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SERVICES COMMITTEE

September 9, 2008

1:00 P.M.

A G E N D A

1. Smoking Ban - Stevens (1-37)
2. Items in Committee (38-39)

"Services Committee, to which should be referred matters relating to public safety, public works, urban county courts, and constitutional officers."

Council Rules & Procedures, Section 2.102(3)



Mayor Jim Newberry

LEXINGTON-FAYETTE URBAN COUNTY GOVERNMENT

Department of Law

TO: Dr. David Stevens, Councilmember at Large
Council Office

FROM: Department of Law

DATE: August 25, 2008

RE: Smoking Ban
Log No. 08-CC0785

Attached please find an updated draft revision of the smoking ban ordinance as suggested by Peggy Miller in her letter of August 22, 2008. Please let me know how I may be of further assistance.

Michael R. Sanner
Attorney Sr.

cc: Jim Newberry, Mayor
Joe Kelly, Sr. Administrator for Management
Rebecca Langston, Council Office

This memorandum is intended to remain confidential pursuant to the attorney-client privilege as it contains privileged or confidential information.

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DRAFT 8/25/08

ORDINANCE _____ - 2008

AN ORDINANCE AMENDING SECTION 14-97(1) OF THE CODE OF ORDINANCES RELATING TO SMOKING INDOORS TO AMEND THE DEFINITION OF BUILDING INCLUDE STRUCTURES WITH FORTY PERCENT (40%) OR MORE OF ITS PERIMETER ENCLOSED; AMENDING SECTION 14-97(2) OF THE CODE OF ORDINANCES RELATING TO SMOKING INDOORS TO AMEND THE DEFINITION OF DWELLING TO INCLUDE BUILDING; AMENDING SECTION 14-97(3) OF THE CODE OF ORDINANCES RELATING TO SMOKING INDOORS TO DELETE THE DEFINITION FOR ENCLOSED AREA AND REPLACE IT WITH A DEFINITION FOR ESTABLISHMENT; AMENDING SECTION 14-97(4) OF THE CODE OF ORDINANCES RELATING TO SMOKING INDOORS TO AMEND THE DEFINITION OF PRIVATE ORGANIZATION TO DELETE ESTABLISHMENT; AMENDING SECTION 14-97(5) OF THE CODE OF ORDINANCES RELATING TO SMOKING INDOORS TO AMEND THE DEFINITION OF RETAIL TOBACCO STORE CHANGING FIFTY PERCENT (50%) TO TWENTY-FIVE PERCENT (25%); AMENDING SECTION 14-97(6) OF THE CODE OF ORDINANCES RELATING TO SMOKING INDOORS TO AMEND THE DEFINITION OF SMOKE OR SMOKING TO INCLUDE BURNING OR CARRYING OF A TOBACCO PRODUCT; AMENDING SECTION 14-97(7) OF THE CODE OF ORDINANCES RELATING TO SMOKING INDOORS TO DELETE THE DEFINITION FOR TOBACCO WAREHOUSE AND REPLACE IT WITH A DEFINITION FOR WORKPLACE IN BUILDINGS OR A PORTION THEREOF; AMENDING SECTION 14-98(1) OF THE CODE OF ORDINANCE RELATING TO SMOKING INDOORS TO PROHIBIT SMOKING IN AN ESTABLISHMENT OR WORK PLACE; AMENDING SECTION 14-98(1)(a) OF THE CODE OF ORDINANCES RELATING TO SMOKING INDOORS TO DELETE THE WORD "IN"; AMENDING SECTION 14-98(1)(b) OF THE CODE OF ORDINANCES RELATING TO SMOKING INDOORS TO DELETE THE WORD "IN" AND MOVE THE REMAINDER OF SECTION (b) TO SECTION (c); AMENDING SECTION 14-98(1)(c) RELATING TO SMOKING INDOORS TO ALLOW FOR EXCEPTIONS FOR PRIVATE GATHERINGS, TREATMENT OF NICOTINE ADDICTION BY LICENSED HEALTHCARE PROFESSIONALS INDEPENDENTLY VENTILATED ROOMS IN HOSPITAL, HOSPICE OR NURSING HOMES; AMENDING SECTION 14-98(1)(d) OF THE CODE OF ORDINANCES TO ALLOW AN EXCEPTION FOR A RETAIL TOBACCO STORE; AMENDING SECTION 14-98(1)(e) OF THE CODE OF ORDINANCES RELATING TO SMOKING INDOORS TO ALLOW AN EXCEPTION FOR PERFORMERS IN A THEATRICAL PRODUCTION AND TO DELETE THE EXISTING SECTION; AMENDING SECTION 14-98(1)(f) OF THE CODE OF ORDINANCES TO ALLOW AN EXCEPTION USED BY A PRIVATE ORGANIZATION NOT OPENED TO THE PUBLIC; DELETING SECTION 14-98(1)(g) OF THE CODE OF ORDINANCES RELATING TO SMOKING INDOORS IN A TOBACCO WAREHOUSE; AMENDING SECTION 14-98(2) OF THE CODE OF ORDINANCE RELATED TO SMOKING INDOORS TO INCLUDE BUILDING OR ESTABLISHMENT; CREATING SECTION 14-98(4) OF THE CODE OF ORDINANCES RELATING TO SMOKING INDOORS MAKING BUILDINGS OWNED, LEASED OR OPERATED BY THE LEXINGTON-FAYETTE URBAN COUNTY GOVERNMENT SUBJECT TO THE PROVISIONS OF SECTIONS 14-97 TO 14-104; AMENDING SECTION 14-99(1) OF THE CODE OF ORDINANCES RELATING TO SMOKING INDOORS TO INCLUDE WORKPLACE; AMENDING SECTION 14-99(2) OF THE CODE OF ORDINANCES RELATING TO SMOKING INDOORS TO APPLY TO ANY BUILDING OR WORKPLACE; AMENDING SECTION 14-99(3) OF THE CODE OF ORDINANCES RELATING TO SMOKING INDOORS TO INCLUDE ASHTRAYS IN ESTABLISHMENTS; AMENDING SECTION 14-99(4) OF THE CODE OF ORDINANCES RELATING TO SMOKING INDOORS TO REPLACE THE WORD "DWELLING" WITH "BUILDING"; AMENDING SECTION 14-100(1) OF THE CODE OF ORDINANCES RELATING TO SMOKING INDOORS TO INCLUDE WORKPLACE; AMENDING SECTION 14-100(1)(a) OF THE CODE OF ORDINANCES RELATING TO SMOKING INDOORS TO ADD SMOKING MATERIALS; AMENDING SECTION 14-100(1)(b) OF THE CODE OF ORDINANCES RELATING TO SMOKING INDOORS TO INCLUDE ALL PERSONS IN CONTROL OF A BUILDING OR WORKPLACE TO DEMAND PERSONS WHO REFUSE TO STOP SMOKING TO LEAVE THE PREMISES; CREATING SECTION 14-100(1)(c) OF THE CODE OF ORDINANCES RELATING TO SMOKING INDOORS TO ALLOW REFUSAL OF SERVICE TO PERSONS

