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Elevated Suicide Levels Associated with Legalized Gambling

David P. Phillips, Ph.D.
Ward Welty
Marisa Smith, M.A.

Sociology Department
University of California at San Diego, La Jolla, CA 92093
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ABSTRACT

There has been no systematic, large-scale statistical investigation of the link between gambling and suicide, despite the suggestion of such a link from small-scale case studies. This paper seeks to determine whether: i) gamblers or those associated with them are prone to suicide, ii) gaming communities experience atypically high suicide rates. Las Vegas, the premier U.S. gambling setting, displays the highest levels of suicide in the nation, both for residents of Las Vegas and for visitors to that setting. In general, visitors to and residents of major gaming communities experience significantly elevated suicide levels. In Atlantic City, abnormally high suicide levels for visitors and residents appeared only after gambling casinos were opened. The findings do not seem to result merely because gaming settings attract suicidal individuals.

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In 1994 Americans legally wagered $482 billion (Standard & Poor's Industry Surveys, 1996), substantially more than government spending on Medicare and Medicaid combined (Levit et al., 1996). U.S. legal casino gambling has developed very rapidly, spreading from two states in 1988 to twenty-three in 1996 (Christiansen, 1993; Frank, 1993; Goodman, 1995). Gaming can have positive consequences (stemming from economic development) (Sternlieb & Hughes, 1983; O'Hara, 1995), and negative

consequences (stemming from an increase in problem gamblers) (Volberg, 1994, 1993). Case studies suggest that gamblers are prone to white-collar crime (Ladouceur et al., 1994; Blaszczynski, McConaghy & Frankova, 1989; Meyer & Fabian, 1993), substance abuse (Rosenthal, 1992; Lesieur, 1992; Ramirez et al., 1983), child-abuse (Lesieur & Rothschild, 1989), and suicide Kezwer, 1995; Clement, 1993; Lester & Jason, 1989). However, there has been no systematic, large-scale, quantitative effort to determine whether: i) gamblers or those associated with them are prone to suicide, ii) gaming communities experience atypically high suicide rates. Here we will determine whether suicide levels are abnormally high for visitors to gambling settings and for residents of those settings.

METHODS

The computerized mortality data under study (U.S. National Center for Health Statistics) provide no information on geographic entities smaller than a county or SMSA. We defined gambling settings (GS) as three Standard Metropolitan Statistical Areas (SMSA) i) Las Vegas (coincident with Clark County, Nevada); ii) Reno (coincident with Washoe County, Nevada), iii) Atlantic City (coincident with Atlantic County, New Jersey)[1] Henceforth, the terms "Las Vegas," "Reno," and "Atlantic City," denote their corresponding SMSAs. We could not easily study the effects of very recent legal casino gambling, which accelerated most markedly at the end of 1991. At the start of our study, U.S. computerized mortality data were available for only one year beyond this acceleration period.

RESULTS

Figure 1 compares the suicide level of adult, out-of-state visitors to these three counties with suicide levels of adult, out-of-state visitors to other U.S. counties. "Suicide level" is measured here as adult suicides/total adult deaths (Mausner & Kramer, 1985). A preferable measure, the suicide rate (i.e., adult suicides/number of adult out-of-state visitors), cannot be calculated because the denominator is unknown. On average, suicides are .97% of all visitor deaths for all counties examined (SD = .59%; interquartile range = .66%). In contrast, suicides are 4.28% of visitor deaths in Las Vegas--noticeably the highest percentage for all counties examined. The equivalent figures for Reno and Atlantic City are 2.31 % and 1.87%, respectively. Thus, visitor suicide levels appear elevated in the GS under study.

