

Published in final edited form as:

*J Psychiatr Res.* 2012 May ; 46(5): 675–683. doi:10.1016/j.jpsychires.2012.02.007.

## The Relationship Between Age of Gambling Onset and Adolescent Problematic Gambling Severity

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### Abstract

The aim of this study was to characterize the association between problem gambling severity and multiple health, functioning and gambling variables in adolescents aged 13–18 stratified by age of gambling onset. Survey data in 1624 Connecticut high school students stratified by age of gambling onset ( 11 years vs. 12 years) were analyzed in descriptive analyses and in logistic

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#### Contributors

Drs. Desai, Krishnan-Sarin and Potenza were responsible for participant recruitment, data collection, and managing the experimental design of this study. Dr. Marvin Steinberg provided input on the study questionnaire. Drs. Pilver and Desai designed and conducted data analyses. Mr. Rahman, with Dr. Potenza's assistance, conducted literature searches and wrote the first draft of the manuscript, including abstract, introduction, methods, results, and discussion. All authors, including Dr. Rugle, have read, provided comments on and approved the final draft of the manuscript.

#### Conflict of Interest

Dr. Potenza has served as a consultant or advisor to Boehringer Ingelheim, Somaxon, various law offices, and the federal defender's office in issues related to impulse control disorders. He has financial interests in Somaxon. He has received research support from the National Institutes of Health, Veteran's Administration, Mohegan Sun Casino, the National Center for Responsible Gaming and its affiliated Institute for Research on Gambling Disorders, Psyadon, Forest Laboratories, Ortho-McNeil, Oy-Control/Biotie, and GlaxoSmithKline. He has participated in surveys, mailings, or telephone consultations related to drug addiction, impulse control disorders, or other topics. He has provided clinical care in the Connecticut Department of Mental Health and Addiction Services Problem Gambling Services Program. He has performed grant reviews for the National Institutes of Health and other agencies. He has guest-edited journal sections, has given academic lectures in grand rounds, continuing medical education events, and other clinical and scientific venues, and has generated book or book chapters for publishers of mental health texts. Drs. Pilver, Desai, Rugle, Steinberg, and Krishnan-Sarin and Mr. Rahman have no conflicts of interest to disclose.

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regression models. Earlier age of onset was associated with problem gambling severity as indexed by a higher frequency of at-risk/problem gambling (ARPG). Most health, functioning and gambling measures were similarly associated with problem gambling severity in the earlier- and later-age-of-gambling-onset groups with the exception of participation in non-strategic forms of gambling, which was more strongly associated with ARPG in the earlier-onset (OR=1.74, 95% CI=[1.26, 2.39]) as compared to later-onset (OR=0.94, 95% CI=[0.60, 1.48]) group (Interaction OR=1.91, 95% CI=[1.18, 3.26]). Post-hoc analysis revealed that earlier-onset ARPG was more strongly associated with multiple forms of non-strategic gambling including lottery (instant, traditional) and slot-machine gambling. The finding that problem gambling severity is more closely associated with multiple non-strategic forms of gambling amongst youth with earlier onset of gambling highlights the relevance of these types of youth gambling. The extent to which non-strategic forms of gambling may serve as a gateway to other forms of gambling or risk behaviors warrants additional study, and efforts targeting youth gambling should consider how best to address non-strategic gambling through education, prevention, treatment and policy efforts.

## Keywords

gambling; adolescence; underage gambling; age of onset; non-strategic gambling; risk behaviors

## 1. Introduction

Gambling is common with over two-thirds of the U.S. adult population having gambled in the past year (Lynch, Maciejewski, & Potenza, 2004; Potenza, Kosten, & Rounsaville, 2001a). Most adults gamble without problems, although an estimated 12 million individuals experience either problematic or pathological gambling (PPG; Lynch et al., 2004). Adult PPG has been associated with substance use problems, legal troubles, and poor physical and mental health (Barry, Stefanovics, Desai, & Potenza, 2011; Potenza et al., 2001a; Shaffer & Korn, 2002; Toneatto & Wang, 2009).

Most adults with PPG begin gambling prior to adulthood (Lynch et al., 2004; Volberg, 1994). Recent research demonstrates that the prevalence of past-year gambling among adolescents is 50% to 90% (Gupta & Derevensky, 2000; Shaffer & Hall, 2001). Multiple factors (risk-taking propensities during adolescence, accessibility, social acceptance) may influence adolescent gambling tendencies (Lloyd et al., 2010; Wilber & Potenza, 2006). Adolescence is a developmental period marked by high impulsivity, risk taking, and vulnerability to addiction, all of which can persist into adulthood (Auger, Lo, Cantinotti, & O'Loughlin, 2010; Chambers, Taylor, & Potenza, 2003; Van Leijenhorst et al., 2010; Volberg, 1994). Consistently, when compared to adult populations, adolescents may be two to four times more likely to experience gambling problems (Burge, Pietrzak, & Petry, 2006; Wilber et al., 2006).

