The Relationship Between Gambling Behavior and Binge Drinking, Hard Drug Use, and Paying for Sex

*Douglas M. Walker**
Christopher Clark
Jessie Folk

Abstract

We examine the relationship between gambling behavior and other "vices": hard drug use, binge drinking, and paying for sex. We utilize survey data from the National Longitudinal Study of Adolescent Health, a comprehensive survey of a representative sample of young adults in the US. We analyze survey data on the behavior of 6,145 respondents using linear probability modeling and a comprehensive set of control variables. Our results indicate that individuals who exhibit signs of problem gambling behavior are significantly more likely to use hard drugs, to binge drink, and to pay for sex. These findings, based on data collected on the general public, provide an interesting contribution to the gambling literature.

Introduction

Although gambling research has made significant advances in past years, there is still much to be learned about problem gambling behaviors. More research is needed on various facets of problem gambling, especially diagnosis and treatment. As researchers study new population samples and utilize new empirical models and data, our understanding of problem gambling will continue to advance.[1]

In this paper we utilize survey data from a large, representative sample of US young adults to analyze the relationship between gambling behavior and other "vices" – hard drug use, binge drinking, and paying for sex. This study complements the existing body of research because it utilizes a previously unused data source, has a very large sample size, and is based on many unique survey questions. The paper is organized into four sections. In Section I we provide a very brief overview of the relevant literature. Our data and models are explained in Section II, and the results are presented in Section III. A discussion of the results and the conclusion are in Section IV.

I. Background

The gambling literature is replete with studies of problem gambling and comorbid behaviors; we do not attempt a comprehensive literature review here. Instead, in this section we wish to give a short overview of the literature and the issues related to the current study. Readers interested in a more detailed literature review should see Johansson et al. (2008), Petry (2007), or papers cited therein.

1 We use the term "problem gambling" throughout the paper and do not distinguish among different severities of risks or problem gambling behavior. Such distinction is not necessary for this study, as our empirical analysis addresses unique gambling criteria.

Douglas M. Walker, Ph.D.
* Corresponding Author
Assoc. Professor of Economics
Dept. of Economics & Finance
College of Charleston
66 George Street
Charleston, SC 29424
Ph. 843-953-8192
Email: walkerd@cofc.edu

Christopher Clark
Asst. Professor of Economics
Georgia College & State University
231 W. Hancock St.
Milledgeville, GA 31060
Ph. 478-445-2588
Email: christopher.clark@scsu.edu

Jessie L. Folk
Instructor
Dept. of Economics & Finance
Georgia College & State University
231 W. Hancock St.
Milledgeville, GA 31060
Ph. 478-445-1199
Email: jessie.folk@gcsu.edu

Evidence on problem gambling risk factors and comorbid behaviors in the literature is based on a variety of sources, including studies of members from the general public, individuals who have been diagnosed as problem gamblers with one of various screening instruments, clinical studies of individuals in treatment, and Gamblers Anonymous members. Many studies rely on small sample sizes or limited empirical rigor. Yet, the link between problem gambling and other problematic behaviors is well established. Still, there is much to learn about problem gambling, and there is room for improvement in research methodologies and data quality.

Original research and meta-analyses suggest that around 0.4% to 2.0% of the general public represents problem gamblers (Petry et al. 2005). This prevalence rate is surprisingly independent of the region/country studied. Research further confirms that problem gamblers often have comorbid behaviors, such as alcohol use disorders, drug abuse, compulsive shopping, etc. The comorbidity issue has been a very important one, as numerous articles have been published on the topic. For example, an entire issue of *Journal of Gambling Studies* was dedicated to comorbidity in 2003 (vol. 19, no. 3, pp. 257-337). Another issue of the *Journal* examined only gambling and alcohol use (vol. 21, no.3, pp. 223-361). Several recent studies illustrate just how widespread comorbid behaviors are among problem gamblers. Petry et al. (2005) estimate that 73% of pathological gamblers have other behavior problems. Westphal and Johnson (2007) estimate a similar comorbidity prevalence rate of 77%. There have been many studies on the comorbidity issue, and researchers' understanding of it continues to develop.

The different risk factors for problem gambling have received significant attention in the literature. Johansson et al. (2008) summarize the research in this area. Among the risk factors that they classify as well-established are alcohol and drug use, two issues which we examine in this paper. The study by Ladouceur et al. (1999) confirms the association between problem gambling and drug and alcohol use, and shows that poor grades and delinquency may also be associated with problem gambling. The relationship between problem gambling and alcohol use disorders is examined by Grant et al. (2002), Stewart and Kushner (2005), and many others. Welte et al. (2004) provide further evidence of a relationship between alcohol and drug use, and other risk factors for problem gambling, using a large sample in the US. Vitaro et al. (2001) take a more general look at the risk factors of problem gambling, delinquency, and drug use among adolescents. Huang et al. (2007) focus on problem gambling and related disorders among US college student-athletes. Other papers in the literature look at gambling behavior and mood/anxiety disorders (e.g., el-Guebaly et al. 2006). Still others look at the relationship between gambling and other problems, such as binge eating (Fischer and Smith 2007) and impulsivity (Nower et al. 2004).

The relationship between sexual behavior and gambling has not been addressed to the extent of many other behaviors typically associated with problem gambling, such as drinking and drug use (Petry 2000, p. 1090). However, the evidence that does exist suggests that problem gamblers are more likely to engage in risky sexual behaviors (Petry 2000; Huang et al. 2007). Grant and Steinberg (2005) examine the incidence of compulsive sexual behavior among problem gamblers, and find a strong link.

The current study makes a contribution by examining how gambling behavior affects binge drinking, hard drug use, and paying for sex, using a large representative sample of 6,145 young adults in the US.