To determine whether the elevated suicide levels of GS are an artifact of sex, race, age, state of residence, we corrected for these 4 variables as follows: For each visitor death in a GS, we randomly chose interstate travelers who i) matched the GS decedent by age, race, sex, and state-of-residence, and ii) did not die in their own state or in Nevada or New Jersey.[2] This general procedure allows us to find n matched controls for each GS under study (Table 1A; n=4 [Las Vegas]; n=5 [Reno]; n=14 [Atlantic City]).[3]

Using these controls to calculate the Proportionate Mortality Ratio (PMR) (Mausner & Kramer, 1985), one estimates the expected number of suicides in Las Vegas as 63. Thus, after correction for 4 demographic variables, the suicide PMR for Las Vegas is 255.56, i.e. 255.56% the value expected from the behavior of matched controls (=100 x 161/63), [P<.0001, two-tailed ratio test (Bland, 1995, pp. 295-6)]. The equivalent PMRs for Reno and Atlantic City are 154.49 (P< .001) and 175.93 (P< .004) respectively.

Before casinos were opened in Atlantic City, the observed number of suicides was not significantly higher than the expected number derived from matched controls (Table 1A; P .22). Thus, visitors to Atlantic City began to experience atypically high suicide levels only after the establishment of gaming. This type of "before-vs-after" comparison cannot be conducted for Las Vegas or Reno, because the appropriate sex-race-age visitor mortality data are unavailable before gaming was established in Nevada (1931).

The above findings do not seem to result from i) geographic variations in suicide or from ii) flaws in the PMR. i) Controlling on state of residence ensures that a high suicide PMR in Las Vegas cannot arise because visitors from high-suicide states prefer Las Vegas as a destination: When visitors from these same high-suicide states die in non-gambling counties they are far less likely to die from suicide; this is evident. from an examination of the control group. ii) A high PMR for suicide in each of the three GSs cannot merely reflect *under*representation of other causes of death (Great Britain Registrar General, 1986): There is no disease which is underrepresented in all three GS. Even if this type of underrepresentation were present, this should raise the PMR, not only for suicide, but for other diseases as well. No cause of death, aside from suicide, displays elevated PMRs for all three GS.

Figure 1 and Table 1A indicate that visitors to all three GS experience statistically significant, atypically high, suicide levels. Because these visitors contain an unusually concentrated mixture of gamblers, it seems plausible that gamblers are more suicide-prone than other interstate travelers with the same sex, age, race, and state of residence. The data are consistent with at least three scenarios: i) gambling settings prompt some persons (not necessarily gamblers) to suicide, ii) gambling settings attract suicidal people, iii) both processes are operating. The relative merit of these scenarios will be evaluated later.

Table 1B suggests related conclusions for *residents* of GS, 1989-1991. For these years it is possible to calculate not only the PMR, but the SMR (Standardized Mortality Ratio) as well (Bland, 1995; Great Britain Registrar General, 1986). The SMR uses population figures to calculate suicide rates, standardized by age, sex, race, and geographic region, which in turn determine the ratio: 100 x observed/expected numbers of suicides. An SMR of, say, 200, indicates that the study group has a suicide rate which is twice that expected from the behavior of matched controls. In the three years centered on the 1990 census period, Las Vegas and Reno residents had the highest and second-highest crude suicide rates of all counties examined. After correction for the influence of age, race, sex, and geographic region, these two GSs had significantly high SMRs (Las Vegas SMR=160.20, P <.0001, two-tailed ratio test (Bland, 1995); Reno SMR=149.40, P<.0001).

Similarly, the standardized SMR of Atlantic City residents (152.49) was significantly high for 1989-1991 (P<.002). One cannot determine whether Atlantic City had an elevated SMR before casinos were introduced, because county population data on each combination of sex-age-race are lacking for this earlier period. However, it is possible to track Atlantic City's suicide level with the PMR rather than the SMR, because the PMR does not require population data. Figure 2 compares the PMR for 1989-91 with the PMR for earlier three-year periods; and reveals that observed suicides for residents significantly exceed the expected number only *after* the introduction of casinos.

Perhaps GS residents display an elevated PMR only because suicidal people move to gambling settings -- i.e., the GS generates no suicides; it only attracts them. This "attraction hypothesis" can be tested by subdividing Atlantic City residents into those born in New Jersey and those born outside of New Jersey. The "out-of-staters" consist entirely of migrants, whereas the "natives" are a mix of intrastate migrants and persons born in Atlantic City. Table 2 reveals that "out-of-staters" and "natives" have approximately equal, and significantly elevated, PMRs. This suggests that attraction alone is probably not the complete explanation for the elevated suicide levels of Atlantic City residents.

