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The Relationship Between the Number of Types of Legal Gambling and the Rates of Gambling Behaviors and Problems Across U.S. States

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Abstract In this article, we examine the relationship between the total number of types of gambling that are legal in a state and the gambling involvement of state residents. Of particular interest is whether more types of legal gambling are associated with higher rates of problem gambling. Telephone surveys of U.S. adults were conducted in 1999–2000 and 2011–2013. The same questions were used and the data sets were combined for most of the analyses. Gambling exposure was defined as the sum of the number of years that all types were legal. Results tabulated by state showed progressively higher rates of problem gambling, frequent gambling and any past year gambling as the number of legal types of gambling increased. Holding constant the number of legal types, problem gambling rates increased as exposure increased. States with longer exposure to legal lotteries or casinos tended to have higher rates of problem gambling. An analysis was also conducted in which the data sets from 1999 to 2000 and from 2011 to 2013 were compared. Among the states, there was a striking positive relationship between changes in the number of legal types of gambling between the two studies and changes in rates of frequent gambling between the two studies. For states that had fewer types of legal gambling in 2011 than in 1999, the rates of frequent gambling went down. For states that increased their types of legal gambling, rates of frequent gambling typically, but not always, went up. Possible explanations for these results were discussed.

Keywords Problem gambling · Gambling laws · Gambling surveys

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Introduction

In this article, we will be examining the relationship between the gambling laws in U.S. states and the gambling involvement of survey respondents living in those states. If gambling laws influence gambling involvement, this influence is presumably mediated by the availability of gambling venues. There is an extensive literature relating rates of problem gambling to proximity to gambling venues, of which the following are only a few examples. A national survey of adults conducted by the National Opinion Research Center and funded by the National Gambling Impact Study Commission found that respondents living within 50 miles of a casino had twice the rate of problem or pathological gambling as those living farther from a casino (Gerstein et al. 1999). Our own research group found that adult respondents in a national survey who lived within 10 miles of a casino had twice the rate of problem or pathological gambling as those who lived farther from a casino (Welte et al. 2004). Most studies, but not all, have found positive results for the relationship between distance from a casino and the likelihood of problem gambling. In a Quebec study, Sevigny et al. (2008) found a positive relationship between distance from a casino and gambling participation, but failed to find a relationship with problem gambling.

Research has also been conducted on the relationship between gambling involvement and the availability of electronic gambling machines (EGMs). DelFabbro (2002) found a positive relationship between rates of problem gambling and density of EGMs across census districts in Adelaide, Australia. In a meta-analysis of surveys from New Zealand and Australia, Storer et al. (2009) found the same positive relationship between the density of EGMs and rates of problem gambling. They also found that the passage of time, with availability of EGMs held constant, resulted in a decrease in rates of problem gambling. They conjectured that initial exposure to EGMs caused an increase in problem gambling, but that continued exposure caused adaptation as the population learned to cope with exposure to greater gambling opportunities.

There have also been studies which compared the prevalence of problem gambling before and after the availability of gambling in a designated region was increased. Room (1999) reported on a casino which opened in Niagara Falls Ontario in December 1996. Telephone surveys were conducted in Niagara Falls in 1996 and 1997 and in Ontario as a whole in 1995 and 1997. In Niagara Falls, prevalence of all 18 problem gambling items increased between the surveys, clearly very statistically significant. Unfortunately, pre/post data was not available for the problem gambling items in the Ontario survey, but casino gambling increased in Niagara Falls more than in Ontario as a whole. Christian et al. (2000) conducted a before-and-after study which included a control venue and was longitudinal. They interviewed RDD samples in both Hull and Quebec City, Quebec, before a casino was opened in Hull in 1996. They interviewed the same experimental and comparison subjects at 1, 2 and 4 year follow-ups. They did not find an increase in problem gambling in the casino city (Hull), either absolutely or in comparison with Quebec City. They speculated that adaptation might be taking place, when residents developed defenses against gambling availability. In general, before-and-after studies have not shown positive results as much as have proximity studies.

