

Smoke-Free Ordinances in Mississippi Predict Lower Hospital Admission Rates for Acute Cardiovascular, Stroke, and Pulmonary Events

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Abstract

Purpose: Although Mississippi does not have statewide smoke-free legislation, 157 municipalities in Mississippi have smoke-free ordinances. This study compares hospital admission rates for acute cardiovascular, stroke, and pulmonary events for counties with and without smoke-free county seats.

Methods: The Mississippi Inpatient Outpatient Data System provided admission data. Admission rates for tobacco smoke related events were compared using ANCOVAs, adjusting for county demographics. Admission rates for events not associated with tobacco smoke were also compared.

Results: Admission rates for tobacco smoke related events were lower in counties with smoke-free seats (152.5) than those without smoke-free seats (173.7), $p < .05$. There were no differences in admission rates for events not associated with tobacco smoke (18.0 vs 16.4, ns).

Conclusions: The findings of this study suggest that smoke-free ordinances predict lower hospital admissions for tobacco smoke related health events. Broader protections from tobacco smoke at the state-level could improve health and reduce healthcare costs.

Key Words: Tobacco smoke pollution, hospital admissions, smoke-free ordinances

There are more than 7,000 chemicals in tobacco smoke. Among the 250 chemicals that are known to be harmful to health, at least 69 are carcinogenic.¹ The harms of tobacco smoke exposure to non-smokers are well documented, and include both acute and chronic diseases.²⁻⁴ These health risks from exposure also generate substantial healthcare costs to the state. Annual Medicaid direct costs due to exposure to secondhand smoke exceed \$36 million.⁵

In order to improve health and reduce healthcare costs, twenty-five states and the District of Columbia have implemented statewide smoke-free legislation for indoor public places, including restaurants, bars, and workplaces. Mississippi has not yet implemented statewide legislation. However, 157 municipalities in Mississippi have enacted local smoke-free ordinances (as of 1 February 2018) in order to protect their citizens from tobacco smoke in indoor public spaces (although 13 of these municipalities have exemptions for bars or other establishments).

Numerous studies have shown that smoke-free legislation is associated with decreased hospital admissions for myocardial infarction and other cardiovascular events,⁶⁻¹⁴ strokes,¹⁵ and respiratory events.^{7,16-19} To illustrate, admissions for coronary heart disease in Bowling Green,

KY, decreased by 39% the year after the city implemented a smoke-free ordinance, whereas admission rates did not change in a matched control city (Kent, OH).²⁰ These studies examined admissions for numerous types of acute events, in very different types of places, from small cities to states, and even entire countries. Although the methods and the size of reductions in admissions have varied across studies, the general finding of a reduction in admissions for acute events related to tobacco smoke exposure has remained consistent.

Within Mississippi, our previous research from controlled observational studies demonstrated that hospital admissions for heart attacks in both Starkville and Hattiesburg decreased substantially following the implementation of the smoke-free ordinances.²¹ Starkville residents experienced a 27.7% reduction in heart attack admissions compared to the 14.8% reduction observed among those who did not live in Starkville, while Hattiesburg residents experienced a 13.4% reduction in heart attack admissions compared to the 3.8% reduction observed among those who did not live in Hattiesburg. In both municipalities, the observed decrease in heart attack admissions was much higher than that observed in control communities that did not have a smoke-free ordinance.

This study expands this body of observational research by using a state-wide database of hospital admissions in Mississippi to examine the relationship between local smoke-free ordinances and hospital admissions for acute myocardial, stroke, and pulmonary events.

Methods

This study applied a controlled observational approach to objectively examine hospital admission rates for adverse health events related to tobacco smoke, such as acute myocardial, stroke, and pulmonary events. Specifically, we compared admission rates in counties with a county seat that had implemented a smoke-free ordinance to counties that had not. Admission data are currently available for the years 2013 to 2016 from the Mississippi Inpatient Outpatient Data System (IODS), maintained by the Mississippi Hospital Association and the Mississippi State Department of Health.

Unit of Analysis

Admission rates within Mississippi counties were selected as the unit of analyses. Rates per 10,000 residents rather than total admissions were examined in order to standardize admissions across counties with different population sizes. Counties were selected as the unit of analyses because the IODS does not provide data on patients' municipality of residence. Although the IODS includes zip code data for patients, the US Census does not provide the population data by zip codes necessary to calculate rates.

Mississippi's 82 counties are classified based on whether or not the county seat had a smoke-free ordinance in place during the study period (2013-2016). For the ten counties with two county seats, classification was based on the municipality with the higher population. Within Mississippi, 28 counties were classified as not having a smoke-free county seat and 36 had a smoke-free county seat for all four years of the study period. Sixteen counties became smoke-free during the study period and two did so after 2016 (Table 1).

