate, and 5407 completed the interview, resulting in a refusal rate of 25.2%. The mean age of the sample was 50.2 years (SE = 0.56) (95% CI: 49.08–51.30). The majority of participants were men (83.9%). Regarding ethnicity, 43.4% (SE = 1.9%: 95% CI: 39.6–47.2) were mixed ethnicity, 40.5% (SE = 2.0%, 95% CI: 36.7–44.5) White, 12.3% (SE = 0.8%; 95% CI: 0.4–3.0) Black, and 3.8% (SE = 0.4%; 95% CI: 3.0–4.8) reported being of another ethnicity. The majority were married or co-habituating (64.9%, SE = 1.2%) (95% CI: 62.5–67.2). In regard to education, 41.8% (SE = 1.7%) of the sample had less than high school education, 38.3% (SE = 1.6%) had completed high school, 19.1% (SE = 1.5%) reported post-secondary or post-graduate education, and the education status was unknown for 0.8% (SE = 0.1%) of the sample. There were several demographic differences between Jogo do Bicho players and non-players. Current Jogo do Bicho players were older, male, self-identified as an ethnic minority, and more likely to be widowed or divorced (Table 1).

Jogo do Bicho

Regarding Jogo do Bicho, 62.6% (SE = 2.1%; 95% CI: 58.4–66.5) reported never having engaged in Jogo do Bicho, 27.0% (SE = 1.6%, 95% CI: 23.9–30.2) reported having played Jogo do Bicho in the past year, and 10.5% (SE = 1.6%, 95% CI: 8.5–12.8) reported having played in their lifetime. Of the Jogo do Bicho players, 79.2% (SE = 1.4%, 95% CI: 76.3–81.8) indicated that Jogo do Bicho was their preferred form of gambling, whereas 27.1% (SE = 1.4; 95% CI: 24.4–29.9) indicated that Jogo do Bicho was the game they bet the most in their lifetime. Current Jogo do Bicho players reported playing on average of 7.15 days (SE = 0.57) (95% CI: 6.03, 8.27) with an average wager of $3.92 (SE = 0.46) (95% CI: 3.01, 4.83) in the past 30 days.

Gambling-Related Harms

Current Jogo do Bicho players were significantly more likely to report experiencing the following harms caused by gambling in general compared to lifetime and non-players: professional or employment ($p = 0.022$); relationship problems with family ($p < 0.001$);

Table 1 Demographic characteristics and differences in current, lifetime, and non-Jogo do Bicho players ($N = 5407$)

Demographics	Current Jogo do Bicho players ($n = 1421$; 27.0%, SE = 1.6%, 95% CI: 23.9–30.2)		Lifetime Jogo do Bicho players ($n = 549$; 10.5%, SE = 1.6%, 95% CI: 8.5–12.8)		Non-Jogo do Bicho players ($n = 3437$; 62.6%, SE = 2.1%, 95% CI: 58.4–66.5)		Significance test	
	% (SE)	M (SE)	% (SE)	M (SE)	% (SE)	M (SE)	Likelihood ratio (χ^2)	p
Age		51.92 (.71)[a]		53.05 (1.26)[a]		48.97 (.53)[b]	17.54^	< .001
Gender							16.09	.039
Men	27.9 (1.6)		10.0 (1.1)		62.0 (2.1)			
Women	22.0 (2.4)		12.8 (2.1)		65.2 (3.2)			
Ethnicity							52.03	.008
White	23.9 (1.8)		12.6 (1.6)		63.5 (2.5)			
Black	33.0 (2.7)		10.6 (2.5)		56.4 (2.9)			
Mixed	28.8 (1.8)		8.2 (1.1)		63.0 (2.4)			
Other	19.6 (5.2)		13.7 (3.3)		66.7 (6.1)			
Education							38.62	.014
Less than high school	28.3 (1.7)		9.1 (1.1)		62.6 (2.4)			
Completed high school	27.8 (2.1)		10.5 (1.3)		61.6 (2.6)			
Completed college	21.3 (2.8)		13.2 (2.2)		65.5 (2.8)			
Unknown	44.3 (10.1)		17.3 (6.5)		38.1 (8.2)			
Marital status							49.27	.037
Single	26.1 (3.9)		8.1 (1.2)		65.8 (3.9)			
Married/co-living	25.3 (1.7)		10.4 (1.2)		64.3 (2.1)			
Widowed	34.2 (6.2)		14.6 (4.9)		51.3 (5.7)			
Divorced	33.9 (2.3)		12.5 (2.3)		53.6 (3.2)			

