

## Potential Disease Reduction and Health Care Cost Savings from A Hypothetical Comprehensive Smoke-Free Law in Nevada

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### Abstract

**Objectives:** To estimate the effect of a hypothetical smoke-free legislation on hospital admissions and emergency department visits attributable to major groups of smoking related diseases and the resulting health care cost savings.

**Methods:** Three years (2016-2018) of Nevada emergency department (ED) visit and inpatient data were used for analysis. The total charge of a hospitalization or an ED visit was used to estimate total health care cost savings by using estimates of potential reductions in ED visits and hospitalizations obtained from a meta-analysis based on 45 domestic and international studies of three major smoking related clinical conditions: coronary, cerebrovascular, and respiratory conditions.

**Results:** Overall, there was substantial reduction in number of hospital admissions and ED visits for all three primary conditions following the hypothetical law. The estimated annual healthcare cost savings for coronary events was about \$305 million, \$136 million for cerebrovascular events, and \$132 million for respiratory events.

**Conclusion:** Comprehensive smoke-free laws, which prohibit tobacco smoke in enclosed public spaces to protect public health, can significantly reduce health spending and save lives in Nevada and nationwide. The findings add to the increasing evidence suggesting that comprehensive smoke-free policies protect health and reduce health care spending.

### Keywords

Smoking, Healthcare spending, Smoke-Free Policy

## Introduction

Although smoking has declined from 20.9% in 2005 to 13.7% in 2018 in United States, nearly 34 million adults are current cigarette smokers (Creamer et al., 2019) and more than 16 million lived with a smoking-related disease (Center for Disease Control & Prevention [CDC], 2019). Exposure to secondhand smoke [SHS] also accounts for substantial premature morbidity and mortality (CDC, 2019) related to both, lung cancer (Zhong et al., 2000) and coronary heart disease (Khoramdad et al., 2020). Additionally, disease and loss of production due to workplace exposure to SHS costs the U.S. economy an estimated \$5.6 billion each year (CDC, 2019).

According to Surgeon General's report, there is no level of SHS that is risk free (CDC, 2019). The only way to effectively eliminate involuntary exposure to SHS is to make all indoor areas completely smoke free. Evidence-based comprehensive, sustained, and accountable smoke free laws have exhibited reduction in number of smokers, smoking related diseases, deaths, as well as health care spending in different states (Tan & Glantz, 2012; Lightwood & Glantz, 2016).

Gambling, a major industry employing more than 400,000 hospitality workers, significantly influences smoke free policy in Nevada (American Nonsmokers Rights Foundation, 2019). Unlike comprehensive smoke free laws in some states (Tynan et al., 2016), Nevada passed a partial smoking control law called the Nevada Clean Indoor Act, which prohibits smoking in all indoor places but with blanket exemptions to casinos, brothels, tobacco stores, and bars (Nevada Tobacco Prevention Coalition, n.d.). Nevada's lung cancer rate and mortality from cardiovascular events continues to exceed national rates and about \$1.08 billion of Nevada's total annual healthcare cost was attributed to smoking related diseases in 2019 (Nevada Tobacco Prevention Coalition, n.d.). We estimate the effect of a hypothetical comprehensive smoke-free legislation on hospitalizations and emergency department visits and resulting savings in health care cost due to three major clinical conditions in Nevada.

## Methods

Three years of Nevada inpatient and emergency department (ED) visit data, from 2016 to 2018, were used for analysis. Smoking related clinical conditions were categorized into three broad categories: coronary, cerebrovascular, and respiratory conditions, each having further subcategories. The coronary events were divided into acute and chronic coronary conditions, the cerebrovascular conditions were

divided into ischemic stroke and hemorrhagic stroke, while the respiratory conditions were divided into lung infections and chronic obstructive pulmonary disease (COPD). The International Classification of Diseases, 10<sup>th</sup> Edition, (ICD-10) diagnostic codes were used to identify conditions belonging in these three categories.

Number of ED visits or hospitalization and inflation-adjusted (adjusted to 2016 dollars) total charge of an inpatient hospitalization or an ED visit due to the selected clinical conditions were used to calculate potential economic outcome of the smoke free law. First, we estimated potential reductions in hospitalization and ED visits after hypothetical smoke-free legislation by applying condition-specific relative risk estimates obtained from a meta-analysis based on 45 studies.<sup>5</sup> According to this study, smoke-free laws, on average may reduce the risk of coronary and cerebrovascular events by 16%. For respiratory events, it reduces risk by 24%. Then, we calculated the smoke free law's health care cost savings by multiplying the mean (i.e., average), standardized deviation, and range of the total charges for each clinical condition with number of cases reduced for each that clinical category.