WHO ARE SMOKING; CREATING SECTION 14-100(1)(d) OF THE CODE OF ORDINANCES RELATING TO SMOKING INDOORS TO ALLOW PERSONS IN CONTROL OF BUILDINGS AND WORKPLACES TO TAKE LEGAL MEANS TO STOP SMOKING IN THE PREMISES; AMENDING SECTION 14-100(2) OF THE CODE OF ORDINANCES RELATING TO SMOKING INDOORS TO INCLUDE BUILDING, ESTABLISHMENT OR WORKPLACE; CREATING SECTION 14-100(3) OF THE CODE OF ORDINANCES RELATING TO SMOKING INDOORS EXEMPTING BUILDINGS COVERED IN SECTION 14-98; AMENDING SECTION 14-101 OF THE CODE OF ORDINANCES RELATING TO SMOKING INDOORS TO ALLOW ENFORCEMENT OF THIS SUBCHAPTER BY THE HEALTH DEPARTMENT; DELETING SECTION 14-102(2) OF THE CODE OF ORDINANCES RELATING TO SMOKING INDOORS; AMENDING SECTION 14-104 OF THE CODE OF ORDINANCES RELATING TO SMOKING INDOORS TO ALLOW ANY PERSON AGGRIEVED BY A VIOLATION OF THIS SECTION TO APPLY FOR INJUNCTIVE OR OTHER LEGAL RELIEF.

BE IT ORDAINED BY THE COUNCIL OF THE LEXINGTON-FAYETTE URBAN COUNTY GOVERNMENT:

Section 1 — In order to serve the public health, safety and general welfare, it is the declared purpose of Sections 14-97 to 14-104 to prohibit smoking in all buildings open to the public: or used as workplaces:

Section 2 — That Sections 14-97 to 14-104 of the Code of Ordinances of the Lexington-Fayette Urban County Government be and hereby are amended to read as follows:

Section 3 – That Section 14-97 of the Code of Ordinances of the Lexington-Fayette Urban County Government be and hereby is amended to read as follows:

For the purpose of ~~sections~~ Sections 14-97 to 14-104, the following definitions shall apply unless the context clearly indicates or requires a different meaning:

- (1) *Building.* ~~Any structure enclosed from the weather, whether or not windows or doors are open. If a person leases or possesses only a portion of a building, the term "building" applies to the leasehold or possessory interest as well~~ area which is enclosed overhead by a roof or other covering of any material, whether permanent or temporary, and has forty (40) percent or more of its perimeter enclosed by walls, windows, doors, or other coverings of any material, whether permanent or temporary, or open or closed.
- (2) *Dwelling.* Any place ~~building~~ used primarily for sleeping

overnight and conducting activities of daily living, including, without limitation, a hotel or motel room or suite or a hospital, hospice or nursing home room, ~~but not a hotel, motel, hospital, hospice or nursing home lobby, common elevator, common hallway or other common area.~~

- (3) *Establishment.* ~~Enclosed area. An area that: Any business or other entity operating or otherwise located in a building or portion thereof.~~

(a) ~~Is closed in overhead by a roof or other covering of any material, whether permanent or temporary; and~~

(b) ~~Has forty (40) percent or more of its perimeter closed in by walls or other coverings of any material, whether permanent or temporary.~~

- (4) *Private organization.* ~~An establishment organization which is the owner, lessee, or occupant of a building used exclusively for the organization's purposes at all times, which maintains selective members, and is operated by the membership, does not The organization neither provides food, drink, nor lodging for pay to anyone who is not a member or a member's guest, nor permits others to provide food, drink, or lodging for pay to anyone who is not a member or a member's guest, and The organization has been granted an exemption from the payment of federal income tax as a club under 26 U.S.C. § 501. is not profit oriented.~~

- (5) *Retail tobacco store.* A retail store devoted primarily to the sale of any tobacco product, including but not limited to cigarettes, cigars, pipe tobacco and chewing tobacco, and accessories and in which the sale of other products is ~~merely~~ incidental. The sale of such other products shall be considered incidental if such sales generate less than ~~fifty (50)~~ twenty-five (25) percent

of the total annual gross sales.

- (6) *Smoke or smoking.* The act of inhaling or exhaling ~~the smoke from, or the burning or carrying of,~~ any lighted ~~or heated~~ cigarette, cigar, or pipe, or other combustible tobacco product.
- (7) ~~Tobacco warehouse.~~ Any warehouse building offering tobacco for purchase at auction and meeting the definition established in ~~KRS 248.010(4).~~ *Workplace.* Any building or portion thereof in which an establishment is located, including, but not limited to, work areas, private offices, lounges, restrooms, conference rooms, meeting rooms, classrooms, cafeterias, and hallways.

(Ord. No. 171-2003, § 2, 7-1-03)

Section 4 – That Section 14-98 of the Code of Ordinance of the Lexington-Fayette Urban County Government be and hereby is amended to read as follows:

- (1) No person shall smoke within any building to which the public is invited or permitted, any establishment therein or any workplace, except in one (1) of the following locations: The prohibition does not apply to the following locations, provided that smoke does not infiltrate into areas where smoking is prohibited under the provisions of Sections 14-97 to 14-104:
 - (a) ~~In any~~ Any dwelling. This exception does not extend to a lobby, common elevator, common hallway, or any other common area of a building containing attached dwelling units, ~~or~~ hotel ~~room~~ or motel rooms, but if a hospital, hospice, or nursing home permits smoking in its dwelling rooms, smoking is not allowed in any room shared with a nonsmoker without that person's consent.
 - (b) ~~A in a~~ room or hall being used by a person or group for a private social function that is not open to the public.
~~In any room used for psychological treatment of nicotine addiction by a licensed health care professional, or in a~~

~~physically separate and independently ventilated room in a hospital, hospice, or nursing home open to all residents as a smoking room and for no other purpose.~~

- ~~(c) In a retail tobacco store. Any room used for psychological treatment of nicotine addiction by a licensed health care professional, or in a physically separate and independently ventilated room in a hospital, hospice, or nursing home open to all residents as a smoking room and for no other purpose.~~

~~A performer as part of a theatrical production so long as adequate notice is provided patrons both before the performance and by specific signage at the theater.~~

- ~~(d) A retail tobacco store. A performer as part of a theatrical production so long as adequate notice is provided patrons both before the performance and by specific signage at the theater.~~

- ~~(e) Indoor smoking areas provided in governmental office buildings or workplaces pursuant to KRS 61.165. A theatrical production by a performer as part of the performance so long as adequate notice is provided patrons both before the performance and by specific signage at the theater.~~

- ~~(f) Facilities operated by private organizations. A building operated or used by a private organization, provided that the building is not open to the public.~~

- ~~(g) In a tobacco warehouse.~~

- (2) Nothing in this chapter shall prevent an owner, lessee, principal manager or person in control of any building or establishment therein, or any other place, including, without limitation, any motor vehicle, outdoor area, or dwelling, from prohibiting

smoking completely in any such place, ~~and no person shall fail to abide by such a private prohibition.~~

- (3) Nothing in this chapter shall authorize smoking in any place where it is otherwise prohibited by statute, ordinance, regulation or by order of the fire marshal.
- (4) All buildings owned, leased, operated by or under the jurisdiction of the Lexington-Fayette Urban County Government or any unit thereof shall be subject to the provisions of Sections 14-97 to 14-104 unless the Lexington-Fayette Urban County Government Council adopts a written policy pursuant to KRS 61.165 (3)(a) 1 or 2, in which event the written policy shall apply to the extent KRS 61.165(3) is controlling.