There have been studies which used the number of types of legal gambling as the independent variable and problem gambling, or some factor associated with problem gambling, as the dependent variable. Cox et al. (2005) analyzed data from a very large, sophisticated national Canadian gambling survey. They compared the provincial rates of problem gambling with the population density of video lottery terminals (VLTs) and

presence of casinos. The provinces with highest per capita VLTs combined with legal casinos had the highest problem gambling rates. Our own research group found that in a U.S. national survey of respondents aged 14–21, the number of types of gambling that were legal in a state was positively related to the prevalence of problem gambling among the respondents who lived in that state (Welte et al. 2009). Volberg (1994) found a positive relationship between the number of types of legal gambling in five states and lifetime rates of problem gambling. There have been similar studies which used some variable associated with problem gambling (sometimes remotely associated) as the dependent variable. In an often-cited study, Lester (1994) found that the number of Gamblers Anonymous chapters in a state was positively related to the number of types of legal gambling in that state. McCleary et al. (2002) examined suicide rates in 148 U.S. metropolitan areas. After controlling for many possible confounders, they discovered a positive correlation between casino presence and suicide rates. Barron et al. (2002) analyzed county-level U.S. data, and after controlling for many confounders found a positive relationship between legal casinos and bankruptcy rates.

The related but competing notions of exposure and adaptation often surface in discussions of gambling availability (LaPlante and Shaffer 2007). Exposure theory proposes that exposure to gambling venues causes an increase in gambling involvement and the prevalence of problem gambling. The theory of adaptation states that while initial increases in exposure to gambling venues lead to increases in rates of problem gambling, a population will eventually adapt and further negative consequences will not be forthcoming in spite of increased exposure. This might work by various mechanisms, including waning of novelty effects, development of interventions, and a reaction to increases in harmful consequences. The exposure and adaptation notion can, of course, also be applied to the situation where there is a general increase in the number of types of gambling that are legally allowed.

In this article, we are examining the relationship between the gambling laws in U.S. states and the gambling involvement of survey respondents living in those states. The fundamental question we are asking is whether residents of states with more types of legal gambling have a tendency to gamble more and have higher rates of problem gambling. We will also be asking whether the length of time that states have been exposed to various forms of legal gambling is related to the extent of their residents' gambling behavior and pathology. This is the most comprehensive examination of the relationship between gambling laws and gambling involvement that has been conducted in the U.S. to date.

Methods

The research projects described in this article were approved by the Social and Behavioral Sciences Institutional Review Board of the State University of New York at Buffalo. All respondents gave informed consent for their inclusion in the study.

Our research group at the Research Institute on Addictions (RIA) conducted two telephone surveys concerning gambling behavior and problem and pathological gambling among adults in the U.S. Twenty-six hundred and thirty-one (2631) interviews were conducted for the first Survey of Gambling in the U.S. (SOGUS1) in 1999–2000, and 2963 interviews were conducted for SOGUS2 in 2011–2013. Both surveys interviewed respondents in all 50 states and the District of Columbia. The sample for SOGUS1 contained landline numbers only; for SOGUS2 both a landline sample and a cell phone sample

were used. Eligible respondents were persons 18 or older. Respondents in each landline household were recruited randomly by selecting the potential respondent with the next birthday. This has been shown to be equivalent to random selection (Lavrakas 1993) and results in higher response rates because it does not require listing all household members. Cell phones were assumed to be dedicated to the person who answered, and that person was recruited if he or she was 18 or older. The response rate (defined as the number of interviews divided by the number of eligible respondents located) for SOGUS1 was 65.2 %; for the SOGUS2 landline sample (1748 respondents) it was 54.0 % and for the cell phone sample (1215 respondents) it was 62.7 %.