It is less meaningful to test the "attraction hypothesis" with Nevada data, because nearly all (96.3%) of Las Vegas and Reno adult, resident decedents were born out of state. However, even with these data, "native" residents have significantly elevated suicide levels (Table 2) and the PMR for this group is not significantly different from the PMR for those born out of state (P .20, two-tailed ratios test (Morris & Gardner, 1989, pp. 50-63)).

DISCUSSION

This paper showed that Las Vegas, the premier U.S. gambling setting, displays the highest levels of suicide in the nation, both for residents of Las Vegas and for visitors to that setting. In general, visitors to and residents of major gaming communities experience significantly elevated suicide levels. In Atlantic City, abnormally high suicide levels for visitors and residents appeared only after gambling casinos were opened. The findings do not seem to result merely because gaming settings attract suicidal individuals.

Our statistical findings are consistent with small-scale case studies linking gambling with suicide. For example, Lester & Jason (1989) found that three of the six Atlantic City suicides for which they had information probably occurred because of gambling problems. Our findings suggest but do not prove that *gamblers* experience abnormally high risks of suicide. Our data are consistent with the hypothesis that one or more of the following subpopulations experience elevated risks of suicide: 1) Gamblers visiting gaming communities. 2) Spouses of gamblers or children of gamblers who visit gaming settings in the company of a gambling relative (but do not themselves gamble). 3) Gamblers residing in gaming communities. 4) Non-gambling relatives of gamblers who reside in gaming communities. 5) Non-gambling residents who work in the gaming industry.

However, no matter which of these scenarios is true, the findings suggest that gambling or some factor closely associated with gambling settings is linked to elevated suicide levels. Whichever of the scenarios is true, our findings raise the possibility that the recent expansion of legalized gambling and the consequent increase in gambling settings may be accompanied by an increase in U.S. suicides.

Figure 1. Suicide as a proportion of all deaths of interstate travelers, for counties with or without casino gambling. Data are for county where death occurs and derive from U.S. computerized mortality files (U.S. National Center for Health Statistics). The study period starts in 1982 (when Federal Information Processing Standards identification codes were first standardized for counties) and ends in 1988 (the last year before legalized gambling began to spread). Counties with <1000 visitor deaths, 1982-88, are excluded. For the

average county under study, suicides constitute .97% of all visitor deaths (SD = .59%). The three counties with legalized gambling all have atypically high levels of suicide, particularly Las Vegas, which has the highest level of all counties studied. The second and third ranking counties (Bernalillo, N.M. and Fulton, GA) have high levels that appear unrelated to legalized gambling. This paper does not seek to provide a comprehensive analysis for all counties with high suicide levels, only to demonstrate an association between gambling and suicide in those counties with long-established casino gambling: Las Vegas, Reno, and Atlantic City. Consequently, we did not feel obliged to find explanations for the high suicide levels in such counties as Bernalillo and Fulton. (Incidentally, Bernalillo did not have casino gambling during the study period (though it does now); consequently the high suicide level for that county cannot be ascribed to casino gambling.)

Figure 2. Observed versus expected number of suicides, for Atlantic City residents, before and after the establishment of gambling casinos. Dates of casino openings (Standard & Poor's Industry Surveys, 1996): 5/78, 6/79, 12/79, 8/80, 11/80, 12/80, 11/81, 11/81, 5/84, 6/85, 3/87, 4/90. To increase sample size, data are aggregated into five 3-year intervals: 1969-71, 1974-76, 1979-1981, 1984-86, 1989-1991. Although county identification codes changed irregularly for many counties, this is not true for Atlantic, and thus mortality in this county can be easily tracked prior to federal standardization of FIPS codes. Expected number of suicides in Atlantic City was estimated using the PMR Mausner & Kramer, 1985) and **n** randomly selected controls drawn from New Jersey counties (other than Atlantic) and matching each Atlantic City decedent with respect to sex, race, and age. **n**=9 (1969-71); **n**=8 (1974-76); **n**=12 (1979-81); **n**=12 (1984- 86); **n**=11 (1989-91). See text for further details.