As mentioned above, many studies focus on samples of known problem gamblers or individuals in treatment for problem gambling or other problem behaviors. For example, Feigelman et al. (1995) study problem gambling among methadone patients. Other studies focus on how different comorbid behaviors affect the treatment of problem gambling. Stinchfield et al. (2005), for example, find that alcohol and substance abuse are associated with more serious gambling problems, but they do not affect the effectiveness of problem gambling treatment. Rush et al. (2007) focus on proximity to gambling venues and access to treatment as factors affecting problem gambling prevalence.

As is clear from even this very brief overview of the literature, gambling researchers have undertaken study of many facets of problem gambling behavior. Recently published work varies by sample source (general public, diagnosed problem gamblers, and those in treatment; children, adolescents, and adults), sample size (under 50 to several thousand subjects), comorbid disorders and other behavioral issues examined (alcohol, drugs, binge eating, impulsivity, delinquency/criminal behavior, risky or compulsive sexual behavior, etc.), and of course, empirical and survey methodologies. Research in this area continues to expand in numerous directions.

It is clear that alcohol and drug use disorders are commonly associated with problem gambling (Johansson et al. 2008), but more research is needed as many issues are still being debated in the literature (Petry 2007). The current study makes a contribution by examining how gambling behavior affects binge drinking, hard drug use, and paying for sex, using a large representative sample of 6,145 young adults in the US. To our knowledge, our data source has never been used to study these three behaviors commonly associated with problem gambling behavior. The findings from our study complement previous research in this area. We utilize a large number of control variables and a large sample size, relative to many other studies, and we believe our results provide an interesting contribution to the literature.

II. Data and Models[2]

The National Longitudinal Study of Adolescent Health (Add Health)[3] is a survey of a US nationally representative sample of adolescent students in grades seven through twelve, from 134 schools. It includes a follow up survey conducted when the individuals were between 18 and 27 years old. Our study relies mostly on the data from this last wave of the study, when the average age of respondents was 22.

The Add Health contains an initial in-school survey administered to 90,118 students for the 1994-95 school year. Subsequently, there were three waves of in-home surveys administered to many of the same students in 1994-95, 1996, and 2001-02, as well as two school administrator questionnaires, and a parents' survey. The wave 1 in-home survey includes responses from 20,745 students and approximately 18,000 parents. The wave 2 in-home survey contains information on 14,738 adolescents. The wave 3 in-home survey contains information on 15,197 individuals. The in-school and wave 1 and 2 in-home surveys cover health related behavior and life experiences, while the wave 3 in-home survey is targeted at evaluating academic, career, and personal outcomes for these individuals. Individuals who participated in the in-home surveys were surveyed twice during the ages of 12 through 19 (waves 1 and 2), and again when most of the respondents were 18 to 27 years old (wave 3). In order to ensure a complete data set, we eliminated any individuals from the wave 3 survey who were missing any survey data. This adjustment reduces our sample for the drug use and binge drinking analyses to 6,145 individuals – all of whom complete all three waves of the Add Health. For the paying for sex analysis, an additional 9 individuals were dropped, as they failed to answer that specific question, leaving us with a sample of 6,136. The means and standard deviations for the other variables in the model do not vary across the two samples.

The Add Health survey is one of the most comprehensive sources of information on US young adults available, and has been widely used in research. (Many of the studies that have used Add Health data are posted at http://www.cpc.unc.edu/projects/addhealth/pubs. See Harris et al. (2003) for a detailed description of the Add Health design.) The study includes self-reported data on a number of variables, including academic

2 This description of the Add Health data set borrows from Clark and Walker (2009).

3 This research uses data from Add Health, a program project designed by J. Richard Udry, Peter S. Bearman, and Kathleen Mullan Harris, and funded by a grant P01-HD31921 from the National Institute of Child Health and Human Development, with cooperative funding from 17 other agencies. Special acknowledgment is due Ronald R. Rindfuss and Barbara Entwisle for assistance in the original design. Persons interested in obtaining data files from Add Health should contact Add Health, Carolina Population Center, 123 W. Franklin Street, Chapel Hill, NC 27516-2524 (addhealth@unc.edu).

performance, weight, relationships with parents, previous criminal behavior, sexual activity, and relationships with peers. Generally, interviewees answered questions asked by the interviewer who then recorded the answer on a laptop computer. For sensitive questions interviewees entered answers directly into the laptop. The primary benefits of using Add Health data for examining the relationship between gambling and drug use, binge drinking, and paying for sex are that the sample is very large, it examines young adult gambling behavior and the other relevant risky behaviors, the survey does not focus only on problem or pathological gamblers, and it includes many questions other than gambling behavior that may help explain drug use, binge drinking, and paying for sex.

Data

Among a variety of other questions in the Add Health, respondents to the third wave of the survey were asked about their gambling behavior and any drug or alcohol use, as well as questions about their sexual behavior. The survey questions dealing with gambling are reproduced in Table 1. Also included in the table are similar questions from two well-known diagnostic instruments, the DSM-IV (American Psychiatric Association 1994) and the South Oaks Gambling Screen (SOGS; Lesieur and Blume 1987). (Other instruments are available, such as the DSM-IV-J and SOGS-RA, designed for juveniles and adolescents. However, none of these instruments more closely parallels the Add Health questions than the DSM-IV or SOGS.) Although the Add Health questions are not identically worded to the DSM and SOGS questions, there are interesting parallels among questions.

Table 1. Selected gambling-related questions from the Add Health, DSM-IV, and SOGS (Similar questions are shown across rows.)

