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Childhood impulsive behavior and problem gambling by adulthood: A 30-year prospective community-based study

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Abstract

Aims—Problem gambling can create major financial, emotional and sometimes criminal problems for an individual. This study prospectively investigated the association between impulsive behavior at age 7 and the development of lifetime problem gambling by adulthood. We also examined the specificity of any observed association between impulsive behaviors and problem gambling by conducting parallel analyses examining the link between respondents' shy/depressed behavior in childhood and later problem gambling.

Design, setting and participants—Cohort study of 958 offspring of mothers enrolled in the Collaborative Perinatal Project who participated in an adult follow-up study at a mean age of 39 years.

Measurements—Multivariable logistic regression models were fit to determine associations between psychologist-rated impulsive and shy/depressed behaviors at age 7 and lifetime self-reported gambling as measured by the South Oaks Gambling Screen administered during the adult follow-up study.

Findings—Children who exhibited impulsive behaviors at age 7, compared to their non-impulsive counterparts, were 3.09 (95% confidence interval: 1.40–6.82) times as likely to report problem gambling years later. In contrast, we did not find a significant association between childhood shy/depressed behavior and problem gambling by adulthood in adjusted analyses.

Conclusions—Impulsive behaviors at age 7 are a specific and significant risk factor for later problem gambling..

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INTRODUCTION

Since its legalization in Nevada in 1931, gambling has become ubiquitous in all American states except Hawaii and Utah [1,2]. Growth of the gambling industry is paralleled with an increase in the prevalence of problem gambling [3], characterized by gambling in spite of psychosocial problems as well as legal and financial problems [4,5]. The public health significance of problem gambling (PG) underscores the need to identify early antecedents to forestall its onset.

Studies of community-based adults suggest that, compared to the general population, problem gamblers are more likely to be male, non-White, unmarried, and less educated [3,4,6,7]. Problem gamblers are also more likely to abuse legal and illegal substances [8–12]. Findings from a range of investigations also suggest that manifestations of impulsivity appear to be a key personality characteristic among adult problem gamblers.

Cross-sectional studies of self-reported and laboratory assessed impulsive personality traits consistently, but not uniformly [13], show that problem gamblers are more likely than others to exhibit traits linked to impulsivity [14–20]. This link is further supported by evidence showing that problem gamblers are more likely to retrospectively report aspects of childhood impulsive behavior, including attention problems, hyperactivity, and problems with behavioral restraint [21,22]. However, due to limitations inherent in cross-sectional and retrospective study designs (e.g., potential biases in recall and disentangling temporal relationships), conclusions from such investigations are limited. Additionally, prior retrospective studies afford limited generalizability to the general population as they have mostly included persons who either self-identify as a problem or pathological gambler or are in treatment for gambling problems. Prospective investigations of community-based groups are needed to provide more conclusive evidence for the link between early impulsivity and later PG.

To date, evidence from longitudinal studies is sparse. Among a group of Canadian kindergartners from intact families (n=163), impulsivity, assessed by the Social Behavior Questionnaire, at mean age of 5.5 years was associated with risk of engaging in gambling behaviors 6 years later [23]. Among a group (n=168) of disadvantaged Canadian adolescents, identified from teacher reports of physically aggressive and anxiety-related behaviors, impulsivity at ages 12–14 was associated with an increased likelihood of developing PG (assessed by the South Oaks Gambling Screen (SOGS)) approximately 4 years later [24,25]. This relationship was independent of demographic factors and gambling behaviors at baseline. In two related studies, conducted among overlapping groups of adolescents (ns=699, 625) recruited from a representative sample of households in metropolitan Buffalo, NY, impulsivity at ages 16–19 predicted frequency of gambling behaviors approximately 2 years later independently of socio-demographic factors, personality factors, history of substance use, extent of parental monitoring and peer

delinquency [26]. Among a group of 17-year old African American adolescents (*n*=452), engaging in gambling during the past year (assessed by SOGS-RA) was predicted by parental ratings of impulsivity taken when the adolescents were in first grade [27]. Finally, among a birth cohort from New Zealand (*n*=993), risk taking and impulsivity assessed at age 18 predicted PG (assessed by the SOGS) at age 21 [8].

