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Smoke-free Laws and Indoor Air Pollution in Lexington and Louisville

Secondhand smoke (SHS) exposure is the third leading cause of preventable death in the United States.¹ SHS is a mixture of the smoke from the burning end of tobacco products (sidestream smoke) and the smoke exhaled by smokers (mainstream smoke).^{1,2} Secondhand smoke is a major source of indoor air pollution containing a complex mixture of more than 4,000 chemicals, more than 50 of which are cancer-causing agents.^{1,2} Secondhand smoke is known to cause cancer^{2,3} and is associated with an increased risk for lung cancer and coronary heart disease in nonsmoking adults.^{1,2,3}

Approximately 60 percent of people in the United States have biological evidence of secondhand smoke exposure.⁴ Among children aged less than 18 years, an estimated 22 percent are exposed to secondhand smoke in their homes, with estimates ranging from 11.7 percent in Utah to 34.2 percent in Kentucky.⁵

The purpose of this study was to (a) assess the impact of Lexington-Fayette County's smoke-free law on indoor air quality; and (b) compare air quality in Lexington, Ky. after the ordinance was enacted with air quality in Louisville, Ky. without a smoke-free law. Indoor fine particle concentrations were measured before and after the smoke-free law went into

effect in Lexington and during the second time period in Louisville.

Although many states and local communities have adopted strong workplace smoking restrictions, the tobacco-growing states lag behind in protecting workers from the dangers of secondhand smoke.² In July 2003, the Lexington-Fayette Urban County Council passed Kentucky's first smoke-free law by an 11-3 vote. After a seven-month legal delay, the smoke-free law was implemented on April 27, 2004. The law prohibits smoking in most public places including, but not limited to, restaurants, bars, bowling alleys, bingo halls, convenience stores, laundromats, and other businesses open to the public. There are 1,903 U.S. municipalities with local clean indoor air laws, 358 of which provide 100 percent smoke-free protection, as of Jan. 4, 2005 (<http://www.no-smoke.org/pdf/mediaordlist.pdf>). About one-third of the U.S. population is protected by a local or state smoke-free indoor air law.⁶

Indoor fine particle concentrations were measured using the Aerocet 531 photometer before and after the smoke-free law went into effect in Lexington and during the second time period in Louisville. The monitor was calibrated against a gravimetric measurement of particulate matter with

Some countries that have enacted forms of smoke-free policies

Armenia	New Zealand
Australia	Norway
Bhutan	Pakistan
Bulgaria	Romania
Canada, Ottawa	Russia
China, Hong Kong	Scotland
England	South Korea
Germany	Spain
Greece	Sweden
India	Thailand
Ireland	Tanzania
Italy	Uganda
Iran	Vietnam
Japan, Tokyo	Wales
Newfoundland	Zimbabwe
Netherlands	

Some states that have enacted forms of smoke-free policies

California	Massachusetts
Connecticut	Maine
Delaware	New York
Florida	South Dakota
Idaho	Utah



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2.5 micrometer in diameter and smaller (2.5PM) in a series of laboratory experiments to ensure accuracy. The first phase (before the smoke-free law was scheduled to go into effect in Lexington) was conducted Friday and Saturday from 7:30 p.m. to 12:30 a.m. in September 2003. The second phase (after the law was in effect in Lexington and in Louisville without a smoke-free law) was conducted during the same time periods in September 2004. The average time spent in each venue was 43 minutes. The number of people inside, the number of burning cigarettes, and building characteristics were recorded. Of the 10 establishments in each city, three were restaurants, three were bars, and four were other venues including two music clubs, a bowling alley, and a coffee house. Measurement in one Lexington location was excluded because of apparent smoking after the smoke-free law.

