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Relations Among Gambling Behavior, Associated Problems, Game Type, and Risk Factors in a Rural, African American, Adolescent Sample

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Abstract
Problem gambling is a rising concern among adolescent populations; youth gamble more frequently than adults, and those who gamble are more susceptible than adults to maladaptive outcomes. Research shows that gambling problems are exacerbated among minorities, despite lower rates of gambling frequency. Minority youth are at especially high risk for problematic gambling outcomes, though they have not been widely studied. The objectives of this study were to (a) investigate gambling frequency and rates of associated problems among rural, African American youth, (b) examine risk factors associated with gambling problems, and (c) explore preferences for game type. Hypotheses were tested with survey data from 270 African American youth from rural communities in Georgia, ages 14–17. Past-year gambling prevalence was 38% (48% of males and 28% of females), and 30% of those who gambled (11% of the total sample) reported at least one problem behavior associated with gambling. Confirmatory factor analysis established a distinction between games of skill versus luck. Gambling problems were associated with skill games, and youth played skill games more than luck games. Substance use and anger scores predicted gambling frequency, and gambling frequency predicted gambling problems. Depression scores provided no predictive utility. Poverty status was negatively associated with skill gambling, and there was no association between poverty status and luck gambling. Males gambled more frequently, had more gambling problems, and were more likely to engage in skill gambling relative to females.

Keywords African American · Adolescent · Low SES · Luck-based games · Skill-based games · Problem gambling

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Introduction

The problems associated with gambling are well documented (American Psychiatric Association [APA], 2013; Gobet & Schiller, 2014; Kryszajtys et al., 2018; Langham et al., 2015; Martins et al., 2008); however, gamblers are not a homogeneous population. Differences in gambling outcomes exist at the level of the individual, the community, the culture, and even game preferences, such as luck- or skill-based games. As such, it is not sufficient to refer to gambling "in America" or "among youth." Gambling outcomes vary extensively depending on the subgroup an individual belongs to. The current study examines gambling prevalence, preference for skill vs luck type games, and other correlates in a particularly high-risk and underrepresented population—rural, African American adolescents, ages 14–17, who experience disproportionate rates of poverty relative to their non-African American peers.

Gambling Risk

The majority of gamblers (80–85%) do not experience negative consequences and are said to be "social gamblers." These are individuals who gamble in a recreational context, are able to control their behavior, and as such do not experience long-term negative consequences (Fong, 2005). However, a significant portion of gamblers experience persistent, uncontrollable, or maladaptive gambling that interferes with daily life. Behaviors that are consistent with this pattern are indicative of problem gambling. Whether an individual is a recreational or problematic gambler is influenced by a variety of social, psychological, and biological factors that extend beyond the individual.

Possible consequences of problem gambling include accruing debt; losing property or homes; neglecting family, work, and hobbies; divorce; losing a job; and experiencing emotional distress, such as depression, anxiety, and suicidal thoughts. There is an increased risk for stress-related conditions, such as hypertension, cardiovascular disease, and sleep deprivation among problem gamblers (APA, 2013; Fong, 2005).

Many of the negative outcomes that derive from problem gambling are perceived as primarily applicable to adults, but youth may experience similar negative effects. They may experience legal, vocational, and interpersonal struggles similar to those of adults (Deverensky, 2015). They also experience guilt, stress, anxiety, and depression (Hardoon & Deverensky, 2002; Kryszajtys et al., 2018). The harmful effects of problem gambling are exacerbated among adolescents due to adolescence being a critical period of neural development. Adolescents experience more activity in the reward and habit systems of the brain, and they do not yet have fully developed executive control systems with which to check this hyperactivity (Jordan & Andersen, 2017). Compared to individuals who do not gamble in adolescence, those who do are more likely to experience continued negative physical and psychiatric health outcomes into adulthood (APA, 2013; Goldstein et al., 2009).

If certain clinical criteria are met, as established by the DSM-5, then a person may be diagnosed with Gambling Disorder (GD). The current study is conducted outside of a clinical context, so the term problem gambling will be used, rather than GD, to designate negative outcomes related to gambling activity (Carlson & Moore, 1998). When applicable, GD-consistent symptoms will be noted.

Risks for Adolescent Gambling

Gambling is a restricted activity for minors; nevertheless, studies reveal that minors are able to, and do, participate in gambling activities at high rates (Kryszajtys et al., 2018; Schiller & Gobet, 2014). The knowledge that minors are gambling at high rates is of concern, not only because it is unlawful, but because gambling during adolescence is riskier than adult gambling (Carlson & Moore, 1998; Kryszajtys et al., 2018). Relative to adults, adolescents are more susceptible to developing addictions of *any* type (Crews et al., 2007), including Gambling Disorder (GD), and they are more likely to maintain their addictions (Jordan & Andersen, 2017). The prevalence of GD among adolescents, which is two to four times the rate of GD among adults, suggests an elevated level of risk present for adolescents who engage in such activities (Chambers & Potenza, 2003; Sussman et al., 2011). Furthermore, research shows that adolescents do not need to participate in gambling themselves in order to be affected by it; adolescents who are exposed to gambling, regardless of their own involvement, are more likely to develop gambling problems as adults (King et al., 2009).

Prevalence of Adolescent Gambling

Prevalence rates for adolescent gambling vary across the literature; however, some findings remain consistent. Underage adolescents are gambling, are doing so at higher rates than adults, are exhibiting higher rates of *problem* gambling relative to adults, and the prevalence rates for adolescents are increasing, both in terms of problem gambling and social (or non-problematic) gambling (Calado et al., 2017; Carlson & Moore, 1998; Chambers & Potenza, 2003; Delfabbro et al., 2016; Goldstein et al., 2009; King et al., 2020; Martins, 2008; Shaffer & Hall, 2001; Sussman et al., 2011; Winters et al., 1993). Minors report participating in both legal and illegal forms of gambling, and they report encountering few barriers to participating in legal forms, which should be inaccessible to them due to age restrictions (Carlson & Moore, 1998; Deverensky, 2015).