In sum, evidence from longitudinal studies links impulsivity with an elevated likelihood of engaging in gambling behaviors or becoming a problem gambler over a period of short-term follow-up. It is noteworthy that these studies measured impulsivity utilizing a variety of scales including the Eysenck's impulsiveness, venturesomeness, empathy scale [28,29] and the Multidimensional Personality Questionnaire [30]. The fact that the link between early impulsiveness and subsequent PG is not dependent on a particular measure further supports the validity of this link. However, the length of follow-up in these studies only ranges from 2–4 years. None assessed behavior problems as early as childhood; nor did any of the investigations follow participants beyond early adulthood (age 21). Moreover, several samples consisted of adolescents who were selected either based on their behavioral problems [26] or residence in a disadvantaged neighborhood [24,26].

Findings from the extant literature, along with their limitations, provide the impetus to examine the link between childhood impulsive behavior and PG among a relatively large community-based, non-referred sample. To our knowledge, this study is the first to measure impulsive behavior prospectively in childhood and follow participants for an average of 30 years. Additionally, we examined the specificity of (any) observed association between impulsive behaviors and PG by conducting parallel analyses examining the link between childhood shy/depressed behavior and PG. This additional analysis will provide needed evidence as to whether any general type of behavior problem in childhood increases the risk of later PG or whether only particular types of childhood problems elevate the likelihood of subsequent PG. Such questions have relevance to our understanding of the etiology of PG as well as the prevention of this problem behavior.

METHODS

Study design, setting and participants

As shown in Figure 1, participants were selected from the Boston, Massachusetts and Providence, Rhode Island cohorts of the Collaborative Perinatal Project (CPP). The CPP was a multicentre study of prenatal and perinatal antecedents of childhood mental, neurological, and physical abilities [31,32]. Pregnant women were recruited from 1959–1966 and approximately 50,000 pregnancies from 12 university-affiliated medical centers were enrolled, including 17,741 pregnancies in Boston and Providence. Enrolled women were largely representative of patients receiving prenatal care at each participating center. Women were followed prospectively, and events of gestation, labor, delivery, and the neonatal period were assessed. Children's development was assessed at various times up to age 7.

Building on the CPP, the Transdisciplinary Tobacco Use Research Center: New England Family Study (TTURC:NEFS) was established in 1999 to locate and interview a subsample

of the adult CPP offspring in the Boston and Providence sites [33]. Screening questionnaires were mailed to 4,579 of the 15,721 offspring known to be alive at age 7, including sibling sets at the Providence site, a random sample of the remaining offspring at Providence site, and a random sample of sibling sets at the Boston site. Of the 3,121 offspring who returned their questionnaires (68.2%), 2,271 were selected for participation since they met eligibility criteria for at least one of three substudies comprising the overall project. Eligible subjects included adult respondents (a) with a child aged 12–17 years, (b) who reported being a current smoker, and/or (c) who had a sibling who also returned a screening questionnaire [33]. In total, 1,674 of 2,271 eligible subjects were enrolled (73.7%). Data from 49 individuals were excluded because either a pilot version of the survey was administered (n =11) or because of problems with interview administration (n=38). This yielded 1,625 complete adult assessments. A mailing containing self-reported instruments, including the lifetime version of the SOGS, was sent to these 1,625 respondents and 990 participants completed and returned the SOGS. In this manuscript we report on 958 participants with data on all covariates considered in the current analyses.

The analytic sample was not found to differ from members of the full TTURC:NEFS sample who were excluded from these analyses on childhood impulsive (χ^2=0.01, df=1, P=0.94) or shy/depressed behavior (χ^2=0.01, df=1, P=0.92). The study received human subject protections approval from the Brown University and Miriam Hospital institutional review boards. Written informed consent was obtained from participants during the adult follow-up interview after a thorough description of the study was provided.