Question ID (Used in Table 2)	Add Health	DSM-IV	SOGS
Lotto played	Have you ever bought lottery tickets, such as daily, scratch-offs, or lotto?		1. Please indicate which of the following types of gambling you have done in your lifetime. For each type, mark one answer: "Not at all," "less than once a week," or "once a week or more". Options include: played cards for money; bet on horses, dogs, or other animals; bet on sports; played dice games; went to casino; played the numbers or bet on lotteries; played bingo; played the stock and/or commodities market; played slot machines, or other gambling machines; bowled, shot pool, etc. for money
Casino games played	Have you ever played casino tables or video games for money – such games as craps, blackjack, roulette, slot machines, or video poker?		
Other games played	Have you ever played any other games, such as cards or bingo, for money, or bet on horse races or sporting events, or taken part in any other kinds of gambling for money?		
Largest amount behind	In all the time since you first started any type of gambling, what would you say was the largest amount of money that you have ever been behind across an entire year of gambling? Options include: none/never gamble; loss < $100; $100-500; $501-1000; $1001-5000; $5001-10000; loss > $10000		2. What is the largest amount of money you have ever gambled with on any one day? Options include: never have gambled; $1 or less; up to $10; up to $100; up to $1000; up to $10000; more than $10000
Thinking about gambling	Have there ever been periods lasting two weeks or longer when you spent a lot of time thinking about your gambling experiences or planning out future gambling ventures or bets?	1. is preoccupied with gambling (e.g., preoccupied with reliving past gambling experiences, handicapping or planning the next venture, or thinking of ways to get money with which to gamble	
Gamble to relieve feelings	Have you ever gambled to relieve uncomfortable feelings such as guilt, anxiety, helplessness, or depression?	5. gambles as a way of escaping from problems or of relieving a dysphoric mood (e.g., feelings of helplessness, guilt, anxiety, depression)	
Gamble to get even	Has there ever been a period when, if you lost money gambling one day, you would return another day to get even?	6. after losing money gambling, often returns another day to get even ("chasing" one's losses)	4. When you gamble, how often do you go back another day to win back money you lost?
Relationship problems	Has your gambling ever caused serious or repeated problems in your relationships with any of your family members or friends?	9. has jeopardized or lost a significant relationship, job, or educational or career opportunity because of gambling	12. Have you ever argued with people you live with over how you handle money?

Below we explain how the different questions from the Add Health, DSM-IV, and SOGS were incorporated into our empirical model to help explain the drug use, drinking, and paying for sex by young adult gamblers.

One important issue to keep in mind is that the DSM-IV and SOGS, among the other more recently-developed diagnostic instruments, are often administered to individuals presumed to or suspected of having a gambling problem. The Add Health survey, on the

other hand, was administered to a nationally representative sample, and was not aimed at individuals who were suspected of having a gambling problem. The Problem Gambling Severity Index (PGSI), for example, is designed for use with the general public. However, its questions are formatted as "how much" rather than "yes/no." For this reason we do not compare Add Health questions to the PGSI criteria.

For this study we are using data primarily from the third wave of the Add Health survey, with some demographic variables pulled from the earlier waves. There are thousands of questions asked of participants in the Add Health survey. We have collected response data on those questions which we believe most closely relate to problem gambling behavior and our dependent variables, *Binge drinking, Hard drug use*, and *Pay for sex*, which are defined in Table 2. The explanatory variables used in our study, along with their descriptions and summary statistics, are also presented in Table 2. The table also indicates the Add Health wave from which the survey the questions were taken. For the sake of brevity, Table 2 excludes a series of state and county level variables that are included in the regressions.

Table 2. Variable Definitions and Summary Statistics (n=6,145)