A number of studies have demonstrated majorities of adolescent populations engaging in gambling within the past year, for example 66% of 12–19-year-old participants (Hardoon et al., 2004), 77–83% of adolescents (Martins, 2008), and up to 86% of 15–18-year-old participants (Winters et al., 2002). One study (Goldstein, 2009) found prevalence of only 23% for ages 14–18, but importantly, this sample was recruited from youth presenting to an inner-city emergency department, with African Americans being over-represented. A large-scale study of students in Minnesota public schools found 70% of male and 37% of female 9th graders gambled in the past year; and 83% of male and 60% of female 12th graders gambled in the past year (Stinchfield, 2000).

The average age of gambling onset for American youth is between nine and 10 years old, and the average age of onset of purchasing lottery tickets is age 12.1 years (Felsher et al., 2004; Hardoon & Deverensky, 2002; Wilber & Potenza, 2006). The earlier gambling onset occurs, the more likely it is that an individual will experience severe gambling problems, both as an adolescent and as an adult (Hardoon & Deverensky, 2002; Rahman et al., 2012). Systematic reviews report prevalence rates for GD among teenagers to be between 2.1% and 10% (Shaffer & Hall, 2001; Sussman et al., 2011). By contrast, studies of U.S. adults determine GD prevalence to be between 1 and 3% (Sussman et al., 2011). According to the DSM-5, GD is present in about 0.2—0.3% of the general population, with lifetime

prevalence up to 1% (APA, 2013). This variation in prevalence rates reflects key differences in age groups, further emphasizing the dangers of youth gambling; however, variation may also reflect the differences in data collection methods, measurement tools, and region of study. For example, the DSM-5 relies on clinical data, whereas the cited studies report non-experimental research data.

Risk Factors Associated with Gambling

The role of gambling as a process addiction rather than a substance use addiction may make it seem less deleterious; however, neurophysiological research reveals that gambling and drug use operate on similar neurobehavioral mechanisms and follow the same patterns, suggesting an etiological relationship between substance use and gambling addiction (Chambers & Potenza, 2003; APA, 2013; Kryszajtys et al., 2018). It is not surprising, then, that the most commonly reported comorbidities for problem gambling are substance use and alcohol use, regardless of gender, social status, race, ethnicity, or age group (Fong, 2005; Martins et al., 2008; Schiller & Gobet, 2014; Welsh et al., 2014; Winters et al., 2002).

Problem gamblers report high levels of depression, anxiety, other mood disorders, and personality disorders, with anxiety and depression being more common among female gamblers relative to male gamblers (Chambers & Potenza, 2003; Desai & Potenza, 2008; APA, 2013; Gobet & Schiller, 2014; Welsh et al., 2014). Non-violent criminal offenses and anger/hostility are reported at high levels among male gamblers (Kryszajtys et al., 2018).

Gambling Types

Gambling games have been meaningfully divided into strategic, or skill-based games, and non-strategic, or luck-based games in previous research (Chantall & Vallerand, 1996; Goodie, 2015; Martins, et al., 2008). Distinctions are made primarily based on personal involvement, but functional motives also play a role in whether a game is categorized as "skill" or "luck." Skill-based games are those that require some form of personal involvement, such as playing cards, whereas games of luck are those that preclude personal involvement, such as lottery games. Seemingly luck-based games, such as throwing dice or flipping coins, may also be categorized as skill-based due to a high level of personal involvement and the player's general *belief* that their actions influence the outcome. In other research, games that are primarily motivated by monetary gains are categorized as luck, and games that are primarily motivated by entertainment or social contact are categorized as skill (Chantall & Vallerand, 1996).

Findings show that game preference can differentially predict problem gambling outcomes. Research among adult gamblers shows that those who engage in skill-based games are more likely to be male and have more gambling problems (Boldero & Bell, 2012; Martins et al., 2008). One explanation for the link between skill gambling and gambling problems may be explained by the illusion of control—a cognitive distortion which is paramount in games of skill (Goodie & Fortune, 2013). In games of skill, players believe they have the ability to control the outcome of the game, despite their input having a negligible influence. In some cases, the increased skill may lead to better chances; however, all games include an element of luck, and the influence of skill does not change the outcome markedly (Chantall & Vallerand, 1996). Prior research links problem gambling with

decision-making deficits and higher cognitive biases, such as the illusion of control (Schiller & Gobet, 2014).

Conversely, research conducted with youth shows that an earlier age of gambling onset is associated with luck-based games, rather than skill-based games (Fesher et al., 2004). Studies report lottery games as the preferred gambling type among adolescents (Griffiths & Barnes, 2008; Jacobs, 2000). Zhou et al. (2012) found that luck-based gambling, rather than skill-based gambling, was a predictor of gambling frequency. Among youth, non-strategic, luck-based games were linked to problem gambling severity and earlier onset GD (Rahman et al., 2012). Some research suggests that the variation in findings is a result of gender difference (Carlson & Moore, 1998). The current study will investigate whether skill and luck as distinct gambling categories will describe gambling in this sample, as well as determine whether one, if either, is a better predictor of negative gambling outcomes.

Rural, African American Adolescents

Findings from the current gambling literature show that males gamble more frequently than females. Adolescents experience more problems relative to adults; minorities experience more problems relative to Caucasians; and lower SES is associated with more gambling problems (Deverensky, 2015; Welte et al., 2007).

