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CASINO REVENUE AND AMERICAN INDIAN HEALTH: THE LINK BETWEEN TRIBAL GAMING AND THE HEALTH STATUS AND BEHAVIORS OF AMERICAN INDIANS*

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Abstract

Recent legalization of American Indian (AI) casino gaming and the resulting income flows to this population create a unique opportunity to examine the elusive causal relationship between income and health in a quasi-experimental way. Net revenue from AI gaming accrues to individual tribes, and has been used for both income support to tribe members and for tribal infrastructure, such as health care facilities. Selected tribes have established gaming facilities, both because of varying state law and tribal heterogeneity. In our study, we report the before gaming-after gaming health status of members of tribes that have established gaming facilities, and the health status after gaming of members of gaming tribes with that of members of tribes without gaming. We have assembled annual data on tribal gaming over time, health access data from the Area Resource File, and individual health and socio-economic characteristics data from the Behavioral Risk Factors Surveillance System from 1988-2003. Our results provide identified estimates of the effect of the presence of gaming (and implicitly the revenues derived from gaming) on individual AI health, health related behaviors, cash income, and poverty outcomes.

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I. INTRODUCTION

The true nature of the relationship between income, health outcomes, and health behaviors remains elusive despite substantial research on the topic. While a strong link between low income and poor health has been demonstrated (Smith and Kington, 1997), much less is known about the health effects of an exogenous increase in income. Estimation of the exogenous link between income and health is complicated because of issues of reverse causality and the presence of unobserved factors related to both income and health.

The exogenous income changes associated with the legalization and institution of Class III (casino) gambling in American Indian (AI) communities provide a unique natural experiment to assess the causal relationship between income and health (Rutter 2007). While our primary concern is with the effects of the presence of gaming (and the potential income increases that derive from it) on the health status and health care utilization of the affected populations, we also study the relationship of gaming on other aspects of the well-being of AIs, one of the nation's most impoverished and vulnerable populations. These include poverty levels, access to medical care, and risk-taking behaviors, all of which are themselves related to health disparities among AI populations.

Our primary hypothesis is that AIs who are members of tribes with gambling facilities have higher levels of health status, greater access to health care services, and superior health-related behaviors (and other aspects of well-being) than those in tribes without gaming. We measure these patterns by 1) comparing differences in these outcomes between individuals in tribes with and tribes without gaming facilities, and 2) comparing differences in these outcomes from before to after the institution of casino gambling for individuals in tribes that have, at some time, established gaming facilities.

II. BACKGROUND AND SIGNIFICANCE

American Indian Health and Income Disparities

The devastating post-colonial history of forced migration, cultural assimilation, and dietary changes has contributed to persistent, dramatic health disparities within AI communities (Manson et al. 2005). AIs face a mortality disadvantage relative to Whites at each life stage, with acute disparities in infant mortality, life expectancy, and age-specific mortality resulting from higher rates of infectious and chronic diseases (Lille-Blanton and Roubideaux 2005). Nearly a quarter of AIs 25 years of age and older did not complete high school, a rate that is more than double that of non-Hispanic Whites (Figure 9, US Bureau of the Census 2007). AIs also are one of the most economically marginalized groups in American society with twenty five percent of American Indians living below the poverty line, a rate twice the national average; nearly one-third of AI children under eighteen live in poverty (Bureau of the Census 2007). A majority of AIs live on federally recognized reservation lands, often in isolated, rural environments with minimal development and few economic opportunities. Nearly half of the available

reservation workforce is unemployed. Of the one-half of adult tribe members who are employed, 32 percent have earnings below the 2003 Department of Health and Human Services poverty guidelines (BIA 2003).

Using data from the 1980 and 1990 Census public use micro sample (PUMS) and the Indian Health Service, the National Research Council undertook one of the first studies of AI socioeconomic wellbeing and health (Sandefur, et al. 1996). The study documented high levels of poverty and unemployment and continuing problems with health conditions, such as adult-onset diabetes and alcoholism. However, because AI gaming only became widespread after 1990, the authors were unable to examine the impact of tribal gaming on improvements in these outcomes. Cornell et. al (1998) conducted a report on the socioeconomic effects of AI gaming on behalf of the National Indian Gaming Commission. While they found significant positive social and economic impacts of gaming, they did not examine health indicators.

American Indian Gaming

Beginning in the early 1980s, AI tribes initiated gaming enterprises consisting largely of Class I (social gaming for minimal prizes) and Class II (bingo, and other games similar to bingo) gaming activities. After the Congress recognized the sovereign right of AI tribes to institute gaming operations with the passage of the Indian Gaming Regulatory Act (IGRA) in 1988, the prevalence of casino-style gaming facilities (Class III) increased rapidly; Class III is the most lucrative form of gaming (Gonzales 2003). The most recent AI gaming statistics indicate that there are approximately 360 AI gaming establishments in the United States as of 2005.[1] These casinos are operated by approximately 220 federally recognized tribes (out of 562 such tribes), and offer Class I, Class II and Class III gaming opportunities.

The revenues generated in these establishments can be substantial; data from the National Indian Gaming Commission (NICG), the federal regulatory agency charged with overseeing tribal gaming, estimates the revenue from all tribal gaming operations to have grown from $9.8 billion in 1999 to $25.08 billion in 2006.[2] From 2001 to 2003, AI

[1] Statistics from the National Indian Gaming Commission (NIGC); see http://www.nigc.gov/ .

[2] The information in this paragraph is from the NIGC website http://www.nigc.gov/nigc/index.jsp . While separate figures just for Class III gaming are not available, these estimates are dominated by Class III activities. According to the NIGC, tribal casinos generated $25 billion in 2006, up from $22.5 billion in 2005 and approximately $11 billion in 2000. Casinos in the Eastern part of the U.S. generated roughly $6.2 billion, those in the Northwest $2.1 billion, those in the West $7.7 billion, those in the Southwest $3 billion and those in the Midwest nearly $6.2 billion. The number of casinos decreased in 2006 by 5 while nominal revenue increased by 11 percent . The NIGC also reports that tribal gaming revenues are concentrated with the largest 6 percent of operations accounting for more than 40 percent of revenues; the median operation had revenue in the range of $10 to $25 million, with a mean of $17 million all as of 2006. See http://www.nigc.gov/Portals/0/NIGC%20Uploads/Tribal%20Data/gamingrevenue s2006.pdf for more detail.

gaming operations reporting revenue of $100 million or more represented 12-13 percent of the total number of gaming operations and accounted for approximately 65 percent of total AI gaming revenue. By 1998, approximately one third of the on-reservation population of the lower 48 states (as estimated in the 1990 census) lived on a reservation with a Class III gaming compact (Cornell et al., 1998).

Most Class III gaming operations are located on a reservation or tribal trust land (see Figure 1) subject to variations in state negotiated compact regulations. There is also broad regional variation in the length of established gaming operations, with the upper Midwest having most of their casinos established over 10 years and most recent casino growth in Western States (see Figure 2).

[Figure 1. Reservations and Casinos by County]

[Figure 2. Length of Casino Operation]

Hailed as "the new buffalo," the revenues from gaming enterprises are associated with substantial positive impacts on tribal budgets, leading to increased tribal spending on social services and direct income transfers for some tribes (Gonzales 2003). The stimulation of local tribal economic development through gaming has lowered reservation unemployment and raised AI median incomes. According to a recent study by Taylor and Kalt (2005), real median income on AI reservations with gaming increased by 35 percent compared to 14 percent on reservations without gambling[3]. The National Indian Gaming Association (2008) reports that AI gaming has introduced 670,000 jobs, of which 75 percent are filled by non-AI employees. The total AI employment related to gaming (about 150,000 persons) is less than seven percent of the total AI labor force of 2,176,088 in 2000 (Taylor and Kalt 2005). This employment, however, is concentrated in those AI communities close to tribal land. Moreover, the revenue generated by gaming also supports a variety of related businesses and other local activities that generate jobs.

Linking American Indian Income, Health, and Tribal Gaming

Extensive prior research on the relationship between socioeconomic status and health outcomes gaming leads us to hypothesize that income increases associated with the presence of tribal gaming would lead to better health-related outcomes for AIs who are members of tribes with gaming relative to those in tribes without gaming (see for example, Link and Phelan, 1996; Menchik, 1993; Wilkinson, 1990). However, beyond anecdotal reports of potential health-promoting benefits of casino-related income increases (e.g., funding of health centers and new health initiatives), few studies to date have rigorously tested this relationship.

Costello et al. (2003) report improvement in some psychiatric outcomes among a North Carolina cohort of AI children following the opening of a nearby tribal casino. The families of these children experienced a reduction in poverty due to the income supplement derived from gaming revenue. The present study furthers these findings by

[3] This tabulation excludes Navajo tribes.

examining the relationships between income, health and gaming in a national sample of AI adults with a broader range of physical and mental health measures.

Evans and Topoleski (2005) found that four or more years after a tribal casino opened, all-cause mortality rates significantly declined by approximately 2 percent in counties with tribal casinos while counties less than 50 miles from a casino showed a mortality decline of approximately half that amount. Our study goes beyond the association between income and mortality to assess how casino income influences individual health behaviors and chronic health states such as diabetes, hypertension, and asthma.

The Urban Indian Health Institute (UIHI 2008) combined multiple years of the Behavioral Risk Factors Surveillance System (2001-2005) for an aggregate analysis of health disparities between urban AIs and their non-native counterparts, dichotomized into high and low income groups. Low income urban AIs (< 200%FPL) experienced reduced access to care, lower self-reported health, and poorer oral health though although generally AIs did not score as favorably as the general population. According to their analysis, there is no association between income and rates of smoking, diabetes, overweight and hypertension; however, they fail to take advantage of the full variance contained in the interval-level income variable by using a dichotomous (and somewhat arbitrary) operationalization of household income. This observational study also cannot infer causality due to the endogenous relationship between income and health. In contrast, our paper utilizes the quasi-experimental conditions of Indian gaming to explore the effects of an exogenous income shock on health.

III. CONSTRUCTION OF DATA SET

We pursue a multi-level, multi-source data strategy in estimating the potential effects of gaming on AI income and health. This strategy results in a micro-dataset on individual American Indians and their characteristics linked to AI tribes, tribal gaming operations, and broader community health resources.

Gaming and American Indian Tribes

Our research framework accounts for variation in state-permitted forms of gambling for AI tribes. To identify AI tribes with Class III gaming, we begin with tribal gaming data collected by Evans and Topoleski (2002).[4] We then supplement this information with

[4] Data collection consisted of a complete list of non-gaming tribes and gaming tribes both with and without compacts. Several internet sources (i.e., Bureau of Indian Affairs website, National Indian Gaming Commission website, Gamblinganswers.com, Casinocity.com), as well as popular press articles, phone correspondence, and tribal casino websites were used to determine dates of gaming compacts, the opening dates of tribes' first casinos, number of slots in tribes' first casinos, and square-footage of tribes' first casinos. The U.S. Census Bureau's publication *General Population Characteristics: American Indian and Alaska Native Areas* (based on the 1990 Census) was used to determine the state and county location(s) of federally-recognized tribal land. They use county data (rather than individual data) in their analysis of the economic impacts of legalizing gambling among Native Americans. They found that four years after tribes

two additional forms of data. The first is an exhaustive casino-by-casino data collection effort seeking specific information on the locations and characteristics of nearly all[5] AI gaming facilities in the contiguous 48 states[6]. These data give us gaming facility-specific information on tribal affiliation, county of location, the presence of a Class III gaming compact or casino-style gaming, date of facility opening (see Table 1).[7] These gaming facility data are restructured into a tribal-level dataset, containing summary gaming data for each tribe, including the opening year of the first tribal gaming facility. We add additional information on the geographic location of all tribal reservation land to the tribal level data.

[Table 1: Key Tribal and Casino Variables/Sources]

Individual-level Health and Socioeconomic Data

We use the Behavioral Risk Factors Surveillance System (BRFSS), sponsored by the U.S. Centers for Disease Control and Prevention, to obtain information on the health status and health care utilization of both Native American and non-Native American individuals[8]. In addition to health information, BRFSS respondents report basic socio-demographic and socioeconomic characteristics.[9]

We compiled 16 years of cross section BRFSS data from 1988 to 2003. When aggregated, these data provide us with a large sample of Native Americans (n =23,429). Appendix Table 1 is a data dictionary that describes the variables for all AIs obtained from the BRFSS data.