Table 1. Mississippi counties

County	County Seat	Smoke-Free Ordinance
Adams County	Natchez	None
Alcorn County	Corinth	2007
Amite County	Liberty	None
Attala County	Kosciusko	2007
Benton County	Ashland	None
Bolivar County	Cleveland	None
Calhoun County	Pittsboro	2015
Carroll County	Vaiden	2012
Chickasaw County	Houston	None
Choctaw County	Ackerman	None
Claiborne County	Port Gibson	None
Clarke County	Quitman	After 2016
Clay County	West Point	None
Coahoma County	Clarksdale	2014
Copiah County	Hazlehurst	None
Covington County	Collins	2008
DeSoto County	Hernando	2007
Forrest County	Hattiesburg	2007
Franklin County	Meadville	2015
George County	Lucedale	2013
Greene County	Leakesville	2016
Grenada County	Grenada	2009
Hancock County	Bay Saint Louis	None
Harrison County	Gulfport	2008
Hinds County	Jackson	2010
Holmes County	Lexington	2016
Humphreys County	Belzoni	2010
Issaquena County	Mayersville	2005
Itawamba County	Fulton	None
Jackson County	Pascagoula	2013
Jasper County	Bay Springs	None
Jefferson County	Fayette	2015
Jefferson Davis County	Prentiss	2010
Jones County	Laurel	2008
Kemper County	De Kalb	None
Lafayette County	Oxford	2006
Lamar County	Purvis	None
Lauderdale County	Meridian	2010
Lawrence County	Monticello	2012
Leake County	Carthage	None
Lee County	Tupelo	2006
Leflore County	Greenwood	2007
Lincoln County	Brookhaven	2011
Lowndes County	Columbus	2010
Madison County	Canton	2012
Marion County	Columbia	None
Marshall County	Holly Springs	2016

County	County Seat	Smoke-Free Ordinance
Monroe County	Aberdeen	2007
Montgomery County	Winona	None
Neshoba County	Philadelphia	None
Newton County	Decatur	None
Noxubee County	Macon	2016
Oktibbeha County	Starkville	2006
Panola County	Batesville	2010
Pearl River County	Poplarville	2015
Perry County	New Augusta	2012
Pike County	Magnolia	After 2016
Pontotoc County	Pontotoc	2008
Prentiss County	Booneville	2012
Quitman County	Marks	2011
Rankin County	Brandon	2015
Scott County	Forest	2012
Sharkey County	Rolling Fork	2011
Simpson County	Mendenhall	2014
Smith County	Raleigh	None
Stone County	Wiggins	2013
Sunflower County	Indianola	2012
Tallahatchie County	Charleston	2015
Tate County	Senatobia	2015
Tippah County	Ripley	None
Tishomingo County	Iuka	2015
Tunica County	Tunica	None
Union County	New Albany	2011
Walthall County	Tylertown	None
Warren County	Vicksburg	None
Washington County	Greenville	2007
Wayne County	Waynesboro	None
Webster County	Walthall	None
Wilkinson County	Woodville	2014
Winston County	Louisville	2014
Yalobusha County	Water Valley	None
Yazoo County	Yazoo	None

Admission Classification

Findings are based on the principle diagnosis for each hospital admission. This code is for the condition established after study to be chiefly responsible for occasioning the admission of the patient to the hospital for care.²² That is, the code is for the primary reason that the patient was admitted to the hospital. We identified admissions with principle diagnosis ICD-9/10 codes to select admissions for cardiovascular, respiratory, and control conditions in Mississippi. Based on prior research, we selected three cardiovascular conditions (acute myocardial infarction, angina, and ischemic stroke; I20-I25, I63-I66, G45, G46),^{6,7,9,10,23-27} and three respiratory conditions (asthma, chronic obstructive pulmonary disease, and bronchitis or pneumonia; J40, J41, J32, J43, J44, J45, J46, J12-J18, J20).^{7,16,17} Previous research demonstrates a relationship between smoking bans and rates of admission to hospital for these acute conditions. We selected acute cholecystitis (K81), bowel obstruction (K56), and appendicitis (K35, K36, K37) as control conditions.⁷ Hospital admissions because of these conditions should be independent of any changes in smoking legislation, given that no known relationship exists between these conditions and smoke exposure.

County Admission Rates

Admissions with a primary diagnosis code meeting inclusion criteria

were aggregated at the county level for each year of the study. The resulting data set included the annual total number of admissions for tobacco-related and control diseases for each county. Rates per 10,000 for each year were calculated for each county by dividing the total number of admissions by the county population, and then multiplying by 10,000.

Analyses

Analyses are based on annual hospital admission rates for each of the 82 Mississippi counties from 2013 to 2016. Over this four year period, there are 328 county-years for these counties. Among these, 180 county-years had a smoke-free county seat and 148 did not. We conducted one-way ANCOVAs to compare rates of hospital admissions in counties with and without smoke-free ordinances implemented in the county seat. County demographics serving as covariates in the ANCOVA included percent of residents with health insurance, ratio of primary care providers to resident, percent of residents with college degrees, median income, and prevalence of cigarette smoking among adults. None of the covariates had a correlation coefficient greater than 0.8 with another covariate.