African Americans are less likely to gamble overall, and research shows no clear preference for gambling type. However, among African Americans who gamble, they do so more heavily and exhibit more problems than other racial groups (Welte et al., 2002). A nationally-representative sample revealed that, although African Americans gamble less frequently, they experience problem gambling rates twice that of Whites (Alegria et al., 2009). In another study of inner-city youth, being male and African American was associated with more gambling problems, betting larger amounts of money, and gambling more frequently relative to non-African Americans, despite fewer individuals reporting gambling participation (Goldstein et al., 2009). In a study of 17-year old urban African American adolescents, past-year gambling prevalence was 47.4% (56.6% of males, 36.5% of females), and gambling problems were present for 29.8% of individuals (Martins, et al., 2008). Other underage samples in the literature, which aggregate across racial or ethnic subgroups, report much lower problem gambling rates—between 2 and 10% (Martins, 2008; Sussman et al., 2011).

To date, there is sufficient research to demonstrate that African Americans and adolescents are at higher risk for problematic outcomes relative to Caucasians and adults. However, there are few studies of adolescent gambling that focus on African Americans. Prior studies tend to have low African American representation, in addition to low base-rates of gambling among African Americans, making it difficult to detect effects among this group. Studies that focus on African Americans have generally focused on inner-city and urban samples. Current studies of rural African American youth risk factors do not include gambling measures. As such, rural individuals are not yet represented in gambling studies of African American adolescents.

The current study examines prevalence, game type, and other correlates of gambling among this unique subgroup. Although substance use, depression, and hostility are commonly cited comorbidities of gambling, the prior literature has not addressed whether this holds true for rural youth. Urban African American adolescents tend to experience a disproportionate rate of gambling problems, but it is unknown whether this holds true for rural youth. Likewise, although general samples of adolescents present high rates of

gambling activity, it is unknown whether gambling is occurring in rural adolescent populations. Previous research has contributed to understanding the topography of African American risk factors and adolescent gambling, but the group in question for this study remains unrepresented.

We expected that gambling prevalence would be lower than what is reported in the current literature for the general adolescent population, due to lower prevalence of gambling among African Americans. We expected that gambling problems would be higher than the 2–10% range documented among general adolescent samples due to the higher rates of gambling problems that present among African Americans. Based on current studies, we expected to see more male than female gamblers, and males presenting with more gambling problems and greater gambling frequency relative to females. Due to the high rate of poverty among this sample, poverty status was explored as a potential predictor of negative gambling outcomes. Substance use was expected to be a significant predictor of gambling problems for both males and females. We expected anger and depression to be significant predictors of gambling problems; however, based on prior research, anger should be predictive for males and depression should be predictive for females. Skill and luck gaming types were also examined to determine whether previous findings regarding type of gaming pertain to a rural, African American, adolescent sample.

Method

Participants and Procedure

Study hypotheses were tested with follow-up data from a sample of 270 African American youth and their caregivers who had participated in a randomized prevention trial ($N=472$ at baseline; Kogan et al., 2019). In the parent study, youth were assigned to one or two developmentally timed, family-centered, alcohol use prevention programs or to a control group (see Kogan et al., 2019 for intervention details). We expected random but equivalent variation in comparison groups (e.g., males/females, above/below poverty), as individuals who had or had not received intervention during previous waves were equally likely to be represented. Further, experimental condition was included in regression models to control for potential variability in gambling behavior introduced by random assignment to an intervention or control group.

Families were recruited for the parent study from eight rural school districts in Georgia. Schools provided lists of African American students in the fifth grade whose parents were then contacted by phone in random order by research staff to screen for eligibility. Eligibility requirements were (a) youth age 11 or 12 years and (b) youth self-identification as African American or Black. Of the 825 families screened for eligibility, 625 were eligible to participate; of these, 472 were enrolled in the study at baseline (a 76% recruitment rate). This study reports on data from a random sample of participants in the parent study (Wave 6, $n=270$), five years post-baseline when target youth were age 16. Attrition analysis revealed no significant differences in target gender, caregiver gender, poverty status, or monthly income from Wave 1 to Wave 6, ($t(470)=0.598$, $p=0.550$, $t(470)=0.644$, $p=0.520$, $t(470)=-0.228$, $p=0.819$, $t(439)=0.599$, $p=0.996$, respectively).

African American research staff conducted home visits during which data were collected from primary caregivers and youth via audio computer-assisted, self-interviews on laptop computers (ACASI). ACASI technology provides video and audio enhancements

that obviate literacy concerns. Interviews took place in private settings so that each participant could respond without other family members viewing their responses. Informed consent/assent was obtained from parents and youth. Youth incentives were $40 at each assessment. All study protocols were approved by the university IRB.

Target adolescents were 51% female ($n = 139$) and 14–17 years of age ($M = 15.84$) during Wave 6. The majority of primary caregivers were female (96%, $n = 259$). Adolescents mostly indicated a parent as the primary caregiver (92%), with the remainder reporting living with a grandparent, aunt/uncle, sibling, or other caregiver. Income was not used as a screening factor, but our sample of rural African Americans is disproportionately impoverished relative to the general rural population of Georgia. Of the sample, 54% ($n = 146$) of participants reported living below the federal poverty threshold, while the overall poverty rate for rural Georgia is 20.9% (Rural Health Information Hub, 2018).

Measures

Gambling Measures

Gambling measures included gambling status, gambling frequency, gaming type (luck/skill), and gambling problems. Adolescents responded to a gambling questionnaire which yielded measures of gambling type, gambling frequency, problem gambling behaviors, and problem gambling symptoms. Gambling status was identified as "gambler" if the participant endorsed at least one type of gambling or "non-gambler" if the participant endorsed no types of gambling.