Variable	Definition	Wave	Mean	(Std. Dev.)
	Dependent Variables			
Binge drinking	During the past 12 months, on how many days did you drink five or more drinks in a row? =1 if the individual reported binge drinking more than twice; =0 otherwise	Third	0.347	(0.476)
Pay for sex (Sample Size = 6,136)	During the past 12 months, how many times have you paid for sex? =1 if individual reports paying for sex in the last 12 months; =0 otherwise	Third	0.024	(0.154)
Hard drug use	=1 if cocaine=1, crystal=1, or other drugs=1 (see below); =0 otherwise	Third	0.069	(0.253)
Cocaine	During the past 30 days, how many times have you used any kind of cocaine? =1 if individual reports using cocaine at all over the last 30 days	Third	0.031	(0.174)
Crystal meth	During the past 30 days, how many times have you used crystal meth? =1 if individual reports using crystal meth at all over the last 30 days; =0 otherwise	Third	0.015	(0.121)
Other drugs	During the past 30 days, how many times have you used any of these types of illegal drugs (LSD, PCP, ecstasy, mushrooms, inhalants, ice, heroin, or prescription medicines not prescribed for you)? =1 if individual reports using any of these illegal drugs at all over the last 30 days; =0 otherwise	Third	0.048	(0.213)
	Add Health Gambling Questions			
DSM	=1 if yes to all four: Thinking about gambling, Gamble to relieve feelings, Gamble to get even, Relationship problems; =0 otherwise	n/a	0.022	(0.148)
SOGS	=1 if yes to "Down over $500, or if "yes" to more than four of the following: Lotto played, Casino games played, Other games played, Thinking about gambling, Gamble to relieve feelings, Gamble to get even, Relationship problems; =0 otherwise	n/a	0.021	(0.142)
Down $501-1000	=1 if down $501-1000 across one year of gambling; =0 otherwise	Third	0.020	(0.139)
Down $1001-5000	=1 if down $1001-5000 across one year of gambling; =0 otherwise	Third	0.014	(0.117)
Down $5001-10000	=1 if down $5001-10000 across one year of gambling; =0 otherwise	Third	0.002	(0.040)
Down $10001 or more	=1 if down $10001 or more across one year of gambling; =0 otherwise	Third	0.001	(0.029)
Lotto played	=1 if yes; =0 if no (see Table 1 for definition)	Third	0.629	(0.483)
Casino games played	=1 if yes; =0 if no (see Table 1 for definition)	Third	0.496	(0.500)
Other games played	=1 if yes; =0 if no (see Table 1 for definition)	Third	0.425	(0.494)
Largest amount behind	=0 if none/never gamble; =1 if down < $100; =2 if $100-500; =3 if $501-1000; =4 if $1001-5000; =5 if $5001-10000; =6 if > $10000 (see Table 1 for definition)	n/a	0.758	(0.850)
Thinking about gambling	=1 if yes; =0 if no (see Table 1 for definition)	Third	0.013	(0.114)
Gamble to relieve feelings	=1 if yes; =0 if no (see Table 1 for definition)	Third	0.005	(0.069)
Gamble to get even	=1 if yes; =0 if no (see Table 1 for definition)	Third	0.020	(0.138)
Relationship problems	=1 if yes; =0 if no (see Table 1 for definition)	Third	0.004	(0.068)
	Demographic			
Male	=1 if the individual is male; =0 otherwise	n/a	0.483	(0.500)
White	=1 if the individual reports being Caucasian and reports that he/she is not Hispanic; =0 otherwise	n/a	0.613	(0.487)
GPA	Math and English GPA	First	2.697	(0.942)
Vocab	Add Health Picture - Vocabulary Test Score	First	102.89	(14.03)
South	=1 if individual lives in southern region of United States; =0 otherwise	Third	0.259	(0.438)
West	=1 if individual lives in western region of United States; =0 otherwise	Third	0.274	(0.446)
Midwest	=1 if individual lives in midwestern region of United States; =0 otherwise	Third	0.313	(0.464)
Age	Individual's current age	Third	21.770	(1.665)
Education	Individual's current education level (years of school)	Third	13.415	(1.949)
Work	Individual's current work status, =1 if working; =0 otherwise	Third	0.720	(0.449)
Welfare	=1 if the individual currently received welfare; =0 otherwise	Third	0.038	(0.187)
Income	Individual's current annual income (in US dollars)	Third	13833.55	(16460.13)
Married	=1 if the individual is currently married; =0 otherwise	Third	0.147	(0.354)
Serious Crime	=1 if steal, break & enter, assault, sell drugs, or fight, during past year; =0 otherwise	Third	0.151	(0.358)
Expelled	=1 if the individual has ever been expelled from school; =0 otherwise	Third	0.062	(0.240)
	Parents and Family			
Children 0-6	Number of children in the household under the age of 6	Third	0.306	(0.852)
Children 6-12	Number of children in the household age between 6 and 12	Third	0.114	(0.412)
Disapprove college	=1 if strong parental disapproval if adolescent does not attend college; =0 otherwise	First	0.458	(0.498)
Neighborhood	=1 if parent moved to neighborhood because of school system; =0 otherwise	First	0.494	(0.500)
Brilliant	=1 if parent believes adolescent being brilliant is top priority; =0 otherwise	First	0.626	(0.484)
Project help	=1 if parent recently aided adolescent with school project; =0 otherwise	First	0.204	(0.403)
Grade talk	=1 if parent recently spoke with adolescent about grades; =0 otherwise	First	0.469	(0.499)
Single Parent	=1 if single-parent household; =0 otherwise	First	0.267	(0.442)
Parent graduate	=1 if parent graduated from college; =0 otherwise	First	0.263	(0.440)
Parent works	=1 if parent is employed outside the home; =0 otherwise	First	0.764	(0.425)
Curfew	=1 if parent has strict weekend curfew for adolescent; =0 otherwise	First	0.685	(0.472)
Weekly dinners	Number of days per week adolescent has dinner with family	First	4.668	(2.451)
Religion	Measure of family attendance at religious services (0=no attendance, 1=weekly, 2=monthly, 3=yearly)	First	2.289	(1.202)
No monitor	=1 if parent does not monitor friends of adolescent; =0 otherwise	First	0.053	(0.224)
Older sibling	=1 if older sibling in household; =0 otherwise	First	0.383	(0.486)
Household income	Household income (in thousands of US dollars)	First	49.579	(54.219)

Although the table describes each of the variables, several are worth highlighting. First, note that roughly 7% of the sample (430 of 6,145 individuals) admits to having used cocaine, crystal meth, or another illegal drug over the past 30 days (*Hard drug use*, one of our dependent variables). Roughly a third of the sample (35% or 2,151 individuals) reports binge drinking more than twice in the last year. This number is perhaps not as large as it might seem, as the threshold for *Binge drinking* is rather low – drinking five or more drinks in a row more than twice in the past year. Only 2.4% of the individuals in the sample (147) report having paid someone to have sex with them in the last 12 months.

A large proportion of the survey respondents has gambled at some point in their lifetime: 63% (3,865 individuals) have played the lotto, about 50% (3,048 individuals) have played casino games, and 43% (2,612 individuals) have gambled in some other form. When asked how much is the largest amount of money they have been down from gambling over the course of a year, the average response was "less than $100." Relatively few respondents gave a positive answer to any of the other gambling questions listed in Table 1: *Thinking about gambling* (1.3% or 80 individuals), *Gambling to relieve feelings* (0.5% or 31 individuals), *Gamble to get even* (2% or 123 individuals), and *Relationship problems* (0.4% or 25 individuals).

We created a series of dichotomous variables to partition the *Largest amount behind* variable from the Add Health. These resulting new variables provide more detailed information on the extent to which the Add Health respondents have lost money gambling. As noted above, relatively few respondents reported being down a significant amount of money. Approximately 3.7% of survey respondents (227 individuals) indicated being down at least $501 during a particular year. About 1.4% (86 individuals) indicated that they have been down a maximum of between $1,001 and $5,000 during a particular year. Only 0.1% (six individuals) indicated being down more than $10,000 during a particular year.