(Ord. No. 171-2003, § 2, 7-1-03)

Section 5 – That Section 14-99 of the Code of Ordinances of the Lexington-Fayette Urban County Government be and hereby is amended to read as follows:

- (1) ~~No An~~ owner, lessee, principal manager, or person in control of a building ~~or, an establishment in any building open to the public therein or a workplace~~ shall fail to post signs, with letters of not less than one (1) inch high or symbols no less than three (3) inches high, using the words "No Smoking" or the international "No Smoking" symbol (consisting of a pictorial representation of a burning cigarette enclosed in a red circle with a red bar across it) conspicuously either on all public entrances or in a position clearly visible on entry into the building or establishment therein.
- (2) The owner, ~~lessee operator~~, manager, ~~or designee person in control~~ or employee of every any building, establishment in a building open to the public therein or workplace shall inform persons violating ~~this chapter~~ Sections 14-97 to 14-104 of the applicable provisions thereof and require compliance.

- (3) All ashtrays ~~and other~~ that are intended to be used on the premises of an establishment for the collection of ashes, butts, or other residue from smoking paraphernalia shall be removed from any area where smoking is prohibited by ~~sections~~ Sections 14-97 to 14-104 and shall not be permitted by the owner, operator, manager or other person having control of the establishment. Any permanent structure that functioned or was used as an ashtray shall be disabled or altered to prevent its use as an ashtray.
- (4) The requirements of this section do not apply to any exempt dwelling building, establishment therein or workplace as set forth in Section 14-98.

(Ord. No. 171-2003, § 2, 7-1-03)

Section 6 – That Section 14-100 of the Code of Ordinances of the Lexington-Fayette Urban County Government be and hereby is amended to read as follows:

- (1) ~~No An~~ owner, lessee, principal manager, or person in control of a building, ~~or any establishment therein or workplace~~ shall fail to:
- (a) ~~Ask smokers~~ a person who is smoking to refrain from smoking ~~in any no-smoking area; and to extinguish any smoking materials.~~
 - (b) Demand that a person who is smoking leave the premises if the person refuses to refrain from smoking or refuses to extinguish any smoking materials after being asked to do so.
 - ~~(b) Use any other legal means which may be appropriate to further the intent of this chapter.~~
 - (c) Refuse service to a person who is smoking.
 - (d) Take necessary steps and use any other legal means which may be appropriate to stop a person from smoking

and further the intent of Sections 14-97 to 14-104.

- (2) No owner, ~~lessee~~, principal manager, proprietor, ~~on~~ employer, or any other person in control of a ~~business building, establishment therein or workplace~~ shall fail to ensure compliance by subordinates, employees, and agents with this ~~chapter. Sections 14-97 to 14-104.~~
- (3) The requirements of this section do not apply to any exempt building, establishment therein or workplace as set forth in Section 14-98.

(Ord. No. 171-2003, § 2, 7-1-03)

Section 7 – That Section 14-101 of the Code of Ordinances of the Lexington-Fayette Urban County Government be and hereby is amended to read as follows:

Enforcement of ~~sections~~ Sections 14-97 to 14-104 shall be by citation issued by the Lexington-Fayette Urban County Health Department. Notice of the provisions of the chapter shall be given by the Lexington-Fayette Urban County Government to all applicants for a business or other license. The Lexington-Fayette Urban County Health Department shall enforce the provisions of this subchapter through the issuance of citations, and, for this purpose, during times when employees are scheduled to work, may enter those portions of the building, establishment or workplace where employees perform their duties or take breaks, including, but not limited to, those areas where food and beverages, alcoholic or otherwise, are served, prepared or stored. Nothing herein shall be construed to prevent a citation officer of the Lexington-Fayette Urban County Health Department from issuing a citation for a violation of any provisions of Section 14-97 to 14-104 committed in his or her presence.

(Ord. No. 171-2003, § 2, 7-1-03)

Section 8 – That Section 14-102 of the Code of Ordinances of the Lexington-Fayette Urban County Government be and hereby is amended to read as follows:

- (1) Any person who violates any provision of ~~sections~~ Sections 14-97 to 14-104, including a person who smokes in an area where smoking is prohibited, shall be subject to the following

penalties:

- (a) A fine of one hundred dollars (\$100.00) for the first offense;
- (b) A fine of two hundred fifty dollars (\$250.00) for the second offense;
- (c) A fine of five hundred dollars (\$500.00) for the third and each subsequent offense.
- (d) Persons who smoke in an area where smoking is prohibited and who refuse to extinguish their smoking material when asked; may be required to leave the premises, and shall be subject to prosecution for trespass if they do not leave when asked.

~~(2) Each calendar day during which the violation occurs shall constitute a separate and distinct offense.~~

(Ord. No. 171-2003, § 2, 7-1-03)

Section 9 – That Section 14-104 of the Code of Ordinances of the Lexington-Fayette Urban County Government be and hereby is amended to read as follows:

No person or employer shall discharge, refuse to hire, or in any manner retaliate against an employee, applicant for employment, or customer because that employee, applicant, or customer exercises any rights afforded by ~~sections 14-97 to 14-104.~~ Sections 14-97 to 14-104. Any person aggrieved by a violation of Section 14-104 may apply for injunctive or other legal relief in any court of competent jurisdiction.

(Ord, No. 171-2003, § 2, 71-03)

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Summary of Research on Smoke-free Laws in Kentucky

Smoke-free laws dramatically improve air quality.¹

- Indoor air pollution in restaurants, bars, and other entertainment venues dropped 91% after Lexington's smoke-free ordinance went into effect.
- Lexington's air quality after the law took effect was 17 times better than Louisville's air quality before their partial law took effect.

Smoke-free laws improve workers' health.²

- Hair nicotine levels declined by 56% among smokers and nonsmokers working in restaurants and bars after Lexington's smoke-free ordinance took effect.
- Bar workers showed a larger decline in hair nicotine levels than restaurant workers.
- Restaurant and bar workers were less likely to report breathing problems after the law took effect, whether or not they smoked.

Smoke-free laws decrease emergency visits for asthma.³

- There was a 22% decline in emergency department visits for asthma in the 32 months after Lexington's smoke-free law.
- The decline was greater for adults than children (24% vs. 18%).

Smoke-free laws decrease smoking rates.⁴⁻⁶

- The smoking rate in Fayette county declined nearly 32% (from 25.7% before the smoke-free law to 17.5% after), while smoking rates remained stable in other similar Kentucky counties without smoke-free ordinances.
- Lexington's law resulted in 16,500 fewer smokers for an estimated annual healthcare cost savings of \$21 million.
- The longer smoke-free laws are in effect, the more likely smokers are to reduce cigarette consumption and quit smoking.

Smoke-free laws appeal to the public.⁷

- There was a significant increase in public support for Lexington's smoke-free law, from 56.7% before the law took effect to 64.0% six months afterwards.
- Since the smoke-free law took effect, there was a significant jump in perceived importance of smoke-free environments and concern about the harmful effects of exposure to secondhand smoke.