BRFSS does not identify the specific tribe to which a Native American respondent belongs. In order to link individual BRFSS respondents to tribes and tribal gaming, we assume tribal affiliation based on county of residence. BRFSS collects geographic identifiers for respondents' county of residence.[10] Using this information, we create a

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open casinos, employment increased by 26 percent and the fraction of adults who work but are poor has declined by 14 percent. As indicated above, they were able to study only limited health effects.

[5] Extremely small gaming operations such as laundromats and trading posts were excluded.

[6] Evans and Topoleski (2002) only collected information on tribes' first casinos. While we include this information in our dataset, we also include any additional casinos that may be associated with gaming tribes.

[7] Indicators of gaming facility size (i.e., square-footage and number of slot machines) were also collected. However, these size indicators were ultimately not used in the present analysis. Gaming facility size was a static variable collected in 2005; therefore, we had no way to measure how these variables may have changed over time due to tribal expansion into new gaming facilities or remodeling of existing facilities. Estimated changes in income and health using facility size were not robust.

[8] BRFSS is a source of timely cross-sectional prevalence data for common health status indicators, health care utilization, health care insurance coverage, health related-behaviors, and health risk factors for adults in the United States.

[9] Because the BRFSS is designed to collect prevalence data for individual states, each state conducts its own monthly random digit dial telephone survey. This state-by-month data is then aggregated yearly by the Centers for Disease Control and Prevention.

[10] We use the restricted-access BRFSS data in order to include respondents living in rural or sparsely populated counties. Due to confidentiality concerns, BRFSS does not allow public access to data from respondents living in a county where the annual sample is small.

geographic link between individual observations in the BRFSS sample and county-specific federally-recognized tribal reservations and/or AI casinos. That is, we match tribal information on the existence and nature of gaming to the county in which the tribal reservation is located and then to the BRFSS data containing information on Native American status, county of residence, and individual health status, utilization, and behavior information.

County Data on Population, Health, and Economic Characteristics

In addition, we also collect county-level data using the Area Resource File (ARF), available from the U. S. Department of Health and Human Services[11]. ARF contains information on the availability and aggregate utilization of health resources and facilities, population and economic data for the county. We link these data to individual BRFSS respondents based on their county of residence. These indicators allow us control for the environmental conditions, including health care availability, in the counties in which AIs live.

Table 2 indicates means and standard deviations for the individual BRFSS variables for all AIs in our sample (the 'full sample'), broken down into those AIs whose affiliated tribe at the time of observation had a gaming facility for more than two years (Gaming AI sample) and those AIs whose tribe did not have a gaming facility at the time that they are observed (Non-gaming AI sample).[12]

Table 3 indicates means and standard deviations for those AIs affiliated with a tribe observed to have a gaming facility at some time during our period of observation (the restricted sample), broken down into AIs observed before the existence of the facility and AIs observed after the facility has existed for more than two years.[13] The purpose of doing a pre-post analysis with the restricted sample is to adjust for possible endogeneity concerns; wealthier tribes are likely to be better equipped to establish gaming operations. Consistent with previous research, the BRFSS data indicate that the AI population is at a persistent disadvantage for various health-related and socioeconomic characteristics when compared to the non-AI population.

[Table 2: Full Sample Descriptives]

[11] The Area Resource File "is a national county-level health resources information system designed to be used by planners, policymakers, researchers, and other analysts interested in the nation's health care delivery system and factors that may impact health status and health care in the United States. The ARF database contains statistics on the following categories of health resources: health professions, health training programs, health facilities, measures of resource scarcity, and health status. The system contains information on more than 6,000 variables for each of the nation's counties." See http://www.arfsys.com/ for details on this data source.

[12] We omit observations whose affiliated tribe established a gaming facility during the year of observation or the subsequent year.

[13] We omit from both samples AIs living in counties which newly acquire a casino during the year of acquisition and one subsequent year. We do this since we do not know the date the casino started operation and to permit the casino to be a going enterprise which generates income.

[Table 3: Restricted Sample Descriptives]

The data set that we have assembled is unique, and enables us to estimate the relationship of AI gaming to a variety of health and well-being characteristics of AIs. In constructing this data set, we have had to assume a particular relationship between AI individuals' tribal affiliations and tribal gaming based on county-based information, as described above (see Appendix 3 for a graphic representation of our model assumptions). We do not use information on per capita dividends that AIs may or may not receive as a direct result of gaming revenues, nor do we use a direct measure of either AI or tribal income due to tribal gaming[14]. Our county-based linkage yields a data set with several distinct advantages over other data sets commonly used to study AIs. In particular, our dataset:

1. measures individual-level, rather than aggregate population-level, health-related indicators,

2. is collected using a random-digit-dial sampling procedure that captures AIs who do not live on tribal land but may be tribally and/or geographically connected to a gaming facility as long as they live in the same county as gaming tribe,

3. is not limited to AIs who use the Indian Health Service, unlike much of the Native American health information available, and

4. includes variables that are frequently collected and annually aggregated to allow for a dynamic data analysis.

These data allow us to expand our understanding of the linkage between exogenous income changes from AI casino gambling activities and a variety of health status, health care utilization and health behavior indicators of AIs.[15]

IV. HYPOTHESES TO BE EXAMINED

We make several with-without comparisons that attempt to identify the effects of the presence of Class III gaming activities on these health-related variables. In particular, we compare outcomes between AIs that are and are not affiliated with a tribe that has a gaming facility using both the full sample and a restricted sample. We frame a set of hypotheses, and then test these hypotheses using data from both the full sample (all AI respondents included in the BRFSS data; N=24,079) and the restricted sample (those AI respondents linked to a tribe that operated a Class III gaming facility at any point during our period of observation; N=8,973).

[14] Some tribes are required to disclose the size of these dividends as part of their state gaming compacts; however, other tribes refuse to officially disclose this information. Other tribes do not pay out dividends.
[15] The health effects that we measure will reflect changes in individual income received directly from tribe-generated gaming revenue, employment related to gaming activities, and the effects of tribal investment of gaming revenues in tribal health-related infrastructure, such as health clinics, etc.

Hypotheses Examined Using the Full Sample

Across all AIs in our sample, a comparison of 1) AIs whose affiliated tribe at the time of observation has had a gaming facility for more than two years with 2) AIs whose tribe did not have a gaming facility at the time that they are observed indicates that:

H1a: Being affiliated with a tribe that has gaming is positively associated with income.

H1b: Having higher income is associated with better health, fewer risky health behaviors, and greater health care utilization.

H1c: Being affiliated with a tribe that has gaming is positively associated with better health, fewer risky behaviors, and greater health care utilization.

Hypotheses Examined Using the Restricted Sample

Across AIs connected to tribes that have ever had Class III gaming during our period of observation, a comparison of 1) AIs observed before the existence of the facility and 2) AIs observed after the facility has existed for more than one year indicates that:

H2a: Having gaming in the affiliated tribe is positively associated with income.

H2b: Having gaming in the affiliated tribe is positively associated health status, fewer risky behaviors, and health care utilization.

In our estimation, we use a two-stage multiple regression analysis strategy. The first stage estimates the influence of gaming on income. In the second stage, we use OLS regression models to estimate the association between gaming, household income, and continuous health indicators, and logistic regression models to estimate the association between gaming and binary health indicators. We include both reported household income and tribal gaming in our analyses, with the binary gaming variable representing the possible benefits of gaming net of increased household income. We are then able to estimate 1) the direct effects of gaming on health indicators, 2) the indirect effects of gaming through income, and 3) the total effect of gaming and income on health indicators. Our regression models control for both individual and county-level characteristics that may be associated with income and health. We also include controls for year to account for any historical trends associated with income or health characteristics in the AI population.

V. VARIABLES EXAMINED

Dependent Variables

Household Income

BRFSS gathers information on household income levels for all years of our analysis. Income is operationalized in the BRFSS using an ordinal income ranges with an open top income category (see Appendix 2). Because we pool annual cross-sections, we adjust all class intervals for inflation (year 2000 dollars) and take the midpoint of all categories. Respondents with income in the open-ended top income category are assigned an income equal to the top code (inflation-adjusted income) * 1.5. Though we treat household income as continuous in our analysis, we caution against a literal interpretation of our income and gaming coefficients into dollars.

Overall, AIs in the BRFFS full sample from 1988-2003 have a pooled mean household income of about $33,208 (2000 constant dollars) (see Table 2). When we restricted this sample to AIs living in counties where tribal gaming is observed at any time during the 1988-2003 period (restricted sample), we see a somewhat lower household income of $31,820 (see Table 3). The restricted sample is likely to have fewer AIs living in metropolitan areas since AIs must live in the same county as a reservation in order to be in the restricted sample.[16]

Within the full AI sample, bivariate analysis reveals no statistically significant ($p < .05$) income difference between AIs connected to gaming and AIs who are not connected to gaming when using log income (see Table 2). We do, however, find that within the restricted AI sample, there is a statistically significant difference in mean household income of $2,659 ($t = -4.6938$); AIs living in counties where gaming is observed by 2003 have a statistically significantly greater level of mean household income at least 2 years after gaming is introduced than those AIs living in counties without Class III gaming[17]

Health Indicators and Health Risk Behaviors

We obtain information on several health indicators and behaviors from the BRFSS. As Table 2 and 3 indicate, in terms of risky behavior, about 36 percent of AIs in our full sample are smokers, compared to 34 percent of those in the restricted sample. In both samples, five percent are considered at risk for heavy drinking, while those in the full sample reported drinking five or more drinks in a day an average of 4.75 times per month and those in the restricted sample 4.26 times on average.

In the restricted sample, a somewhat greater proportion of respondents are overweight or obese than in the full sample (respectively, 66 percent versus 63 percent and 57 percent versus 54 percent). Other measures of physical health included in the analysis are

[16] Year 2000 general population estimates of all BRFSS variables can be found in Appendix 6.

[17] In a comparison suggesting a stronger difference between gaming and nongaming AI areas, cross tabulations in Taylor and Kalt (2005b) indicate that average per capita income of nongaming AI areas in 2000 was $7472, and $9771 in AI gaming areas. http://www.hks.harvard.edu/hpaied/pubs/documents/AmericanIndiansonReservationsADatabookofSocioeconomicChange.pdf (page 9)

hypertension (21 percent in both samples), being diabetic (10 percent in the full sample and 12 percent in the restricted sample), high cholesterol (30 percent in the full sample and 29 percent in the restricted sample), asthma (11 percent in the full sample versus 10 percent in the restricted sample), and having a disability (24 percent in the full sample and 21 percent in the restricted sample). Measures of mental health include an overall number of days in the past month with poor mental health (a mean of 4.63 in the full sample and 4.15 in the restricted sample), days in the past month feeling depressed (a mean of 4.45 in the full sample and 4.15 in the restricted sample), and anxiety days in the past month (a mean of 6.73 in the full sample and 5.83 in the restricted sample). Overall, 24 percent in the full sample and 22 percent in the restricted sample reported being in either poor or fair health.

Health Care Coverage and Medical Care Utilization

Two additional dependent variables measure the availability of health care coverage and usage of medical services. For the first, 75 percent of BRFSS respondents in the full sample reported have some sort of health insurance versus 73 percent in the restricted sample. For the second measure—whether the individual had forgone medical care because of cost—17 percent in the full sample reported having done so and 15 percent in the restricted sample.

Independent Variables

The most important independent variable in the analysis is an indicator variable ("gaming") for the presence of one or more Class III gaming tribes in the respondent's county of residence. This variable is coded as 1 if any such gaming facility was operating in that county in a given year. Data for this variable were collected from the NIGC and NIGA (for tribal affiliation) and, in turn, these tribes were matched to respondents' counties of residence. Among AIs in our sample, about 15 percent live in a county with a gaming tribe (see Table 2). Of those BRFSS respondents living in counties that eventually had a gaming tribe, 41 percent had gaming for 2 years or more (see Table 3).