Questions about gaming type were adapted from the South Oaks Gambling Screen (SOGS; Lesieur & Blume, 1987) and reworded to be more appropriate for the adolescent audience (see Table 1 for full list of items). Adolescents responded to nine questions about the types of gambling they had participated in during the past 12 months. Participants responded on a Likert scale from 1 (*never*) to four (*at least once per week*). A frequency index was created by converting responses to a 0–3 scale and summing the scores, such that a score of zero indicates an individual who did not report any gambling, and 27 indicates the highest possible score.

Individuals were categorized by gambling type depending on whether they endorsed skill-based games, luck-based games, or both. Games were categorized based on prior research, which distinguishes between "skill" and "luck" on the dimensions of personal involvement and functional motive (Chantall & Vallerand, 1996; Goodie, 2015; and Martins, et al., 2008). Luck-based games included slot machines and poker machines, Bingo, picking lottery numbers, lottery scratch games, and online lottery games. Skill-based games included playing cards/throwing dice; betting on games of personal skill, like pool or bowling; betting on sports teams; and betting on internet or video games (Martins et al., 2008). A confirmatory factor analysis (CFA; discussed on page 18) was consistent with the expected categorization.

Questions about gambling behaviors were adopted from the South Oaks Gambling Screen – revised for adolescents (SOGS-RA; Winters et al., 1993) and the DSM-5 (APA, 2013). Adolescents responded to a total of sixteen dichotomous (*yes/no*) questions about gambling behaviors exhibited over the past 12 months. Seven questions addressed commonly reported gambling-related problems from the SOGS-RA, and the remaining nine questions addressed the nine symptoms of Gambling Disorder outlined in the DSM-5. Problem behaviors are distinguished as those that produce negative consequences, whereas

Table 1 Types of gambling endorsed among target adolescents

Question (During the past 12 months, how often have you bet/gambled, even casually, for money or valuables in the following ways?)	CFA Component	*N*	% of Total population	% of Gamblers
Played cards or dice, or flipped coins, for money	Skill	26	10	25
Bet on games of personal skill, like pool, golf, or bowling	Skill	41	15	40
Bet on sports teams	Skill	58	22	57
Played Bingo for money	Luck	13	5	13
Played slot machines, poker machines, or other gambling machines	Luck	10	4	10
Played lottery games by picking numbers, like PowerBall, Cash 4 or Cash 5	Luck	9	3	9
Played the lottery's scratch games	Luck	25	9	25
Played the lottery's online games	Luck	7	3	7
Bet on internet or video games	Skill	39	15	38

symptoms are those specifically outlined by the DSM-5 as diagnostic criteria. Separate indices were created for gambling problems and gambling symptoms by summing the number of items endorsed.

Risk Factors

Youth depression was measured using the Center for Epidemiologic Studies Depression Scale for Children (CES-DC; Weissman et al., 1980). The CES-DC is modified from the adult version CES-D (Radloff, 1977) and includes 20 Likert format self-report questions, ranging from 0 (*not at all*) to 3 (*A lot*). Weissman et al. (1980) suggest that a score of 16 or higher indicates high risk for depression. The APA recognizes the CES-D as a suitable scale for a range of age groups, races, and ethnicities (APA, 2020).

Anger was measured using a subscale of the Client Evaluation of Self and Treatment (CEST; Institute of Behavioral Research, 2007). The anger subscale is an eight-item, self-report measure with a 1 (*strongly disagree*) to 4 (*strongly agree*) Likert response set, which has been shown to have good psychometric properties (Joe et al., 2002). An anger index was calculated by summing the Likert responses, such that a score of eight would indicate the lowest level of anger, and a score of 32 would indicate the highest level of anger. Wave 6 coefficient alpha reliability was 0.90.

Participants self-reported substance use for the three-month period directly preceding the study. Questions asked about frequency of marijuana use, tobacco use, alcohol use, and binge drinking. Items used in this questionnaire have been used in previous research with similar populations (Brody et al, 2006, 2012). Participants indicated the frequency with which they had used each category of substance, ranging from 0 (*none*) to 6 (*30 or more times*). For cigarette use, the scale ranged from 0 (*none*) to 6 (*about 2 packs/day*). Scores were standardized and summed to create a cumulative substance use index.

Target adolescents' poverty status was determined based on the federal poverty threshold as established by the Census Bureau at the time of data collection. Poverty status was analyzed dichotomously (*yes/no*). Demographic data were collected during each wave of the study; statistics reported in the current article are based on Wave 6 data.

Data Analysis Plan

Initially, we described the prevalence of gambling in the whole sample, then we examined prevalence rates by gender. We then used a Confirmatory Factory Analysis (CFA) to test a two-factor model of gambling activity based on games of skill and games of luck. Game type (skill/luck) factor scores were established for each participant on each game type. We conducted t-tests using the factor scores to determine if game type differed based on gender.

Correlations were examined between game type, gambling frequency, and gambling problems. Logistic regression models were used to determine the predictive utility of gambling frequency and gambling problems on the risk factors of depression, anger, and substance use. Gender was assessed as a possible moderator for all models. Factorial ANOVA was used to analyze the effect of gambling status and gender on depression, anger, and substance use, and interactions were explored. Finally, t-tests were used to determine if gambling outcomes (status, frequency, type, problems) differed based on poverty status.