Finally, we created variables to account for a positive response to all of the Add Health questions that were closely related to the DSM-IV and SOGS criteria listed in Table 1. The variable DSM is scored with a 1 if a respondent gives an affirmative response to the four Add Health questions of *Thinking about gambling; Gamble to relieve feelings, Gamble to get even, and Relationship problems*. If the respondent does give a negative response to any of the four criteria, the *DSM* variable is scored with a 0 for that respondent. As shown in Table 2, 2.2% (or 135) of the respondents gave an affirmative response to all four questions considered in *DSM*. The *SOGS* variable is recorded as a 1 if the Add Health respondent had a *Largest amount behind* response of 3, 4, 5, or 6 (that is, being behind by at least $501), or if he/she gave an affirmative response to more than four of these variables: *Lotto played, Casino games played, Other games played, Thinking about gambling, Gamble to relieve feelings, Gamble to get even*, and *Relationship problems*. Otherwise, the respondent gets a 0 for the *SOGS* variable. Approximately 2.1% of Add Health respondents (129 people) received an affirmative score on the *SOGS* variable.

The *DSM* and *SOGS* variables are included in order to allow us to determine how Add Health respondents may compare to individuals if they were evaluated under the DSM-IV and SOGS instruments. Importantly, we are not claiming that the *DSM* and *SOGS* variables we created replicate the actual instruments. First, the Add Health items are not worded the same as items in the *DSM* or *SOGS*. Second, the Add Health contains only four items similar to those in the *DSM*, and only four items similar to those in *SOGS*. Clearly, we are not suggesting that the Add Health is a substitute for either diagnostic tool. Rather, we are simply suggesting that there are some potentially interesting parallels with some of the survey items, and that a person who affirms our *DSM* or *SOGS* criteria may be more likely to be diagnosed as a problem gambler.

The other variables in the model, as shown in Table 2, are related to the individual's demographic information which may be expected to have an impact on the propensity to use drugs, binge drink, and perhaps, to pay for sex. These include income, education,

school performance, employment, criminal behavior, and marital status. Additional variables accounting for aspects of the survey respondent's parental and family situation are also included in the model. For the sake of brevity we do not discuss the parental and familial variables here.

Models

In order to test whether gambling has a significant impact on drug use, binge drinking, or paying for sex, we posit a series of linear probability models to explain these behaviors, measured as *Hard drug use, Binge drinking*, and *Pay for sex*:

$$\Pr(\textit{Hard drug use}_i = 1) = \beta_0 + b_1\textit{Gambling}_i + b_2X_i + b_3\textit{State/county controls} + \varepsilon_i \quad (1)$$

$$\Pr(\textit{Binge drinking}_i = 1) = \beta_0 + b_1\textit{Gambling}_i + b_2X_i + b_3\textit{State/county controls} + \varepsilon_i \quad (2)$$

$$\Pr(\textit{Pay for sex}_i = 1) = \beta_0 + b_1\textit{Gambling}_i + b_2X_i + b_3\textit{State/county controls} + \varepsilon_i \quad (3)$$

As listed in Table 2, *Hard drug* use equals 1 if, within the year prior to taking the wave 3 survey, the individual used any of the following drugs: cocaine, crystal meth, LSD, PCP, ecstasy, mushrooms, inhalants, ice, heroin, or prescription medicines not prescribed for them. *Binge drinking* equals 1 if the individual reported binge drinking (drinking five or more drinks in a row) more than twice in the last 12 months. Finally, *Pay for sex equals* 1 if the individual reported paying for sex in the last 12 months.

A linear probability model is designed to explain and predict the likelihood that the event measured in the dependent variable will occur. In this case, we use the variety of right-side variables to explain and predict the likelihood than an individual will have used drugs, binge drank, or paid for sex, in the time period leading up to their wave 3 survey. We are particularly interested in the role that gambling behavior may have on the dependent variables. The linear probability model provides more reliable results than simple correlations, for example, as it attempts to control for many other factors that might explain the propensity to engage in the activities we test. Therefore, the specific effect of gambling on these behaviors is isolated in this type of model.

The explanatory variables in equations 1-3 are described in turn. The variables contained in X_i are listed in Table 2 under "Demographic" and "Parents and Family" headings. Some of these variables are "current," from wave 3 of the Add Health, while others are from the respondents' adolescence (wave 1). The X_i variables are intended to control for many factors or effects that may contribute to or reduce the likelihood of drug use, binge drinking, and paying for sex.

The *State/County controls* variables include a variety of state and county-level data on population demographics (e.g., income, unemployment, poverty rate), designed to control for state and county-specific population characteristics. For the sake of brevity, we do not list these variables or their results. A full list of these forty-one variables and the results are available from the authors.

Of particular interest in our study, the $\textit{Gambling}_i$ variables are intended to measure the individuals' current gambling practices. We test three different model specifications based on variations of the $\textit{Gambling}_i$ variables. In model A, gambling is measured using the variables *Lotto played, Casino games played*, and *Other games played*, as defined in Table 1. These variables take a value of 1 if the respondent indicated having played the relevant game(s). In models B and C, gambling is measured using the *DSM* and *SOGS* variables, respectively, as explained above and in Table 2. We present and discuss the results in the next section.

III. Results

Our models highlight the extent to which Add Health survey respondents' gambling activities can explain their propensities to use drugs, binge drink, or pay for sex as young adults. The results from the three variations on equations 1-3 are presented in Table 3. We discuss the models of each dependent variable in turn.