In addition, our multivariable models predicting income control for age, gender, education, marital status, employment status, county-level unemployment, county per capita income, the proportion in the county living under the poverty line, and a series of dummy variables for the year of the survey. Our models predicting health control for income, age, gender, education, marital status, employment status, and year. All individual-level variables come from BRFSS data; county-level variables come from the ARF.

For both these sets of models, the gender variable is an indicator variable for female. In both samples, females represent the majority of respondents (57 percent in the full sample and 59 percent in the restricted sample). Educational attainment is broken into four indicator variables: less than high school (8 percent in the full sample, 6 percent in the restricted sample), high school diploma or GED (16 percent in both samples), some

college (60 percent in the full sample, 63 in the restricted), and college graduate (16 percent in the full sample, 15 percent in the restricted sample).

Marital status is similarly broken into six variables: married (46 percent in the full sample, 44 percent in the restricted), divorced (18 percent in both samples), widowed (8 percent in both samples), separated (4 percent in both samples), never married (20 percent the full sample, 21 percent in the restricted sample), and cohabiting (5 percent in both samples). Finally, we convert employment status into three indicator variables, including working (60 percent in the full sample, 61 percent in the restricted sample), not working but economically active (12 percent in both samples), and not working and economically inactive (28 percent in the full sample, 26 percent in the restricted sample).

County per capita income is measured per $10,000 in 1990, with a mean of 1.56 in the full sample and 1.45 in the restricted sample. The county-level poverty rate has a mean of 18.36 for the full sample and 20.43 in the restricted sample. For the county unemployment rate, the average for the full sample is 5.95 and for the restricted sample 6.46.

VI. ANALYSIS AND RESULTS

We begin our analysis by estimating the effect of being in a tribe that introduced casino gaming on the income of AIs. The equation we estimate is

$$Y = \alpha G + \beta I + \gamma C + \mu \qquad \text{(Equation 1)}$$

Y is income, G is a dummy variable indicating that the individual's tribe has casino gambling and I is a vector of individual variables such as age, sex, education marital status, employment status and C are a series of community variables including unemployment, income and poverty rate.

In the second stage, we estimate

$$H = \delta G + \theta Y + \xi I + \psi C' + \eta \qquad \text{(Equation 2)}$$

H is our vector of health outcome measures, and δ, θ, γ, ψ and ξ are coefficients or vectors of coefficients to be estimated. μ and η are error terms which are assumed to be uncorrelated given the specification and C variables include medical care resources in the community.

Our focus is on α, the coefficient on gaming in equation 1. In equation 2, we focus on δ, the coefficient on the gaming dummy variable, and on θ, the coefficient on income. Once we estimate equation 1 and a series of equations for each of our health variables in the form of equation 2, we combine the change in income from equation 1 with the coefficients on income in equations 2 to estimate the importance of the increase in income tied to gambling on our various health outcomes. We bring these together with the result on gaming itself in our hypotheses tests.

Tests of Full Sample With-Without Gaming Effects Hypotheses

Income: Hypotheses H1a & H2a

The first equation of our multiple regression analysis estimates the difference in household income between AIs in the full sample associated with Class III gaming and AIs in the full sample who are not associated with Class III gaming. We control for age, gender, education, marital status, employment status, county-level unemployment, county per capita income, proportion in county living under the poverty line, and year.

Table 4 indicates the OLS regression estimation of the direct effect of tribal gaming on log household income net of individual socio-demographic and environmental characteristics. Those AIs who live in a county with a Class III gaming tribe have a statistically significantly larger household income than AIs not associated with Class III tribal gaming. When measured as a linear relationship, we estimate that association with a gaming tribe predicts a $1,149 increase in annual household income. When we assume an underlying log distribution of income (that is, individuals with lower levels of income are assumed to experience greater changes income), we estimate that, on average, Class III gaming predicts a 3.34 percent increase in annual income, or $721 ($e^{Constant}*e^{b} - e^{Constant}$ = $21,219*1.034 - $21,219 = $721). This finding leads us to accept hypothesis H1a, that tribal gaming is associated with higher income for AIs. We caution, however, that the household income variable is measured categorically, so we cannot invoke a literal interpretation of the magnitude of the direct effect of gaming on income.[18]

[Table 4 about here]

Our second comparison indicates the difference in household income between AIs living in counties with Class III gaming tribes before tribal gaming facilities were opened and AIs living in counties with Class III gaming tribes at least 2 years after tribal gaming facilities were opened. We conduct this analysis in response to a concern that there may be some selectivity in which tribes (and states) adopt Class III gambling. The "cost" of this restriction is a smaller sample size. As Table 4 indicates, AIs living in Class III gaming counties 2 years after a casino opening have higher household income than AIs living in these same counties prior to casino opening . We estimate that gaming increases log-distributed annual household income by 6.25 percent or $1,450 on average ($e^{Constant}*e^{b} - e^{Constant}$ = $22,498*1.064 - $22,498 = $1,450).[19] Again we caution against using a literal interpretation of the magnitude of the direct effect of gaming on income.

[18] A multivariate OLS regression model predicting linear household income, rather than log income, estimates a linear increase of $1,148 or a 6.6 percent increase in annual household income at the intercept. See Appendix 4.

[19] When we assume a linear relationship, we estimate that the introduction of Class III gaming increases annual household income by $2,647 for AIs living in counties with gaming tribes by 2003. See Appendix 5.

These findings provide support for our hypotheses that tribal gaming is associated with higher income for AIs for both the with-without (H1a) and before-after gaming (H2a) comparisons.

Health Risk Behaviors, Health and Health Care Utilization: Hypotheses H1b & H1c

Our multivariate models predicting health outcomes (see Equation 2) include an independent variable for log income and also control for age, gender, education, marital status, employment status, county-level unemployment, county per capita income, proportion in county living under the poverty line, and year. We use logistic regression models for all binary outcomes and OLS regression for continuous health outcomes (binge drinking and mental health variables). Direct effects (marginal coefficients) for gaming and income, indirect effects of gaming through increases in income, and the total effect of gaming (direct effect + indirect effect) predicting income and health outcomes are summarized in Table 5.

[Table 5 about here]

ealth Risk Behaviors

Our estimates provide some support for our hypothesis that tribal gaming is associated with a lower probability of engaging in risky behaviors, specifically smoking and drinking, but we find mixed support for the negative influence of income on these behaviors.

Table 5 shows that both Class III gaming and income are negatively associated with smoking ($p < .001$). The total effect of Class III gaming (both directly and indirectly through the increase in household income) predicts a relatively large 12.37 percent decrease in the probability of smoking. Gaming has a negative relationship to heavy drinking, while income is positively associated with heavy drinking. The total effect of gaming on heavy drinking is negative, but these relationships are not statistically significant. Consistent with our results on heavy drinking, the direct effect of gaming on number of binge drinking days is negative but non-significant. Income has a positive and marginally non-significant direct effect on binge drinking, but the total influence of gaming on binge drinking is about a half-day reduction (-0.51) in binge drinking events among AIs associated with Class III gaming. However, income and gaming coefficients are not jointly significant in this model.

ealth Indicators

We find strong support for our hypothesis that income is associated with better health indicators, but mixed support for the hypothesis that Class III gaming is associated with more favorable health indicators.

As Table 5 shows, an increase in income is negatively associated with obesity, overweight, poor/fair self-reported general health, diagnoses of hypertension, diabetes,

high cholesterol, asthma, and disability. All of these direct income associations are statistically significant. Direct effects show that AIs connected to Class III gaming tribes have a significantly lower probability of being diagnosed with asthma or have a disability which limits activity. The total effects of gaming on asthma and disability are relatively large; AIs associated with Class III gaming tribes have a 15 percent lower probability of asthma diagnosis and have a 22 percent lower probability of reporting a disability. Self-reported poor/fair health, hypertension and high cholesterol all have negative but non-statistically significant direct associations with Class III gaming. The total effects of gaming on these variables are negative and relatively small, but the joint effects of income and gaming are statistically significant ($p < .05$).

AIs connected to Class III gaming tribes have a higher probability of being overweight, being at risk for obesity, and having a diagnosis of diabetes than AIs not affiliated with Class III gaming. While these estimated relationships are somewhat small, they are consistent for both direct and total effects of gaming and are statistically significant. Moreover, the magnitudes of these effects—approximately a seven percent increase in overweight, obesity, and diabetes—are consistent across these co-morbidities. These estimates tied to obesity then are inconsistent with our hypothesis that tribal gaming is associated with more favorable health outcomes[20]

ealth Care Coverage

Our estimates provide mixed support for the hypothesis that gaming is associated with greater health care coverage, but strong support for the hypothesis that higher income is associated with greater access to health care. Estimates of the relationship between Class III tribal gaming and health care coverage do not provide support for our hypothesis that gaming leads to increased coverage[21]

As Table 5 indicates, gaming is associated with a lower probability of reporting any kind of health coverage. We do not find a statistically significant direct effect of gaming on health coverage, but we find that the total effect is also negative with gaming and income having jointly significant effects. A positive, statistically significant relationship between health care coverage and household income does exist. This finding supports our hypothesis that higher income increases health care coverage. While there is a direct positive relationship between income and having access to health coverage ($p < .001$), we estimate a small (< 1 percent) negative total association between gaming and health care coverage.

ealth Care Utilization

[20] Controlling for whether AIs lived in the same counties as Pima Tribe reservations did not change the relationships between gaming, obesity, and diabetes. The Pima Tribe has unusually high levels of obesity and diabetes.

[21] This is perhaps not surprising since both gambling and not buying insurance can be viewed as risk taking or risk preferred activities.

We also find that Class III gaming is strongly associated with a lower probability that AIs report that they did not seek medical care because they could not afford it ($p < .001$). We estimate that AIs connected to Class III gaming have a 16.42 percent lower probability of foregoing medical care due to expense compared to AIs who are not connected to Class III gaming (see Table 5). Household income is significantly and positively associated with a lower probability of forgone care. These findings are consistent with our hypotheses that gaming and income are both positively correlated with health care utilization[22].

ental Health Indicators

Analyses of mental health outcomes show consistent support for our hypotheses that gaming and higher income are associated with better mental health. Gaming total effects show that AIs associated with Class III gaming tribes are estimated to report fewer days of poor mental health in the last 30 days (.57 days), fewer days of reported depression (1.13 days) and fewer days of reported anxiety (1.25 days). These effects are statistically significant and relatively large.

Interpretation

Overall, our results using our entire sample of AIs suggest that the presence of Class III gaming leads to higher income and better health and access to health care. The only exception to this is obesity and related illnesses and certain risky behaviors. These results then support the link from income to health and health related behaviors; when income increases, due to an exogenous increase in income, nearly all measured indicators of health, mental health and access to health respond positively—health does indeed improve.

Health Risk Behaviors, Health and Health Care Utilization: Hypothesis H2b

ealth Risk Behaviors and Health Indicators

While our restricted sample gaming comparison indicates that the association between income and health outcomes are highly consistent with the full sample comparison discussed above, we find less evidence of a statistically significant *direct* effect of gaming on physical and mental health after gaming facilities open. Results are summarized in Table 6.

As with the full sample comparison, we find jointly significant effects of *gaming* and *income* on obesity, poor/fair general health, hypertension, diabetes, asthma, health care coverage, forgone care, poor mental health days, and anxiety days, but the magnitudes of the total gaming effects tend to be small. Smoking is the only health outcome for which

[22] This finding, as well as our health findings more generally may reflect an increase in the availability of medical care. Using county data from the Area Resource File merged with our casino data, we find a statistically significant increase in doctors per capita and general practice doctors per capita associated with the introduction of class 3 gambling in a county.

gaming has a statistically significant direct effect. The estimated total effect is that gaming reduces the probability of smoking by 8.53 percent at least 2 years after casinos open.