Indoor Air Pollution in Lexington Dropped 91 percent after the Smoke-free Law

Among the nine Lexington locations before the smoke-free law went into effect, indoor 2.5PM concentrations ranged from 21 to 422 $\mu\text{g}/\text{m}^3$, with an average of 199 $\mu\text{g}/\text{m}^3$ (see Figure 1 on page 394). After the smoke-free law was implemented, average indoor 2.5PM concentrations in the same locations was 18 $\mu\text{g}/\text{m}^3$, which was 11 times lower than before the smoke-free law. While there is no federal or state standard for indoor air quality, the National Ambient Air Quality Standard for 2.5PM is 65 $\mu\text{g}/\text{m}^3$ for 24 hours.⁷

Smoke-free Laws Significantly Improve Indoor Air Quality

When air quality in 10 Louisville locations was measured in September 2004, indoor 2.5PM concentrations ranged from 29 to 1,110 $\mu\text{g}/\text{m}^3$, with an average of 304 $\mu\text{g}/\text{m}^3$ (see Figure 2 on page 394). When comparing average indoor particulate levels in Lexington pre-ordinance and Louisville, air pollution was slightly higher in the Louisville venues (see Figure 3 on page 415). However, when comparing average indoor air pollution in Lexington post-ordinance to Louisville during the same time period, particulate levels were 17 times higher in Louisville without a smoke-free law. It is hypothesized that if Louisville enacted and enforced a comprehensive smoke-free ordinance, there would be a dramatic drop in indoor air pollution similar to the Lexington experience.

Indoor Air Pollution Increased As More Cigarettes Were Smoked

The data also were analyzed to identify factors such as building characteristics as well as smoking density that might explain the differences in indoor fine particle levels. Building characteristics included room size, number of persons present, description of the

venue, temperature, relative humidity, air pressure at entryways and maximum occupancy. Smoking density was calculated by the number of burning cigarettes per 100 m.³ Building characteristics and smoking density did not show a significant association with indoor fine particles. When smoking density was classified into three groups, there was a clear association between smoking density and indoor fine particles (see Figure 4 on page 415). When no cigarettes were burned, indoor particulate levels were $19.3 \pm 18.6 \mu\text{g}/\text{m}^3$. When less than one cigarette was burned in 100 m³, indoor levels were $194.3 \pm 312.4 \mu\text{g}/\text{m}^3$. When more than one cigarette was burned, indoor levels were $300.0 \pm 212.2 \mu\text{g}/\text{m}^3$.

Conclusions

Similar to other studies, we found a significant improvement in air quality as a result of implementing a smoke-free law. One California study showed an 82 percent average decline in air pollution after smoking was prohibited.⁸ In Delaware, 90 percent of the respirable suspended particle (RSP) level in hospitality venues was attributed to tobacco smoke in a study conducted before and after implementation of their statewide smoke-free law.⁹ When indoor air quality was measured in 20 hospitality venues in western New York, average levels of RSP decreased 84 percent in these venues after the smoke-free law took effect.¹⁰

While the measurement of actual improvement in respiratory and/or cardiac health was beyond the scope of this study, there is empirical evidence that smoke-free laws not only improve air quality but they also lead to better health outcomes. When a smoke-free law was implemented in Helena, Montana, the number of admissions for acute myocardial infarction fell significantly in just six months after implementation of the law.¹¹ As a result, the Centers for Disease Control and Prevention issued a warning to all patients with heart disease to avoid secondhand smoke exposure. In another study of bartenders in San Francisco after a smoke-free law went into effect, mean FEV₁ values improved significantly after controlling for personal smoking and recent upper respiratory tract infections.¹² As Louisville continues to debate the proposal to prohibit smoking in public places and workplaces, these data provide empirical evidence that workers and patrons would indeed breathe easier as a result of a comprehensive smoke-free ordinance. **LM**

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2. National Toxicology Program. *10th Report on Carcinogens*. Research Triangle Park, NC: U.S. Department of Health and Human Services, Public Health Service, National Toxicology Program, December 2002.