## Results

Table 1 shows the projected effects of smoking ban on health care cost of coronary, cerebrovascular, and respiratory conditions in Nevada for both, emergency and inpatient care. There was a total of 1,58,968 ED visits and 98,640 hospital discharges related to selected clinical conditions from 2016 to 2018. Overall, the projected number of hospitalizations and emergency department (ED) visits decreased by 16% (41,217 cases) for three major groups of diseases from January 2016 till December 2018 after implementation of a hypothetical smoke-free law. Reduction in all the three types of major events contributed \$1.5 billion towards health care cost savings in three years, with an annual average total of \$500 million. Given the total population of Nevada was 2,887,725 in 2017, the average annual reduction per capita was about \$176. Coronary events alone accounted for approximately \$290 million towards annual inpatient healthcare savings and about \$15 million towards annual emergency healthcare cost savings. Cerebrovascular and respiratory events contributed about \$112 million and about \$130 million towards annual inpatient health care cost savings, respectively. Reduction in emergency department visits for respiratory and cerebrovascular events will contribute to savings of about \$5 million and \$50 million annually, respectively.

## Discussion

We find that adopting a comprehensive smoke free legislation (like one currently in place in many states/municipalities) would yield substantial health care cost savings in Nevada. These savings represent a 2.1% reduction in total annual health care expenditure for the state of Nevada. Our findings add to the existing body of strong evidence regarding the salutary economic impact of smoke free laws (Lightwood & Glantz, 2016). Nevada is fairly unique in having two large population centers with a thriving gaming and hospitality industry that employs a large work force regularly exposed to secondhand smoke (American Nonsmokers Rights Foundation, 2019). The industry has resisted prior attempts at adopting smoke free laws (Mandel & Glantz, 2004), fearing that cumbersome building regulations and smoking restrictions will deter potential customers and impose other costs on the industry. While some of these concerns may be real, it is unclear whether smoke free laws will, in the aggregate, deter gaming customers, since some customers with smoking related illness may find gaming services more attractive after the passage of a smoke free laws. Moreover, any rational cost-benefit calculus must evaluate such costs against potential savings resulting from such laws. Such a calculus must also consider the potential economic losses to employers due to their employees who smoke in the form of workplace absenteeism and loss of productivity (Asay et al., 2016).

The main limitation of our study is that because the cost of care data was not available in the dataset, the total charge was used to approximately estimate the cost. The total charges may in some cases overstate the total healthcare expenditures paid by insurers and patients since payers often negotiate discounted rates with providers. Conversely, some real costs of care, including (non-hospital employee) physician's fees, are not included in the total charge estimates. The other limitation is that Nevada residents who went to hospitals outside of Nevada (e.g., Utah, California) were not included in the datasets.

Exposure to secondhand smoke is still a major public health issue despite a decrease in smoking prevalence. Our study supports the assertion that smoke-free laws are low-cost, safe, and effective way to reduce secondhand smoke exposure, in turn leading to reduction in number of hospitalizations and health care expenditures for various major diseases.

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**Table 1. Projected Effects of Smoking Ban on Hospital Care Cost in Nevada (2016-2018)**