[Table 6 about here]

ealth Care Coverage

Our results for health care coverage show a clear link between increased income and a greater probability of having health care coverage. In this case, the combination of gaming and increased income indicates a significant increase in the probability of coverage. The combined influence suggests an increase of about half a percent in the probability of having coverage.

ealth Care Utilization

In the case of the restricted sample we once again find that the presence of gambling and the associated income lead to a substantial reduction in the probability that these AIs had to forego care when needed. In this case our estimate is that the probability of foregoing care was reduced by about five and a half percent (compared to an estimate of 16 percent for the larger group.)

ental Health Indicators

Our estimates for the restricted sample are more mixed than in the case of the full sample. In every case we find that the role of the increased income associated with the introduction of gambling leads to a significant decline in mental health, depression and anxiety days. However, somewhat surprisingly, we find that gambling appears associated with an increase in these indicators. Our calculation of the influence of income is actually greater than in the case of our full sample. Nevertheless, only for anxiety do the combined results suggest a reduction in days with some reported mental condition.

Overall, then, the consistent results between the two samples suggest that the combination of the presence of casino gambling and associated increase in income is tied to a reduction in the probability of at least one risky behavior – namely smoking. This is consistent with measured reductions in poor/fair health, hypertension, asthma, disability, and anxiety days, and the share of the population with forgone care. In terms of physical health, where there is an inconsistency in results between the two samples. The restricted sample suggests more evidence of an improvement in health (a reduction in obesity, diabetes and no significant increase in being overweight) associated with the introduction of gambling; however, the full sample suggests a greater likelihood of a reduction in mental health and depression days than does the restricted sample. Overall, we view our results as clearly consistent with our hypothesis on the tie between income and improved health.

VII. SENSITIVITY TESTS

In order to test the prudency of a joint model of income and casino gaming, we analyze these separate health outcome models first with only income as the key predictor, then only gaming as the key predictor (see Table 7 for full sample and Table 8 for restricted sample). Results of these models are highly consistent with our health outcome regressions that jointly model income and gaming. This is as expected since our estimates of equation 1 provide evidence of the link between the presence of a casino and higher income.

[Table 7 about here]

[Table 8 about here]

Finally we separate the full sample into urban (Metro) and rural (non-Metro) subsets which divide our observations into approximately equal halves, in which a little more than 15 percent are designated as members of a gaming tribe in both subsamples[23]. As expected we find that average income is higher among American Indians living in metropolitan areas, but the general pattern of results is consistent across subsets with the overall results. Gaming leads to a small increase in average income in both subsamples but the increase is greater in the non-metropolitan area.

The results for the Metro subgroup (see table 9) are very consistent with those for the overall sample (see Table 5). The two exceptions are that among American Indians in metro areas, there is a statistically significant overall reduction in binge drinking with tribal gaming (percent reductions are the same in both) but not a statistically significant reduction in high cholesterol though again the reductions in percentage terms are very similar. For the non-Metro subgroup the influence of gaming appears to offer fewer improvements in health habits and health but similar results for access to care and mental health days. In particular the non-metro results suggest an increase in smoking, an increase in poor health, in hypertension and high cholesterol. For this population gambling seems to be tied to an even larger reduction in foregone care than among the overall sample and a somewhat larger reduction in those reporting they had a disability. Those while there are some differences in results, the overall pattern appears robust to splitting the sample by metropolitan status.

[Table 9 about here]

[Table 10 about here]

VIII. CONCLUSION

Our results identify the potential impact of an important and publicly contentious social policy and poverty alleviation approach—the stimulation of local economic development

[23] County of residence was defined as metropolitan or non-metropolitan based on the 1993 Rural-Urban Continuum Codes developed by the U.S. Department of Agriculture.

through gaming— on the income and health of AIs, and by implication the overall wellbeing of the populations concerned.

The evidence that we have presented suggests that the increased revenue streams and employment opportunities associated with the presence of Class III gaming has lead to improvements in health behaviors and outcomes. Our estimation of these effects contributes to the ongoing debate regarding the impact of gaming on the overall wellbeing of the AIs affected by this development.

Our findings also provide substantial evidence regarding the link between income and health. Using a natural experiment, which links an exogenous increase in income to health and health related behaviors, we find clear evidence of improvements in health and access to health in response to the exogenous increase in income. More income appears to lead to a decrease in smoking; a decrease in poor and fair health, a decrease in hypertension, asthma and disability, a decrease in the probability of foregoing needed health care, and an improvement in terms of fewer days of reported anxiety and poor mental health days more generally. To highlight these results table 11 shows just the tie between ln income and health. In this table we calculate the elasticities. Again we show that with the exception of drinking, all indicators of health related behaviors, health indicators, mental health days and access to health show the expected improvements hypothesized in the models linking income to health.
We find no evidence of selection of wealthier AI tribes into gaming; however, we believe that the possibility of a selection bias warrants further investigation.

Two caveats remain: First, we base our income measure on categorical data; second, we assign AIs to tribes with gambling according to county of residence. These conventions suggest the possibility of measurement error, and could lead to an underestimate of the influence of gaming on both income and health/health-related behaviors. The measurement issue seems particularly salient regarding our matching of AIs to individual tribes.

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FIGURES & TABLES

Figure 1: Reservations and Casinos by County (Data Source: see Table 1)

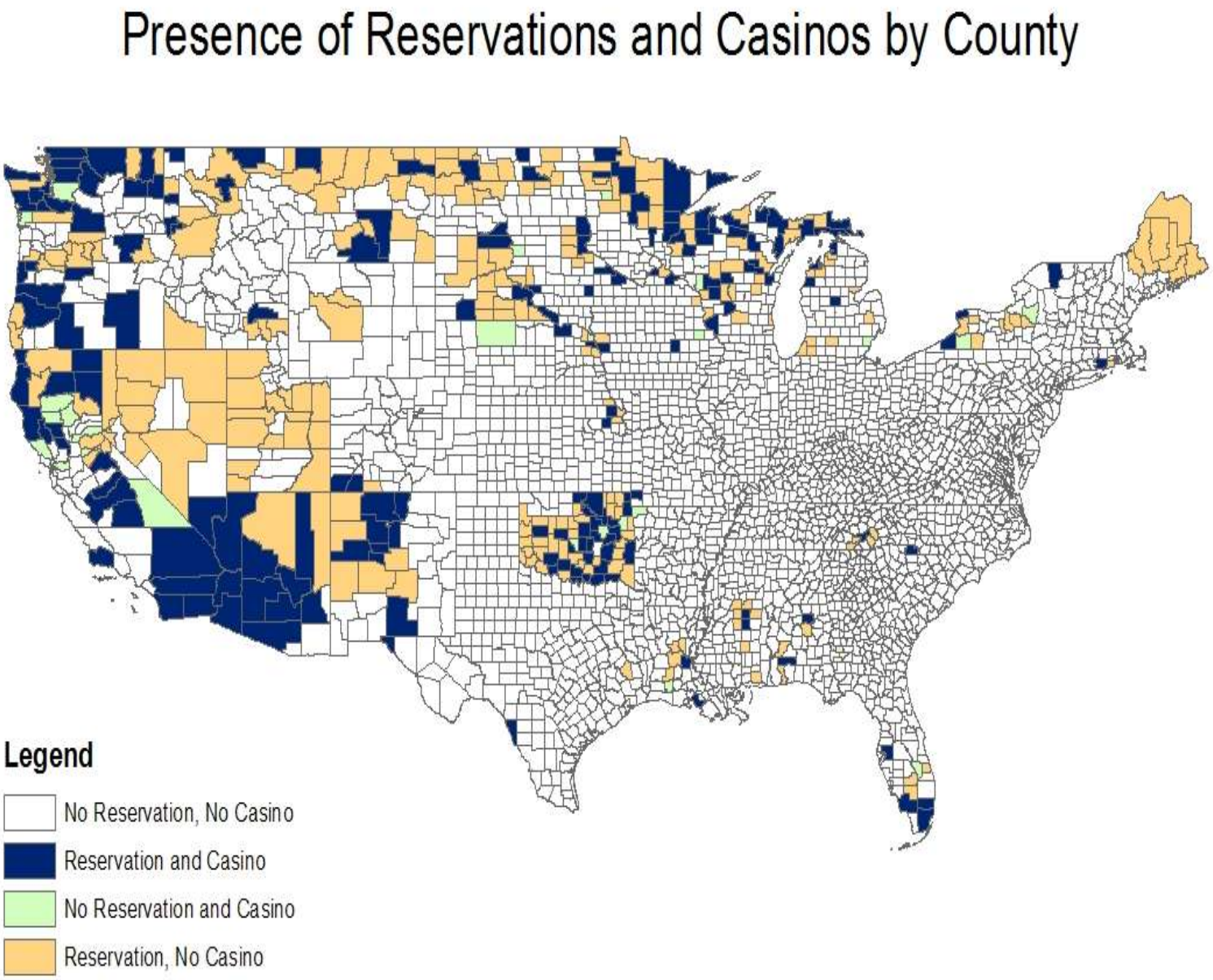


Figure 2: Length of Casino Operation (Data Source: see Table 1)

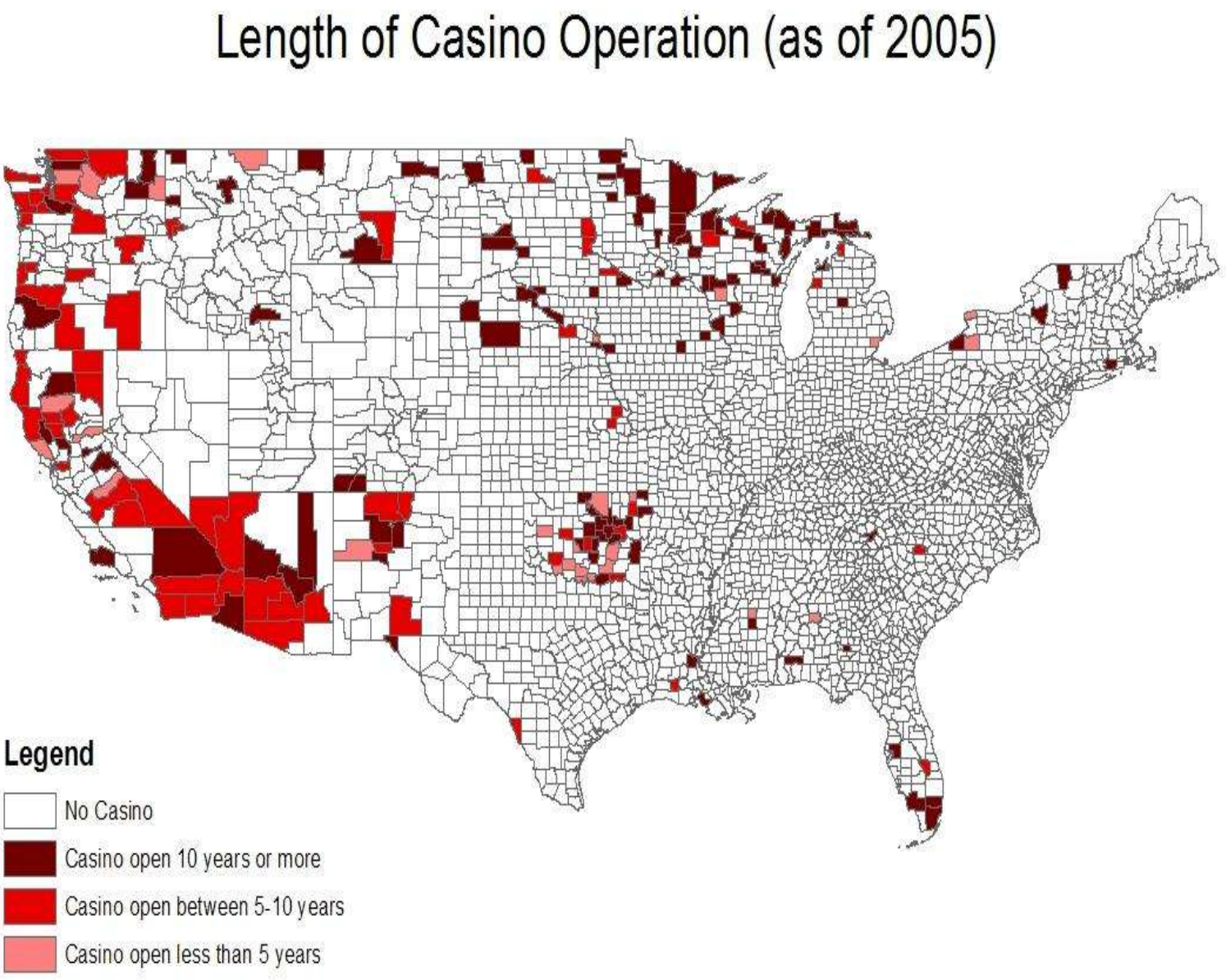


Table 1. Key tribal and casino variables and their sources

Tribal Variables:	**Data Source(s):**
Class III gaming compact	Evans & Topoleski (BIA); NIGC; NIGA
Date of gaming compact	Evans & Topoleski (BIA)
Number of casinos	NIGC; NIGA
County(s) where tribe is located	Census Bureau
Casino Variables:	
Tribal affiliation	NIGC; NIGA
Casino open date	Evans & Topoleski; casino website; phone/email correspondence; NIGC
Square-footage	Gamblinganswers.com; Casinocity.com
Number of slots	Gamblinganswers.com; Casinocity.com