Measures

Childhood behavior ratings—Behavioral functioning was assessed by psychologists on a structured profile completed as part of a two-hour battery of cognitive, sensory, and motor tests at the age 7 child assessment. The reliability and validity of these ratings has been published elsewhere [34]. This profile included 15 items: separation from mother, fearfulness, rapport with examiner, self-confidence, emotional reactivity, degree of cooperation, level of frustration tolerance, degree of dependency, duration of attention span, goal orientation, activity level, nature of activity, nature of communication, assertiveness, and hostility. Items were scored on a 5-point Likert scale, with the mid-point reflecting adaptive behavior. Response options did not typically fall along a continuum, but instead poles reflected qualitatively different behaviors. For example, for emotional reactivity, one endpoint reflected “flat affect” and the other reflected “unstable emotional response.” Given this, each continuous rating was converted into two new behavioral indices, each utilizing a three-point scale (0=not true; 1=somewhat true; 2=very true).

This approach is consistent with the orientation of behavior problem checklists like the Child Behavior Checklist (CBCL) [35]. Thus, for the original item of emotional reactivity, two new variables were created, “flat affect” and “unstable emotional response.” An individual who was rated as “1=extremely flat” on the initial item was re-scored as “2=very true” on the new “flat affect” variable and “0=none” on the “unstable emotional response” variable. This logic was used to convert the 15 continuous behavior ratings to 30 behavior items, with 15 of these items representing the “low” end of the original variable (e.g., flat

affect) and 15 representing the "high" end of the original variable (e.g., unstable emotional reactivity).

A principal components analysis of the 30 derived behavior variables, with varimax rotation, yielded three behavioral subscales: impulsive (Eigenvalue=2.63),[1] shy/depressed (Eigenvalue=3.34), and outgoing (Eigenvalue=2.32). The impulsive behavior scale was created by summing the following six items: unstable emotional reactivity, resistive, assertive, low frustration tolerance, impulsive, and hostile. Each item is associated with a form of impulsive behavior, either lack of emotional or behavioral control. Unstable emotional reactivity and low frustration tolerance are behaviors characterizing children who become emotionally reactive quickly. Being resistive, assertive, impulsive, and hostile are descriptors of children who have difficulty sitting still, following directions, and working together with the examiner to complete the task in a timely manner. These behaviors represent the involuntary, undercontrolled nature of impulsivity in children [36]. Cronbach's alpha was 0.72 for the scale and scores ranged from 0–7 (mean=0.1, standard deviation[*SD*]=0.6).

The shy/depressed scale was created by summing six items: shy/withdrawn, flat affect, having little to no communication, having low activity, being passive, and being fearful or apprehensive. Cronbach's alpha was 0.83 for the scale and scores ranged from 0–11 (mean=1.2, *SD*=1.8).

The outgoing scale included four items: is friendly, shows little fear, has low separation anxiety, and communicates freely. The other two identified scales, impulsive and shy/depressed behavior, measure behavior problems, while the outgoing scale does not capture inherently problem behavior. This scale is therefore not considered further in these analyses.

Because the distributions for the behavior problem scales were skewed (especially for the impulsive behavior scale), we created dichotomous indicators for both impulsive and shy/depressed behavior. Since only a small percentage of the sample (7.9%) was rated as exhibiting one or more impulsive behaviors we created a binary indicator based on the presence or absence of any of these problematic behaviors. We created a comparable dichotomous measure of shy/depressed behavior by categorizing those in the top decile (i.e, scores of ≥5 vs. 1–4) as having this type of behavior problem (7.5% of the sample). We selected this cut-point for the shy/depressed scale so that the prevalence of both behavior problems would be comparable and capture problems of similar severity.