SE standard error. The *n's* reported are unweighted. ^ = Wald F. Superscripts denote significant differences

relationship problems with friends, neighbors, or acquaintances ($p=0.028$); and financial ($p=0.001$), legal ($p=0.008$), emotional ($p=0.005$), and health problems ($p=0.008$). The pattern of results remained the same when controlling for demographic variables (Table 2). Current Jogo do Bicho players ($M=0.14$, $SE=0.02$) were significantly more likely to report experiencing a greater number of harms compared to both lifetime ($M=0.07$, $SE=0.15$) and non-players ($M=0.05$, $SE=0.01$), Wald F=7.043, $p=<0.001$, which remained significant in a pairwise comparisons with Bonferroni correction. These results remained significant when controlling for other types of gambling activities, including legal lotteries, slot machines, bingo, scratch cards, cards, sports betting, and others, Wald F=5.78, $p=0.004$. In contrast, there were no differences in the number of harms between lifetime Jogo do Bicho players and non-players ($p=0.817$).

When comparing harms causes by Jogo do Bicho, current players were significantly more likely to report experiencing professional or employment harms ($p=0.010$) and relationship problems with their family ($p=0.030$) compared to lifetime Jogo do Bicho players. The pattern of results remained significant when controlling for demographic variables (Supplemental Table 1). Participants who reported that Jogo do Bicho was the gambling activity they bet most in their life were more likely to report experiencing professional and employment harms ($p=0.022$), problems with family ($p<0.001$), and financial ($p<0.001$) and emotional harms ($p=0.025$). When controlling for demographic variables, professional and employment harms were no longer statistically significant (Supplemental Table 2). In contrast, participants who reported that Jogo do Bicho was their most preferred activity were more likely to report experiencing problems with friends, neighbors, or acquaintances ($p<0.001$) but *less likely* to report experiencing problems with family ($p=0.009$) and financial problems ($p=0.037$). The pattern of results remained consistent when controlling for demographic variables (Supplemental Table 3). The pattern of results suggests that engaging rather than preferring Jogo do Bicho is associated with harms experienced.

Gambling Disorder

Current Jogo do Bicho players were significantly more likely to experience each of the symptoms of GD as well as meet criteria for GD (5.7%; SE=1.0) compared to lifetime (2.0%; SE=0.6) and non-Jogo do Bicho (2.5%; SE=0.4). The pattern of results remained consistent when controlling for demographic variables with the exception of loos of control now reaching statistical significance (Table 3). Current Jogo do Bicho players met on average of 0.81 (SE=0.06) symptoms, compared to 0.61 (SE=0.09), for lifetime and 0.52 (SE=0.04) for never. These results remained significant when controlling for other types of gambling activities, Wald F=9.89, $p<0.001$. Custom contrasts indicated that current Jogo do Bicho players reported significantly more DSM-5 symptoms than lifetime Jogo do Bicho players and never players, which remained significant when correcting for multiple comparisons.