For both surveys, the telephone samples were purchased from Survey Sampling International. Every landline phone number in the U. S. had an equal probability of being included in the sample, and every cell phone number likewise had the same probability as every other cell phone number. The samples were stratified by county and by telephone block within county. This resulted in samples that were spread evenly across the U.S. according to population distribution. Each telephone number in the landline sample was called at least seven times to determine if that number was assigned to a household containing an eligible respondent. Once a household was designated as eligible, the number was called until an interview was obtained or refusal conversion had failed. Each number in the cell phone sample was called at least seven times in an attempt to determine whether that number was associated with an eligible respondent. Interviews for both surveys lasted from 20 to 50 min, depending on the answering speed of the respondents and the extent of their involvement with gambling, alcohol, and drugs. The median interview lasted slightly over 40 min. Respondents in SOGUS1 were paid $25, and respondents in SOGUS2 were paid $30. Sample management and interviewing was conducted by trained interviewers using the Computer-Assisted Telephone Interviewing (CATI) facility at the University at Buffalo's Research Institute on Addictions.

Both the SOGUS1 and SOGUS2 surveys included questions on the frequency of past-year gambling on specific types of gambling. These were: (1) raffles, office pools, and charitable gambling; (2) pulltabs; (3) bingo; (4) cards, not in a casino; (5) games of skill, e.g., pool, golf; (6) dice, not in a casino; (7) sports betting; (8) horse or dog track; (9) horses or dogs off-track; (10) gambling machines, not in a casino; (11) casino; (12) lottery; (13) lottery video-keno; (14) internet gambling; and (15) other gambling. An overall gambling frequency variable was produced by summing the frequency of these types of gambling, and various gambling frequency variables were constructed by recoding this overall variable.

Our measure of pathological or problem gambling in both surveys is the DIS-IV for pathological gambling (Robins et al. 1996). The DIS-IV contains 13 items that map into the 10 DSM-IV criteria, such as preoccupation with gambling and needing to gamble with increasing amounts of money to get the same excitement ("tolerance"). Endorsement of three or more criteria was considered to be DIS problem gambling.

In both studies, the measure of socioeconomic status was based on respondent's years of education, occupational prestige and family income. Occupational prestige was measured using the method of Duncan updated (Stricker 1988). The respondent's occupation was classified into predefined categories used by the U.S. Census, and these categories were subsequently recoded into scores based on the average prestige ratings given those categories by a U.S. general population sample. This prestige score and the respondent's years of education and the respondent's family income were scaled in the 0–10 range and then averaged.

Neighborhood disadvantage was measured using a method that has been used by other researchers (Boardman et al. 2001). Data from each respondent's census block group (average population 1765) was attached to his or her case. The variables used to make the disadvantage scale were: (1) the percentage of households on public assistance, (2) the percentage of families headed by a female, (3) the percentage of adults unemployed, and (4) the percentage of persons in poverty. These percentages were standardized and averaged with equal weights. Each respondent lived in a distinct block group, so these variables were independent across respondents.

For our measure of the total number of legal types of gambling we used the number of types that were legal in a given state in 1999 (if applied to a SOGUS1 respondent) or 2011 (if applied to a SOGUS2 respondent). We considered 27 different forms of gambling, so that our scale for any respondent could theoretically range from 0 (no gambling legal in the respondent's state) to 27 (all 27 types legal). In practice, it ranged from 0 to 16. Examples of states with the lowest number of legal types in 2011 are Hawaii, Utah and Tennessee, with totals of 1, 1, and 2 respectively. Examples states with the most legal types are California, Iowa, Montana, New York and Louisiana, with totals of 15, 15, 15, 15 and 16 respectively. See Table 1 for a complete list.

We identified the 27 types of gambling by extensive research and going directly to original sources (Tidwell et al. 2015). We examined the state constitutions, state statutes and regulations that governed gambling in 1999 and 2011. In many cases, we needed to refer to case law and opinions by the state Attorney General. Many states had commissions to regulate gambling, and the commission's web sites provided valuable information. We also examined newspaper articles and private sector gambling association websites. On occasion we made phone calls to the state legal departments or gambling commissions to confirm or supplement information. The 27 types of gambling ranged from widely used forms (e.g., state lottery, commercial casinos) to less common types such as jai alai or historical horse racing.