Gambling behavior—Lifetime gambling behavior was assessed with the SOGS [37]. Designed to identify pathological gamblers, the SOGS is based on the Diagnostic and Statistical Manual of Mental Disorders, version III [38] criteria for pathologic gambling and consists of 20 items reflecting symptoms associated with pathologic gambling. The total number of endorsed items are summed and participants can be categorized as follows: 0–2 indicates non-problem gambling behavior, 3–4 indicates problem gambling, ≥5 indicates

[1]In previous publications we describe the six items reflecting impulsive behavior as "conduct problems". We view both terms as appropriate to describe the constellation of items included in this scale.

probable pathological gambling [37]. For the current study, we compared those with no gambling problems (i.e., those with SOGS scores ranging from 0–2) with the group of participants who evidenced at least some problems with gambling (i.e., those with a score 3 or more). We did not examine those with probable pathological gambling separately from problem gamblers since only a small percentage of the sample (*n*=35, 3.7%) had SOGS scores ≥5.

Covariates—In addition to controlling for study site (Boston vs. Providence), analyses adjusted for a several demographic covariates identified from the literature. Demographic correlates of PG include: age (in years), gender (coded as male vs. female), race/ethnicity, marital status, and educational attainment [4,9,39–41]. Due to a low prevalence of non-Black minorities race/ethnicity was dichotomized as Black/Hispanic/Other versus non-Hispanic White. Participants' marital status was coded as never married, widowed/separated/divorced, or married. Dummy variables were created for use in analyses and those who were never married served as the referent group. Dummy variables were also created based on educational attainment: less than a high school education or GED, high school graduate, technical school or some college, or a 4 year college degree or higher. In analyses, those with less than a high school education or GED served as the referent group. Since lower IQ may predict risk of impulsive behaviors [42] we controlled for this covariate in our models. Full scale IQ scores during childhood were derived using an abbreviated version of the Wechsler Intelligence Scales for Children [43] that was administered by trained psychologists when the children were age 7. Additional variables, such as childhood socioeconomic status and mother's religion, were initially considered but dropped from the final analyses since they were not found to be associated with PG. Correlates of PG which could be a consequence of impulsive behavior, such as substance use and mental disorders, were considered to be on the causal pathway linking impulsive behavior and PG. Consequently, these variables were not included in the regression models. Due to the relatively low prevalence of PG in our sample (6.0%) we were interested in creating a parsimonious model for PG.

Statistical analysis

Three multivariable logistic models were constructed to investigate the relationship between the childhood behavior problems and PG. In the first model, the dichotomous age 7 impulsive behavior variable was included as a covariate along with the demographic factors, childhood IQ, and an indicator for study site. The second model included the age 7 indicator of shy/depressed behavior in addition to the control variables. The third model included both the impulsive and shy/depressed behavior variables as well as all other control variables. Adjusted odds ratios (AORs) and 95% confidence intervals (CIs) were computed. The correlation between observations caused by the oversampling of siblings in the adult follow-up study was modeled using an exchangeable working correlation matrix and empirical standard errors were used in statistical tests. All analyses were conducted using SAS version 9 (SAS Institute, 2007).

RESULTS

Sample characteristics

Table 1 shows the distribution of the behavioral and demographic variables for the overall analytic sample and by the PG groups. Psychologist-rated impulsive behaviors were substantially more common among the group with lifetime PG versus those without a history of PG (24.1% vs. 6.9%). Shy-depressed behavior was also more common among participants who indicated having problems with gambling (13.8% vs. 7.1%). As compared to non-problem gamblers, problem gamblers were more likely to be male (53.5% versus 34.7%), and to have never been married (41.4% versus 21.6%), and to have less than a high school education or a GED (27.6% vs. 9.3%).