Results

Admission rates for tobacco-related health events ranged from 37.40 to 316.54 per 10,000 residents, with an average rate of 160.62. Admission rates for health events unrelated to tobacco smoke exposure ranged from 0.0 to 44.88, with an average rate of 17.00.

Hospital admissions for health events related to tobacco smoke were significantly higher in counties without smoke-free ordinances in the county seat (173.7 per 10,000 residents) than counties with a smoke-free ordinance (152.5 per 10,000 residents) [$F(1,312)=4.8, p=0.029$]. Admissions for the health events serving as controls were the same in counties without smoke-free ordinances in the county seat (18.0 per 10,000 residents) than those with a smoke-free county seat (16.4 per 10,000 residents) [$F(1,314)=2.8, ns$].

Follow-up analyses compared admission rates for the sub-categories of tobacco smoke related health events; acute coronary, stroke, asthma, COPD, and pneumonia events. Admission rates for pneumonia (50.5 vs 60.2) [$F(1,312)=4.8, p=0.029$] and stroke (35.7 vs 33.7) [$F(1,312)=4.6, p=0.032$] were statistically lower in counties with smoke-free ordinances. Admission rates were also lower for acute coronary, asthma, and COPD, but the differences were not statistically significant.

Discussion

The Institute of Medicine is an independent, nonprofit organization that works outside of the government. Their mission is to provide unbiased and authoritative advice to the federal government on policy matters pertaining to the health of the public. Based on an independent review of all of the relevant research this institute concluded that the consistent findings from these studies confirms that smoking bans decrease the rate of heart attacks.²⁸

Consistent with the IOM report and previous research, admission data from Mississippi hospitals revealed that smoke-free ordinances were associated with lower admission rates for health events related to tobacco smoke exposure. Fewer hospital admissions for tobacco related health events were found to be associated with the implementation of a smokefree ordinance. Moreover, there were no differences in admission rates for health events unrelated to tobacco smoke. When considered in the context of the growing body of research linking smoke-free policies to reductions in hospital admission, this demonstrates that

Mississippi could experience a substantial decrease in heart attacks, as well as substantial cost savings, if more communities and/or the state implemented smoke-free legislation.

Despite the increasing evidence that smoke-free legislation has immediate and long-term health benefits, states and municipalities may be reluctant to implement smoke-free legislation due to concerns about public support or loss of tax revenue from the hospitality sector. However, public support for a state-wide smoke-free law is robust. According to our 2016 Mississippi Social Climate Survey of Tobacco Control, more than three-quarters of Mississippi adults (75.2%) favor a state law prohibiting smoking in most indoor places, including workplaces, public buildings, offices, restaurants, & bars. Support is nonpartisan, Republicans (79.5%) and Democrats (75.5%) are equally supportive of a state law.²⁹

In addition to strong public support, prior research reveals no harmful economic consequences of smoke-free legislation. Numerous studies have found that tax revenue from restaurants and bars remained stable or increased slightly after implementation of smoke-free legislation.³⁰⁻³⁵ Within Mississippi, our analysis of Tourism and Economic Development (TED) Tax revenue found no evidence that smoke-free ordinances had an adverse effect on the local hospitality industry. Analyses of TED tax revenue indicated that inflation-adjusted tax revenues increased slightly during the 12 months following implementation of the smoke-free ordinance, whereas there was no change in revenue in aggregated control municipalities.³⁶

Limitations

There are several limitations to this research. First, most of the smoke-free ordinances that impacted our more populated areas of the state occurred before the IODS was in existence. There were not substantial changes in the percentage of the Mississippi population protected from 2013 to 2016. Thus, it is not possible to conduct pre/post analyses of admissions in these areas. Second, counties were the unit of analysis and were categorized by their county seat. Although more geographically precise data on residence are available in the IODS, the Census does not provide population data at the zip code level. The number of people residing in a geographic area is needed in order to compute admission rates. Third, a small number of county seats did not have a smoke-free ordinance, but other municipalities in the county did have one. These counties were classified as not having a smoke-free ordinance. However, if this classification strategy biased the results, it would have been against our hypothesis. Finally, although admission rates were also lower for acute coronary, asthma, and COPD, these differences were not statistically significant.

Conclusions

Consistent with the IOM report and previous research, the findings of this study suggest that smoke-free ordinances predict lower hospital admissions for tobacco smoke related health events. Broader protections from tobacco smoke at the state-level could improve health and reduce healthcare costs. Moreover, the public strongly supports these protections and smoke-free legislation has not been found to hurt tax revenues. □

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