PPG appears heterogeneous (Blaszczynski & Nower, 2002; Jimenez-Murcia et al., 2010; Ledgerwood & Petry, 2006). From a clinical perspective, identifying subgroups based on distinguishing characteristics may aid in advancing prevention and treatment strategies. Age of gambling onset may represent an important distinguishing feature in PPG as in substance use disorders. Early age of onset of alcohol use has been linked to later-life substance use, other risk behaviors and adverse measures of life functioning (Chou & Pickering, 1992; DeWit, Adlaf, Offord, & Ogborne, 2000; Grant & Dawson, 1997; Hawkins et al., 1997; Hingson, Heeren, & Winter, 2006). Similarly, early age at gambling onset may be predictive of future problems as it associates with adult problems including substance use disorders, depression and other psychiatric concerns (Grant, Kim, Odlaug, Buchanan, & Potenza, 2009; Jimenez-Murcia et al., 2010; Lynch et al., 2004). In another study, early-onset adult

PPG was associated with suicidal ideation, early onset of alcohol use, and prior substance abuse treatment (Burge et al., 2006). Together, these findings highlight the importance of examining the age of gambling onset in relation to gambling characteristics and psychiatric outcomes.

To date, few studies have focused on the relationship between age of gambling onset and the psychiatric profile of adolescents (13–18 years) with respect to their age at gambling onset. Felsher et al. (2004) studied gambling behaviors in a sample of Canadian adolescents (10–18 years) and found that compared to individuals who did not engage in lottery gambling, those who did reported a younger age of onset for gambling behaviors. A longitudinal study which examined a large sample of Canadian adolescents (11–16 years) showed that earlier- and later-onset gamblers followed different developmental trajectories and suggested that prevention strategies should be specific to each group (Vitaro, Wanner, Ladouceur, Brendgen, & Tremblay, 2004). As earlier-onset gambling has been linked to lottery gambling, a non-strategic form of gambling, the extent to which this type of gambling may associate to risky or problematic gambling in youth warrants further investigation. A recent study showed that early age of gambling onset was associated with at-risk/problem gambling (ARPG) in adolescent Internet gamblers (Potenza et al., 2011). In this study, a lower threshold for problem gambling severity (individuals reporting one or more inclusionary criteria for pathological gambling) was employed to examine gambling behaviors. This threshold was selected given findings that less severe forms of problem gambling during adolescence to be associated with poorer functioning during adolescence as well as in adulthood (Desai, Maciejewski, Pantalon, & Potenza, 2005; Duhig, Maciejewski, Desai, Krishnan-Sarin, & Potenza, 2007; Lynch et al., 2004; Pantalon, Maciejewski, Desai, & Potenza, 2008). To better understand and characterize adolescent PPG is crucial as it may be the most opportune time to prevent further development of the pathology (Wilber et al., 2006).

The aim of this study was to investigate health, functioning and gambling measures associated with problem gambling severity in adolescents stratified by earlier ( 11 years) and later ( 12 years) age of gambling onset. To examine these questions, we utilized data from a cross-sectional survey that assessed risk behaviors in Connecticut high school students; these data have been used previously to investigate correlates of problem gambling severity in general (Yip et al., 2011) and amongst internet and non-internet gamblers (Potenza et al., 2011). However, prior research with these data did not consider age of onset of gambling behavior in relation to health, functioning, and gambling measures.

We hypothesized that the prevalence of ARPG would be greater among adolescents who reported an earlier onset of gambling. Furthermore, we hypothesized that problem gambling severity would be more strongly associated with poorer academic performance, substance use, depression, and aggression in early onset gamblers, compared to late onset gamblers. Given prior findings linking early age of gambling onset with lottery gambling (Felsher et al., 2004), we also hypothesized that problem gambling severity would be more strongly associated with non-strategic forms of gambling amongst earlier-onset as compared to later-onset gamblers.

## 2. Methods

### 2.1 Participants

The recruitment and description of participants are as previously described (Cavallo et al., 2010; Desai, Krishnan-Sarin, Cavallo, & Potenza, 2010; Grant, Potenza, Krishnan-Sarin, Cavallo, & Desai, 2011a; b; Liu, Desai, Krishnan-Sarin, Cavallo, & Potenza, 2011; Schepis et al., 2011; Schepis et al., 2008; Yip et al., 2011). Briefly, all 4-year and non-vocational or

special education high schools in the state of Connecticut were invited to participate. Schools were offered an assessment of the risk behaviors associated with their respective student bodies as incentive for participation. Any school showing interest was contacted by research staff; a targeted selection was conducted for geographic regions not sufficiently represented. The final sample population included schools from all geographic regions and district reference groups (DRGs) in Connecticut. DRGs are based on the socio-economic status of the households comprising those districts and were included in this survey to account for the socio-economic differences between the various schools. The final overall selection (N=4,523) was not random, but still similar to the sample demographics of the 2000 Census for individuals 14–18 years of age.

## 2.2 Procedure

A passive consent procedure was utilized to obtain parental permission. Letters were mailed to parents outlining the study and those who did not want their child participating in the study were asked to contact the school directly. If no contact was made, then parental consent was assumed. Students were also given the option of not participating if they so desired. This consent procedure was approved by the participating schools as well as the Institutional Review Board of the Yale University School of Medicine.

A research group was sent to each of the schools and administered the survey in either English/Health class or in a school-wide assembly. Students were given pens for the survey and instructed not to write any identifying information on the survey. Students were informed that participation was voluntary. Individuals wishing not to participate or those students not given consent by their parents were instructed to sit quietly and complete other work. The survey consisted of 154 questions concerning demographic characteristics, gambling activity, substance use, and other risk behaviors.

## 2.3 Demographic and Health Measures

Socio-demographic variables assessed in the survey included gender, race/ethnicity and familial structure. Students' grade averages were examined in addition to their involvement in extracurricular activities. Self-reported measures of academic performance have been previously shown to be valid reflections of actual school performance as assessed by academic grades (Gilger, 1992).