Smoke-free laws do not hurt business.^{8,9}

- Restaurant employment increased by about 3% and bar employment remained stable in the 14 months after Lexington's smoke-free ordinance went into effect.
- Bingo revenues have not declined after implementation of local smoke-free laws in Kentucky.

¹Lee, K., Hahn, E.J., Okoli, C.T.C., Repace, J., Troutman, A. Differential impact of smoke-free laws on indoor air quality. *Journal of Environmental Health*, 2008;70(8):24-30.

²Hahn E, Rayens M, York N, Okoli C, Zhang M, Al-Delaimy W. Effects of a smoke-free law on hair nicotine and respiratory symptoms in restaurant and bar workers. *Journal of Occupational and Environmental Medicine*, 2006; 48(9):906-913.

³Rayens, M.K., Burkhart, P.V., Zhang, M., Lee, S., Moser, D.K., Mannino, D., Hahn, E.J. Reduction in asthma-related emergency department visits after implementation of a smoke-free law. *Journal of Allergy and Clinical Immunology*, 2008;doi 10.1016/j.jaci.2008.06.029.

⁴Hahn, E.J., Rayens, M.K., Butler, K.M., Zhang, M., Durbin, E., Steinke, D. Smoke-free laws and adult smoking prevalence. *Preventive Medicine*, 2008;47:206-209.

⁵Hahn, E.J., Rayens, M.K., Langley, R.E., Darville, A., Dignan, M. Time since smoke-free law and smoking cessation behaviors. *pending review*.

⁶Hahn, E.J., Rayens, M.K., Ridner, S.L., Butler, K.M., Zhang, M., Staten, R.R. Smoke-free laws and smoking and drinking among college students. *pending review*.

⁷Rayens, M.K., Hahn, E.J., Langley, R.E., Hedgecock, S., Butler, K.M., Maggio, L. Public opinion and smoke-free laws. *Policy, Politics, & Nursing Practice*, 2007;8(4): 262-270.

⁸Pyles M, Mullineaux D, Okoli C, Hahn E. Economic impact of a smoke-free law in a tobacco-growing community. *Tobacco Control*, 2007;16(1):66-68.

⁹Pyles, M.K. Hahn, E.J. *Economic impact of smoke-free ordinances on charitable gaming in Kentucky*, unpublished report, University of Kentucky College of Nursing, August 18, 2008

Indoor Air Quality in Bingo Halls, Lexington, Kentucky, 2008

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July 10, 2008

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Executive Summary

Indoor air quality was assessed in five bingo halls in Lexington, Kentucky. Fine particulates were measured from February 15 to February 22, 2008, using the TSI SidePak AM510 Personal Aerosol Monitor. The average $PM_{2.5}$ level from the five locations was compared to the average $PM_{2.5}$ levels in the Georgetown bingo hall and a sample of Lexington hospitality venues before and after implementation of their smoke-free laws, as well as the National Ambient Air Quality Standard (NAAQS; $35\mu g/m^3$) for 24 hours.

Key findings of the study are:

- The level of indoor air pollution measured in the five Lexington bingo halls (average $PM_{2.5} = 237 \mu g/m^3$) was approximately 5.5 times higher than the Georgetown bingo hall post-law and 13 times higher than Lexington's post-law average $PM_{2.5}$ level in a sample of hospitality venues (see Figure 1). Further, the level of indoor air pollution in Lexington bingo halls was 6.8 times higher than the National Ambient Air Quality Standard for outdoor air.
- The average $PM_{2.5}$ levels in the five Lexington bingo halls ranged from 102 to $439 \mu g/m^3$ (see Figure 2). Air pollution in all five bingo halls exceeded the National Ambient Air Quality Standard for outdoor air.

Introduction

Secondhand smoke (SHS) contains at least 250 chemicals that are known to be toxic.^{1,2} There is no safe level of exposure to SHS.² SHS exposure is the third leading cause of preventable death in the United States.³ SHS is a mixture of the smoke from the burning end of tobacco products (sidestream smoke) and the smoke exhaled by smokers (mainstream smoke) and is known to cause cancer in humans.^{1,2,3} SHS exposure is a cause of heart disease and lung cancer in nonsmoking adults.¹⁻⁴ An estimated 3,000 nonsmokers die from lung cancer⁵ annually and over 46,000 nonsmokers die from heart disease² every year in the U.S due to secondhand smoke exposure. It is estimated that approximately 60% of people in the United States have biological evidence of SHS exposure.⁶

Currently in the U.S., 13,689 local municipalities are covered by either local or state 100% smoke-free laws in workplaces and/or restaurants and/or bars.⁷ It is estimated that approximately 65.1% of the U.S. population are protected by clean indoor air regulations that cover virtually all indoor worksites including bars and restaurants. There are 2,883 local ordinances or regulations that restrict smoking to some extent in workplaces across the United States and Washington D.C.⁷ The extent of protection provided by these laws vary widely from community to community.

Currently in Kentucky, 19 communities have enacted and 16 communities have implemented smoke-free laws or regulations. The most comprehensive ordinances/regulations, 100% smoke-free workplace *and* 100% smoke-free enclosed public place laws (including bingo halls), have been implemented in Georgetown, Morehead, Ashland, Elizabethtown, Hardin County (unincorporated areas), Madison County (Board of Health regulation) and Louisville. The next most comprehensive ordinances, 100% smoke-free enclosed public place laws, have been implemented in Lexington, Letcher County, Frankfort and Paducah. Danville recently enacted a 100% smoke-free workplace and enclosed public places law to be implemented in August 2008. Woodford County Board of Health recently adopted a 100% smoke-free workplace and enclosed public places regulation to be implemented in August 2008. Five communities have implemented partial smoke-free laws, protecting workers and patrons in some public venues: Daviess County, Henderson, Oldham County, Paintsville and Pikeville. Only Daviess County, the City of Henderson, Pikeville, and Paintsville's smoke-free ordinances contain specific language that exempts bingo parlors. Beattyville recently enacted a partial smoke-free workplace and enclosed public places law to be implemented in August 2008.

On April 27, 2004, Lexington-Fayette County implemented a smoke-free ordinance prohibiting smoking in all buildings open to the public including bingo parlors. According to the Lexington-Fayette County Health Department, the bingo halls have not been in compliance with the ordinance since the law took effect. A series of legal challenges over a three-year period debated whether Lexington's bingo halls and the high school booster clubs that operate bingo were eligible for the private clubs exemption of Lexington's law. The most recent ruling came on January 18, 2008, when Fayette Circuit Judge James Ishmael affirmed a 2005 District Court ruling that found that booster clubs qualify as private organizations under the Lexington-Fayette County smoke-free ordinance. Private organizations are exempt from the ordinance.

The purpose of this study was to (a) assess air quality in five Lexington bingo halls; and (b) compare the results to air quality in the Georgetown bingo hall and a sample of Lexington hospitality venues before and after the smoke-free laws took effect.

Methods

Between February 15 and February 22, 2008, indoor air quality was assessed in five Lexington bingo halls, Kentucky. The Georgetown bingo hall was visited on September 16, 2005 before the smoke-free law took effect and January 28, 2006 during the post-law period.