	2016	2017	2018	Total	2016	2017	2018	Total
	Inpatient Care Cost				Emergency Care Cost			
<b>Acute Coronary conditions</b>								
No. of cases	6203	6471	6611	19285	1578	1540	1520	4638
Average charge (\$)	\$154,354	\$159,450	\$159,134		\$19,099	\$19,426	\$19,244	
Adjusted No. of cases	5211	5436	5553	16199	1326	1294	1277	3896
Total charge (\$)								
- Without Smoking Ban	\$957,457,304	\$1,031,799,915	\$1,052,033,287	\$3,041,290,506	\$30,138,869	\$29,916,779	\$29,250,318	\$89,305,966
- With Smoking Ban	\$804,264,135	\$866,711,928	\$883,707,961	\$2,554,684,025	\$25,316,650	\$25,130,095	\$24,570,267	\$75,017,011
\$ Saved	\$153,193,169	\$165,087,986	\$168,325,326	\$486,606,481	\$4,822,219	\$4,786,685	\$4,680,051	\$14,288,955
<b>Chronic Coronary Conditions</b>								
No. of cases	9714	5435	4169	19318	3214	2330	2141	7685
Average charge (\$)	\$107,743	\$135,399	\$146,358		\$25,515	\$26,999	\$23,961	
Adjusted No. of cases	8160	4565	3502	16227	2700	1957	1798	6455
Total charge (\$)								
- Without Smoking Ban	\$1,046,617,931	\$735,895,630	\$610,165,001	\$2,392,678,562	\$82,006,303	\$62,908,719	\$51,300,694	\$196,215,715
- With Smoking Ban	\$879,159,062	\$618,152,329	\$512,538,601	\$2,009,849,992	\$68,885,294	\$52,843,324	\$43,092,583	\$164,821,201
\$ Saved	\$167,458,869	\$117,743,301	\$97,626,400	\$382,828,570	\$13,121,008	\$10,065,395	\$8,208,111	\$31,394,514
<b>Hemorrhagic Stroke</b>								
No. of cases	1328	1396	1414	4138	452	534	523	1509
Average charge (\$)	\$170,329	\$189,101	\$226,417		\$15,552	\$15,731	\$16,780	
Adjusted No. of cases	1116	1173	1188	3476	380	449	439	1268
Total charge (\$)								
- Without Smoking Ban	\$226,197,350	\$263,985,177	\$320,153,581	\$810,336,109	\$7,029,432	\$8,400,349	\$8,776,081	\$24,205,862
- With Smoking Ban	\$190,005,774	\$221,747,549	\$268,929,008	\$680,682,332	\$5,904,723	\$7,056,293	\$7,371,908	\$20,332,924
\$ Saved	\$36,191,576	\$42,237,628	\$51,224,573	\$129,653,777	\$1,124,709	\$1,344,056	\$1,404,173	\$3,872,938
<b>Ischemic Stroke</b>								
No. of cases	4031	4175	4421	12627	876	903	1121	2900
Average charge (\$)	\$95,224	\$102,090	\$108,831		\$26,781	\$28,401	\$28,170	
Adjusted No. of cases	3386	3507	3714	10607	736	759	942	2436
Total charge (\$)								
- Without Smoking Ban	\$383,847,178	\$426,225,249	\$481,139,641	\$1,291,212,068	\$23,459,981	\$25,645,787	\$31,578,929	\$80,684,696
- With Smoking Ban	\$322,431,630	\$358,029,209	\$404,157,298	\$1,084,618,137	\$19,706,384	\$21,542,461	\$26,526,300	\$67,775,145
\$ Saved	\$61,415,548	\$68,196,040	\$76,982,342	\$206,593,931	\$3,753,597	\$4,103,326	\$5,052,629	\$12,909,551
<b>Lung Infection</b>								
No. of cases	8250	6772	7941	22963	20099	19855	19252	59206
Average charge (\$)	\$63,091	\$57,185	\$60,454		\$5,925	\$6,112	\$6,327	
Adjusted No. of cases	6,930	5,688	6,670	19,289	16,883	16,678	16,172	49,733
Total charge (\$)								
- Without Smoking Ban	\$520,502,730	\$387,254,179	\$480,066,088	\$1,387,822,996	\$119,084,967	\$121,349,988	\$121,801,628	\$362,236,583
- With Smoking Ban	\$437,222,293	\$325,293,510	\$403,255,514	\$1,165,771,317	\$100,031,372	\$101,933,990	\$102,313,368	\$304,278,730
\$ Saved	\$83,280,437	\$61,960,669	\$76,810,574	\$222,051,679	\$19,053,595	\$19,415,998	\$19,488,261	\$57,957,853
<b>Chronic Obstructive Pulmonary Diseases (COPD)</b>								
No. of cases	6451	7643	6215	20309	26518	28503	28009	83030

Average charge (\$)	\$53,817	\$54,564	\$48,547		\$6,858	\$7,103	\$7,145	
Adjusted No. of cases	5419	6420	5221	17060	22275	23943	23528	69745
Total charge (\$)								
- Without Smoking Ban	\$347,173,596	\$417,036,397	\$301,719,854	\$1,065,929,847	\$181,862,831	\$202,465,645	\$200,111,421	\$584,439,896
- With Smoking Ban	\$291,625,821	\$350,310,574	\$253,444,677	\$895,381,071	\$152,764,778	\$170,071,142	\$168,093,594	\$490,929,513
\$ Saved	\$55,547,775	\$66,725,824	\$48,275,177	\$170,548,775	\$29,098,053	\$32,394,503	\$32,017,827	\$93,510,383