Results

Gambling Prevalence

The overall past-year gambling prevalence of the 270 adolescents surveyed during Wave 6 was estimated to be 38% ($n=102$), based on self-report of at least one type of gambling for money or valuables during the past 12 months. Of the entire sample, 28% of females ($n=39$) and 48% of males ($n=63$) had gambled in the past year, and males ($M=2.09$, $SD=3.53$) gambled more frequently than females ($M=0.62$, $SD=1.82$, $t(191.5)=4.27$, $p<0.001$). Of those who gambled, 38% ($n=39$) were female and 62% ($n=63$) were male; and males ($M=4.29$ $SD=4.07$) gambled more frequently than females ($M=2.31$, $SD=2.89$, $t(98.04)=-2.87$, $p=0.005$). The average frequency score among those who gambled was 3.53 ($SD=3.8$) on a scale from 0 to 27.

Of the 102 adolescents who reported some type of gambling, 31 also reported at least one problematic behavior associated with gambling. In other words, 11% of the total sample, or 30% of those adolescents who gamble, are at risk for developing Gambling Disorder (GD). Twenty-eight adolescents (10% of total, 27% of gamblers) indicated at least one problem symptom as designated by DSM-5 diagnostic criteria, suggesting high risk for GD. Six adolescents endorsed four or more of the DSM-5 symptoms, which would be consistent with a designation of GD (2% of total, 6% of gamblers). These findings are especially noteworthy because all adolescents in our sample are below the legal gambling age in Georgia.

Due to the low rate of participants who reported gambling problems consistent with DSM-5 symptoms, all further analyses were conducted using a cumulative index of all 16 problem items, including problem behaviors and problem symptoms, herein referred to as "gambling problems." The mean number of total gambling problems endorsed was 1.15 ($SD=2.23$), and males experienced more gambling problems relative to females ($M=1.47$, $SD=2.32$, $M=0.61$, $SD=1.98$, respectively, $t(87.58)=1.997$, $p=0.049$). There was a moderate correlation between gambling frequency and gambling problems ($r=0.42$, $p<0.001$). This correlation did not hold true for females who gambled ($r=0.1$, $p=0.536$), but it was significant for males who gambled ($r=0.50$, $p<0.001$).

The three most popular types of gambling among adolescents were all skill-based games, including betting on sports teams ($n=58$), betting on personal games of skill ($n=41$), and betting on internet or video games ($n=39$, see Table 1 for percentages for each gaming type).

Gaming Types

A confirmatory factor analysis (CFA) was conducted to test a two-factor model of gambling activity based on gaming type (games of luck or games of skill). The data for this analysis included nine gambling items from the SOGS; five items measured the participants' frequency of luck-based gambling activity, and four items measured the participants' frequency of skill-based gambling activity.

The CFA was conducted using the lavaan package, version 0.6–7, in R version 1.3.1073. The maximum likelihood (ML) method was used for estimation, and full information maximum likelihood (FIML) was used to account for missing data. The model fit was good based on the Comparative Fit Index (CFI; 0.92). Using the more

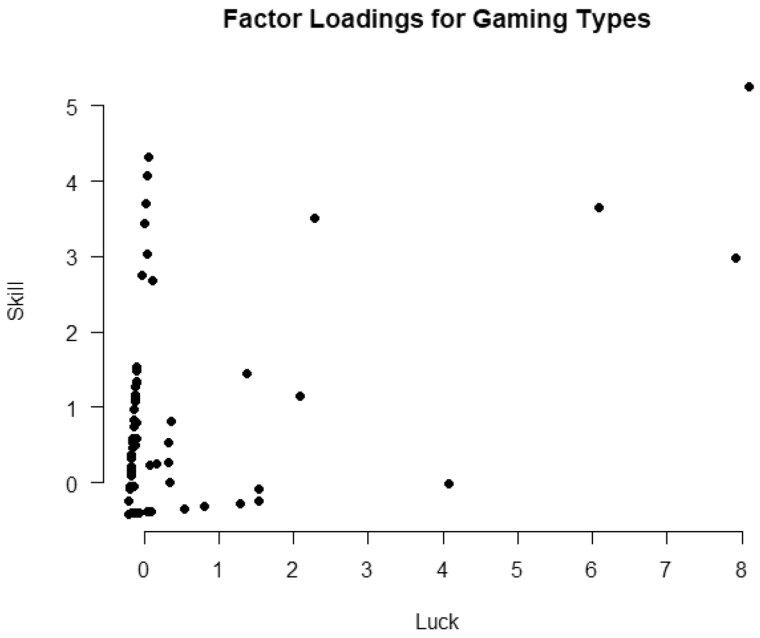

Fig. 1 CFA factor loadings for two-factor solution using whole sample data with FIML approach

Table 2 CFA factor loadings for two-factor solution using whole sample data with FIML approach

Latent factor	Indicator	B	SE	Z	Beta	Sig
Luck	Bingo	0.394	0.057	6.883	0.635	< .001
Luck	Slots	0.515	0.045	11.391	0.916	< .001
Luck	Pick numbers	0.351	0.054	6.493	0.606	< .001
Luck	Scratch	0.091	0.068	1.333	0.138	0.183
Luck	Online lotto	0.437	0.041	10.658	0.877	< .001
Skill	Personal Skill	0.641	0.082	7.808	0.75	< .001
Skill	Cards and dice	0.629	0.075	8.428	0.802	< .001
Skill	Sports	0.613	0.092	6.674	0.655	< .001
Skill	Internet and video	0.327	0.099	3.303	0.352	0.001

*Solution converged in 22 iterations

conservative Tucker Lewis Index (TLI) yielded an acceptable fit, although not excellent (0.89). AIC (1671.57) and sample-size adjusted BIC (1661.43) were acceptable. RMSEA was acceptable (0.097, 90%CI[0.056—0.136]). The p of close fit did not indicate good fit ($p = 0.032$), likely due to sample size. Taken together, these scores suggest the model is a good fit. The model indicates that gambling activity is a function of two distinct factors of luck and skill (see Fig. 1 and Table 2 for factor loadings).