Lifetime cigarette smoking was coded as either "never", "occasionally", or "regularly". Lifetime marijuana and alcohol use were coded dichotomously as either "yes" or "no" with regards to having ever tried either substance. Current alcohol consumption (having one whole drink of alcohol in the past 30 days) was coded into either "never regular" (1–5 days), "light" (6–9 days), "moderate" (10–19 days) or "heavy" (20–30 days). Other drug use (e.g., ecstasy, Special K, cocaine, and heroin) was dichotomized as either "yes" or "no" with regards to having ever consumed these drugs. Caffeine use (servings per day) was divided into "none", "1–2 per day", and "3+ per day".

Past-year dysphoria/depression (feelings of sadness or hopelessness) and aggressive/violent behaviors (getting into a fight or carrying a weapon) were assessed and coded as "yes" or "no".

## 2.4 Gambling Measures

Participants were instructed to consider gambling as "any game you bet on for money OR anything else of value." Types of gambling were coded into "strategic" (e.g. card games, craps, and games of skill), "nonstrategic" (e.g. traditional and instant (scratch card) lotteries, and bingo), and "machine" (e.g. slot machines, poker machines, and other gambling

machines). Gambling motivation responses were classified into four groups: Gambling for Excitement; Gambling for Financial reasons; Gambling for Escape; and Gambling for Social reasons. Gambling urges were assessed through items regarding pressure to gamble (“Do you ever feel pressure to gamble when you do not gamble”) or gambling-related anxiety (“In the past year have you ever experienced a growing tension or anxiety that can only be relieved by gambling”). Gambling partners assessed and classified as gambling with: adults, family, friends, strangers, and alone. Gambling duration was classified as either  $\leq 1$  hour or  $> 1$  hour and the ranges for gambling age of onset included:  $\leq 8$  years, 9–11 years, 12–14 years, and 15–17 years.

Individuals that responded to having a gambling age of onset of  $\leq 11$  years were grouped as “earlier-onset” and  $\geq 12$  years of age were “later-onset”. A study conducted by Winters et al. (1990) showed that among high school students, 40% of non-problem gamblers reported an age of onset before 11 years of age (sixth grade), compared to 50% of at-risk gamblers and 60% for problem gamblers. Additionally, the survey showed among the same sample that 91% of non-problem gamblers reported an age of onset after 12 years of age (seventh grade) compared to 10% of at-risk gamblers and problem gamblers (Jacobs, 2004).

Problem-gambling-severity groups were based on *DSM-IV-TR* criteria as assessed through items from the Massachusetts Gambling Screen (MAGS; Shaffer, LaBrie, Scanlan, & Cummings, 1994). Where multiple MAGS items correspond to the same DSM-IV criterion, a single point was awarded for endorsing either item. Only participants that responded to all 12 MAGS items directly corresponding with DSM-IV criteria were classified into the gambling groups. Problem gambling severity was defined as either low-risk gambling (LRG; individuals who reported past-year gambling but did not meet any DSM-IV criteria) or at-risk/problem gambling (ARPG; individuals who met one or more DSM-IV criteria), as done previously (Potenza et al., 2011).

## 2.5 Data Analysis

Individuals were selected for inclusion in the study if they provided valid data for the age-of-gambling-onset question, as well as responses to all twelve of the DSM-IV gambling questions. A total of 4,523 participants were administered the questionnaire. From the entire sample, 2,484 students had completed the gambling sections, with 454 (18%) of these students reporting non-gambling (Yip et al., 2011). For this study, 1,624 students were included that completed the gambling sections of the questionnaire, answered all 12 DSM-IV gambling questions, and indicated an age of gambling onset. All data were double-entered, reviewed to ensure within-range values, and randomly spot-checked to verify accuracy. Statistical analysis was conducted using SAS software (Cary, NC). Two-tailed, Pearson chi-square analyses were used to compare earlier-onset and later-onset gamblers. To produce odds ratios (ORs) and 95% confidence intervals (95% CIs) as a measure of the magnitude of the association between problem-gambling severity and our dependent variables of interest, we utilized logistic regression models for binary outcomes and multinomial logistic regression models for categorical outcomes, stratified according to age of gambling onset. To determine whether age of gambling onset moderated these relationships, we utilized the entire sample and included the main effects for age of onset and gambling problem severity, as well as the interaction term (age-of-onset-by-problem-gambling-severity) in the appropriate logistic or multinomial logistic regression model. All models were adjusted for age, race, gender, and household structure. Statistical significance was set at  $p < 0.05$ .

### 3. Results

#### 3.1 Demographics

Of the 1,624 adolescents studied, 1,116 (69%) indicated an earlier (prior to 12 years) age of gambling onset (Table 1). Among the earlier-onset gamblers, 43% were classified as ARPG while 57% were classified as LRG. For later-onset gamblers, 32% were classified as ARPG while 68% were classified as LRG, generating a significant between-group difference ( $\chi^2(1, N=1624)=16.59, p<.0001$ ).