Multivariable analyses

Findings from the multivariable models provide evidence that the influence of early behavior problems on the development of lifetime PG is specific to measures of childhood impulsivity. In our first multivariable model (Table 2, Model 1), we found a significant relationship between childhood impulsive behavior and problem gambling in adulthood after adjusting for study site, demographic factors, and childhood IQ. Participants rated as impulsive at age 7 were over three times as likely to later develop problems with gambling (AOR: 3.24, 95% CI: 1.47–7.14). Alternatively, in our second multivariable model, we did not find a statistically significant association between early shy/depressed behavior and later problem gambling after accounting for several potential confounders (AOR: 2.30, 95% CI: 0.97–5.44) (Table 2, Model 2). Results from our final multivariable model including both impulsive and shy/depressed behavior (Table 2, Model 3) affirmed the pattern of results seen in models considering each behavioral indicator separately. Although the association between impulsive behavior and lifetime PG was somewhat attenuated in the model including shy/depressed behavior, children rated as impulsive were over 3 times as likely to develop PG compared to their non-impulsive counterparts (AOR: 3.09, 95% CI: 1.40–6.82). Consistent with earlier findings, associations between shy/depressed behavior and lifetime gambling problems were not statistically significant (AOR: 2.08, 95% CI: 0.87–4.99).

Our conclusions regarding the specificity of the link between impulsivity and later PG are bolstered by findings from additional multivariable models (data not shown) that were fit to examine whether our selected cut-point for the shy/depressed scale may have accounted for our lack of significant findings (only 8 participants with scores of ≥5 on the age 7 shy/depressed scale developed PG). Models using less stringent thresholds for categorizing participants as shy/depressed (e.g., any shy/depressed behavior, ≥3 shy/depressed behaviors) led to the same conclusion that childhood shy/depressed behavior does not independently increase the risk of PG by adulthood. In all of the adjusted models no statistically significant association was found between shy/depressed behavior and PG.

Our findings also implicate the independent role of demographic factors in the etiology of PG. More specifically, in the adjusted models males experienced a significant, approximately twofold increased risk of PG as compared to females. Alternatively, being

married (versus being never married) and having a college-level education (versus less than high school or GED) had a significant protective influence.

CONCLUSION

We conducted the first prospective investigation of the link between childhood impulsive behavior and lifetime PG by mid-adulthood. In line with previous work, we found that men are more likely than women to be problem gamblers, and that being married and relatively more educated protects against the development of PG [3,4,6]. Our key findings were two-fold. First, 7-year old children exhibiting impulsive behaviors had an elevated risk of becoming problem gamblers during their lifetimes. Second, shy/depressed behavior at age 7 does not confer an increased risk of PG by mid-adulthood.

Impulsivity and impulse control disorders tend to impair individuals' ability to resist an act that is harmful to the person or to others. The link between behavioral manifestations of impulsivity and lifetime PG also suggest an early pathway to gambling problems. However, although effective treatments for PG exist that are modeled after cognitive behavioral treatments for substance use disorders [44], there are currently no known effective *prevention* programs which specifically target children with impulsive behavior problems [45]. This, coupled with the fact that although non-impulsive children are at a relatively lower risk of developing PG than impulsive children their larger number gives rise to more cases of PG (in our sample, 76% of problem gamblers did not exhibit childhood impulsive behaviors), suggests that universal public health efforts [2] promoting the health and well-being of all children may be a more efficient and effective approach to preventing PG. In this approach the entire community is targeted with the aim of promoting psychological, physical, and social development of all children [46]. The premise of this approach is that even individuals not at risk of the target condition benefit from improved functioning, and by promoting well-being of all individuals this approach avoids issues associated with labeling individuals as having psychopathology [47]. Finally, decisions regarding timing and place of delivery of such services should consider that the onset of gambling behavior appears to be influenced by both a propensity toward impulsivity *and* having low socioeconomic background and/or residing in a low socioeconomic area [48].