Of the 102 adolescents who reported gambling, 61 (60% of gamblers, 22.7% of total sample) reported engaging in skill gambling exclusively, 20 (19.6% of gamblers, 7.4%

of total sample) reported engaging in luck gambling exclusively, and 21 (20.6% of gamblers, 7.8% of total sample) reported engaging in both types of gambling.

In this sample, participants who engaged in games of skill were more likely to have gambling-related problems ($r=0.39$, $p<0.01$) and tended to gamble more frequently, ($r=0.786$, $p<0.01$), relative to those who engaged in games of luck. Comparing those who did or did not live below poverty using gambling factor scores revealed a significant correlation for games of skill, such that skill-gamblers were less likely to be those who lived below poverty ($r=0.164$, $p<0.01$). There was no association between poverty and games of luck. Males ($M=0.38$, $SD=1.29$) engaged in more games of skill relative to females ($M=0.36$, $SD=0.34$, $t(146.95)=6.31$, $p<0.001$), but there was no significant difference between males and females on games of luck (mean difference = 0.1).

Risk Factors for Gambling

Depression

A factorial ANOVA was conducted to examine the relationship between gender, gambling status, and depression. There was no main effect of gender ($p=0.383$) or gambling status ($p=0.929$) on CES-D scores, and there was no interaction between gender and gambling status ($p=0.845$). Depression levels were not self-reported as being different between males, females, gamblers or non-gamblers. CES-D scores did not predict gambling frequency or gambling problems.

Anger

A factorial ANOVA was conducted to examine the relationship between gender, gambling status, and anger. There was a significant main effect of gambling status such that those who gambled ($M=15.26$, $SD=6.42$) displayed more anger relative to those who did not gamble, ($M=13.8$, $SD=5.73$, $F(1,265)=4.99$, $p=0.026$). There was no significant main effect of gender ($p=0.12$), and there was no significant interaction effect between gender and gambling status, ($p=0.230$). Individuals who gambled displayed higher anger scores regardless of gender (see Fig. 2). Anger scores predicted gambling frequency in a linear regression model, ($F(1,100)=12.27$, $p=0.001$, $R^2=0.11$), but they did not predict gambling problems.

Substance Use

Gambling Status A factorial ANOVA was conducted to examine the relationship between gender, gambling status, and substance use. In the overall sample, there was no main effect of gender on substance use ($p=0.791$), and there was no interaction between gender and gambling status ($p=0.843$). However, there was a main effect of gambling status, such that those who gambled ($M=0.69$, $SD=1.6$) engaged in more substance use relative to non-gamblers ($M=0.16$, $SD=0.66$, $F(1,265)=13.6$, $p<0.001$; see Fig. 3). Gambling status was predictive of substance use, regardless of gender.

Gambling Frequency Linear regression was used to examine the predictive value of substance use on gambling frequency. The substance use questionnaire was a significant predictor of gambling frequency and explained 23% of variance for the whole sample ($n=269$,

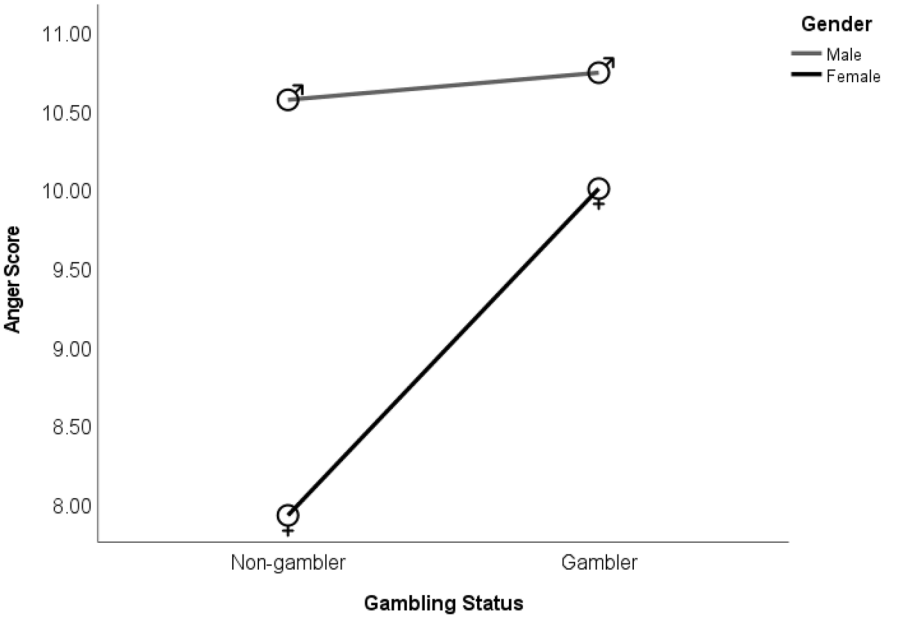

Fig. 2 Plot showing effect between gambling status and gender for anger scores

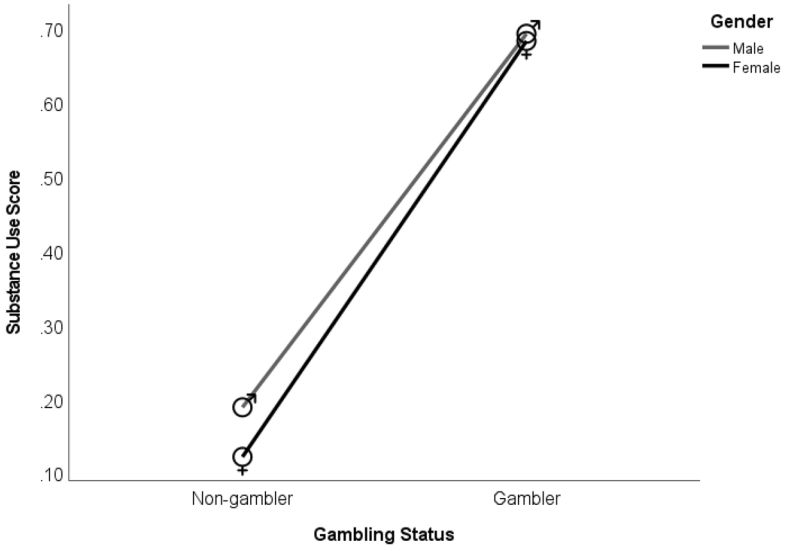

Fig. 3 Plot showing main effect of gambling status on past three-month substance use scores