#### 3.2 Health and Well-being Measures

Chi-square (Table S1) and logistic regression (Table 2) analyses examining the relationships between problem gambling severity and health and well-being measures by gambling group (earlier- vs. later-onset) are presented. Chi-square analyses tabulated frequencies for respondents on the given variables while logistic regression was used to understand the association between these variables and the different gambling groups. Among earlier-onset gamblers, ARPG individuals were more likely than LRG individuals to have a 'D's or lower' grade average (OR=1.85, 95% CI=[1.28, 2.66]). Amongst earlier-onset gamblers, ARPG individuals were more likely than LRG ones to report regular smoking (OR=2.13, 95% CI=[1.47, 3.06]), lifetime marijuana use (OR=1.61, 95% CI=[1.21, 2.12]), heavy drinking (OR=1.90, 95% CI=[1.10, 3.25]), and other drug use (OR=2.32, 95% CI=[1.55, 3.45]). Amongst later-onset gamblers, ARPG individuals were more likely than LRG ones to report lifetime marijuana use (OR=1.56, 95% CI=[1.002, 2.425]). ARPG individuals were more likely to report dysphoria/depression than LRG individuals (OR=2.14, 95% CI=[1.524, 3.005]). Amongst earlier-onset gamblers, ARPG individuals were more likely to report engaging in serious fights (OR=2.49, 95% CI=[1.679, 3.689]) and carrying a weapon within the past month (OR=2.09, 95% CI=[1.574, 2.772]). Interaction analyses testing the strengths across the gambling groups of the associations between ARPG and measures of health and well-being did not identify any significant effects, suggesting that the correlates of problem gambling severity were similar in the earlier- and later-onset gambling groups.

#### 3.3 Gambling Measures

The relationships between ARPG and gambling motivations and behaviors according to age of onset are presented (Tables 3, S2). Amongst earlier-onset gamblers, ARPG respondents were more likely than LRG respondents to report engagement in strategic (OR=2.99, 95% CI=[1.10, 8.2]), non-strategic (OR=1.74, 95% CI=[1.26, 2.39]), and machine (OR=2.06, 95% CI=[1.56, 2.71]) forms of gambling. Amongst later-onset gamblers, ARPG individuals were more likely than LRG individuals to report engagement in machine gambling (OR=1.67, 95% CI=[1.10, 2.52]). The interaction odds ratio between earlier-onset and later-onset gamblers was significant for engagement in non-strategic gambling, indicating a stronger association between ARPG and non-strategic gambling amongst earlier-onset individuals compared to later-onset individuals (OR=1.91, 95% CI=[1.18, 3.26]).

Amongst earlier-onset gamblers, ARPG individuals were more likely than LRG individuals to gamble for excitement (OR=1.75, 95% CI=[1.22, 2.50]), financial reasons (OR=2.77, 95% CI=[2.06, 3.73]), escape (OR=2.29, 95% CI=[1.75, 3.00]), and social reasons (OR=1.62, 95% CI=[1.25, 2.11]). Amongst later-onset gamblers, ARPG individuals differed from LRG individuals in gambling motivation for excitement (OR=2.05, 95% CI=[1.18, 3.54]), financial reasons (OR=2.14, 95% CI=[1.37, 3.33]), and escape (OR=1.88, 95% CI=[1.23, 2.89]).

With regards to gambling urges, earlier-onset ARPG individuals were more likely than LRG individuals to report feeling pressure to gamble (OR=4.18, 95% CI=[2.59, 6.73]) and anxiety

prior to gambling (OR=9.65, 95%CI=[4.84, 19.2]). Later-onset ARPG individuals were more likely than LRG individuals to feel pressure to gamble (OR=1.29, 95%CI=[0.59, 2.86]). Results for anxiety relief in later-onset gamblers were unstable due to low cell size.

Regarding gambling partners, earlier-onset ARPG individuals were more likely than LRG individuals to gamble with adults (OR=1.78, 95%CI=[1.36, 2.33]), strangers (OR=3.26, 95%CI=[2.12, 5.01]), and alone (OR=3.32, 95%CI=[2.12, 5.21]). A similar pattern was observed in later-onset gamblers, with ARPG individuals more likely than LRG individuals to gamble with adults (OR=2.12, 95%CI=[1.25, 3.59]), strangers (OR=7.55, 95%CI=[2.87, 19.8]), and alone (OR=2.52, 95%CI=[1.26, 5.04]). With respect to gambling duration, both earlier-onset ARPG individuals (OR=4.32, 95%CI=[3.03, 6.16]) and later-onset ARPG individuals (OR=4.24, 95%CI=[2.19, 8.19]) were more likely than their LRG counterparts to gamble for longer than one hour per week.

Aside from the non-strategic gambling finding, no other interactions were significant. To follow up on the significant interaction effect involving non-strategic gambling, post-hoc analyses examining specific forms of non-strategic gambling were conducted. Amongst earlier-onset gamblers, ARPG individuals were more likely than LRG individuals to have :bought instant (scratch) lottery tickets for themselves ( $\chi^2(1, N=1116)=36.37, p<.0001$ ); bought other lottery tickets for themselves ( $\chi^2(1, N=1116)=46.11, p<.0001$ ); received instant (scratch) lottery tickets as a gift ( $\chi^2(1, N=1116)=11.41, p=.0007$ ); received other lottery tickets as a gift ( $\chi^2(1, N=1116)=36.19, p<.0001$ ); played bingo at church, synagogue, or other public place ( $\chi^2(1, N=1116)=7.7, p=.005$ ); and played slot or other gambling machines ( $\chi^2(1, N=1116)=36.96, p<.0001$ ) (Table 4).