Table 3. Effects of Gambling on Hard Drug Use, Binge Drinking, and Payment for Sex

	Dependent Variable = Hard Drug Use			Dependent Variable = Binge Drinking			Dependent Variable = Pay for Sex		
	Model A	Model B	Model C	Model A	Model B	Model C	Model A	Model B	Model C
Lotto played	0.0051	–	–	0.0146	–	–	-0.0007	–	–
	(0.0069)			(0.0131)			(0.0027)		
Casino games played	0.0090	–	–	0.0731***	–	–	0.0041*	–	–
	(0.0075)			(0.0137)			(0.0025)		
Other games played	0.0208***	–	–	0.0920***	–	–	0.0017	–	–
	(0.0073)			(0.0133)			(0.0027)		
DSM	–	0.0577*	–	–	0.1094***	–	–	0.0636**	–
		(0.0299)			(0.0390)			(0.0270)	
SOGS	–	–	0.0508*	–	–	0.0928**	–	–	0.0628**
			(0.0313)			(0.0413)			(0.0281)
Sample Size (# of individuals)	6,145	6,145	6,145	6,145	6,145	6,145	6,138	6,138	6,138

Notes: Coefficients are listed with standard errors in parentheses. * indicates statistically significant at the 10% level, ** at the 5% level, and *** at the 1% level. All variables included in X_i and *State/county controls* are included in each model, but their results are omitted for brevity. Full results are available from the authors5

Hard Drug Use

The first model on drug use includes the three types of gambling questions (*Lotto played, Casino games played*, and *Other games played*) from the Add Health survey in a linear probability model to explain drug use within the month prior to the wave 3 Add Health survey being administered. The results of model A indicate that when respondents report having gambled on "other games" (i.e., not lotto or casino games) they are more likely to have used drugs in the last 30 days. The coefficient on the variable *Other games played* is 0.02 and is statistically significant at the 1% level, indicating that if the individual engaged in gambling outside a casino the probability that they use drugs increases by 2 percentage points. The mean value for drug use is 0.069, so a 2 percentage point increase translates to a 30% increase in the probability that an individual will use drugs. The other gambling variables in model A were statistically insignificant.

In models B and C we are examining individuals who gave positive responses to Add Health questions that were similar to some of the criteria from the DSM-IV or SOGS. That is, in these models, the explanatory gambling variables include a bundle of conditions. The DSM variable in model B counts individuals who *affirm* all of the four variables: *Thinking about gambling, Gamble to relieve feelings, Gamble to get even*, and *Relationship problems*. In model B, the coefficient on *DSM* is 0.058. Given the mean for *Hard drug use* is 0.069, the *DSM* coefficient implies that individuals to which the DSM variable applies are almost 84% more likely than the average Add Health respondent to have used hard drugs. This result confirms that individuals who have at least four of the DSM criteria – individuals who are perhaps more likely to be diagnosed as problem gamblers – are much more likely to use hard drugs.

Finally, the results of model C support the above results. Like the *DSM* variable, the *SOGS* variable in model C tests a combination of Add Health questions. These questions are similar to some of the questions found in the SOGS instrument. As shown in Table 2, the *SOGS* variable tracks individuals who were down at least $501, or if they gave affirmative responses to at least four of the following criteria: *Lotto played, Casino games played, Other games played, Thinking about gambling, Gamble to relieve feelings, Gamble to get even*, and *Relationship problems*. The coefficient on SOGS is 0.051; relative to the mean of 0.069, this indicates that *SOGS* respondents are 73% more likely than the average respondent to use hard drugs.

Binge Drinking

When using *Binge drinking* as the dependent variable, the results of model A indicate that when respondents report having gambled inside *or* outside of a casino they are more likely to have binge drunk more than twice in the last year. The coefficient on the variable *Casino games played* is 0.07 and is statistically significant at the 1% level, indicating that if the individual engaged in casino gambling the probability that they binge drink increases by 7 percentage points. The mean value for binge drinking is 35%, so a 7 percentage point increase translates to a 20% increase in the probability that an individual will binge drink. The coefficient on the variable *Other games played* is 0.09 and is also

statistically significant at the 1% level. This coefficient translates to a 26% increase in the probability that the individual will binge drink.

Model B uses the *DSM* variable, as described above, to explain binge drinking. The coefficient of 0.11 indicates that individuals for whom our *DSM* criterion applies are about 31% more likely than the average respondent to binge drink (the mean value of *Binge drink* is 0.35).

The results of model C support the DSM results from model B. The coefficient on SOGS is 0.09, a statistically significant result at the 1% level. Since the mean value of Binge drink is 0.35, this coefficient implies that individuals who affirm the SOGS criterion are over 26% more likely than the average respondent to binge drink.

Paying for Sex

The last three columns of Table 3 contain the results of estimating models A through C with *Pay for sex* as the dependent variable. The results for model A indicate that individuals who gamble in casinos are significantly more likely to have paid for sex. The coefficient on *Casino games played* is 0.004, which is statistically significant at the 10% level. Given about 2.4% of the Add Health respondents acknowledged that they had paid for sex in the past year, the coefficient indicates that casino patrons are almost 17% more likely than the average survey respondent to have paid for sex in the past year.

As with drug use and binge drinking, model B for *Pay for sex* focuses on the *DSM* variable. The coefficient on *DSM* is 0.06, indicating that if an individual affirms the *DSM* criterion the probability that he/she has paid for sex increases by 6 percentage points. This result is statistically significant at the 5% level. Given the mean value of the *Pay for sex* variable, 0.024, this implies that the individual to whom the *DSM* variable applies is over 2.6 times (260%) as likely as the average survey respondent to hire a prostitute. Model C for *Pay for sex*, shown in the rightmost column of Table 3, shows a similar result as in model B. The coefficient on *SOGS* is also roughly 0.06. As in model B, this coefficient indicates that the *SOGS*-affirmative respondents are more than 2.6 times as likely as the average respondent to have paid for sex.