TSI SidePak AM510 Personal Aerosol Monitor



A TSI SidePak AM510 Personal Aerosol Monitor (TSI, Inc., St. Paul, MN) was used to sample and record the levels of respirable suspended particles in the air. The SidePak uses a built-in sampling pump to draw air through the device and the particulate matter in the air scatters the light from a laser to assess the real-time concentration of particles smaller than $2.5\mu\text{m}$ in micrograms per cubic meter, or $\text{PM}_{2.5}$. The SidePak was calibrated against a light scattering instrument, which had been previously calibrated and used in similar studies. In addition, the SidePak was zero-calibrated prior to each use by attaching a HEPA filter according to the manufacturer's specifications.

The equipment was set to a one-minute log interval, which averages the previous 60 one-second measurements. Sampling was discreet in order not to disturb the occupants' normal behavior. For each venue, the first and last minute of logged data were removed because they are averaged with outdoor and entryway air. The remaining data points were summarized to provide an average $\text{PM}_{2.5}$ concentration within each venue. The Kentucky Center for Smoke-free Policy (KCSP) staff trained student researchers from the University of Kentucky College of Nursing and College of Public Health, who did the sampling and sent the data to KCSP for analysis.

Statistical Analyses

Descriptive statistics including the venue volume, number of patrons, number of burning cigarettes, and smoker density (i.e., average number of burning cigarettes per 100 m^3) were reported for each venue and averaged for all venues.

Results

The five Lexington bingo halls were visited Friday through Friday for an average of 124 minutes (range 75-156 minutes). Visits occurred at various times of the day from 12:00 AM to 9:00 PM. The average size of the bingo halls was 954 m^3 (range $150\text{--}1,908\text{ m}^3$) and the average smoker density was $1.33\text{ \#bc}/100\text{ m}^3$. On average, 71 patrons were present per venue and 6.8 burning cigarettes per venue were observed. Descriptive statistics for each venue are summarized in Table 1.

Table 1. Air Quality Data for Five Bingo Halls in Lexington, Kentucky, February 2008

Venue	Date Sampled	Size (m ³)	Average # people	Average # burning cigs	Smoker density (#bc/100m ³)	Average PM _{2.5} level
Bingo Hall A	2/15/2008	150	37	3.2	2.13	102
Bingo Hall B	2/16/2008	221	52	6.1	2.76	378
Bingo Hall C	2/16/2008	1908	156	11	0.58	145
Bingo Hall D	2/19/2008	1696	69	8.3	0.49	123
Bingo Hall E	2/22/2008	794	40	5.3	0.67	439
Averages		954	71	6.8	1.33	237

As depicted in Figure 1, the average level of indoor air pollution in the five Lexington bingo halls (average PM_{2.5} = 237 µg/m³) was approximately 5.5 times higher than the Georgetown bingo hall post-law and 13 times higher than Lexington's post-law average PM_{2.5} level. Further, the level of indoor air pollution in Lexington bingo halls was 6.8 times higher than the National Ambient Air Quality Standard (35 µg/m³) for 24 hours.

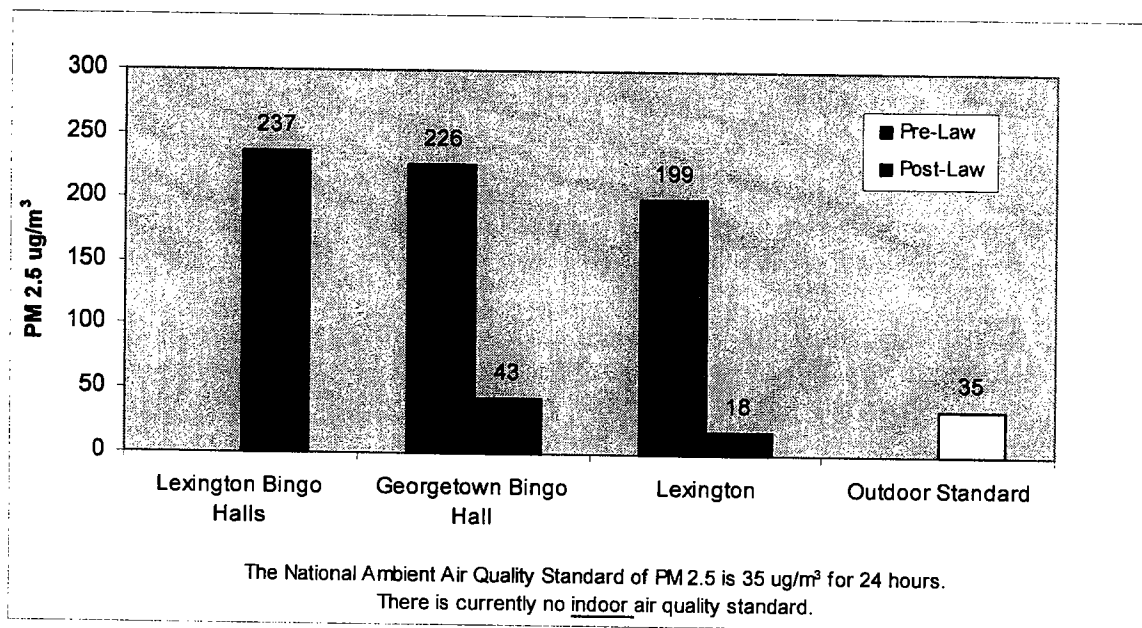


Figure 1. Average fine particle air pollution in Lexington and Georgetown bingo halls and Lexington hospitality venues, pre- and post-law

Figure 2 shows the average level of indoor air pollution in each of the five tested bingo halls. The average PM_{2.5} levels ranged from 102 µg/m³ to 439 µg/m³. Air pollution in all five bingo halls exceeded the National Ambient Air Quality Standard for outdoor air (NAAQS; 35 µg/m³).