## 4. Discussion

### 4.1 Summary of Study

This study examined the correlates of ARPG as related to age of gambling onset amongst a sample of adolescents. Importantly, many youth (close to 70%) report an age of gambling onset prior to age 12. Previous research indicates that there are clinical differences in earlier- and later-onset pathological gamblers, with earlier-onset gamblers exhibiting a more severe psychiatric profile (Burge et al., 2006; Grant et al., 2009; Jimenez-Murcia et al., 2010; Lynch et al., 2004). These associations are not fully understood within an adolescent group, though studies suggest that pre-adolescent onset of gambling is associated with ARPG during adolescence (Lynch et al., 2004). Accordingly, this investigation hypothesized that there would be a higher frequency of ARPG individuals in the earlier-onset group. Analyses supported this hypothesis. Second, it was hypothesized there would be a stronger association within the earlier-onset group as compared to the later-onset group between ARPG and measures of: (a) academic standing, (b) substance use, and (c) dysphoria/depression. The data did not support this hypothesis as interaction odds ratio indicated similar associations with ARPG across earlier- and later-onset groups. Third, this study hypothesized that earlier-onset ARPG would be more strongly associated with non-strategic gambling types when compared to later-onset ARPG, and this hypothesis was supported. Overall, results from this study indicate that the correlates of ARPG are largely similar for earlier- and later-onset gamblers. An exception, however, exists for gambling type in which earlier-onset ARPG is more strongly associated with engagement in non-strategic forms of gambling, with post-hoc analyses suggesting contributions from a broad range of non-strategic forms of gambling. Together, the findings highlight areas which may warrant increase focus in the development of more effective prevention and treatment efforts for youth problem gambling.

## 4.2 ARPG and Age of Gambling Onset

The results of this study show that ARPG is more frequent amongst earlier-onset adolescent gamblers than amongst later-onset adolescent gamblers. This is similar to findings that associate earlier-onset gambling with a more severe gambling profile (Burge, Pietrzak, Molina, & Petry, 2004; Burge et al., 2006; Jimenez-Murcia et al., 2010; Lynch et al., 2004; Zapata, Torres de, & Montoya, 2011). Notably, nearly 70% of the overall respondents in this study indicated an earlier age of gambling onset (prior to an age of 12 years). The widespread nature of earlier-onset gambling coupled with previous findings of a more severe gambling pathology associated with earlier-onset gambling suggests that improved efforts are needed to target underage gambling. Age of gambling onset has been shown to relate to treatment efficacy in adults (Jimenez-Murcia et al., 2010); future studies should investigate whether age of gambling onset might impact treatment success in adolescents.

## 4.3 Health and Well-being Measures and Gambling Attitudes and Behaviors

Overall, there were no significant differences in the strengths of the relationships between ARPG and health and well-being measures in earlier- as compared to later-onset gamblers. The strengths of the relationships between ARPG and gambling attitudes and behaviors were also largely similar amongst earlier- and later-onset gamblers. For example, greater likelihoods of participation in strategic forms of gambling by ARPGs were observed in both earlier- and later-onset gamblers. Similarly, ARPGs in both earlier- and later-onset groups were several times more likely to report gambling due to pressure, and ARPGs from both groups were more likely to gamble with strangers and gamble for longer periods of time (more than 1 hour). These findings suggest that there exist multiple gambling variables that are similar in clinical relevance for both age of onset groups and warrant attention from those involved in overseeing and caring for adolescents.

A significant difference between earlier- and later-onset gamblers was observed in the strength of the relationship between ARPG and participation in non-strategic forms of gambling (e.g. lottery tickets, scratch cards, bingo, and gambling machines), and this relationship was approximately twice as strong in earlier- as compared to later-onset gamblers. This finding supported our hypothesis based on previous findings by Felsher et al. (2004) which showed that participation in non-strategic forms of gambling occurred at the younger ages in adolescent gamblers in Canada. Additionally, a more recent study showed that two of most frequently reported forms of gambling amongst children and young adolescents (youth ages 10–14 years) from Colombia were slot machines and scratch cards (Zapata et al., 2011). The current study, however, is the first to link this type of gambling to problem gambling severity in a large sample of American high school students and show a differential strength in its association in earlier- versus later-onset adolescent gamblers. The extent to which non-strategic gambling may have a broad appeal to children whose strategic abilities have not yet fully developed warrants consideration, as do the extent to which other behaviors (e.g., receiving lottery tickets as gifts) may promote early onset of gambling. It may be possible that non-strategic gambling represents an early developmental behavior that increases risk for later adolescent problematic gambling. The extent to which such gambling may serve as a “gateway” for other types of gambling as well as more severe patterns of gambling warrants investigation in longitudinal studies. While the current cross-sectional results can address the correlative nature of non-strategic gambling and ARPG, a longitudinal study may facilitate the temporal role of how non-strategic gambling relates to ARPG.