Our findings should be considered in light of study's limitations and strengths. Impulsivity is a complex behavioral characteristic to measure. For example, it could reflect an inability to inhibit a thought or an inability to inhibit a behavior, such as gambling [49]. Behaviors representing an involuntary lack of control [36] over behavior (uncooperative with the examiner, hostile, assertive, and impulsive) or emotional regulation (low frustration tolerance and unstable emotional reactivity) are indicators of an impulsive child. Our data do not assess cognitive components of impulsivity. Moreover, our behavioral ratings were made by psychologists as part of a 2 hour cognitive and behavioral assessment and, as such, reflect child behavior exhibited over a short interval in a limited setting. These ratings likely capture only the most seriously impulsive youth who were unable to modify their behavior during the structured assessment. It is therefore likely that children with lower levels of impulsive behavior were misclassified as non-impulsive, perhaps resulting in an underestimate of the true association between impulsivity and PG. Additionally, since the

lifetime version of the SOGS was used reported gambling problems may not have occurred at the same time. Lastly, the adult participants included in the TTURC:NEFS follow-up study cannot be considered representative of the full CPP cohort. Participants were selected on the basis of inclusion criteria that were necessary for the major substudies conducted with the follow-up sample but not for the analyses described in this manuscript.

Several strengths of the study are also noteworthy. For instance, despite possible limitations with our measure of impulsive behavior, our assessments were collected prospectively in childhood, unlike in many other prior studies. Additionally this is the first study to predict PG over the span of 30-years among a non-referred sample, reflecting the generalizability of our findings to a more broad population than most prior work.

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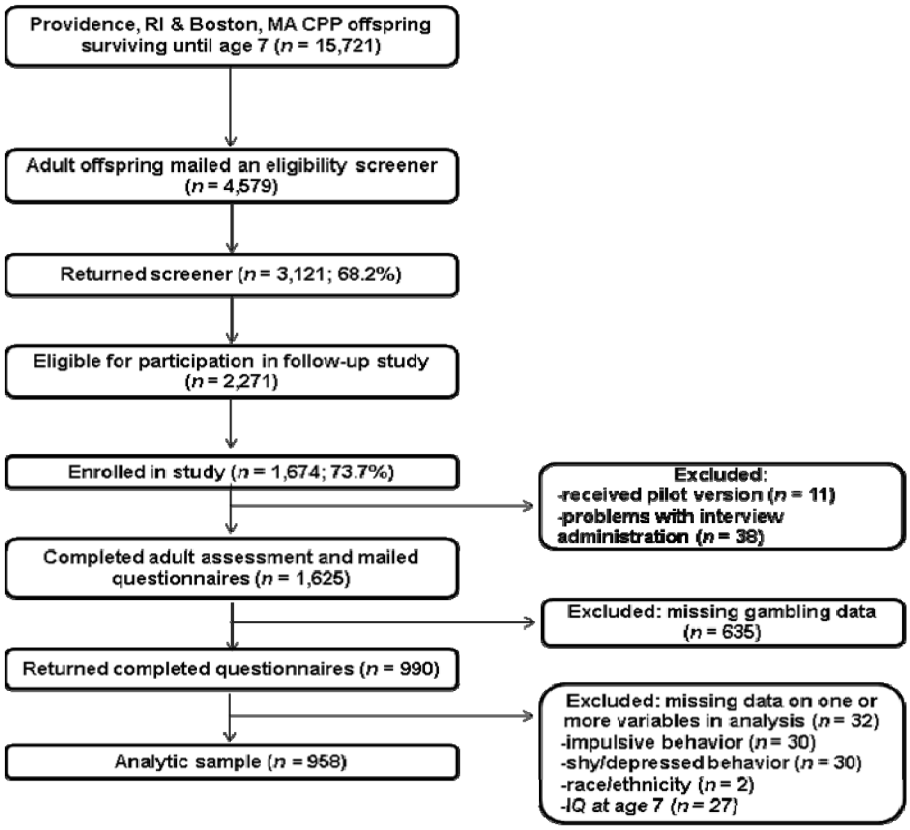

Figure 1.
Flow chart of study sampling.

Table 1

Characteristics for overall analytic sample and by lifetime problem gambling groups.