We measured exposure to gambling as a combination of the number of legal types of gambling and the number of years that they have been legal in the state. For example, suppose a respondent lives in a state with three types of gambling legal at the time of the interview, which have been legal for 20, 10 and 5 years respectively. That respondent's

Table 1 Number for types of legal gambling in 2011 by state

State	# of types
HI UT	1
TN	2
SC VT	5
GA WI	6
AL MS NC NH	7
AK AR DC KS MO	8
CT ID IL MA MD NE RI VA	10
DE MI NJ NV PA WY	11
IN KY MN NM OH OK SD TX WV	12
AZ CO ME ND	13
FL OR WA	14
CA IA MT NY	15
LA	16

exposure score is $20 + 10 + 5 = 35$. For purposes of computing exposure, any form of gambling that had been legal more than 30 years was capped at 30 to prevent any one form of gambling from dominating the measure of exposure.

In this study, sampling weights have been used for analyses in which population parameters, such as the rate of problem gambling, were of primary interest (Welte et al. 2014). However, in analyses exploring variable relationships, sampling weights may do more harm than good, because the standard errors of regression coefficients are larger in a weighted analysis. If weighted and unweighted regression coefficients are similar, the unweighted analysis is preferable, similar to the effect of having a larger sample (Korn and Graubard 1999). Because numerous analyses produced weighted and unweighted results in the same direction, but with unweighted coefficients having smaller standard errors, we have reported unweighted results in this article.

Results

Table 2 shows data from SOGUS1 (1999–2000) and SOGUS2 (2011–2013) combined. The measure of total types of legal gambling applies to the time of the respondent's survey. For a respondent in SOGUS1, we used the number of types of gambling legal in in his/her state in 1999. For SOGUS2 it is the number legal in 2011. Frequent gambling is defined as gambling 104 or more times (twice a week) in the past year. There is a clear pattern of increased gambling behavior and problems in states with more types of legal gambling. The rate of problem gambling shows a steady increase with increased number of types of legal gambling. In the states with the most legal types, the rate of problem gambling is double the rate in the states with the least. The increases in frequent gambling, any gambling in the past year, and any gambling in the respondent's life level off at approximately nine types of legal gambling. All of the logistic regressions presented in this article use the respondent's gender, age, race, socio-economic status and neighborhood disadvantage as controls. This was done to hold constant demographic differences in state populations, which might be confounded with the effect of gambling laws. The tables in this article contain odds ratios so that the reader can see the direction and magnitude of the

Table 2 Gambling behavior and problems by number of legal gambling types in respondent's state

Number of legal gambling types	N	DIS problem gambling in past year	Frequent gambling in past year	Any gambling in past year	Any gambling in life
0–3	238	2.1 %	3.4 %	65.1 %	86.6 %
4–8	1084	3.0 %	6.8 %	75.2 %	89.1 %
9–12	2901	3.3 %	11.0 %	81.2 %	94.1 %
13–16	1371	4.1 %	9.6 %	78.0 %	93.2 %
Sig. of number of types[a]		.01	<.001	<.001	<.001
Odds ratio[a]		1.06	1.07	1.04	1.08

[a] Significance levels and odds ratios are associated with number of types of legal gambling as the independent variable in a logistic regression with gender, age, race, SES and neighborhood disadvantage controlled and the respective gambling involvement measures as dependent variables

effect. For example, for problem gambling in Table 2, the odds ratio of 1.06 means that the respondent's odds of being a problem gambler increase by 6 % for each additional type of legal gambling.