Since men are perhaps more likely than women to pay for sex (e.g., prostitution), we also run the *Pay for sex* models using only the male respondents from Add Health. The sample size is 2,965. The results of these models are presented in Table 4.

The results in the male-only model are consistent with those found in the full model (Table 3). The magnitudes and significance for the *DSM* and *SOGS* models are

Table 4. Gambling and Payment for Sex: Males Only

	Dependent Variable = Pay for Sex		
	Model A	Model B	Model C
Lotto played	-0.0003	--	--
	(0.0059)		
Casino games played	0.0085*	--	--
	(0.0053)		
Other games played	-0.0003	--	--
	(0.0053)		
DSM	--	0.0677**	--
		(0.0303)	
SOGS	--	--	0.0654**
			(0.0305)
Sample Size (# of Individuals)	2,965	2,965	2,965

Notes: Coefficients are listed with standard errors in parentheses.
* indicates statistically significant at the 10% level, ** at the 5% level, and *** at the 1% level.
All variables included in X_i and *State/county controls* are included in each model, but their results are omitted for brevity. Full results are available from the authors.

not different from the full model. However, the magnitude of the coefficient on *Casino games played* in the male-only sample doubles to 0.0085, which is also significant at the 10% level. This result indicates that men who gamble in casinos are 17% more likely to pay for sex than those respondents who do not gamble at casinos. (The mean value for *Pay for sex* is 0.05 for the males in the sample.) This particular result is no different than the result in the full model. These results suggest that, as expected, men are driving the results for the full sample.

IV. Discussion and Conclusion

We have tested the effects of gambling behavior and indicators of problem gambling on the likelihood that Add Health respondents engage in hard drug use, binge drink, or pay money for sex. Our results suggest that individuals who gamble, and more significantly, those who are more likely to be diagnosed with gambling problems, are more likely to also engage in these other behaviors.

Considering all three models on *Hard drug use* (equation 1), our results strongly suggest individuals who give affirmative responses to multiple questions similar to some of those found on the DSM-IV and SOGS diagnostic instruments are also statistically more likely to engage in drug use than the average Add Health wave 3 survey respondent. Interestingly, the results from model A on drug use apply only "Other games played," not to casino or lotto players. One possible explanation of this is that the average age of wave 3 respondents is around 22; about 75% of the respondents were at least 21 years old. Fully one quarter of the survey respondents were not of legal age to gamble in a casino at the time they completed wave 3 of the Add Health.

Our results suggest that individuals who gamble, and more significantly, those who are more likely to be diagnosed with gambling problems, are more likely to also engage in these other behaviors.

Our results on equation 2 for *Binge drinking* imply that individuals who give affirmative responses to multiple questions similar to some of those found on the DSM-IV and SOGS diagnostic instruments are also statistically more likely to engage in binge drinking than the average Add Health wave 3 survey respondent.

The results on *Pay for sex* are perhaps most interesting, as this issue has rarely been addressed in the gambling literature. Taken as a group, the models for equation 3 suggest that individuals who gamble at casinos, and who may be more at risk to be diagnosed as problem gamblers, are significantly more likely than the average Add Health respondent to pay for sex. Perhaps casinos create an atmosphere where risky behavior is acceptable: alcohol is often consumed and it is sometimes provided free to casino patrons. Prostitutes may be more likely to congregate at casinos since casino patrons may have large amounts of cash with them. When we isolate the sex models to males only, we find the effect of potential problem gambling, as indicated by our *DSM* and *SOGS* variables, is much stronger – by a factor of 2.6. This result is consistent with the risk-taking behavior exhibited by gambling.

Moving Forward

Our results are not surprising, and they confirm much of what has been found in studies that focus specifically on problem gamblers. Given the evidence indicating that these comorbid behaviors appear to exist even amongst the general population, it helps to emphasize the lack of understanding of *why* these relationships exist.

Critics of gambling research have noted that there seems to be an enormous amount of research attention given to problem gambling behavior, even though it affects a relatively small percentage (1-3%) of the population. Indeed, several academic journals are dedicated mostly to the prevalence, diagnosis, and treatment of problem gambling. Is continued emphasis on these issues justified?

Problem gambling does affect a large *number* of people in the US – 2 million adults in the US, according to the National Council on Problem Gambling. So we believe research on problem gambling to be worthwhile. But consider all of the people who are *not* problem

gamblers who are affected by the spread of gambling around the US and the world. These impacts of gambling receive scant research attention, considering the number of people affected, relative to research on problem gambling. Legal casinos, for example, can impact state-level and national-level economic growth, taxes, employment, and crime, which can affect everyone living in a community. (Of course, the magnitude of the effects on a particular individual may be minor.) In total, these effects can be sizeable. Yet, there has been relatively little published research on these economic issues, and even less in the way of policy analysis that might guide governments to make wise decisions regarding the expansion of gambling. Of course, the enormous amount of research funding provided for problem gambling, rather than policy-oriented or economic research, may explain most of the research disparity. Still, perhaps a shifting of research priorities is warranted. Rather than focusing so much on the "micro" aspects of gambling behavior, perhaps future studies should focus on the "macro" and policy-related issues surrounding gambling.

Conclusion

Our results confirm what more focused studies on problem gamblers have found: links between problem gambling, drug use, and other risky behaviors. Our results are based on a relatively large and representative sample of young adults in the US. Thus, our analysis complements the literature by showing that comorbid behaviors are not confined to individuals diagnosed with or in treatment for problem gambling. We believe ours to be one of the largest samples used in a study of this type. This is also one of few studies to examine a link between gambling and paying for sex.