Characteristic	Total (*n*=958) *n* (%) or mean (*SD*)	Lifetime problem gambling[a]	
		No (*n*=900) *n* (%) or mean (*SD*)	Yes (*n*=58) *n* (%) or mean (*SD*)
Behavior problem at age 7			
Impulsive	76 (7.9%)	62 (6.9%)	14 (24.1%)
Shy/depressed	72 (7.5%)	64 (7.1%)	8 (13.8%)
Study site			
Boston	535 (55.8%)	513 (57.0%)	22 (37.9%)
Providence	423 (44.2%)	387 (43.0%)	36 (62.1%)
Age at adult interview	39.2 (1.8)	39.3 (1.8)	38.9 (1.7)
Male gender	343 (35.8%)	312 (34.7%)	31 (53.5%)
Race/ethnicity			
Black/Hispanic/Other	136 (14.2%)	126 (14.0%)	10 (17.2%)
Non-Hispanic White	822 (85.8%)	774 (86.0%)	48 (82.8%)
Marital status			
Never married	218 (22.8%)	194 (21.6%)	24 (41.4%)
Widowed/sep/divorced	158 (16.5%)	146 (16.2%)	12 (20.7%)
Married	582 (60.7%)	560 (62.2%)	22 (37.9%)
Educational attainment			
<High school/GED	100 (10.4%)	84 (9.3%)	16 (27.6%)
High school diploma	146 (15.2%)	140 (15.6%)	6 (10.3%)
Tech school/some college	427 (44.6%)	398 (44.2%)	29 (50.0%)
≥4-yr college degree	285 (29.8%)	278 (30.9%)	7 (12.1%)
IQ at age 7	102.9 (12.7)	103.2 (12.6)	98.6 (13.0)

[a]Participants were classified as having problem gambling if they endorsed three or more items on the lifetime version of the South Oaks Gambling Screen.

Table 2

Adjusted associations between age 7 behavior problems and lifetime problem gambling (n= 958).

	Adjusted odds ratios (95% confidence intervals) for lifetime problem gambling[a]		
Characteristic	**Model 1[b]**	**Model 2[c]**	**Model 3[d]**
Behavior problem at age 7			
Impulsive	3.24 (1.47–7.14)		3.09 (1.40–6.82)
Shy/depressed		2.30 (0.97–5.44)	2.08 (0.87–4.99)
Study site			
Boston (vs. Providence)	0.68 (0.33–1.41)	0.72 (0.35–1.48)	0.64 (0.30–1.35)
Age at adult interview	0.96 (0.81–1.14)	0.93 (0.79–1.10)	0.95 (0.81–1.12)
Male gender	2.00 (1.12–3.56)	2.25 (1.28–3.95)	1.99 (1.11–3.57)
Race/ethnicity			
Black/Hispanic/Other (vs. Non-Hispanic White)	0.71 (0.33–1.55)	0.80 (0.38–1.68)	0.74 (0.34–1.60)
Marital status			
Never married	Reference	Reference	Reference
Widowed/sep/divorced	0.66 (0.29–1.48)	0.67 (0.30–1.47)	0.65 (0.29–1.48)
Married	0.42 (0.22–0.79)	0.41 (0.22–0.76)	0.41 (0.22–0.77)
Educational attainment			
<High school/GED	Reference	Reference	Reference
High school diploma	0.34 (0.12–1.03)	0.31 (0.10–0.94)	0.34 (0.12–0.99)
Tech school/some college	0.65 (0.29–1.47)	0.58 (0.26–1.27)	0.65 (0.29–1.44)
≥4-yr college degree	0.24 (0.08–0.78)	0.22 (0.07–0.68)	0.24 (0.08–0.76)
IQ at age 7 [e]	0.99 (0.66–1.48)	0.96 (0.65–1.42)	1.05 (0.69–1.60)

[a] Participants were classified as having problem gambling if they endorsed three or more items on the lifetime version of the South Oaks Gambling Screen.

[b] Adjusted model for the association between impulsive behavior at age 7 and lifetime problem gambling.

[c] Adjusted model for the association between shy/depressed behavior at age 7 and lifetime problem gambling.

[d] Adjusted model including impulsive and shy/depressed behavior at age 7.

[e] Adjusted odds ratios are expressed for a one standard deviation change (15 points) in IQ scores.