references continued on page 409

Smoke-Free Laws & Indoor Air Pollution Graphs 1 & 2

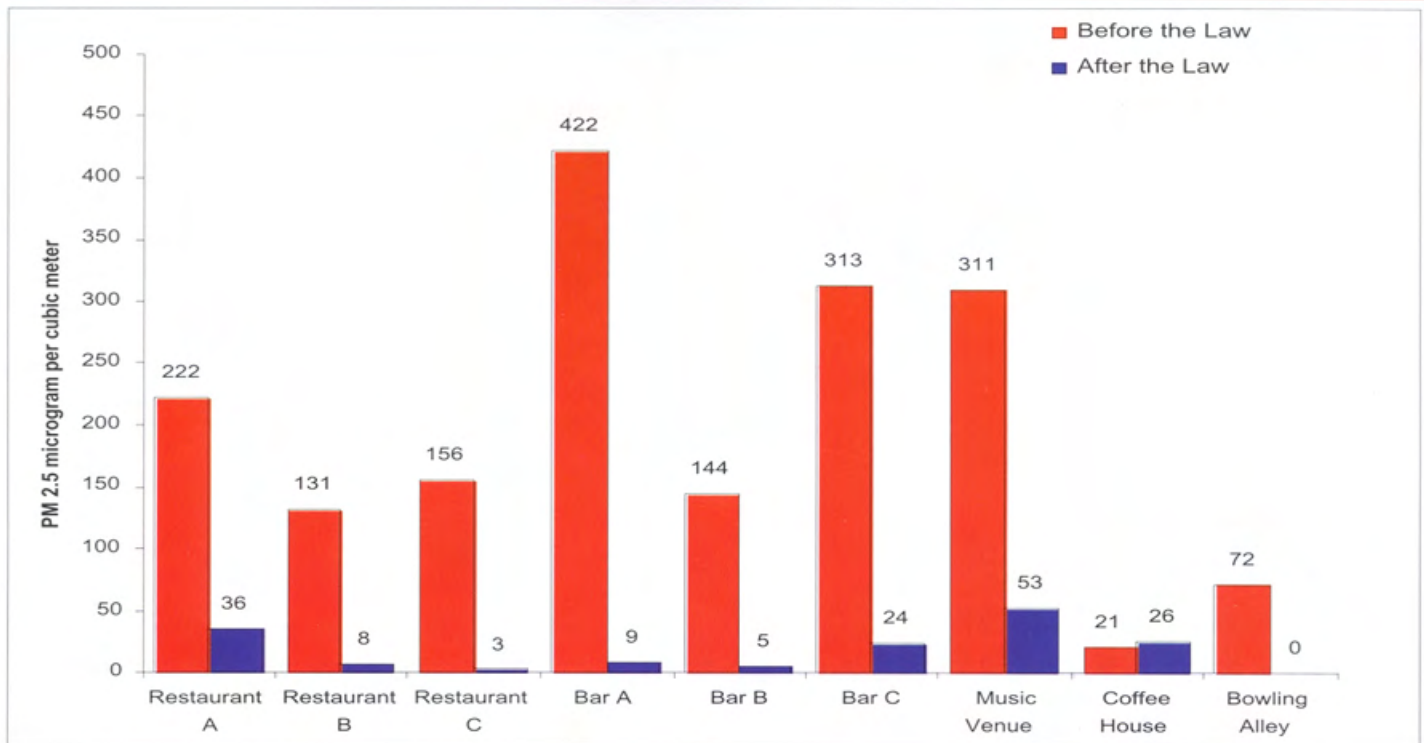


Figure 1. Indoor air quality in nine Lexington venues before and after implementation of the smoke-free law