$F(1, 267) = 81.74$, $p < 0.001$). Adding gender to the model explained an additional 6.2% of variance ($F(2, 266) = 56.62$, $p < 0.001$). A hierarchal multiple regression determined there was an interaction between gender and substance use. Gender moderated the effect of sub-

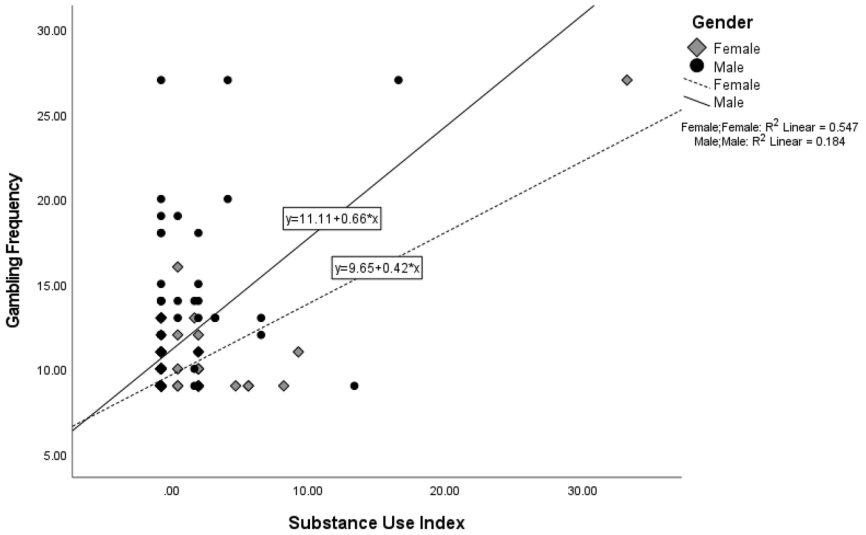

Fig. 4 Plot showing interaction between gender and substance use on gambling frequency

stance use on gambling frequency, as evidenced by an increase in total variation explained of 1.2% ($F(1,265) = 4.59$, $p = 0.03$; see Fig. 4).

Gambling Problems Linear regression was used to examine the predictive value of substance use on gambling problems among those who gambled ($n = 102$). The substance use questionnaire alone was not a significant predictor of gambling problems, but gender was ($F(1,100) = 1.05$, $p = 0.31$, $F(1,99) = 4.78$, $p = 0.031$, respectively). A hierarchal multiple regression determined there was an interaction between gender and substance use on gambling problems. Gender moderated the effect of substance use on past year gambling problems, as evidenced by an increase in total variation explained of 5.5% ($F(1,98) = 6.04$, $p = 0.016$; see Fig. 5).

Poverty Status

There were no significant differences in gambling frequency, gambling problems, or gambling status based on poverty status.

Discussion

These findings reveal that rural, African American adolescents are gambling at non-negligible rates, but the frequency of gambling is considerably less than the frequency reported in previous studies of general adolescent samples (Hardoon et al., 2002; Stinchfield, 2000; Welte et al., 2002; Winters et al., 2002). However, as expected, the rate of gambling problems was higher than has been reported in previous studies of general adolescent samples

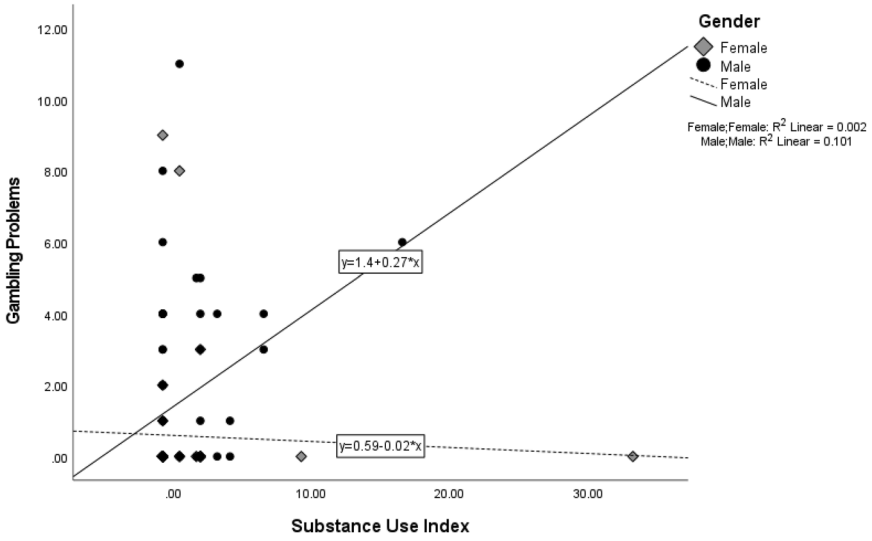

Fig. 5 Plot showing interaction between gender and substance use on gambling problems

(Welte et al., 2002). This sample also exhibits a much higher rate of symptoms consistent with GD diagnosis relative to what is reported for the general population (2%, compared to 0.2–0.3%; APA, 2013).