## 4.4 Prevention Strategies

Consideration of types of gambling may be particularly important in developing improved treatment and prevention strategies for youth. Some studies suggest that forms of non-



strategic gambling may lead to a more rapid development of gambling pathology (Dowling, Smith, & Thomas, 2005; Odlaug, Marsh, Kim, & Grant, 2011; Potenza et al., 2001b; Toneatto et al., 2009). Possible factors that may relate to rapid progression may include rapidity of action of some forms (e.g. machine gambling) or instant nature of others (e.g. scratch lottery tickets), although these factors as related to gambling progression have not been systematically studied in longitudinal studies. As the data from the current study are cross-sectional and do not include information regarding childhood gambling activities per se, additional studies are warranted to examine how specific factors (e.g. availability of lottery tickets at distinct ages or development epochs) may relate to the development of gambling problems, engagement in other risk behaviors, or experiencing of other mental health concerns. Educational efforts aimed at parents and educators may help diminish underage (both child and adolescent) involvement in non-strategic forms of gambling. Policy interventions (e.g., laws mandating that advertisements explicitly state that lottery gifts are not appropriate for youth) and more effective enforcement of selling of non-strategic gambling products (e.g., lottery tickets) to youth may represent important efforts in this regard. A recent holiday campaign by the Connecticut Lottery and the National Council on Problem Gambling that aimed to reduce youth lottery gambling through educating parents may represent a good model for other organizations to adopt. However, despite the potential impact of such prevention and policy efforts, the effectiveness of these approaches requires empirical validation that is currently lacking.

The post-hoc analyses of earlier-onset gamblers indicated that ARPG was associated with all assessed forms of non-strategic gambling. These non-strategic forms of gambling can be classified as either primary engagement (e.g., bought instant lottery for self) or secondary engagement (e.g., received other lottery tickets as gift). In that both types were associated with ARPG, the findings offer guidance for prevention and treatment efforts. First, better educating parents and adults on the potential harms of non-strategic gambling could help curtail underage gambling. Such efforts could be particularly important because non-strategic forms of gambling, like scratch cards and other lotteries, are typically seen more positively than other forms of gambling to children and adolescents (Wood & Griffiths, 2004). When children observe their parents or other prominent adults engage in non-strategic gambling, it may leave the impression that these forms of gambling are not harmful or not as harmful as others. Such an impression may be further solidified by the widespread availability of non-strategic forms of gambling in locations such as gas stations and grocery stores, which may be frequently visited together by parents and their children. As opposed to slot machines, which are confined to specific establishments, scratch cards and other lottery tickets are abundant in many non-gambling-focused environments. Furthermore, a recent study analyzing parents' perceptions of risk behaviors in their own adolescent(s) showed that gambling was ranked as the least concerning risky behavior (Campbell, Derevensky, Meerkamper, & Cutajar, 2011). Educating parents as well as adolescents themselves may help reduce non-strategic gambling amongst youth. Integrating gambling awareness (e.g. presentations on the harms of youth gambling) into parent-teacher-association (PTA) or parent-teacher-organization (PTO) meetings could be a cost-effective and efficient way to teach parents about the potential harms of non-strategic gambling with respect to their children's health and well-being. Additionally, the large number of respondents in this study that indicated purchasing scratch cards or other lottery tickets themselves (44% of earlier-onset ARPG), playing bingo at a religious institution (41% of earlier-onset ARPG), or performing machine-based gambling (43% of earlier-onset ARPG) suggests establishments hosting these forms of gambling could do more to discourage or prevent underage gambling. Under current Connecticut law (18 (CGS § 12-813(d)), minors are not permitted to purchase lottery tickets themselves, but are allowed to receive them as gifts from adults. Considering that 64% of earlier-onset ARPG individuals reported receiving lottery/scratch tickets as a gift, and that these non-strategic forms of gambling have been associated with more severe

gambling behavior in youth, it may be beneficial to remove this portion of the law to minimize the potential impacts on this group of adolescents. Future prevention strategies should consider increasing awareness amongst these establishments on the potential harms of underage gambling in order to minimize this avenue of engagement. The finding that 43% of earlier-onset ARPGs reported playing a slot machine, poker machine, or any other type of gambling machine suggests more can be done by gambling venues to curtail illegal gambling by individuals under the age of 21, which is the legal age for this form of gambling in Connecticut. Reviewing, potentially revising, and better enforcing the legal penalties associated with violating establishments could help reduce these types of non-strategic gambling amongst youth. Similarly, efforts to reduce underage gambling in both casino and non-casino venues deserve attention as the legal age in Connecticut for participation in other forms of gambling (e.g., lottery, pari-mutuel, and charity bingo) is 18 years (Rose, 1999).

## 5. Limitations and Conclusion

Limitations exist in this study. First, while ecologically valid, the sample was not random. Some DRGs were selected in order to get a more representative sample of the state. Second, the cross-sectional design limits the ability to observe how variables may change throughout adolescents and into adulthood, or from childhood to adolescence. It has been suggested that some variables like gambling type are “developmentally progressive”, meaning that as individuals grow older, their gambling preferences change (Nower & Blaszczynski, 2008). Observing how gambling attitudes and behaviors may change from adolescence to adulthood, as in a longitudinal study, could provide insight and better inform long-term prevention and treatment strategies. Such longitudinal studies should include assessments not only of gambling behaviors, but also of intermediary phenotypes including those like impulsivity that have been shown at early ages (e.g., in children at about seven years of age) to link to gambling problems in adults (Shenassa, Paradis, Dolan, Wilhelm, & Buka, 2012). Third, precise data on frequencies of gambling were not collected. Considering the frequency of gambling could provide further insight with regards to prevention strategies. However, this issue is complex in that frequencies of different forms of gambling (e.g., lottery versus poker versus electronic) may each be associated with different health measures, and thus should be examined systematically in future studies. Fourth, the data collected were based on student recall, which is subject to potential biases and inaccuracies. Self-report measures may also be biased in both gambling and non-gambling domains – for example, while students’ self-reported grades correlate adequately with documented reports, there is not a 100% correlation and more complete data from academic records could help further understand the relationships observed in the present study (Gilger, 1992). Fifth, the relatively low proportion of individuals with pathological gambling in the sample precluded the focused study of this clinically relevant group. Sixth, other important differences (e.g., related to gender) also were examined given that the sample did not allow for simultaneous stratification by gender, age of gambling onset and ARPG/LRG status (Desai et al., 2005; Desai & Potenza, 2008; Potenza et al., 2001b). Lastly, the earlier- and later-onset gambling groups were not evenly matched in size, with the earlier-onset group being approximately twice as large as the later-onset group. There exists the possibility that findings that were numerically robust but not statistically significant could reach statistical significance in more evenly numbered groups. However, the large difference in the groups also indicates that earlier-onset gambling is a frequent occurrence amongst adolescents, which is important to note. Furthermore, the categorical assessments of some variables (e.g., age) did not allow for numerical means to be calculated. While analyses were adjusted to account for categorical differences in age, future studies would benefit from ascertaining more precise ages from each participant in examining the potential impact of age.