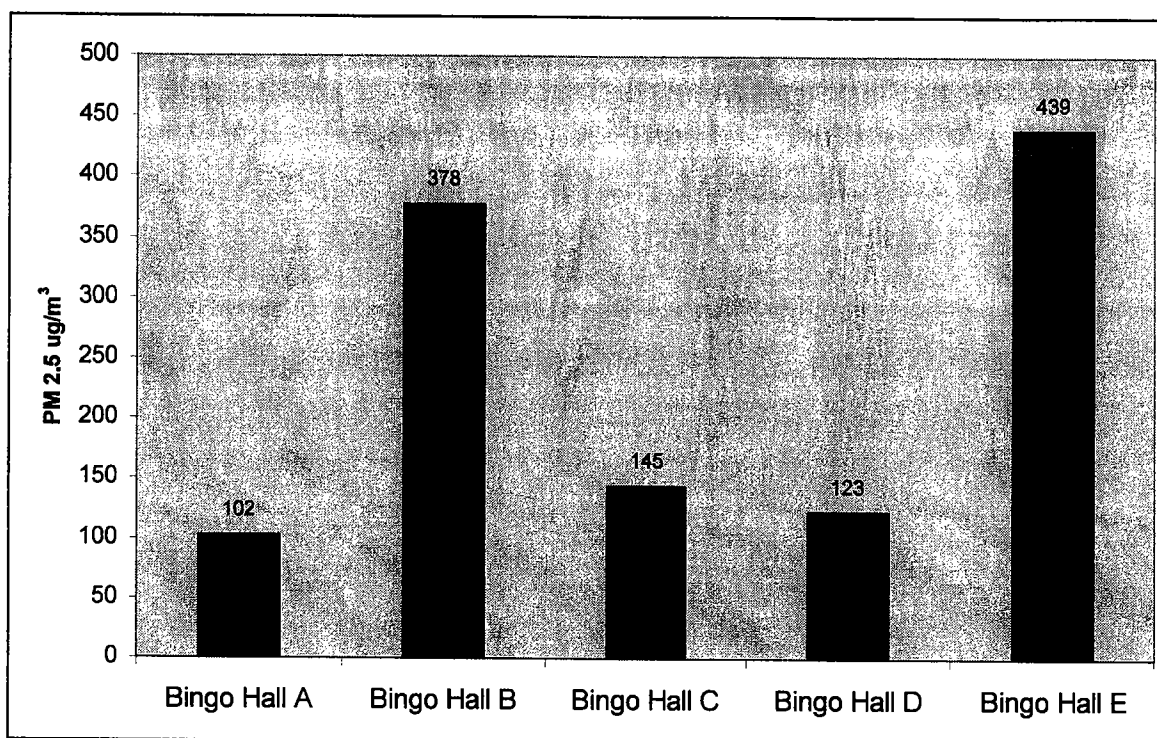


Figure 2. Average indoor fine particle concentration in five Lexington bingo halls, 2008

Discussion

The average PM_{2.5} level in the five bingo halls was 237 $\mu\text{g}/\text{m}^3$, which is 6.8 times higher than the National Ambient Air Quality Standard for outdoor air set by the EPA. There were over 80 EPA cited epidemiologic studies in creating a particulate air pollution standard in 1997.⁸ To protect the public's health, the EPA set a new limit of 35 $\mu\text{g}/\text{m}^3$ on December 17, 2006 as the average level of exposure over 24-hours in *outdoor environments*. There is no EPA standard for indoor air quality.

Two Kentucky air quality studies have demonstrated significant improvements in air quality as a result of implementing a comprehensive smoke-free law. Hahn et al. showed a 91% decrease in indoor air pollution after Lexington, Kentucky implemented a comprehensive smoke-free law on April 27, 2004.⁹ The average level of indoor air pollution was 199 $\mu\text{g}/\text{m}^3$ pre-law and dropped to 18 $\mu\text{g}/\text{m}^3$ post-law. Average levels of indoor air pollution dropped from 86 $\mu\text{g}/\text{m}^3$ to 20 $\mu\text{g}/\text{m}^3$ after Georgetown, Kentucky implemented a comprehensive smoke-free law on October 1, 2005.¹⁰ Similarly, other studies show significant improvements in air quality after implementing a smoke-free law. One California study showed an 82% average decline in air pollution after smoking was prohibited.¹¹ When indoor air quality was measured in 20 hospitality venues in western New York, average levels of respirable suspended particle (RSP) dropped by 84% after a smoke-free law took effect.¹² The level of respirable particulate matter in bowling alleys, pool halls, and bingo halls dropped by 77% in New York's gaming facilities after implementation of smoke-free law,¹³ similar to the reduction in air pollution in the Georgetown bingo hall after the smoke-free law was enforced.¹⁰

Other studies have assessed the effects of SHS on human health. Hahn et al. found a 56% drop in hair nicotine levels in a sample of workers after Lexington implemented a smoke-free law, regardless of whether workers were smokers or nonsmokers.¹⁴ Workers were also less likely to report colds and sinus infections after the law went into effect. Similarly, Farrelly et al. showed a significant decrease in both salivary cotinine concentrations and sensory symptoms in hospitality workers after New York State implemented a smoke-free law in their worksites.¹⁵ Smoke-free legislation in Scotland was associated with significant improvements in symptoms, spirometry measurements, and systemic inflammation of bar workers. The significant improvement of respiratory health was reported in only one month after smoke-free law.¹⁶ Levels of the carcinogen NNAL and cotinine were reduced by 52% and 98%, respectively, in nonsmoking casino employees after a smoke-free law was implemented in Ontario, Canada.¹⁷

Smoke-free ordinances have been shown to have no impact on bingo hall profits. In 2002, Glantz and Wilson-Loots assessed receipts from charitable gaming venues in Massachusetts and concluded that smoke-free ordinances were not associated with any effect on profits from charitable games.¹⁸ Indeed, the continuing presence of a smoky environment appears to discourage consumers from patronizing certain hospitality establishments, including bingo parlors. One study found that of both smoking and non-smoking consumers who avoid patronizing smoky places, bingo halls are most often avoided.¹⁹ Furthermore, the percentage of gamblers who smoke in Nevada casinos was not significantly different from the smoking rate of the general population, refuting the argument that a greater percentage of casino gamblers are smokers.²⁰

There is no longer any doubt in the medical or scientific communities that SHS is a significant public health problem. In 2006, U.S. Surgeon General Carmona, said “The scientific evidence is now indisputable: secondhand smoke is not a mere annoyance. It is a serious health hazard that can lead to disease and premature death in children and nonsmoking adults.”² SHS causes coronary heart disease, lung cancer, other cancers, and lung disease in nonsmoking adults.

Millions of Americans, both children and adults, are still exposed to secondhand smoke in their homes and workplaces. Approximately 60% of people in the United States have biological evidence of SHS exposure.⁶ U.S. Surgeon General Carmona said, “Eliminating smoking in indoor spaces fully protects nonsmokers from exposure to secondhand smoke. Separating smokers from nonsmokers, cleaning the air, and ventilating buildings cannot eliminate exposure of nonsmokers to secondhand smoke.”²

Conclusions

This study demonstrated that workers and patrons in bingo halls in Lexington are exposed to harmful levels of SHS. On average, workers and patrons in bingo halls were exposed to indoor air pollution levels approximately 6.8 times the National Ambient Air Quality Standard, and the level of indoor air pollution in these bingo halls was 13 times higher than Lexington’s post-law.

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Economic Impact of Smoke-free Ordinances on Charitable Gaming in Kentucky



**Economic Impact of Smoke-free Ordinances on
Charitable Gaming in Kentucky**

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Economic Impact of Smoke-free Ordinances on Charitable Gaming in Kentucky

Executive Summary

We analyzed the influence of 13 municipal smoke-free ordinances on charitable gaming revenues throughout the state of Kentucky. We find no differences in either total gross revenues or net revenues, on average, in the 13 communities examined before and after implementation of smoke-free ordinances. We find no evidence to support the notion that charitable gaming revenues declined as a result of the smoke-free legislation.

Note to the reader: Although the raw numbers suggest differences between the before and after-ban samples, a simple comparison of data before and after the implementation of the laws is not sufficient to evaluate the economic impact of such legislation. Thus, we take into account other factors that could have influenced charitable gaming; including economic factors (such as unemployment rates and population size), seasonality factors, and county-specific factors either through control variables or the methodology implemented.

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Purpose of the research study

The purpose of the study was to determine the effect of municipal smoke-free laws in Kentucky on gross and/or net revenues from charitable gaming activities over a 7-year period.