National Indian Gaming Commission (NIGC). **http://www.nigc.gov/nigc/index.jsp**
National Indian Gaming Association (NIGA). http://www.indiangaming.org
Gamblinganswers.com. http://www.gamblinganswers.com
Casinocity.com. http://www.casinocity.com
Bureau of Indian Affairs (BIA)

Table 2: Full Sample Descriptives

	Total AI Sample			Non-gaming AI Sample			Gaming AI Sample		
Variable	**n**	**Mean**	**Std. Dev.**	**n**	**Mean**	**Std. Dev.**	**n**	**Mean**	**Std. Dev.**
Household Income	21342	33207.50	26797.35	18030	33176.27	26891.92	3312	33377.52	26279.90
Log of Household Income	21342	10.10	0.82	18030	10.10	0.82	3312	10.12	0.82
Gaming	24079	0.15	-	20378	0.00	-	3701	1.00	-
Smoking	24021	0.36 [a]	-	20327	0.36	-	3694	0.33	-
Drinking	19378	0.05	-	16258	0.05	-	3020	0.05	-
Binge Drinking (days)	23304	4.75 [a]	6.57	19723	4.84	6.75	3581	4.32	5.63
Obesity	23309	0.54	-	19727	0.53	-	3582	0.58	-
Overweight	21763	0.63 [a]	-	18240	0.62	-	3523	0.67	-
Poor/Fair Health	20357	0.24 [a]	-	17260	0.24	-	3097	0.22	-
Hypertension	24029	0.21 [a]	-	20338	0.21	-	3691	0.20	-
Diabetic	10843	0.10	-	9204	0.10	-	1639	0.11	-
High Cholesterol	13949	0.30	-	11620	0.30	-	2329	0.29	-
Asthma	4760	0.11	-	3900	0.11	-	860	0.09	-
Disability	22904	0.24 [a]	-	19296	0.25	-	3608	0.19	-
Health Plan	20006	0.75 [a]	-	16855	0.75	-	3151	0.73	-
Forgone Care	3425	0.17	-	2821	0.17	-	604	0.14	-
Poor Mental Health (days)	19163	4.63 [b]	8.86	16026	4.72	8.98	3137	4.16	8.20
Depression (days)	2038	4.45 [b]	8.34	1594	4.74	8.64	444	3.41	7.06
Anxiety (days)	3275	6.73 [b]	10.13	2593	6.99	10.32	682	5.73	9.31
Age	24079	43.12	15.86	20378	43.29	15.93	3701	42.17	15.38
Age Squared	24079	2110.41	1528.67	20378	2127.81	1542.92	3701	2014.60	1444.12
Female	24079	0.57	-	20378	0.57	-	3701	0.57	-
Education: Less Than High School	24079	0.08 [a]	-	20378	0.09	-	3701	0.06	-
Education: High School or GED	24079	0.16	-	20378	0.16	-	3701	0.15	-
Education: Some College	24079	0.61 [a]	-	20378	0.60	-	3701	0.64	-
Education: College Graduate	24079	0.16	-	20378	0.15	-	3701	0.16	-
Marital Status: Married	24079	0.46 [a]	-	20378	0.46	-	3701	0.43	-
Marital Status: Divorced	24079	0.18	-	20378	0.18	-	3701	0.18	-
Marital Status: Widowed	24079	0.08	-	20378	0.08	-	3701	0.07	-
Marital Status: Separated	24079	0.04 [a]	-	20378	0.04	-	3701	0.03	-
Martial Status: Never Married	24079	0.20 [a]	-	20378	0.19	-	3701	0.22	-
Marital Status: Cohabiting	24079	0.05 [a]	-	20378	0.04	-	3701	0.06	-
Employment Status: Working	24079	0.60	-	20378	0.60	-	3701	0.62	-
Employment Status: Not Working, Economically Active	24079	0.12	-	20378	0.12	-	3701	0.12	-
Employment Status: Not Working, Economically Inactive	24079	0.28 [a]	-	20378	0.28	-	3701	0.26	-
County Per Capita Income, 1990	24079	15571.41 [b]	4263.07	20378	15762.28	4270.76	3701	14520.46	4063.48
County Percent in Poverty	24079	18.36 [b]	10.80	20378	17.75	10.28	3701	21.68	12.79
County Unemployment Rate	24079	5.95 [b]	2.66	20378	5.81	2.53	3701	6.75	3.15

[a] Chi-squared test for mean differences by gaming, $p<.05$

[b] T-test for mean differences by gaming, $p<.05$

Table 3: Restricted Sample Descriptives

	Total Restricted Sample			Pre-gaming AI Sample			Post-Gaming AI Sample		
Variable	**n**	**Mean**	**Std. Dev.**	**n**	**Mean**	**Std. Dev.**	**n**	**Mean**	**Std. Dev.**
Household Income	7993	31820.27 [b]	24982.37	4681	30718.45	23963.80	3312	33377.52	26279.90
Log of Household Income	7993	10.08 [b]	0.80	4681	10.05	0.78	3312	10.12	0.82
Gaming	8973	0.41	-	5272	0.00	-	3701	1.00	-
Smoking	8954	0.34 [a]	-	5260	0.35	-	3694	0.33	-
Drinking	7510	0.05	-	4490	0.05	-	3020	0.05	-
Binge Drinking (days)	8696	4.26	4.26	5115	4.21	5.73	3581	4.32	5.63
Obesity	8698	0.57	-	5116	0.57	-	3582	0.58	-
Overweight	8090	0.66	-	4567	0.66	-	3523	0.67	-
Poor/Fair Health	7547	0.22	-	4450	0.23	-	3097	0.22	-
Hypertension	8952	0.21	-	5261	0.21	-	3691	0.20	-
Diabetic	4039	0.12	-	2400	0.12	-	1639	0.11	-
High Cholesterol	5397	0.29	-	3068	0.29	-	2329	0.29	-
Asthma	1833	0.10	-	973	0.10	-	860	0.09	-
Disability	8490	0.21	-	4216	0.22	-	3608	0.19	-
Health Plan	7367	0.73	-	3873	0.73	-	3151	0.73	-
Forgone Care	1432	0.15	-	828	0.15	-	604	0.14	-
Poor Mental Health (days)	7010	4.15	8.25	3873	4.13	8.29	3137	4.16	8.20
Depression (days)	795	3.47	7.24	351	3.55	7.48	444	3.41	7.06
Anxiety (days)	1381	5.83	9.46	699	5.93	9.61	682	5.73	9.31
Age	8973	42.38	15.57	5272	42.52	15.70	3701	42.17	15.38
Age Squared	8973	2037.97	1474.96	5272	2054.38	1496.14	3701	2014.60	1444.12
Female	8973	0.59 [a]	-	5272	0.60	-	3701	0.57	-
Education: Less Than High School	8973	0.06 [a]	-	5272	0.07	-	3701	0.06	-
Education: High School or GED	8973	0.16 [a]	-	5272	0.17	-	3701	0.15	-
Education: Some College	8973	0.63 [a]	-	5272	0.62	-	3701	0.64	-
Education: College Graduate	8973	0.15 [a]	-	5272	0.15	-	3701	0.16	-
Marital Status: Married	8973	0.44 [a]	-	5272	0.44	-	3701	0.43	-
Marital Status: Divorced	8973	0.18	-	5272	0.19	-	3701	0.18	-
Marital Status: Widowed	8973	0.08	-	5272	0.08	-	3701	0.07	-
Marital Status: Separated	8973	0.04	-	5272	0.04	-	3701	0.03	-
Martial Status: Never Married	8973	0.21	-	5272	0.20	-	3701	0.22	-
Marital Status: Cohabiting	8973	0.05	-	5272	0.05	-	3701	0.06	-
Employment Status: Working	8973	0.61 [a]	-	5272	0.61	-	3701	0.62	-
Employment Status: Not Working, Economically Active	8973	0.12	-	5272	0.12	-	3701	0.12	-
Employment Status: Not Working, Economically Inactive	8973	0.26	-	5272	0.26	-	3701	0.26	-
County Per Capita Income, 1990	8973	14519.99	3506.01	5272	14519.65	3054.90	3701	14520.46	4063.48
County Percent in Poverty	8973	20.43	10.24	5272	19.55	7.87	3701	21.68	12.79
County Unemployment Rate	8973	6.46 [b]	2.90	5272	6.25	2.69	3701	6.75	3.15

[a] Chi-squared test for mean differences by gaming, $p<.05$

[b] T-test for mean differences by gaming, $p<.05$

Table 4. OLS Regression Of Income (Per $1,000) And Ln(Income) On Tribal Gaming

Covariates	All AI Sample				Restricted Sample			
	Income[a]		ln(Income)		Income		ln(Income)	
	b/se		b/se		b/se		b/se	
Class III Gaming	1.1490	**	0.0334	**	2.6478	***	0.0625	***
	(0.4421)		(0.0129)		(0.5125)		(0.0156)	
Age	0.4736	***	0.0073	***	0.4720	***	0.0072	***
	(0.0606)		(0.0018)		(0.0967)		(0.0029)	
Age-squared	-0.0041	***	0.0001	**	-0.0041	***	-0.0001	**
	(0.0006)		(0.0000)		(0.0010)		(0.0000)	
Female	-3.1221	***	0.1100	***	-3.0876	***	-0.1056	***
	(0.3304)		(0.0096)		(0.5119)		(0.0156)	
Educational Attainment (comparison: High School)								
Less Than High School	-2.1869	**	0.1418	***	-3.2430	**	-0.2113	***
	(0.7141)		(0.0208)		(1.2038)		(0.0367)	
Some College/Tech School	5.8608	***	0.2386	***	4.5418	***	0.2063	***
	(0.4644)		(0.0135)		(0.7178)		(0.0219)	
College Grad	22.2100	***	0.6382	***	18.0858	***	0.5760	***
	(0.5826)		(0.0170)		(0.9076)		(0.0276)	
Marital Status (comparison: Married)								
Divorced	14.8268	***	0.4932	***	-14.3024	***	-0.4822	***
	(0.4380)		(0.0127)		(0.6732)		(0.0205)	
Widowed	12.1318	***	0.4477	***	-11.5594	***	-0.4330	***
	(0.7100)		(0.0207)		(1.1114)		(0.0338)	
Separated	14.8997	***	0.5316	***	-14.0686	***	-0.4878	***
	(0.8031)		(0.0234)		(1.3139)		(0.0400)	
Never Married	11.6078	***	0.4197	***	-11.5360	***	-0.4197	***
	(0.4755)		(0.0138)		(0.7230)		(0.0220)	
Unmarried Couple	-9.8468	***	0.3347	***	-11.6454	***	-0.3949	***
	(0.7784)		(0.0226)		(1.1175)		(0.0340)	
Employment Status (comparison: Employed)								
Economically Active, Not Working	-6.9570	***	0.3275	***	-7.8722	***	-0.3606	***
	(0.5331)		(0.0155)		(0.8042)		(0.0245)	
Economically Inactive	14.1404	***	0.5778	***	-13.5925	***	-0.5738	***
	(0.4212)		(0.0123)		(0.6625)		(0.0202)	
County Unemployment	0.0445		0.0019		0.0400		0.0028	
	(0.0767)		(0.0022)		(0.1096)		(0.0033)	
County Per Capita Income	7.6325	***	0.1617	***	6.1373	***	0.1403	***
	(0.5484)		(0.0160)		(1.2175)		(0.0371)	
County Percent Poverty	-0.1110	***	0.0048	***	-0.1603	***	-0.0062	***
	(0.0234)		(0.0007)		(0.0432)		(0.0013)	
Constant	17.4078	***	9.9626	***	21.1410	***	10.0212	***
	(1.9106)		(0.0556)		(3.4467)		(0.1049)	
N	21342		21342		7993		7993	
R^2	0.27		0.33		0.25		0.32	