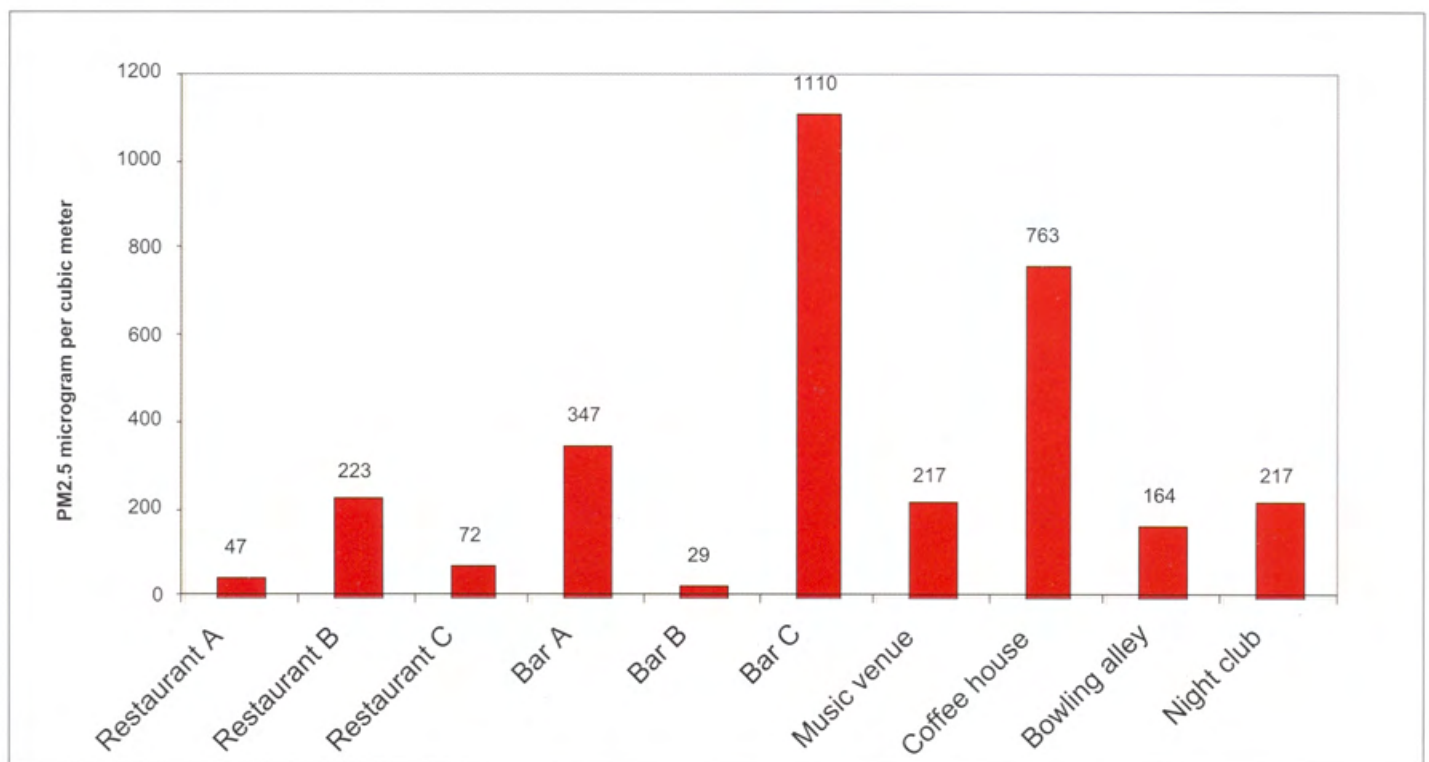


Figure 2. Indoor particulate levels in 10 Louisville venues, September 2004

ALLIANCE ACTIVITIES

Susan Yared, JCMS Alliance President



Feeling lucky? There is still time to make plans to come to the JCMSA's Monte Carlo Night on March 19 at Audubon Country Club. There will be plenty of food and fun, plus an opportunity to bid on great silent auction items. Come try your luck on our Blackjack tables, or maybe Texas Hold-'em is your game. We've got Craps and Roulette also. We will have a great piece of jewelry, donated by Moore Jewelry, which will be raffled off at the end of the evening. All proceeds from the Monte Carlo Night will go toward Alliance charities, including The Healing Place, Supplies Over Seas, McDowell House, Brennan House, Hospital Hospitality House and International Book Project. Please help us make this evening a success.