Using data from a survey of risk behaviors in Connecticut high school students who reported gambling, this study identified a stronger relationship between problem gambling severity and non-strategic gambling amongst youth reporting an earlier- as compared to later-onset of gambling. These findings highlight the importance of formulating prevention and treatment strategies that particularly target early (childhood) gambling.

## Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

## Acknowledgments

We would like to thank Dr. Helena Rutherford for her input on portions of the first draft of this manuscript. We would also like to thank the survey participants and the members of the research group who collected the data.

### Role of the funding source

This work was supported in part by the NIH (R01 DA 019039, P50 AA15632, P50 DA09241), the Connecticut State Department of Mental Health and Addictions Services, The Connection, the Yale Gambling Center of Research Excellence Award from the National Center for Responsible Gaming and its Institute for Research on Gambling Disorders, and an unrestricted gift from the Mohegan Sun casino. The funding agencies did not provide input or comment on the content of the manuscript, and the content of the manuscript reflects the contributions and thoughts of the authors and do not necessarily reflect the views of the funding agencies.

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**Table 1**

Demographic characteristics of the sample (n = 1624)

Variables	Earlier-Onset Gambling (n = 1116)						Later-Onset Gambling (n = 508)					
	Low-Risk Gambling (n = 639)			At-Risk and Problem/Pathological Gambling (n = 477)			Low-Risk Gambling (n = 345)			At-Risk and Problem/Pathological Gambling (n = 163)		
	Total	%	$\chi^2$	Total	%	$\chi^2$	Total	%	$\chi^2$	Total	%	$\chi^2$
Gender			42.380**									16.750*
Boys	385	61.40		374	79.74		190	55.72		121	74.69	
Girls	242	38.60		95	20.26		151	44.28		41	25.31	
Race/Ethnicity			8.6180*									9.8700*
African American												
Yes	62	9.70		74	15.51		20	5.80		23	14.11	
No	577	90.30		403	84.49		325	94.20		140	85.89	
Caucasian			3.3430									3.3840
Yes	470	73.55		327	68.55		275	79.71		118	72.39	
No	169	26.45		150	31.45		70	20.29		45	27.61	
Asian			0.1739									0.3629
Yes	30	4.69		25	5.24		13	3.77		8	4.91	
No	609	95.31		452	94.76		332	96.23		155	95.09	
Other			0.1610									0.0673
Yes	108	16.90		85	17.82		43	12.46		19	11.66	
No	531	83.10		392	82.18		302	87.54		144	88.34	
Hispanic			7.4150*									2.1263
Yes	94	15.46		99	22.00		45	13.60		14	8.97	
No	514	84.54		351	78.00		286	86.40		142	91.03	
Grade			2.2434									3.8526
9	241	37.83		191	40.13		44	12.79		15	9.20	
10	175	27.47		131	27.52		74	21.51		28	17.18	
11	151	23.70		96	20.17		115	33.43		56	34.36	
12	70	10.99		58	12.18		111	32.27		64	39.26	

Variables	Earlier-Onset Gambling (n = 1116)				Later-Onset Gambling (n = 508)				
	Low-Risk Gambling (n = 639)		At-Risk and Problem/Pathological Gambling (n = 477)		Low-Risk Gambling (n = 345)		At-Risk and Problem/Pathological Gambling (n = 163)		
	Total	%	Total	%	Total	%	Total	%	
Family Structure									$\chi^2$
1 parent	156	24.72	103	22.15	81	23.89	31	19.25	2.2417
2 parents	435	68.94	311	66.88	241	71.09	118	73.29	7.8236
Other	40	6.34	51	10.97	17	5.01	12	7.45	

\*  $P < 0.01$

\*\*  $P < 0.0001$

**Table 2**

Adjusted odds ratios for health and well-being measures (n = 1624)