Males gambled more frequently than females, had more gambling problems, and were more likely to endorse skill-based gambling. Skill-based gambling was a strong preference for gamblers in this sample, with over 80% of gamblers endorsing at least one type of skill-based game, and 60% endorsing skill-based games exclusively. This finding differs from studies that find youth typically prefer games of luck, (Fesher et al., 2004; Griffiths & Barnes, 2008; Jacobs, 2000; Zhou et al., 2012), and it is of concern because skill-based games were found to be associated with increased gambling frequency and a higher rate of gambling problems.

Substance use, poverty, depression, and anger did not predict gambling problems; however, the low base-rate of gambling problems in this sample diminished the power available to detect an effect. It is possible that at this age, gambling is occurring, but problems have not yet developed. Gambling frequency was associated with gambling problems, so frequency is used in lieu of gambling problems.

Gambling frequency predicted past-three-months substance use. Males in the general sample had higher substance use scores than females, but this effect disappeared among gamblers, such that there was no difference between males and females in substance use scores. Rather, *all* gamblers demonstrated high substance use. Substance use was predictive of gambling status, regardless of gender. Anger was associated with gambling status but did not predict frequency or problems. Again, anger did not differ between males and females among those who gambled. Rather, *all* gamblers demonstrated higher levels of anger.

The age of gambling onset is unknown in the sample because gambling measures were not added until Wave 6; however, we can ascertain that by 15–16 years old, 38% of this sample had engaged in past-year gambling activity, and 30% of those who gambled have at least one problem behavior associated with gambling.

Limitations

Prevalence rates for adolescent gambling vary depending on region, variance in local regulations, differing attitudes between communities, demographic variables, and type of measurement used. Therefore, it is difficult to make clear comparisons across studies. Further, the majority of accepted gambling measures are intended for use with adults, although some versions have been adapted to meet the unique needs of adolescents (Carlson & Moore, 1998). The gambling measures used in this study were adapted forms of those adult versions. This study, and others, face the limitation of acquiring accurate prevalence rates that are generalizable to the greater population. The findings presented here are specific to Georgia, as gambling regulations vary greatly from state to state. This study was somewhat exploratory in nature—although analyses were theoretically driven with regard to gambling among subgroups, it was difficult to predict outcomes based on combination of these demographic features. The exploratory nature underscores the need to replicate findings in future waves of data.

All participants had been assessed multiple times by the SAAF-Steps project, reporting on high-risk and illegal activities without any negative repercussions; as such, there was no reason to believe there would be deception on a significant scale. However, the nature of self-report data, as compared to clinical data, necessitates there will be a certain level of error.

Conclusions

Even in a conservative gambling state such as Georgia, with strict regulations and limited forms of legalized gambling, among minors who are not permitted to gamble legally, this study finds a high rate of gambling and a high rate of problem gambling. The problems that derive from gambling addiction tend to be thought of as "adult" problems, such as jeopardizing a career, encountering marital problems, or losing one's home. However, adolescents suffer from the same maladaptive behavior patterns—they are affected in their personal and interpersonal relationships, financially, vocationally and in physical health (Delfabbro & King, 2012; Holdsworth et al., 2015; Kryszajtys et al., 2018). The heightened vulnerability of an adolescent brain is the rationale behind age-restricting potentially addictive behaviors, such as smoking and drinking. Gambling is no exception, but because the harm of gambling is not as readily obvious as the harm of substance use—and the negative behaviors that derive from problem gambling are not easily identifiable—gambling compulsions may go unnoticed and untreated for longer periods of time, allowing an addiction to fester well into adulthood as adolescents struggle to control their gambling behavior (Kryszajtys et al., 2018). This may be especially true for African Americans who experience higher rates of gambling problems, despite lower rates of gambling involvement. The cause of this disparity is beyond the scope of the current article; however, African Americans experience systematic disadvantages which place them at higher risk for a number of negative outcomes. Financial instability, less supervision at home, and lack of access to treatment options are possible contributors to the disproportionate negative effects seen in African American samples, placing them at higher risk for experiencing gambling-related problems and addiction.

Gambling is often overlooked as a risky behavior (Deverensky, 2015), but the more research develops, the more obvious it becomes that gambling is part of a larger spectrum

of risky behaviors. Despite many adults, caregivers, and teachers believing that gambling is a low-level risk factor (Deverensky, 2015), it routinely presents in a constellation of other high-level risk factors and should, at the very least, be considered subsyndromal to a larger risk syndrome. Given the frequency with which gambling occurs in conjunction with substance use, in particular, a sensible plan of action is to blend gambling prevention strategies with the array of existing intervention programs that are administered to at-risk youth (Martins et al., 2014).

Authors' Contributions The parent study was designed by Steven M. Kogan. All authors contributed to the current study's conception and design. Material preparation and data collection were performed by Steven M. Kogan and Adam S. Goodie. Analyses were performed by Theresa R. Reilly. The first draft of the manuscript was written by Theresa R. Reilly, and all authors commented on previous versions of the manuscript. All authors read and approved the final manuscript.

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Declarations

Conflicts of interest The authors have no conflicts of interest to disclose, financial or non-financial.

Consent for Publication This manuscript has not been submitted in part or in whole for publication elsewhere. Portions of these findings were presented as a poster at the 2019 annual meeting of the Society for Judgment and Decision Making, Montreal, Québec, Canada.

Ethical Approval All participants were involved in the informed consent and debriefing process in compliance with ethical standards. The study was performed in accordance with the ethical standards as laid down in the 1964 Declaration of Helsinki and its later amendments. The study was approved by the Institutional Review Board at the University of Georgia.

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