In contrast, there were no significant differences between Jogo do Bicho players and never players on current DSM-5 symptoms of GD. Similarly, no significant differences were found when comparing individuals whose gambling activity they had bet most in their life was Jogo do Bicho and those whose most bet gambling activity was not Jogo do Bicho. The pattern of results remained largely unchanged when controlling for demographic variables with the only exception being financial symptoms reaching statistical significance (Supplemental Table 4). Lastly, participants who reported Jogo do Bicho being their most preferred form of gambling did not report greater current symptoms and criteria

Table 2 Comparing general gambling harms and harms caused by legal lotteries between current, lifetime, and non-Jogo do Bicho players ($N = 5407$)

Harms	Current Jogo do Bicho players ($n = 1421$)	Lifetime Jogo do Bicho players ($n = 549$)	Non-Jogo do Bicho players ($n = 3437$)	Significance test		
	% (SE)	% (SE)	% (SE)	Likelihood ratio (χ^2)	*p*	*Adjusted p**
Professional or employment	1.2 (0.4)	0.1 (0.1)	0.2 (0.2)	17.10	.022	.001
Relationship with family	2.7 (0.5)	1.3 (0.4)	1.0 (0.2)	18.95	< .001	< .001
Relationship with friends, Neighbors or acquaintances	1.5 (0.6)	0.4 (0.2)	0.4 (0.2)	15.91	.028	.028
Financial	2.5 (0.6)	0.9 (0.3)	0.7 (0.2)	23.95	.001	< .001
Legal	0.4 (0.2)	0.1 (0.1)	0.1 (0.1)	7.98	.008	.049
Emotional	4.5 (0.9)	3.2 (0.8)	2.1 (0.4)	20.14	.005	.020
Health	0.8 (0.3)	0.5 (0.3)	0.2 (0.1)	10.97	.008	.013
Accidents	0.4 (0.2)	0.1 (0.1)	0.1 (0.1)	4.62	.066	.265

SE standard error

* Adjusted *p* values when controlling for age, gender, ethnicity, education, and marital status

Table 3 DSM-5 symptoms in current, lifetime, and non-Jogo do Bicho players in ($N = 5407$)

	Current Jogo do Bicho players ($n = 1421$)	Lifetime Jogo do Bicho players ($n = 549$)	Non-Jogo do Bicho players ($n = 3437$)	Significance test		
DSM-5 symptoms	% (SE)	% (SE)	% (SE)	Likelihood ratio (χ^2)	*p*	*Adjusted p**
Withdrawal	5.3 (0.8)	3.3 (1.3)	2.9 (0.4)	17.10	.028	.009
Tolerance	3.8 (0.7)	6.0 (1.8)	3.3 (0.5)	9.04	.187	.175
Loss of control	7.2 (1.2)	7.2 (3.4)	4.3 (0.5)	19.21	.165	.049
Preoccupation	26.6 (1.9)	22.4 (2.9)	18.5 (1.5)	40.65	.001	.001
Coping	16.6 (1.3)	13.2 (3.1)	10.1 (1.1)	39.89	.001	< .001
Chasing	15.0 (1.8)	6.7 (1.2)	5.9 (0.6)	100.59	< .001	< .001
Deception	7.1 (1.2)	3.3 (1.1)	2.3 (0.3)	58.69	< .001	< .001
Risk relationship	1.7 (0.5)	0.6 (0.3)	0.3 (0.1)	22.37	< .001	.001
Finances	3.0 (0.7)	0.4 (0.1)	1.1 (0.2)	29.85	< .001	< .001
DSM-5 criteria (4 +)	5.7 (1.0)	2.0 (0.6)	2.5 (0.4)	72.62	< .001	< .001

SE standard error. *DSM-5* 5th edition of the Diagnostic and Statistical Manual of Mental Disorders

*Adjusted *p* values when controlling for age, gender, ethnicity, education, and marital status

for GD compared to participants whose most preferred gambling was not Jogo do Bicho. Similarly, the pattern of results remained unchanged when controlling for demographic variables with the exception of the financial symptoms now reaching statistical significance (Supplemental Table 5).