	Earlier-Onset Gambling		Later-Onset Gambling		Interaction OR	
	OR <sup>a</sup>	95 % CI	OR <sup>a</sup>	95 % CI	OR <sup>a</sup>	95 % CI
<b>Academic and extracurricular</b>						
Grade average (reference: Mostly A's and B's)						
Mostly C's	1.28	0.95–1.72	1.05	0.66–1.66	1.24	0.73–2.09
D's or lower	1.85	1.28–2.66	1.73	0.86–3.48	0.98	0.46–2.08
Any extracurricular – yes	1.14	0.83–1.55	0.93	0.564–1.539	1.24	0.704–2.182
<b>Substance use</b>						
Smoking Lifetime (reference: never)						
Occasionally	1.67	1.223–2.284	1.36	0.843–2.185	1.49	0.868–2.566
Regularly	2.13	1.479–3.060	1.44	0.790–2.613	1.65	0.853–3.190
Marijuana Ever – yes	1.61	1.216–2.120	1.56	1.002–2.425	1.15	0.700–1.885
Alcohol ever sip – yes	0.94	0.582–1.509	0.74	0.342–1.583	1.24	0.533–2.859
Current Alcohol Frequency (reference: never regular)						
Light	1.19	0.768–1.854	1.43	0.732–2.781	1.00	0.469–2.138
Moderate	1.40	0.912–2.163	1.14	0.596–2.171	1.39	0.663–2.892
Heavy	1.90	1.107–3.248	2.19	0.972–4.920	1.25	0.513–3.044
Other Drug Use Ever – yes	2.32	1.555–3.459	1.40	0.632–3.094	2.16	0.928–5.021
<b>Caffeine Use</b>						
1–2 Per Day	0.76	0.520–1.115	0.71	0.413–1.208	1.09	0.578–2.061
3 Per Day	1.08	0.729–1.592	0.96	0.529–1.752	1.10	0.552–2.187
<b>Mood</b>						
Dysphoria/depression – yes	2.14	1.524–3.005	1.27	0.735–2.198	1.74	0.949–3.184
<b>Aggression</b>						
Serious Fights – yes	2.49	1.679–3.689	1.55	0.670–3.598	1.92	0.814–4.530
Carry a Weapon – yes	2.09	1.574–2.772	1.38	0.826–2.295	1.49	0.845–2.616

<sup>a</sup> Adjusted for socio-demographic differences in gender, race/ethnicity, grade level and familial structure.



CI= Confidence Interval; OR= Odds Ratio

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**Table 3**

Adjusted odds ratios for gambling characteristics (n = 1624)

	Earlier-Onset Gambling		Later-Onset Gambling		Interaction OR	
	OR <sup>a</sup>	95% CI	OR <sup>a</sup>	95% CI	OR <sup>a</sup>	95% CI
<b>Gambling Types</b>						
Strategic – yes	2.99	1.10–8.20	2.99	0.63–14.0	0.97	0.16–5.86
Non-strategic – yes	1.74	1.26–2.39	0.94	0.60–1.48	1.91	1.18–3.26
Machine – yes	2.06	1.56–2.71	1.67	1.10–2.52	1.33	0.82–2.15
<b>Gambling Motivations</b>						
Gamble for Excitement – yes	1.75	1.22–2.50	2.05	1.18–3.54	0.78	0.41–1.47
Gamble for Financial – yes	2.77	2.06–3.73	2.14	1.37–3.33	1.32	0.79–2.21
Gamble for Escape – yes	2.29	1.75–3.00	1.88	1.23–2.89	1.30	0.80–2.12
Gamble for Social reasons – yes	1.62	1.25–2.11	1.13	0.74–1.71	1.38	0.86–2.21
<b>Gambling Urges</b>						
Pressure – yes	4.18	2.59–6.73	3.43	1.72–6.49	1.29	0.59–2.86
Anxiety – yes	9.65	4.84–19.2	N/A	N/A	N/A	N/A
<b>Gambling Partners</b>						
Gamble with Adults – yes	1.78	1.36–2.33	2.12	1.25–3.59	0.96	0.55–1.67
Gamble with Family – yes	1.17	0.90–1.52	0.81	0.53–1.25	1.44	0.89–2.33
Gamble with Friends – yes	0.84	0.59–1.22	0.76	0.40–1.42	0.95	0.48–1.89
Gamble with Strangers – yes	3.26	2.12–5.01	7.55	2.87–19.8	0.45	0.16–1.25
Gamble Alone – yes	3.32	2.12–5.21	2.52	1.26–5.04	1.38	0.62–3.03
<b>Gambling Duration (reference: 1 hour)</b>						
> 1 hour	4.32	3.03–6.16	4.24	2.19–8.19	1.02	0.50–2.07

<sup>a</sup> Adjusted for socio-demographic differences in gender, race/ethnicity, grade level and familial structure.

CI= Confidence Interval; OR= Odds Ratio

Table 4

Non-strategic gambling characteristics of early onset gamblers (n = 1116)

		Earlier-Onset Gambling			At-Risk and Problem/Pathological gamblers (n = 477)			$\chi^2$
		Total	%	Total	%	Total	%	
Non-strategic gambling type								
Bought instant lottery/scratch ticket for self								
Yes	171	26.89	209	44.28	36.37***			
No	465	73.11	263	55.72				
Bought other lottery tickets for self								
Yes	70	11.09	125	27.00	46.11***			
No	561	88.91	338	73.00				
Received instant lottery/scratch tickets as a gift								
Yes	345	54.33	306	64.42	11.41*			
No	290	45.67	169	35.58				
Received other lottery tickets as gift								
Yes	191	30.17	227	47.89	36.19***			
No	442	69.83	247	52.11				
Played bingo at church, synagogue, or other public place								
Yes	212	33.39	196	41.53	7.7*			
No	423	66.61	276	58.47				
Played slot machines, poker machines, or other gambling machines								
Yes	166	26.02	205	43.43	36.96***			
No	472	73.98	267	56.57				

\*  $P < 0.01$ \*\*\*  $P < 0.001$