* p<0.05, ** p<0.01, *** p<0.001

[a] Income comes from an interval variable. We take the midpoint of the interval and adjust all to year 2000 dollars. The open-ended top category = (interval midpoint*1.5)

Standard errors in parentheses

Not Shown: All models control for year

Table 5. Estimated Effects Of Class III Tribal Gaming On Ln(Household Income) And Health Outcomes, All American Indians

Outcome[c]	N	Mean	Direct effect of gaming		Direct effect of log income		Indirect effect of gaming through income	Total effect of Gaming		Percent Change due to Gaming	
			1		2		3	4		5	
Smoking	24,021	0.3583	-0.0432	***	-0.0320	***	-0.0011	-0.0443	[a]	-12.3669	[a]
Heavy Drinking	19,378	0.0533	-0.0043		0.0024		0.0001	-0.0042		-7.8353	
Binge Drinking	3,425	4.7454	-0.5246		0.2441		0.0082	-0.5164		-10.8829	
Obesity	23,304	0.5353	0.0379	***	-0.0252	***	-0.0008	0.0371	[a]	6.9243	[a]
Overweight	23,309	0.6267	0.0417	***	-0.0217	***	-0.0007	0.0410	[a]	6.5439	[a]
Poor Health	21,763	0.2387	-0.0103		-0.0692	***	-0.0023	-0.0126	[a]	-5.2708	[a]
Hypertension	20,357	0.2065	-0.0014		-0.0146	***	-0.0005	-0.0019	[a]	-0.9323	[a]
Diabetes	24,029	0.1044	0.0081	***	-0.0178	***	-0.0006	0.0075	[a]	7.1510	[a]
High Cholesterol	10,843	0.3014	-0.0078		-0.0166	*	-0.0006	-0.0083	[a]	-2.7630	[a]
Asthma	13,949	0.1104	-0.0160	*	-0.0141	***	-0.0005	-0.0164	[a]	-14.8974	[a]
Disability	4,760	0.2408	-0.0515	***	-0.0445	***	-0.0015	-0.0530	[a]	-22.0005	[a]
Health Plan	22,904	0.7460	-0.0101		0.0959	***	0.0032	-0.0069	[a]	-0.9249	[a]
Forgone Care	20,006	0.1652	-0.0253	***	-0.0556	***	-0.0019	-0.0271	[a]	-16.4256	[a]
Poor Mental Health (days)	19,163	4.6304	-0.5461	**	-0.8426	***	-0.0281	-0.5742	[b]	-12.4007	[b]
Depression (days)	2,038	4.4480	-1.0791	*	-1.1356	***	-0.0379	-1.1170	[b]	-25.1125	[b]
Anxiety (days)	3,275	6.7298	-1.2072	**	-1.5023	***	-0.0502	-1.2574	[b]	-18.6841	[b]
ln(Income)[d]	21,342	10.1043	0.0334	**							

* p<0.05, ** p<0.01, *** p<0.001

[a] Wald chi-squared test for joint significance of income and gaming, significant at .05 level

[b] F-test for joint significance of income and gaming, significant at .05 level

[c] All health outcomes regressed on covariates: ln(income), gaming, age, age-squared, gender, education, marital status, employment status, county unemployment 1990, county per capita income 1990, county percent poverty 1990, year

[d] ln(Income) regressed on covariates: gaming, age, age-squared, gender, education, marital status, employment status, county unemployment 1990, county per capita income 1990, county percent poverty 1990, year

Column 1 [δ(h)/δ(casino 0-1)]

Column 2 [δ(h)/δ(Y)]; note that Y is measured in $1,000

Column 3 {[δ(h)/δ(Y)] *[δ(Y)/δ(casino 0-1)]};Y is measured in $1,000

Column 4 {[δ(h)/δ(casino 0-1)] +[δ(h)/δ(Y)]* [δ(Y)/δ(casino 0-1)]}; note that Y is measured in $1,000

Column 5 (col. 4/ mean)*100

Table 6. Estimated Effects Of Class Iii Tribal Gaming On Ln(Household Income) And Health Outcomes, American Indians Living In Counties Connected To Tribal Gaming By 2003

Outcome[c]	N	Mean	Direct effect of gaming		Direct effect of log income		Indirect effect of gaming through income	Total effect of Gaming		Percent Change due to Gaming	
			1		2		3	4		5	
Smoking	8,954	0.3440	-0.0277	**	-0.0256	**	-0.0016	-0.0293	[a]	-8.5281	[a]
Heavy Drinking	7,510	0.0489	0.0011		0.0013		0.0001	0.0012		2.4872	
Binge Drinking	1,432	4.2612	0.0525		0.0839	*	0.0052	0.0578		1.3555	
Obesity	8,696	0.5730	-0.0020		-0.0255	**	-0.0016	-0.0036	[a]	-0.6317	[a]
Overweight	8,698	0.6620	0.0018		-0.0168	*	-0.0011	0.0007		0.1121	
Poor Health	8,090	0.2237	0.0016		-0.0606	***	-0.0038	-0.0022	[a]	-0.9732	[a]
Hypertension	7,546	0.2082	-0.0066		-0.0186	**	-0.0012	-0.0078	[a]	-3.7240	[a]
Diabetes	8,952	0.1174	-0.0063		-0.0210	***	-0.0013	-0.0076	[a]	-6.4564	[a]
High Cholesterol	4,039	0.2919	0.0018		-0.0181		-0.0011	0.0007		0.2345	
Asthma	5,397	0.0952	-0.0001		-0.0185	**	-0.0012	-0.0013	[a]	-1.3175	[a]
Disability	1,832	0.2051	-0.0288		-0.0365	**	-0.0023	-0.0310	[a]	-15.1292	[a]
Health Plan	8,490	0.7313	-0.0036		0.1035	***	0.0065	0.0028	[a]	0.3873	[a]
Forgone Care	7,367	0.1459	-0.0054		-0.0441	***	-0.0028	-0.0082	[a]	-5.5867	[a]
Poor Mental Health (days)	7,010	4.1466	0.0716		-0.8031	***	-0.0502	0.0215	[b]	0.5174	[b]
Depression (days)	795	3.4717	0.2013		-0.6385		-0.0399	0.1614		4.6493	
Anxiety (days)	1,381	5.8306	0.0410		-1.3316	***	-0.0832	-0.0421	[b]	-0.7229	[b]
ln(Income)[d]	7,993	10.0777	0.0625	***							

* p<0.05, ** p<0.01, *** p<0.001

[a] Wald chi-squared test for joint significance of income and gaming, significant at .05 level

[b] F-test for joint significance of income and gaming, significant at .05 level

[c] All health outcomes regressed on covariates: ln(income), gaming, age, age-squared, gender, education, marital status, employment status, county unemployment 1990, county per capita income 1990, county percent poverty 1990, year

[d] ln(Income) regressed on covariates: gaming, age, age-squared, gender, education, marital status, employment status, county unemployment 1990, county per capita income 1990, county percent poverty 1990, year

Column1 [δ(h)/δ(casino 0-1)]

Column 2 [δ(h)/δ(Y)]; note that Y is measured in $1,000

Column 3 {[δ(h)/δ(Y)] *[δ(Y)/δ(casino 0-1)]};Y is measured in $1,000

Column 4 {[δ(h)/δ(casino 0-1)] +[δ(h)/δ(Y)]* [δ(Y)/δ(casino 0-1)]}; note that Y is measured in $1,000

Column 5 (col. 4/ mean)*100

Table 7. Sensitivity Tests, Separate Regression Models For Casino And Ln(Income) On Health For All American Indians

Outcome	n	Mean	Direct effect of gaming[1]		Direct effect of log income[2]	
Smoking	24,021	0.3583	-0.0431	***	-0.0320	***
Heavy Drinking	19,378	0.0533	0.0039		0.0024	
Binge Drinking	3,425	4.7454	-0.5212		0.2430	*
Obesity	23,304	0.5353	0.0380	***	-0.0252	***
Overweight	23,309	0.6267	0.0418	***	-0.0216	***
Poor Health	21,763	0.2387	-0.0111		-0.0692	***
Hypertension	20,357	0.2065	-0.0016		-0.0146	***
Diabetes	24,029	0.1044	0.0079		-0.0178	***
High Cholesterol	10,843	0.3014	-0.0081		-0.0166	*
Asthma	13,949	0.1104	-0.0162	*	-0.0143	***
Disability	4,760	0.2408	-0.0520	***	-0.0450	***
Health Plan	22,904	0.7460	-0.0097		0.1623	***
Forgone Care	20,006	0.1652	-0.0255	***	-0.0555	***
Poor Mental Health (days)	19,163	4.6304	-0.5443	**	-0.8436	***
Depression (days)	2,038	4.4480	-1.0598	*	-1.1323	***
Anxiety (days)	3,275	6.7298	-1.1963	**	-1.5012	***
ln(Income)	21,342	9.9626	0.0334	**		

* p<0.05, ** p<0.01, *** p<0.001

[1] [δ(h)/δ(casino 0-1)], models do not include income covariate.

[2] [δ(h)/δ(Y)]; models do not include gaming covariate.

Table 8. Sensitivity Tests, Separate Regression Models For Casino And Ln(Income) On Health For American Indians In Counties With Gaming Tribes By 2003

Outcome	n	Mean	Direct effect of gaming[1]		Direct effect of log income[2]	
Smoking	8,954	0.3440	-0.0280	**	-0.0261	***
Heavy Drinking	7,510	0.0489	0.0012		0.0013	
Binge Drinking	1,432	4.2612	0.0430		0.0848	
Obesity	8,696	0.5730	-0.0024		-0.0255	**
Overweight	8,698	0.6620	0.0016		-0.0168	*
Poor Health	8,090	0.2237	0.0003		-0.0606	***
Hypertension	7,546	0.2082	-0.0072		-0.0187	**
Diabetes	8,952	0.1174	-0.0069		-0.0211	***
High Cholesterol	4,039	0.2919	0.0007		-0.0180	
Asthma	5,397	0.0952	-0.0007		-0.0185	**
Disability	1,832	0.2051	-0.0296		-0.0371	**
Health Plan	8,490	0.7313	-0.0011		0.1035	***
Forgone Care	7,367	0.1459	-0.0058		-0.0441	***
Poor Mental Health (days)	7,010	4.1466	0.0566		-0.8018	***
Depression (days)	795	3.4717	0.1874		-0.6351	
Anxiety (days)	1,381	5.8306	0.0521		-1.3316	**
ln(Income)	7,993	10.0212	0.0625	***		

* p<0.05, ** p<0.01, *** p<0.001

[1] [δ(h)/δ(casino 0-1)], models do not include income covariate.

[2] [δ(h)/δ(Y)]; models do not include gaming covariate.