I would like to thank all of the members who have worked so hard to make this fund-raiser a success, especially **Shirley Jennings Wheeler, Betty Allen, Marie Schwab and Anita Garrison**. Their help has been invaluable. Also, thanks to all of our members who

have donated items to the silent auction. We could not succeed without your help.

For ticket information about the Monte Carlo Night, please contact Shirley Jennings Wheeler at 451-5068, or Susan Yared at 426-7761. We will be happy to help you.

We are in the process of taking applications for our Allied Health Scholarships. Application information is posted at most of the Jefferson County colleges. If you need information about these scholarships, please contact **Jennifer Bratton** at 243-8888. Invitations to our "Day at the Track" will be out shortly. This event will be April 30 at Churchill Downs, and will provide the funds for these scholarships. Plan to come see the newly-renovated Churchill Downs this year. It should be a great day.

Once again, thank you to all who help make the Alliance a success. LM

Smoke-free References . . . continued from page 392

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Smoke-Free Laws & Indoor Air Pollution Graphs 3 & 4

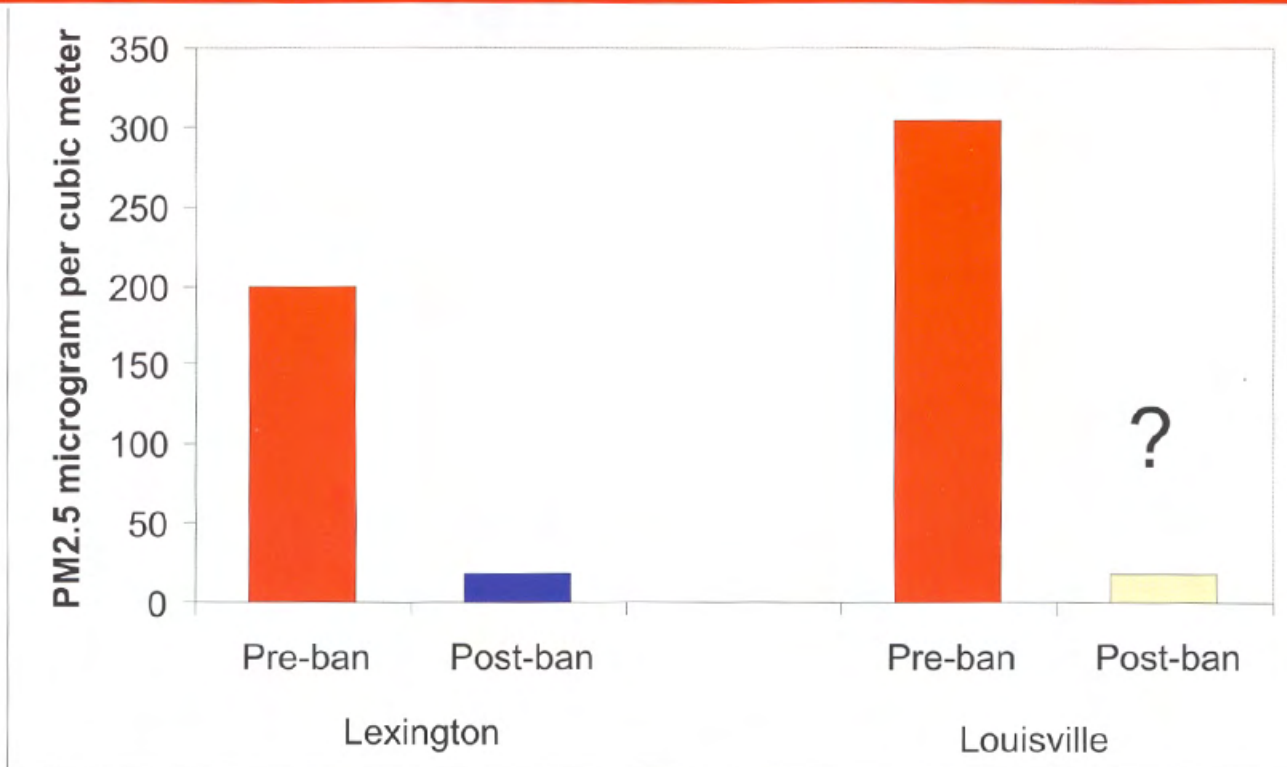


Figure 3. Average indoor particulate levels in Lexington pre- and post-ordinance and Louisville pre-ordinance

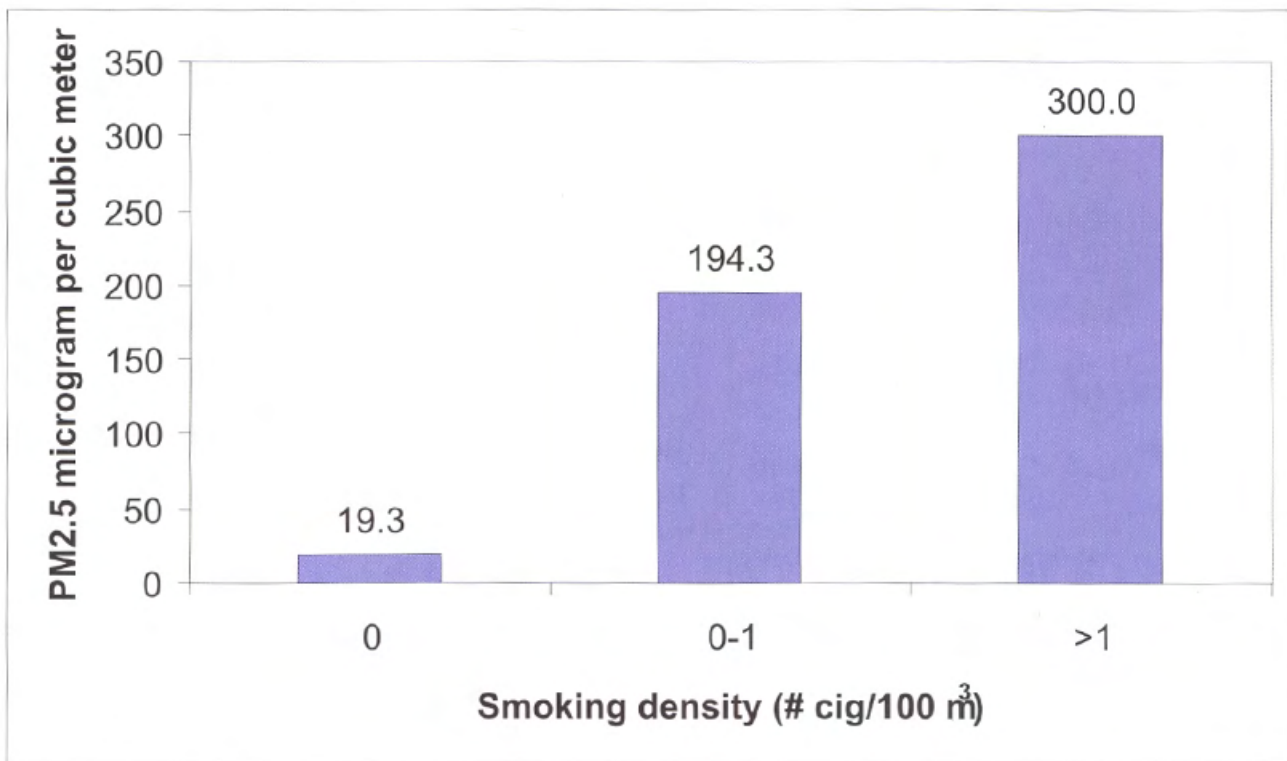


Figure 4. Air particle levels and the average number of burning cigarettes adjusted for room size