Background

Many studies have examined the impact of smoke-free laws on health¹⁻⁶ and economics.⁷⁻¹⁰ The research on charitable gaming and smoke-free laws is less extensive. In 2002, Glantz and Wilson-Loots assessed receipts from charitable gaming venues in Massachusetts communities and concluded that smoke-free ordinances were not associated with any effect on profits from charitable gaming and that any decrease in revenues began before the implementation of these laws.¹¹ While there are mixed findings when reviewing the most current research on casino gaming revenues and smoke-free laws,¹²⁻¹⁴ Delaware racinos use the statewide smoke-free law as an advertising strategy to attract customers, indicating that gaming facilities may view smoke-free policy as having a positive effect on revenues. Despite scientific evidence, opponents of comprehensive smoke-free laws argue that they negatively impact charitable activities such as bingo.

The continuing presence of a smoky environment may discourage consumers from patronizing certain hospitality and gaming establishments, including bingo parlors. Indeed, one study found that of both smoking and non-smoking consumers who avoid patronizing smoky places, bingo halls are most often avoided.¹⁵ While some may think that bingo patrons are more likely to smoke than the general population, the proportion of gamblers who smoke in Nevada casinos was not significantly different from the smoking rate of the general population.¹⁶

As of July 1, 2008, 65% of the U.S. population was protected by local or statewide smoke-free laws that cover virtually all indoor worksites including bars and restaurants.¹⁷ However, during this same time, only 22% of Kentuckians were protected by a smoke-free workplace law. Tobacco-growing states typically have weak tobacco-control laws and provide less public protection from secondhand smoke.¹⁸ From January 2000 to June 2007, 13 Kentucky communities had implemented municipal smoke-free ordinances. Of the 13 laws, only three specifically exempt bingo parlors.

Study Methods

Initially, we examined, by county, the entire state of Kentucky, isolating those counties that had implemented a smoke-free ordinance, or had at least one smoke-free ordinance in the county ($n = 13$). There are a total of 120 counties, thus the remaining 107 counties serve as our control group. Since 20 of the control counties did not report revenues from any charitable gaming activities during the study period, our final sample consisted of 100 counties, 13 of which had implemented a smoke-free ordinance. For each county with a smoke-free ordinance, we designated the quarter as post-law if it had been in effect at least one-half of each respective

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quarter. One county implemented a smoke-free Board of Health regulation on June 12, 2007 and they were included as a control county in this analysis.

Summary statistics for the entire sample are reported in Table 1 below:

Table1. Summary Statistics for All 100 Kentucky Counties with Bingo Revenues, Quarterly Averages, January 1, 2000- June 30, 2007

	<i>Total</i>	<i>SF Law</i>	<i>No Law</i>
Number of Quarters	2,475	58	2,417
TotGross	2,440,115	6,278,035	2,348,018
TotPayouts	2,064,670	5,129,125	1,991,134
AdjGrossRec	375,445	1,148,910	356,863
TotExp	211,615	477,488	156,281
NetRec	163,830	671,422	200,581
Unemployment	6.01	5.12	6.04
LaborForce	21,511	93,328	19,788

Note: Observations included in the "SF Law" column are county-quarters during which a smoke-free ordinance was in place for at least one-half of the quarter. Observations in the "No Law" column are county-quarters (including counties that did not have a ban at all) for which a smoke-free ordinance was not in place. TotGross is all monies collected or received from the conduct of charitable gaming. TotPayouts are prizes awarded to winners (which could be cash or merchandise). AdjGrossRec is equal to TotGross minus TotPayouts. TotExp is all monies spent on the conduct of charitable gaming. NetRec is equal to AdjGrossRec minus TotExp. Unemployment is the unemployment rate for each county and Laborforce is the number of individuals in each county's labor force. All values are quarterly averages.

The counties that had enacted smoke-free laws are, on average, considerably larger, with lower unemployment rates, and have considerably higher levels of charitable gaming activity compared with counties without smoke-free laws.

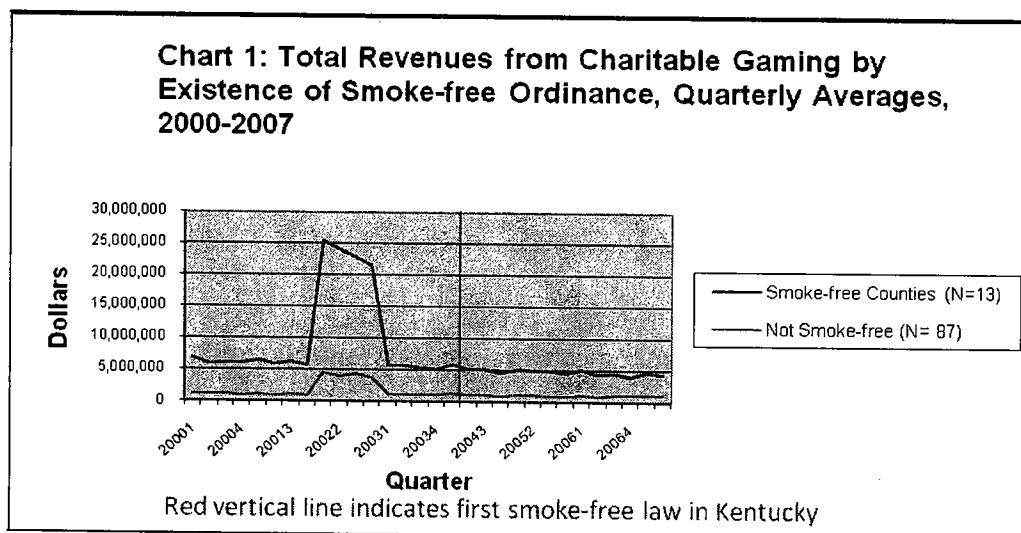
Data Sources: The charitable gaming data were obtained from the Kentucky Department of Charitable Gaming. Economic data, including unemployment rates and other labor force statistics were obtained through the U.S. Department of Labor's Bureau of Labor Statistics. Our sample period was from January 1, 2000 through June 30, 2007. Our unit of observation is quarterly, as that is how charitable gaming revenues are reported.

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Data Analysis and Interpretation: A simple comparison of these data before and after the implementation of the laws is not sufficient to evaluate the law's economic impact. We took into account other factors that could have influenced revenues by estimating an economic model that is designed to control for county-specific effects. In addition, we control for potential seasonal influences and other general macroeconomic conditions. In addition, we examine a variety of statistical techniques in order to confirm the robustness of the results.

Findings

Total revenues from charitable gaming from January 2000 to June 2007 are displayed in Chart 1. The time trends for smoke-free counties vs. those without smoke-free laws are similar over time. There was a sharp increase in total revenues in 2002, well before Kentucky's first local smoke-free law took effect in the second quarter of 2004. Since that time, revenues have remained relatively stable in both groups.



When we examined the entire 100-county sample, we found no significant differences in either gross or net bingo revenues as a result of smoke-free ordinances. Then, we examined pre-and post-law period values for those counties with a smoke-free ordinance during the sample period. Since the implementation dates for each of these laws is different, there were varying numbers of pre-and post-law observations. Nonetheless, the averages for counties with smoke-free laws are presented in Table 2.