Although our models test the effect of gambling behavior on hard drug use, binge drinking, and paying for sex, our analysis does not allow us to rule out these relationships running in the opposite direction as well. Indeed, the direction of causation among coexisting disorders continues to be an important, unresolved issue in the literature, as indicated by Stewart and Kushner (2005), among others. Our analysis here does not address the issue of why these behaviors are linked, but it does provide evidence that gambling behavior among US young adults is often associated with drug use, binge drinking, and paying for sex. But individuals with "problem" levels of these coexisting behaviors represent a miniscule percentage of the population. Rather than further analyzing prevalence issues, future research in this area should attempt to answer the "why" question and what types of treatments and policies could help alleviate such problems.

References

American Psychiatric Association. (1994). *Diagnostic and statistical manual of mental disorders*, 4th ed. Washington, DC: American Psychiatric Association.

el-Guebaly, N., Patten, S., Currie, S., Williams, J., Beck, C., Maxwell, C., & Wang, J. (2006). Epidemiological associations between gambling behavior, substance use & mood and anxiety disorders. *Journal of Gambling Studies, 22*, 275-287.

Clark, C., & Walker, D. (2009). Are gamblers more likely to commit crimes? An empirical analysis of a nationally representative survey of US young adults. *International Gambling Studies, 9*, 119-134.

Feigelman, W., Kleinman, P., Lesieur, H., Millman, R., & Lesser, M. (1995). Pathological gambling among methadone patients. *Drug and Alcohol Dependence, 39*, 75-81.

Fischer, S., & Smith, G. (2008). Binge eating, problem drinking, and pathological gambling: Linking behavior to shared traits and social learning. *Personality and Individual Differences, 44*, 789-800.

Grant, J., Kushner, M., & Kim, S. (2002). Pathological gambling and alcohol use disorder. *Alcohol Research & Health, 26*,143-150.

Grant, J., & Steinberg, M. (2005). Compulsive sexual behavior and pathological gambling. *Sexual Addiction & Compulsivity, 12*, 235-244.

Harris, K., Florey, F., Tabor, J., Bearman, P., Jones, J., & Udry, J. (2003). The National

Longitudinal Study of Adolescent Health: Research design. http://www.cpc.unc.edu/projects/addhealth/design.

Huang, J., Jacobs, D., Derevensky, J., Gupta, R., & Paskus, T. (2007). Gambling and health risk behaviors among U.S. college student-athletes: Findings from a national study. *Journal of Adolescent Health, 40*, 390-397.

Johansson, A., Grant, J., Kim, S., Odlaug, B., & Götestam, K. (2009). Risk factors for problematic gambling: A critical literature review. *Journal of Gambling Studies, 25*, 67-92.

Ladouceur, R., Boudreault, N., Jacques, C., & Vitaro, F. (1999). Pathological gambling and related problems among adolescents. *Journal of Child & Adolescent Substance Abuse, 8*, 55-68.

Lesieur, H., & Blume, S. (1987). The South Oaks Gambling Screen (SOGS): A new instrument for the identification of pathological gamblers. *American Journal of Psychiatry, 144*, 1184-1188.

National Council on Problem Gambling. (2010). Frequently Asked Questions – Problem Gamblers. Washington, DC: National Council on Problem Gambling. Available at http://www.ncpgambling.org/i4a/pages/Index.cfm?pageID=3315.

Nower, L., Derevensky, J., & Gupta, R. (2004). The relationship of impulsivity, sensation seeking, coping, and substance use in youth gamblers. *Psychology of Addictive Behaviors, 18*, 49-55.

Petry, N. (2000). Gambling problems in substance abusers are associated with increased sexual risk behaviors. *Addiction, 95*, 1089-1100.

Petry, N. (2007). Gambling and substance use disorders: Current status and future directions. *The American Journal on Addictions, 16*, 1-9.

Petry, N., Stinson, F., & Grant, B. (2005). Comorbidity of DSM-IV pathological gambling and other psychiatric disorders: Results from the National Epidemiological Survey on Alcohol and Related Conditions. *Journal of Clinical Psychiatry, 66*, 564-574.

Rush, B., Veldhuizen, S., & Adlaf, E. (2007). Mapping the prevalence of problem gambling and its association with treatment accessibility and proximity to gambling venues. *Journal of Gambling Issues, 20,* 193-213

Stewart S., & Kushner M. (2005). Introduction to the special issue on "Relations between gambling and alcohol use." *Journal of Gambling Studies, 21*, 223-231.

Stinchfield, R., Kushner, M., & Winters K. (2005). Alcohol use and prior substance abuse treatment in relation to gambling problem severity and gambling treatment outcome. Journal of Gambling Studies, *21*, 273-297.

U.S. Bureau of Labor Statistics. (2009). Characteristics of minimum wage workers, 2008. Washington, DC: Bureau of Labor Statistics. Available at http://www.bls.gov/cps/minwage2008.htm.

Vitaro, F., Brendgen, M., Ladouceur, R., & Tremblay, R. (2001). Gambling, delinquency, and drug use during adolescence: Mutual influences and common risk factors. *Journal of Gambling Studies, 17*, 171-190.

Welte, J., Barnes, G., Wieczorek, W., Tidwell, M., & Parker, J. (2004). Risk factors for pathological gambling. *Addictive Behaviors, 29*, 323-335.

Westphal, J., & Johnson, L. (2007). Multiple co-occurring behaviours among gamblers in treatment: Implications and assessment. *International Gambling Studies, 7*, 73-99.

Zimmerman, M., Chelminski, I., & Young, D. (2006). Prevalence and diagnostic correlates of DSM-IV pathological gambling in psychiatric outpatients. *Journal of Gambling Studies, 22*, 255-262.

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