Table 3 shows how various measures of gambling involvement vary in prevalence according to our measure of exposure to legal gambling. For problem and frequent gambling, there is a general tendency for respondents who live in states with more exposure to have a higher prevalence. For any gambling in the past year or in the respondent's life, the lowest exposure states have the lowest prevalence, but there is no trend after that. For all four of these variables, the overall trend of more gambling involvement with more exposure is statistically significant. There is, however, a problem with this analysis so far. There is a high correlation between number of legal types and exposure, caused by content overlap. The first significant effects in Table 3 may be just a reprise of the significant effects in Table 2. Therefore, in the last two rows of Table 3 we have examined the statistical significance of gambling exposure with the number of types of legal gambling held constant. Only problem gambling is significant. Put another way, the years of exposure to various forms of legal gambling make a contribution to the prevalence of problem gambling even after the number of types of legal gambling is held constant.

Table 4 shows the relationship between the legal status of casinos in a state and various measures of gambling behavior and pathology. A state was considered to have legal casinos if it had commercial casinos, tribal casinos, riverboat casinos or racinos. Legal casinos are associated significantly with higher levels of problem gambling, frequent gambling in casinos, and gambling in a casino in the past year. Exposure to casinos was computed considering the number of years that any or all of the four types of casinos had

Table 3 Gambling behavior and problems by exposure to legal gambling in respondent's state

Legal gambling exposure metric	N	DIS problem gambling in past year	Frequent gambling in past year	Any gambling in past year	Any gambling in life
0 to 50	220	2.3 %	4.1 %	65.5 %	86.8 %
51 to 100	510	2.7 %	6.1 %	74.5 %	89.4 %
101 to 150	695	3.3 %	8.5 %	79.9 %	92.1 %
151 to 200	1203	3.1 %	10.0 %	79.3 %	92.2 %
201 to 250	997	3.7 %	12.3 %	83.8 %	95.1 %
251 to 300	1278	3.1 %	9.9 %	79.7 %	93.9 %
301 to 400	691	4.9 %	9.4 %	73.7 %	92.0 %
Sig. exposure[a]		.001	<.001	.001	<.001
Odds ratio[a]		1.003	1.003	1.001	1.002
Sig. exposure[b]		.014	.186	.795	.512
Odds ratio[b]		1.005	1.002	1.000	.999

[a] Significance level and odds ratio are associated with gambling exposure as the independent variable in a logistic regression with gender, age, race, SES and neighborhood disadvantage controlled and the respective gambling involvement measures as dependent variables

[b] Significance level and odds ratio are associated with gambling exposure as the independent variable in a logistic regression with gender, age, race, SES and neighborhood disadvantage and number of types of legal gambling controlled and the respective gambling involvement measures as dependent variables

Table 4 Casino gambling and problem gambling by legality of casinos in respondent's state

Casinos legal at time of interview	N	DIS problem gambling past year	Gambled in casino 6+ times past year	Gambled in casino in past year
No	1302	2.7 %	2.2 %	21.4 %
Yes	4292	3.6 %	4.0 %	27.4 %
Sig. casino legal[a]		.043	.003	<.001
Odds ratio[a]		1.5	1.8	1.4
Sig. casino expos[b]		.022	<.001	.003
Odds ratio[b]		1.01	1.02	1.01
Sig. casino expos[c]		.15	<.001	.43
Odds ratio[c]		1.01	1.02	1.00

[a] Significance levels and odds ratios are associated with casinos legal or not as the independent variable in a logistic regression with gender, age, race, SES and neighborhood disadvantage controlled and the respective gambling involvement measures as dependent variables

[b] Significance levels and odds ratios are associated with years of exposure to casinos as the independent variable in a logistic regression with gender, age, race, SES, neighborhood disadvantage controlled and the respective gambling involvement measures as dependent variables

[c] Significance levels and odds ratios are associated with years of exposure to casinos as the independent variable in a logistic regression with gender, age, race, SES, neighborhood disadvantage and casinos legal or not controlled and the respective gambling involvement measures as dependent variables