Table 9. Estimated Effects Of Class III Tribal Gaming On Ln(Household Income) And Health Outcomes, All Metro AIs

Outcome[c]	N	Mean	Direct effect of gaming		Direct effect of log income		Indirect effect of gaming through income	Total effect of Gaming		Percentage Effect of Gaming	
			1		2		3	4		5	
Smoking	11,566	0.3453	-0.0820	***	-0.0385	***	-0.0024	-0.0844	[a]	-24.4422	[a]
Heavy Drinking	9,149	0.0566	-0.0026		0.0030		0.0002	-0.0024		-4.3134	
Binge Drinking	1,678	4.7547	-0.6016		0.5383	*	0.0336	-0.5680	[b]	-11.9464	[b]
Obesity	11,211	0.4826	0.0352	*	-0.0195	*	-0.0012	0.0340	[a]	7.0492	[a]
Overweight	11,215	0.5836	0.0391	**	-0.0155	*	-0.0010	0.0381	[a]	6.5325	[a]
Poor Health	10,382	0.2232	-0.0248	*	-0.0628	***	-0.0039	-0.0287	[a]	-12.8795	[a]
Hypertension	9,809	0.1955	-0.0068		-0.0102	*	-0.0006	-0.0075		-3.8277	
Diabetes	11,577	0.0852	0.0068		-0.0117	***	-0.0007	0.0061	[a]	7.1612	[a]
High Cholesterol	5,278	0.2987	-0.0044		-0.0209	*	-0.0013	-0.0057		-1.9221	
Asthma	6,185	0.1174	-0.0177		-0.0117	*	-0.0007	-0.0184	[a]	-15.6881	
Disability	2,320	0.2418	-0.0493	*	-0.0521	***	-0.0033	-0.0525	[a]	-21.7176	[a]
Health Plan	11,031	0.7759	-0.0087		0.0828	***	0.0052	-0.0036	[a]	-0.4588	[a]
Forgone Care	9,749	0.1720	-0.0160		-0.0630	***	-0.0039	-0.0199	[a]	-11.5890	[a]
Poor Mental Health (days)	9,281	4.8483	-0.7053	**	-0.9156	***	-0.0572	-0.7625	[b]	-15.7262	[b]
Depression (days)	1,100	4.5840	-1.2979	*	-1.2291	**	-0.0768	-1.3746	[b]	-29.9876	[b]
Anxiety (days)	1,716	6.9138	-1.3831	*	-1.3495	***	-0.0843	-1.4674	[b]	-21.2241	[b]
ln(Income)	10,280	10.2144	0.0088		N/A						

* p<0.05, ** p<0.01, *** p<0.001

[a] Wald chi-squared test for joint significance of income and gaming, significant at .05 level

[b] F-test for joint significance of income and gaming, significant at .05 level

1 [δ(h)/δ(casino 0-1)]

2 [δ(h)/δ(Y)]; note that Y is measured in $1,000

3 {[δ(h)/δ(Y)] *[δ(Y)/δ(casino 0-1)]};Y is measured in $1,000

4 {[δ(h)/δ(casino 0-1)] +[δ(h)/δ(Y)]* [δ(Y)/δ(casino 0-1)]}; note that Y is measured in $1,000

5 (col. 4/ mean)*100

[c] All outcomes regressed on full set of covariates

Table 10. Estimated Effects Of Class III Tribal Gaming On Ln(Household Income) And Health Outcomes, All Non-Metro Ais

Outcome[c]	N	Mean	Direct effect of gaming		Direct effect of log income		Indirect effect of gaming through income	Total effect of Gaming		Percentage Effect of Gaming	
			1		2		3	4		5	
Smoking	12,455	0.3666	-0.0071		0.5612	***	0.0350	0.0279	a	7.6184	a
Heavy Drinking	10,229	0.0501	-0.0057		0.2085		0.0130	0.0073	.	14.5994	.
Binge Drinking	1,747	4.6927	-0.4739		0.2575		0.0161	-0.4579	.	-9.7567	.
Obesity	12,093	0.5798	0.0433	***	0.0009	**	0.0001	0.0433	a	7.4737	a
Overweight	12,094	0.6670	0.0474	***	0.0001	**	0.0000	0.0474	a	7.1133	a
Poor Health	11,381	0.2517	0.0018		0.8726	***	0.0545	0.0563	a	22.3508	a
Hypertension	10,548	0.2175	0.0042		0.6733	**	0.0421	0.0462	a	21.2405	a
Diabetes	12,452	0.1219	0.0098		0.1202	***	0.0075	0.0173	a	14.2250	a
High Cholesterol	5,565	0.3045	-0.0118		0.4885		0.0305	0.0187	.	6.1498	.
Asthma	7,764	0.1045	-0.0153		0.0648	***	0.0040	-0.0112	a	-10.7442	a
Disability	2,440	0.2381	-0.0614	**	0.0017	**	0.0001	-0.0613	a	-25.7609	a
Health Plan	11,873	0.7175	-0.0156		0.1741	***	0.0109	-0.0047	a	-0.6522	a
Forgone Care	10,257	0.1590	-0.0359	***	0.0000	***	0.0000	-0.0359	a	-22.5704	a
Poor Mental Health (days)	9,882	4.4361	-0.4136		0.0756	***	0.0047	-0.4088	b	-9.2160	b
Depression (days)	938	4.2796	-0.6491		0.3242	**	0.0202	-0.6289	b	-14.6943	b
Anxiety (days)	1,559	6.4886	-1.1847		0.0574	***	0.0036	-1.1811	b	-18.2022	b
ln(Income)	11,062	9.9973	0.0317		N/A						

* p<0.05, ** p<0.01, *** p<0.001

[a] Wald chi-squared test for joint significance of income and gaming, significant at .05 level

[b] F-test for joint significance of income and gaming, significant at .05 level

1 [δ(h)/δ(casino 0-1)]

2 [δ(h)/δ(Y)]; note that Y is measured in $1,000

3 {[δ(h)/δ(Y)] *[δ(Y)/δ(casino 0-1)]};Y is measured in $1,000

4 {[δ(h)/δ(casino 0-1)] +[δ(h)/δ(Y)]* [δ(Y)/δ(casino 0-1)]}; note that Y is measured in $1,000

5 (col. 4/ mean)*100

[c] All outcomes regressed on full set of covariates

Table 11. Elasticity Estimates From Logistic Regression Of Health Outcomes On Ln (Household Income), All American Indians

Outcome[a]	n	Mean	Direct effect of log income		Elasticity
			1		2
Smoking	24,021	0.3583	-0.0320	***	-0.0894
Heavy Drinking	19,378	0.0533	0.0024		0.0454
Binge Drinking	3,425	4.7454	0.2430	*	0.0512
Obesity	23,304	0.5353	-0.0252	***	-0.0470
Overweight	23,309	0.6267	-0.0216	***	-0.0345
Poor Health	21,763	0.2387	-0.0692	***	-0.2900
Hypertension	20,357	0.2065	-0.0146	***	-0.0709
Diabetes	24,029	0.1044	-0.0178	***	-0.1708
High Cholesterol	10,843	0.3014	-0.0166	*	-0.0552
Asthma	13,949	0.1104	-0.0143	***	-0.1292
Disability	4,760	0.2408	-0.0450	***	-0.1868
Health Plan	22,904	0.7460	0.1623	***	0.2176
Forgone Care	20,006	0.1652	-0.0555	***	-0.3362
Poor Mental Health (days)	19,163	4.6304	-0.8436	***	-0.1822
Depression (days)	2,038	4.4480	-1.1323	***	-0.2546
Anxiety (days)	3,275	6.7298	-1.5012	***	-0.2231

* p<0.05, ** p<0.01, *** p<0.001

[a] All health outcomes regressed on covariates: income, age, age-squared, gender, education, marital status, employment status, county unemployment 1990, county per capita income 1990, county percent poverty 1990, year

Column 1 [δ(h)/δ(Y)]; see footnote a for covariates

Column 2 {[δ(h)/δ(Y)]/mean}

XI. APPENDIX

Appendix 1. Data Dictionary

Variable	Data Source	Level of Measurement	Description
Income	BRFSS	continuous	Household income per 10,000. Minimum 1.4787. Maximum 14.4067.
Gaming	collected	binary	Class III gaming tribe in county of residence. Minimum 0. Maximum 1.
Smoking	BRFSS	binary	Smoker. Minimum 0. Maximum 1.
Heavy Drinking	BRFSS	binary	At risk for heavy drinking. Minimum 0. Maximum 1.
Binge Drinking	BRFSS	continuous	Binge drinking days in past month (5+ drinks). Minimum 1. Maximum 76.
Obesity	BRFSS	binary	Overweight or obese. Minimum 0. Maximum 1.
Overweight	BRFSS	binary	BMI >= 25. Minimum 0. Maximum 1.
Poor health	BRFSS	binary	General health self-report - Poor/fair health. Minimum 0. Maximum 1.
Hypertension	BRFSS	binary	At risk for hypertension. Minimum 0. Maximum 1.
Diabetes	BRFSS	binary	Diabetic. Minimum 0. Maximum 1.
High Cholesterol	BRFSS	binary	High Cholesterol. Minimum 0. Maximum 1.
Asthma	BRFSS	binary	Asthmatic. Minimum 0. Maximum 1.
Disability	BRFSS	binary	Activity limited due to physical, mental, emotional problems. Minimum 0. Maximum 1.
Health Plan	BRFSS	binary	Has any kind of health coverage. Minimum 0. Maximum 1.
Forgone Care	BRFSS	binary	Needed to see a doctor, but couldn't because of cost. Minimum 0. Maximum 1.
Mental Health	BRFSS	continuous	Poor mental health days in past month. Minimum 0. Maximum 30.
Depression	BRFSS	continuous	Depressed days in past month. Minimum 0. Maximum 30.
Anxiety	BRFSS	continuous	Anxiety days in past month. Minimum 0. Maximum 30.
Age	BRFSS	continuous	Age. Minimum 18. Maximum 99.
Age Squared	BRFSS	continuous	Age-squared. Minimum 324. Maximum 9801.
Female	BRFSS	binary	Female. Minimum 0. Maximum 1.
Race/ethnicity	BRFSS	categorical	Race/ethnicity: non-Hispanic white. Minimum 0. Maximum 1.
	BRFSS		Race/ethnicity: non-Hispanic black. Minimum 0. Maximum 1.
	BRFSS		Race/ethnicity: Hispanic, non-AI. Minimum 0. Maximum 1.
	BRFSS		Race/ethnicity: AI. Minimum 0. Maximum 1.
	BRFSS		Race/ethnicity: other. Minimum 0. Maximum 1.
Educational Attainment	BRFSS	categorical	Education: less than high school. Minimum 0. Maximum 1.
	BRFSS		Education: high school or GED. Minimum 0. Maximum 1.
	BRFSS		Education: some college. Minimum 0. Maximum 1.
	BRFSS		Education: college graduate. Minimum 0. Maximum 1.
Marital status	BRFSS	categorical	Marital status: married. Minimum 0. Maximum 1.
	BRFSS		Marital status: divorced. Minimum 0. Maximum 1.
	BRFSS		Marital status: widowed. Minimum 0. Maximum 1.
	BRFSS		Marital status: separated. Minimum 0. Maximum 1.
	BRFSS		Marital status: never married. Minimum 0. Maximum 1.
	BRFSS		Marital status: cohabiting. Minimum 0. Maximum 1.
Employment Status	BRFSS	categorical	Employment status: working. Minimum 0. Maximum 1.
	BRFSS		Employment status: not working, economically active. Minimum 0. Maximum 1.
	BRFSS		Employment status: not working, economically inactive. Minimum 0. Maximum 1.
Year (1988-2003)	BRFSS	binary	Survey year. Minimum 0. Maximum 1.
Per Capita Income	ARF	continuous	County per capita income in thousands, 1990. Minimum 0.7263. Maximum 3.8794.
Percent Poverty	ARF	continuous	County percent poverty. Minimum 2.2. Maximum 63.1.