Table 1 - observed vs. expected no. of adult suicides for visitors to and residents in gambling settings

	Observed	Expected*	100 times	95% Confidence Interval	P
			Obs/Exp		
A - Visitors (1982-1988)			PMR		
Las Vegas	161	63.00	255.56	216.08 to 295.03	<.0001
Reno	55	35.60	154.49	113.66 to 195.33	<.0010
Atlantic City (post-casinos)	25	14.21	175.93	106.97 to 244.90	<.0040
Atlantic City (pre-casinos)†	15	11.00	136.36	67.35 to 205.37	>.2200
B - Residents (1989-1991)			SMR		
Las Vegas	497	310.23	160.20	146.12 to 174.29	<.0001
Reno	166	111.11	149.4	126.67 to 172.13	<.0001
Atlantic City	64	41.97	152.49	115.13 to 189.85	<.0007

All data are for persons ≥21 and come from U.S. computerized mortality records. The label for each gambling setting refers to the Standard Metropolitan Statistical Area. Information for residents uses population data and is centered on the 1990 Census. For further explanation of time periods examined, see text. All P values are for two-tailed tests; see Bland (1995, pp.295-6) for method of calculating significance levels.

* Expected number of suicides in the visitor study group was estimated using the PMR and randomly selected controls, who were interstate travelers matched to each study group decedent with respect to sex, race, age, and state of residence (Mausner & Kramer, 1985; see G. B. Registrar General, 1986 for an alternative method of standardizing). For the resident study group, the five states surrounding Nevada provided age-race-sex-adjusted controls for Las Vegas and Reno; New Jersey counties other than Atlantic provided age-race-sex-adjusted controls for Atlantic City. These controls were used with the SMR technique (Bland, 1995) to estimate expected number of resident suicides in each study group.

† Years examined: 1969-1977; the first casino opened in 1978. The existence of a significant effect for the "post-casino" period and an insignificant effect for the "pre-casino" period does not arise because there were fewer suicides in the pre-casino period

than in the post-casino period. Artificially inflating the number of pre-casino suicides to equal the number of post-casino suicides [1.667 x 15 = 25] does not yield a significant PMR (P. 12).

Table 2 - Suicide level of adult native-born and migrant* residents of gambling settings

	Observed	Expected†	100 times Obs/Exp	95% Confidence Interval	P	Controls per study group decedent
A - Native-Born Residents						
New Jersey (Atlantic City)	56	36.10	155.13	114.50 to 195.75	<.0020	18
Nevada (Las Vegas & Reno)	76	55.52	136.86	106.11 to 167.66	<.0070	62
B - Migrant Residents						
New Jersey (Atlantic City)	71	48.78	145.55	111.70 to 179.41	<.0020	10
Nevada (Las Vegas & Reno)	1032	677.89	152.24	142.95 to 161.53	<.0001	24

All data are for persons ≥ 21 and come from U.S. computerized mortality records. Time periods examined are those revealing significant effects in Figure 2. Because there are so few (3.7% of total) native-born Las Vegas and Reno adult decedents, we combined these locations to increase sample size. All P values are for two-tailed tests; see Bland (1995, pp.295-6) for description of tests used.

* For definition of "native-born" and "migrant" see text.

† Expected number of suicides in the study group was estimated using the PMR (Mausner & Kramer, 1985) and randomly selected controls, who were matched to each study group decedent with respect to sex, race, and age, and lived in adjacent non-gambling locations. Because we corrected for the effects of sex, race, and age, the relatively large Native American population in Nevada cannot explain the high suicide

levels in Las Vegas and Reno. The five states surrounding Nevada provided controls for Las Vegas and Reno; New Jersey counties other than Atlantic provided controls for Atlantic City.

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FOOTNOTES

[1]While an SMSA is not always coincident with a county, it is in these three cases.

[2]This information is provided on the computerized death certificate.

[3]The different number of controls for each GS decedent (n=4 for Las Vegas; n=5 for Reno; n=14 for Atlantic City) is largely determined by the number and variety of visitors who commit suicide in each GS—the greater the number of suicides and the more varied their origin and demographic characteristics, the smaller the value of n.

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