Table 5 Lottery gambling and problem gambling by lottery in respondent's state

Lottery legal at time of interview	N	DIS problem gambling past year	Gambled on lottery 30+ times past year	Gambled on lottery in past year
No	551	2.7 %	1.6 %	37.4 %
Yes	5043	3.5 %	12.8 %	66.4 %
Sig. lottery legal[a]		.07	<.001	<.001
Odds ratio[a]		1.7	10.2	3.8
Sig. lottery expos[b]		.01	<.001	<.001
Odds ratio[b]		1.02	1.02	1.02
Sig. lottery expos[c]		.06	.56	.22
Odds ratio[c]		1.01	1.00	1.00

[a] Significance levels and odds ratios are associated with lottery legal or not as the independent variable in a logistic regression with gender, age, race, SES and neighborhood disadvantage controlled and the respective gambling involvement measures as dependent variables

[b] Significance levels and odds ratios are associated with years of exposure to lottery as the independent variable in a logistic regression with gender, age, race, SES, neighborhood disadvantage as controls and the respective gambling involvement measures as dependent variables

[c] Significance levels and odds ratios are associated with years of exposure to lottery as the independent variable in a logistic regression with gender, age, race, SES, neighborhood disadvantage and lottery legal or not as controls and the respective gambling involvement measures as dependent variables

been legal. No cap on the number of legal years was applied. Exposure to casinos is also associated significantly with higher levels of problem gambling, frequent gambling in casinos, and gambling in a casino in the past year. Exposure to casinos has a somewhat more significant relationship to problem gambling than does the mere legality of casinos.

When the legality of casinos is controlled, only frequent gambling in a casino is related to the number of years that casinos have been legal.

Table 5 gives the same treatment for state lotteries as Table 4 gives for casinos. If we examine the results for frequent lottery play and whether or not lottery was played in the past year, we see that, unsurprisingly, lottery play and frequent lottery play are more likely in states that have a lottery. Legal lottery as a predictor of problem gambling does not quite achieve significance at the .05 level, but lottery exposure does achieve significance. When legal lottery is controlled, exposure to lottery is a near miss, with a relationship to problem gambling that is significant at the .06 level.

In the analyses presented previously, we combined the data from SOGUS1 (1999–2000) and SOGUS2 (2011–2013) and presented them as though they were one study, using legal data from either 1999 or 2011 as appropriate. In Table 6, we present results based on an aggregated data set of 51 cases, one for each state and the District of Columbia. The state level variables were constructed by averaging the individual level variable for all the respondents in a particular survey (SOGUS1 or SOGUS2) for a particular state. Column 1 shows the change in the number of forms of gambling in a state between 1999 and 2011. For example, the first row shows us that there were two states in which the number of forms of legal gambling declined by three between 1999 and 2011. (We counted states in which dog or horse tracks were open in 1999 but none were operating in 2011, even if the law hadn't changed) For further examples, the fifth row shows us that there were 11 states in which the number of forms of legal gambling increased by two, and the last row shows that there were two states in which it increased by five. Column 3 shows the change in the prevalence of frequent (104 times a year or more) gamblers for the states with various changes in the number of legal types of gambling. If, for example, a particular state had 10 % frequent gamblers in SOGUS1 and 12 % frequent gamblers in SOGUS2, it would have a change of +2 %. This change would be averaged with all the other changes for states with the same change in number of legal types, and the average would appear in column three. A quick look at columns one and three shows that as the increase in the number of forms of legal gambling is greater, the increase in the prevalence of frequent

Table 6 Changes in respondents' gambling behavior and problems by changes in number of types of legal gambling

Change in number legal types 1999–2011	Number of states	Change in percent frequent gamblers Corr = .38 sig = .006[a]	Change in percent problem gamblers Corr = .09 not sig[a]
−3	2	−7.5 %	−2.8 %
−1	2	−14.6 %	.0 %
0	14	−1.1 %	+1.6 %
+1	15	−2.0 %	+1.5 %
+2	11	+2.3 %	+.1 %
+3	2	+12.6 %	.0 %
+4	3	−1.2 %	+3.5 %
+5	2	+2.5 %	+1.0 %

Data set consists of states, N = 51

[a] Correlation is between change in number of forms of legal gambling and change in percent frequent or problem gamblers

gambling tends to be greater. And indeed, the correlation between these changes is significantly positive. There is no statistically significant relationship between the change in the number of types of legal gambling and the change in the prevalence of problem gambling. There is a hint of a pattern because the four states in which the number of forms of legal gambling declined constituted four out of the six in which the prevalence of problem gambling declined or stayed the same. Put another way, the 4 states in which the number of types of legal gambling decreased had an average decline in problem gambling of 1.4 %. The 33 states in which the number of legal types increased had an average increase in problem gambling of 1.1 %.