Discussion

The present research assessed the playing habits of current Jogo do Bicho players and differences in demographic, gambling-related harms, and risk of GD compared to lifetime and non-players in a sample of current Brazilian lottery players who were recruited from a representative sample of lottery kiosks in all regions of Brazil. To our knowledge, this research is the first to assess the demographics, gambling habits, gambling-related harms, and risk of GD of Jogo do Bicho in a non-treatment sample and only the third study on the largest clandestine form of gambling in the world.

The results suggest that despite its illegal status, Jogo do Bicho is a popular activity among legal lottery players with 1 in 4 reporting having engaged in Jogo do Bicho in the past year, with roughly 4 in 10 having played Jogo do Bicho in their lifetime. Consistent with previous studies (Mathias et al., 2009; Medeiros et al., 2016), Jogo do Bicho players were also more likely to be men and older. The illegal nature of Jogo do Bicho may potentially account for the gender differences, as men are more likely to engage in illegal activities (Kruttschnitt, 2013). Alternatively, the gender difference may be due to heightened levels of impulsivity, including sensation seeking in men (Cross et al., 2011), which may attract men to Jogo do Bicho given its structural characteristics of increased speed of play and increased size of the wager. The findings that Jogo do Bicho players were older may be particularly disquieting given that gambling problems in older adults are associated with additional negative consequences including health problems and social difficulties (Ariyabuddhiphongs, 2012) and as Jogo do Bicho may increase the risk of GD. Future research that examines whether older men in Brazil are more likely to meet criteria for GD and potential reasons for this increased risk would be quite informative. Participants who self-identified as Black and or of Mixed race were more likely to engage in Jogo do Bicho, which suggests potential systemic inequalities such as lower social determinants of health among people of ethnic minorities in Brazil (Okuda et al., 2016) that may increase the likelihood of engaging in Jogo do Bicho.

Individuals who engaged in Jogo do Bicho were significantly more likely to report experiencing all types of harms except for accidents compared to lifetime and non-players, which suggests that Jogo do Bicho may be a particular risk form of gambling. Furthermore, Jogo do Bicho players reported greater symptoms of GD and were more likely to meet criteria for GD. This was particularly true for current Jogo do Bicho players. When controlling for other gambling activities, engaging in Jogo do Bicho remained a significant predictor of both gambling-related harms and meeting criteria for GD. A potential reason for the greater harms and risk of GD among Jogo do Bicho players may be due to the structural characteristics of the game, including the faster rate of play and increased financial risk, which have been associated with problematic gambling behaviors (Dragicevic et al., 2011; Harris & Griffiths, 2018). However, this is merely a plausible hypothesis in need of empirical testing.

Regarding potential policy implications, the legalization and regulation of Jogo do Bicho have been a hot topic in recent years. Indeed, a bill regarding this topic has been under discussion for 7 years at the Brazilian Congress. Arguments in favor for legalizing and

regulating Jogo do Bicho include generating additional revenue, precluding the involvement of organized crime in Jogo do Bicho, and reducing the harms and risk of developing GD associated with Jogo do Bicho. Conversely, arguments against legalization and regulation state that it is unlikely that illegal gambling will stop solely by regulating Jogo do Bicho. Beyond the debates regarding regulation of Jogo do Bicho, what is clear is that public educational initiatives to increase awareness of the potential negative impacts associated with Jogo do Bicho play are warranted. Additionally, it may behoove law enforcement to better enforce the prohibition of Jogo do Bicho. Indeed, the decreased availability of Jogo do Bicho may help reduce the rates of GD in Brazil considering that an increased risk of GD is associated with Jogo do Bicho.