Appendix 2. Household income categories, Behavioral Risk Factors Surveillance System 1988-2003

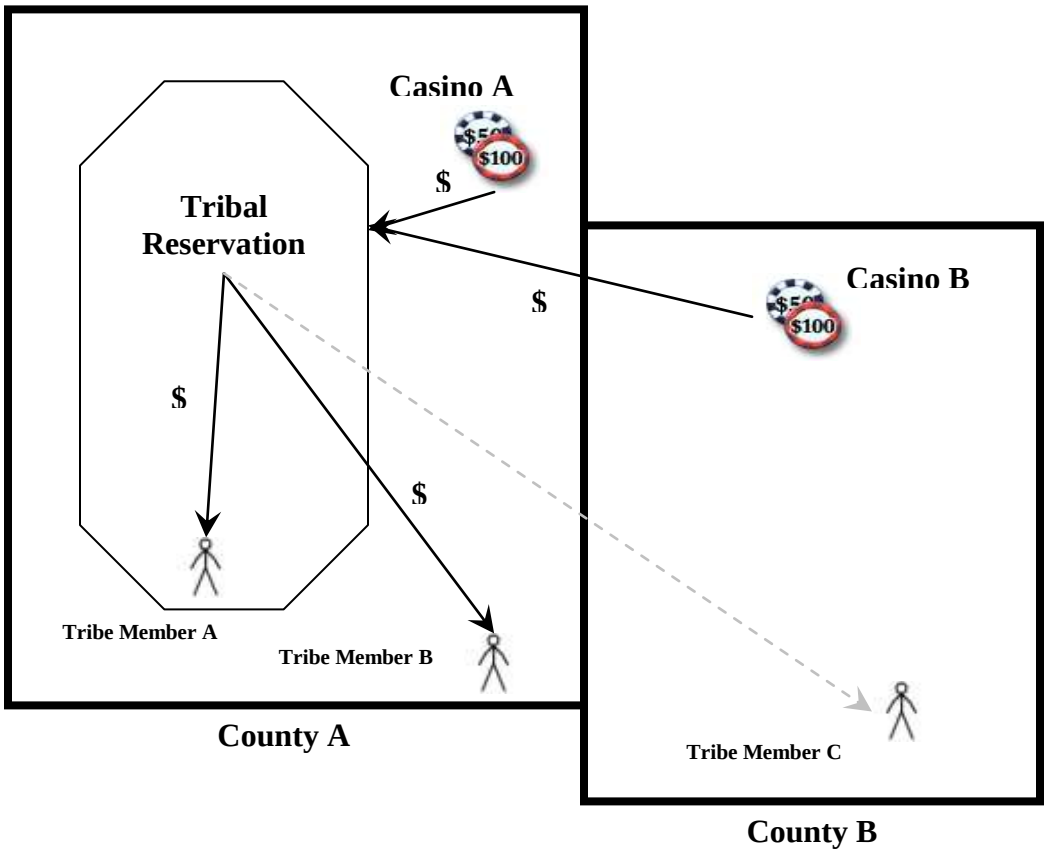
1988-1993:
1= less than $10,000
2= $10,000-$15,000
3= $15,000-$20,000
4= $20,000-$25,000
5= $25,000-$35,000
6= $35,000-$50,000
8= over $50,000
7= Don't know/not sure
9= refused

1994-2003:
1= less than $10,000
2= $10,000-$15,000
3= $15,000-$20,000
4= $20,000-$25,000
5= $25,000-$35,000
6= $35,000-$50,000
7= $50,000-$75,000
8= over $75,000
77= Don't know, not sure
99= Refused

Appendix 3. Model of casino revenue flows for current analysis.

Our models assume that revenue from tribal casinos (located anywhere) ultimately reach tribal members through the tribes themselves. We are able to estimate income changes for on-reservation AIs (Tribe Member A), off-reservation AIs who live in the same county as federally recognized tribal land (Tribe Member B), but not tribal members who do not live in the same county as the tribal land (Tribe Member C).

In the following schematic, revenues from Casinos A and B, both of which are owned by the tribe located in County A are assumed to flow to the Tribe and then to Tribe Members A and B (but not C). We assume that all AIs who live in a county with tribal land are members of that tribe.



Appendix Table 4. Estimated Effects Of Class III Tribal Gaming On Household Income And Health Outcomes, All American Indians

Outcome[c]	N	Mean	Direct effect of gaming		Direct effect of income		Indirect effect of gaming through income	Total effect of Gaming		Percent Change due to Gaming	
			1		2		3	4		5	
Smoking	24,021	0.3583	-0.0433	***	-0.00110	***	-0.0013	-0.0445	[a]	-12.4273	[a]
Heavy Drinking	19,378	0.0533	-0.0042		0.00008		0.0001	-0.0042		-7.7947	
Binge Drinking	3,425	4.7454	-0.5228		0.01398	**	0.0161	-0.5068	[b]	-10.6794	[b]
Obesity	23,304	0.5353	0.0379	***	-0.00076	***	-0.0009	0.0370	[a]	6.9147	[a]
Overweight	23,309	0.6267	0.0417	***	-0.00074	***	-0.0009	0.0408	[a]	6.5107	[a]
Poor Health	21,763	0.2387	-0.0102		-0.00225	***	-0.0026	-0.0128	[a]	-5.3613	[a]
Hypertension	20,357	0.2065	-0.0015		-0.00041	***	-0.0005	-0.0020	[a]	-0.9582	[a]
Diabetes	24,029	0.1044	0.0080	*	-0.00062	***	-0.0007	0.0073	[a]	6.9814	[a]
High Cholesterol	10,843	0.3014	-0.0080		-0.00045	***	-0.0005	-0.0085	[a]	-2.8210	[a]
Asthma	13,949	0.1104	-0.0162	*	-0.00028	*	-0.0003	-0.0165	[a]	-14.9210	[a]
Disability	4,760	0.2408	-0.0520	***	-0.00092	**	-0.0011	-0.0531	[a]	-22.0449	[a]
Health Plan	22,904	0.7460	-0.0101		0.00381	***	0.0044	-0.0058	[a]	-0.7720	[a]
Forgone Care	20,006	0.1652	-0.0247	***	-0.00221	***	-0.0025	-0.0273	[a]	-16.5079	[a]
Poor Mental Health (days)	19,163	4.6304	-0.5478	**	-0.01290	***	-0.0148	-0.5626	[b]	-12.1499	[b]
Depression (days)	2,038	4.4480	-1.0887	*	-0.02407	**	-0.0277	-1.1164	[b]	-25.0990	[b]
Anxiety (days)	3,275	6.7298	-1.2072	**	-0.02244	**	-0.0258	-1.2330	[b]	-18.3214	[b]
Income[d]	21,342	17.4078	1.1490	**							

* p<0.05, ** p<0.01, *** p<0.001

[a] Wald chi-squared test for joint significance of income and gaming, significant at .05 level

[b] F-test for joint significance of income and gaming, significant at .05 level

[c] All health outcomes regressed on covariates: income, gaming, age, age-squared, gender, education, marital status, employment status, county unemployment 1990, county per capita income 1990, county percent poverty 1990, year

[d] Income regressed on covariates: gaming, age, age-squared, gender, education, marital status, employment status, county unemployment 1990, county per capita income 1990, county percent poverty 1990, year

Column 1 [δ(h)/δ(casino 0-1)]

Column 2 [δ(h)/δ(Y)]; note that Y is measured in $1,000

Column 3 {[δ(h)/δ(Y)] *[δ(Y)/δ(casino 0-1)]};Y is measured in $1,000

Column 4 {[δ(h)/δ(casino 0-1)] +[δ(h)/δ(Y)]* [δ(Y)/δ(casino 0-1)]}; note that Y is measured in $1,000

Column 5 (col. 4/ mean)*100

Appendix Table 5. Estimated Effects Of Class III Tribal Gaming On Household Income And Health Outcomes,
American Indians Living In Counties Connected To Tribal Gaming
By 2003

Outcome[c]	N	Mean	Direct effect of gaming		Direct effect of income		Indirect effect of gaming through income	Total effect of Gaming		Percent Change due to Gaming	
			1		2		3	4		5	
Smoking	8,954	0.3440	-0.0271	**	-0.0009	***	-0.0025	-0.0296	[a]	-8.5975	[a]
Heavy Drinking	7,510	0.0489	0.0012		-0.0001		0.0000	0.0012		2.4065	
Binge Drinking	1,432	4.2612	0.0518		0.0023		0.0061	0.0579		1.3591	
Obesity	8,696	0.5730	-0.0015		-0.0008	**	-0.0021	-0.0036	[a]	-0.6279	[a]
Overweight	8,698	0.6620	0.0023		-0.0006	*	-0.0016	0.0007		0.0985	
Poor Health	8,090	0.2237	0.0025		-0.0019	***	-0.0051	-0.0026	[a]	-1.1738	[a]
Hypertension	7,546	0.2082	-0.0065		-0.0005	*	-0.0012	-0.0077	[a]	-3.7137	[a]
Diabetes	8,952	0.1174	-0.0061		-0.0007	***	-0.0018	-0.0078	[a]	-6.6524	[a]
High Cholesterol	4,039	0.2919	0.0019		-0.0005		-0.0014	0.0005		0.1637	
Asthma	5,397	0.0952	0.0003		-0.0007	**	-0.0018	-0.0015	[a]	-1.5878	[a]
Disability	1,832	0.2051	-0.0287		-0.0009		-0.0023	-0.0310	[a]	-15.1073	[a]
Health Plan	8,490	0.7313	-0.0059		0.0041	***	0.0110	0.0051	[a]	0.6927	[a]
Forgone Care	7,367	0.1459	-0.0042		-0.0018	***	-0.0047	-0.0089	[a]	-6.0963	[a]
Poor Mental Health (days)	7,010	4.1466	0.0703		-0.0135	**	-0.0357	0.0346	[b]	0.8341	[b]
Depression (days)	795	3.4717	0.1999		-0.0105		-0.0277	0.1721		4.9577	
Anxiety (days)	1,381	5.8306	0.0638		-0.0230		-0.0608	0.0030		0.0518	
Income[d]	7,993	21.1410	2.6478	***							

* p<0.05, ** p<0.01, *** p<0.001
[a] Wald chi-squared test for joint significance of income and gaming, significant at .05 level
[b] F-test for joint significance of income and gaming, significant at .05 level

[c] All health outcomes regressed on covariates: income, gaming, age, age-squared, gender, education, marital status, employment status, county unemployment 1990, county per capita income 1990, county percent poverty 1990, year

[d] Income regressed on covariates: gaming, age, age-squared, gender, education, marital status, employment status, county unemployment 1990, county per capita income 1990, county percent poverty 1990, year

Column 1 [δ(h)/δ(casino 0-1)]

Column 2 [δ(h)/δ(Y)]; note that Y is measured in $1,000

Column 3 {[δ(h)/δ(Y)] *[δ(Y)/δ(casino 0-1)]};Y is measured in $1,000

Column 4 {[δ(h)/δ(casino 0-1)] +[δ(h)/δ(Y)]* [δ(Y)/δ(casino 0-1)]}; note that Y is measured in $1,000

Column 5 (col. 4/ mean)*100

Appendix Table 6: BRFSS 2000 Weighted Descriptives, all race/ethnicities

	Total Sample		
Variable	**n**	**Mean**	**Std. Dev.**
Household Income	144019	51172.88	35490.00
Log of Household Income	144019	10.57	0.80
Gaming	166301	0.09	-
Smoking	165876	0.22	-
Drinking	34709	0.05	-
Obesity	159695	0.50	-
Overweight	159695	0.50	-
Poor/Fair Health	165996	0.15	-
Hypertension	17407	0.25	-
Diabetic	166148	0.06	-
High Cholesterol	12181	0.31	-
Asthma	163848	0.07	-
Disability	58212	0.16	-
Health Plan	165968	0.86	-
Forgone Care	166041	0.11	-
Binge Drinking (days)	5716	4.12	5.55
Poor Mental Health (days)	163861	3.21	7.24
Depression (days)	57136	3.06	6.46
Anxiety (days)	56876	5.07	8.28
Age	166301	45.36	17.43
Age Squared	166301	2361.26	1734.59
Female	166301	0.52	-
Education: Less Than High School	166301	0.05	-
Education: High School or GED	166301	0.08	-
Education: Some College	166301	0.59	-
Education: College Graduate	166301	0.28	-
Marital Status: Married	166301	0.59	-
Marital Status: Divorced	166301	0.10	-
Marital Status: Widowed	166301	0.07	-
Marital Status: Separated	166301	0.02	-
Martial Status: Never Married	166301	0.19	-
Marital Status: Cohabiting	166301	0.03	-
Employment Status: Working	166301	0.64	-
Employment Status: Not Working, Economically Active	166301	0.11	-
Employment Status: Not Working, Economically Inactive	166301	0.24	-
County Per Capita Income, 1990	166301	1.85	0.46
County Percent in Poverty	166301	13.01	6.22
County Unemployment Rate	166301	4.08	1.43