Discussion

Our purpose is to investigate how gambling behavior and problems of U.S. adults varies as a function of the number of types of gambling legal in their state. We examined data from two adult national U.S. telephone surveys, one which was in the field in 1999–2000 and one which was in the field in 2011–2013. Respondents in these surveys were asked the same questions, and for most of the analyses we combined them as if they were one survey. Fortunately for our purposes, there is a wide variation in the number of types of gambling that are legal in the various states. In 2011, the states of Utah, Hawaii and Tennessee had only one or two forms of legal gambling, while the states of California, Iowa, Louisiana, Montana and New York had 15 or 16.

Our first results show conclusively that states with more types of legal gambling have higher rates of problem gambling, as well as higher rates of frequent gambling and any gambling. It should be noted that this relationship is not necessarily causal. States which are culturally more pro-gambling would also tend to legalize more forms of gambling. It is a reasonable guess that if as a thought experiment the gambling laws of Utah and Nevada were made identical, the Nevadans might still gamble more than the residents of Utah. That having been said, it is also a reasonable conjecture that the ubiquitous nature of gambling opportunities in Nevada might contribute to more gambling, and to more gambling problems.

In our exposure analyses, we asked whether the length of time that forms of gambling had been legal made a difference, after taking into account the number of forms that are legal. We found that for rates of frequent gambling, any gambling in the past year, and any gambling in the respondent's lifetime, only the number of forms of legal gambling made a difference; it didn't matter how long they had been legal. However, for rates of problem gambling, additional years of exposure to legal gambling is associated with a greater rate of problem gambling. This may be because problem gambling takes time to develop, while any gambling can be achieved in a day. The 220 respondents who live in the least exposed states have a problem gambling rate of 2.3 %. The 691 respondents who live in the states with the most exposed states have a problem gambling rate of 4.9 %, over twice as high. The fact that the problem gambling rate is flat over the midrange of exposure, and then jumps at the highest exposure, is not necessarily consistent with the adaptation hypothesis (see Table 3). Adaption theory would predict that problem gambling rates tail off at the highest exposure, not suddenly jump.

We also investigated two common forms of legal gambling—casinos and lottery. For each of these forms of gambling, higher exposure was significantly associated with higher rates of problem gambling. If the respondent lives in a state where these common forms of

gambling have been legal for quite a while, he or she is more likely to be a problem gambler. As stated above, this may be an indication of a pro-gambling culture in the state. Unsurprisingly, residents of states where casinos and lotteries are legal indulge more in these forms of gambling.

Finally, we examined the relationship between changes in the number of types of legal gambling between 1999 and 2011 and changes in gambling behavior and problems. We found a definite relationship concerning the percentage of respondents who were frequent (104 times/year or more) gamblers and changes in the number of legal types of gambling. In states where additional forms of gambling had been legalized between 1999 and 2011, the percentage of frequent gamblers had a strong tendency to increase between those years. We observed earlier that a correlation between the number of types of legal gambling and gambling behavior in a cross-sectional study does not prove causality. This correlation of changes across time likewise does not prove causality, but it goes a step closer. It does not seem likely that the support for gambling in the state culture changed that quickly; it seems more likely that state residents gambled more because changes in the law gave them more opportunity. It is possible to argue that providing new venues for gambling does not induce people to gamble more, but rather causes them to substitute the new forms of gambling for previously available forms. However, our findings suggest that this is not the case.

Conflict of interest   The authors declare that they have no conflict of interest.

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