Limitations

A limitation of the present research was the cross-sectional design, which cannot identify the causal relationship between Jogo do Bicho and gambling-related harm and GD. Future research examining the risks of gambling-related harms of Jogo do Bicho with longitudinal studies would be highly informative. Nonetheless, the representative sampling of lottery kiosks and representative sample of lottery players throughout Brazil provides some confidence in our findings. Second, we used an author-derived measure of harm. Given the recent development of scales that measures the harms associated with gambling (Browne et al., 2018; Murray Boyle et al., 2021), future research investigating harms of Jogo do Bicho with validated measures would be informative. Similarly, whether participants engaged in Jogo do Bicho as well as behaviors related to Jogo do Bicho such as money spent were measured using self-report measures. Fourth, we did not assess differences in psychological characteristics among Jogo do Bicho players. For example, it would have been informative to assess whether Jogo do Bicho players differ in psychological characteristics that have been shown to be a risk factor of GD (e.g., impulsivity). That said, given the paucity of empirical research on this domain, these findings are of importance and underscore that Jogo do Bicho players represent a unique group of people who gamble. Lastly, the participants in the study were all current lottery players. In other words, we did not have a strict sample of players who engage in Jogo do Bicho *but not* legal lotteries. We recruited legal lottery players given the ethical challenges in recruiting participants specifically for a study of an illegal form of gambling. Additionally, with the similarity in structural characteristics between legal lotteries and Jogo do Bicho, it is possible that the majority of Jogo do Bicho players also engage in legal lotteries. Having said that, future research that examines characteristics of individuals who engage in Jogo do Bicho but not legal lotteries would be informative.

Conclusion

Since its humble beginnings at the Rio Zoo, Jogo do Bicho has become a recognized feature of Brazilian culture. Unfortunately, however, given the structural characteristic of the game, Jogo do Bicho appears to be a relatively risky form of gambling whose players report greater gambling-related harms and increased GD. Although the present research has revealed some of the characteristics of Jogo do Bicho players and the differences between lifetime and non-players, more research in this domain is needed. Increased understanding

may help efforts to attenuate some of the harms associated with the world's largest clandestine form of gambling.

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Data Availability Data are available upon request with permission from the authors REB.

Declarations

Ethics Approval Approval was obtained from the Research Ethics Board of Faculty of Medicine at the University of Sao Paulo. The procedures used in this study adhere to the tenets of the Declaration of Helsinki.

Consent All procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation (institutional and national) and with the Helsinki Declaration of 1975, as revised in 2000 (5). Informed consent was obtained from all patients for being included in the study.

Competing Interests HSK has received research funding from the Alberta Gambling Research Institute (Canada), Gambling Research Exchange Ontario (Canada), and International Center for Responsible Gaming (US). HSK has received speaker/travel honorarium from Alberta Gambling Research Institute (Canada), New Horizons (Canada), and the Florida Council on Compulsive Gambling. DCH has received research funds from the Canadian Institutes of Health Research, Health Canada, Alberta Gambling Research Institute, and the Ministry of Health, New Zealand. He has received consulting fees from the Canadian Centre on Substance Use and Addiction. He is a member, but receives no compensation from the National Centre for Responsible Gaming Scientific Advisory Board, UBC Centre for Gambling Research, various journal editorial boards, WHO Committee on the Public Health Implications of Addictive Behaviours, and International Scientific Advisory Board of the Centre of Excellence in Responsible Gaming (CERG) at the University of Gibraltar. He has received conference travel funds from New Horizons, Health Management Systems of America, Gambling International Symposium, Switzerland, V Congresso Clinca Psiquitria, Brazil, NCRG, Las Vegas, and Responsible Gambling Council, Toronto. HT has received grants from the Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq) (National Council for Scientific and Technological Development) for the concession of Productivity Grant Process CNPq 304767/2011–5 and concession of the resource for the Universal Project Research Aid in the Process CNPq 445465/2014–0; Federal Bank of Brazil (CAIXA), worked from March 2015 to August 2017 as a responsible gambling consultant for the national lottery products under Contract #3800/2015 and Process #7066.01.0168.01/2015; World Lottery Association, member of the Independent Assessment Panel for the responsible gambling certification from October 2015 to February 2016; and Serasa-Experian, by granting resource contract with no number for the development of debt management and financial education for young couples' program during 2014. MS and MCM have no conflict of interests to declare.

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