Smoke-Free Ordinances in Mississippi Predict *Lower Hospital Admission Rates* for Acute Cardiovascular, Stroke, + 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.

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THIS PAPER SUMMARIZES INDEPENDENT RESEARCH BASED ON THE INPATIENT OUTPATIENT DATA SYSTEM (IODS). THE MISSISSIPPI HOSPITAL ASSOCIATION AND THE MISSISSIPPI STATE DEPARTMENT OF HEALTH MAINTAIN THE IODS. THE INFORMATION, VIEWS, AND OPINIONS CONTAINED HEREIN ARE THOSE OF THE AUTHORS AND DO NOT NECESSARILY REFLECT THE VIEWS AND OPINIONS OF THESE ORGANIZATION.

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American Academy of Pediatrics
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{INTRODUCTION}

The harms of tobacco smoke exposure to non-smokers are well documented, and include both acute and chronic diseases. 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.

Numerous studies have shown that smoke-free legislation is associated with decreased hospital admissions for myocardial infarction and other cardiovascular events, strokes, and respiratory events. 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 smoke-free ordinances. 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.

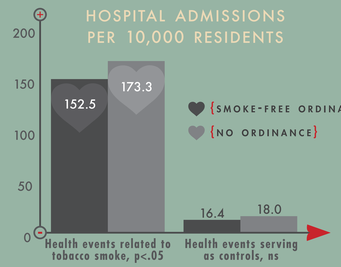
Mississippi's 82 counties were classified based on whether or not the county seat had a smoke-free ordinance in place during the study period (2013-2016). For the ten counties with two county seats, classification was based on the municipality with the higher population. Within Mississippi, 28 counties 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.

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. That is, the code is for the primary reason that the patient was admitted to the hospital. We identified admissions with principal 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 and three respiratory conditions (asthma, chronic obstructive pulmonary disease, and bronchitis or pneumonia.) We selected acute cholecystitis, bowel obstruction, and appendicitis as control conditions. 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.

Conditions Related to SHS Exposure		Control Conditions	
Cardiovascular conditions (acute myocardial infarction, angina, and ischemic stroke)	I20-I25, I63-I66, G45, G46	**Acute cholecystitis**	K81
Respiratory conditions (asthma, chronic obstructive pulmonary disease, and bronchitis or pneumonia)	J40, J41, J32, J43, J44, J45, J46, J12-J18, J20	**Bowel obstruction**	K56
		Appendicitis	K35, K36, K37



{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}

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 smoke-free 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 statewide smoke-free law is robust. According to our 2017 Mississippi Social Climate Survey of Tobacco Control, more than three-quarters of Mississippi adults (71.1%) 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.

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. 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.

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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