The last column indicates no statistically significant differences (which would be evidenced by a value of .05 or less) in charitable gaming revenues between the two time periods. Thus, we find no evidence to suggest that smoke-free laws either helped or harmed charitable gaming revenues.

Economic Impact of Smoke-free Ordinances on Charitable Gaming in Kentucky

We also examined sub-samples where bingo halls were exempt from the smoke-free legislation. This is true for three of the counties with smoke-free legislation. We also examined one additional county as ‘bingo-exempt’ since smoking was observed in the bingo halls due to a legal challenge claiming bingo as a private organization and exempt under the law. We found similar results in these sub-analyses; there was no significant relation between smoke-free laws and charitable gaming revenues.

Table 2: Summary Statistics for Counties with Smoke-free Laws

<i>Counties with Smoke-free Laws Only (1/1/2000 – 6/30/2007)</i>				
<i>Total</i>		<i>Post-law</i>	<i>Pre-law</i>	<i>p-val</i>
Number of	418	58	360	
Quarters				
TotGross	7,438,351	6,278,035	7,645,447	.4719
TotPayouts	6,251,998	5,129,125	6,449,856	.4043
AdjGrossRec	1,186,349	1,148,910	1,195,587	.8837
TotExp	545,843	477,488	558,322	.5657
NetRec	640,507	671,422	637,265	.8497
Unemployment	5.12	5.12	5.13	.9770
LaborForce	58,017	93,328	52,356	.0099

Note: Quarterly observations included in the “Post-law” column are those in which the county had smoke-free legislation implemented for at least one-half of the quarter. TotGross is all monies collected or received from the conduct of charitable gaming. TotPayouts are prizes awarded to winners (which could be cash or merchandise). AdjGrossRec is equal to TotGross minus TotPayouts. TotExp is all monies spent on the conduct of charitable gaming. NetRec is equal to AdjGrossRec minus TotExp. Unemployment is the unemployment rate for each county and Laborforce is the number of individuals in each county’s labor force. All values are quarterly averages.

We find no statistical evidence to support the hypothesis that smoke-free legislation had a negative (or positive) effect on charitable gaming revenues.

Conclusion

Our findings suggest there are no economic reasons to exempt charitable gaming facilities from smoke-free legislation. Since we use statistically robust methods to analyze this issue, we are confident that smoke-free municipal laws have no significant effect on revenues and suggest, rather, that charitable gaming revenues are largely a product of area-specific factors.

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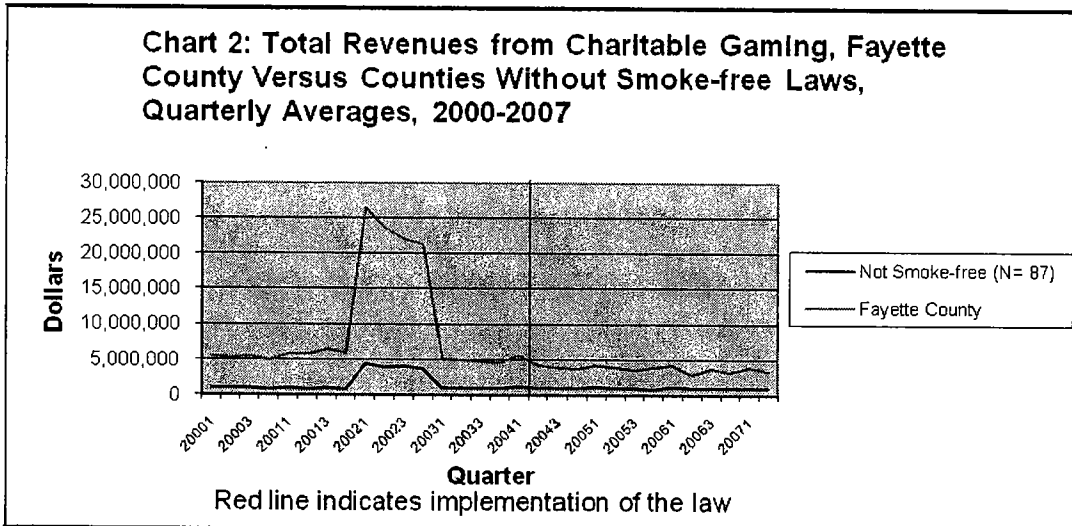
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Appendix



Rapid publication

Reduction in asthma-related emergency department visits after implementation of a smoke-free law

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Background: Secondhand tobacco smoke increases the risk for the development and increasing severity of asthma among adults and children. Reducing exposure to secondhand smoke decreases symptomatic exacerbations among patients with asthma. Emergency department (ED) visits for asthma were assessed before and after the implementation of smoke-free legislation in Lexington-Fayette County, Ky.

Objective: To evaluate the effects of a smoke-free law on the rate of ED visits for asthma.

Methods: The study included ED visits for asthma from 4 hospitals in Lexington-Fayette County, Ky. Age-adjusted rates of asthma ED visits were determined. Poisson regression analysis of ED visits from January 1, 2001, to December 31, 2006 compared the ED visit rates between prelaw and postlaw, adjusting for seasonality, secular trends over time, and differences among demographic subgroups. The actual rates were graphed with the Poisson curve showing the rates predicted by the model. A second prediction curve was generated to show the projected rates in the postlaw period if the law had not been implemented.

Results: Adjusting for seasonality, secular trends, and demographic characteristics, ED visits for asthma declined 22% from prelaw to postlaw ($P < .0001$; 95% CI, 14% to 29%). The rate of decline was 24% in adults age 20 years and older ($P < .0001$), whereas the decrease among children 19 years or younger was 18% ($P = .01$).

Conclusion: Although this study did not establish causation, the smoke-free law was associated with fewer asthma ED visits among both children and adults, with a more significant decline among adults. (J Allergy Clin Immunol ■■■■;■■■:■■■-■■■.)

Key words: Asthma, asthma triggers, asthma exacerbation, second-hand tobacco smoke, environmental tobacco smoke, smoke-free legislation, asthma health outcomes

Secondhand tobacco smoke (SHS) is a well documented environmental trigger for the development of asthma symptoms among adults¹⁻³ and children in the United States.^{4,5} SHS contains respiratory irritants that increase bronchial hyperactivity and airway inflammation with resultant symptomatic exacerbation for individuals with pre-existing asthma.⁶ There is a strong association between the length of SHS exposure time and self-reported number of consultations with doctors, medication use, and missed work days.⁷ Eliminating SHS exposure decreases asthma severity, emergency department (ED) visits, and hospitalizations among nonsmoking adults with asthma.⁸

More than 20 million adults⁹ and 9 million children¹⁰ in the United States have been diagnosed with asthma. The adult self-reported asthma prevalence in Kentucky for 2004 was slightly higher than the national average (8.3% vs 8.1%).¹¹ Kentucky residents may be disproportionately affected by asthma exacerbations because of increased smoking rates and fewer smoke-free homes. Kentucky leads the nation in adult smoking, 28.6% compared with 20.2% nationwide.¹² Similarly, Kentucky led the nation in home exposure to SHS in 2003, with only 53.4% reporting smoke-free homes compared with 72.2% nationwide.¹³

Although 12 US states and 277 communities have adopted laws requiring all workplaces, restaurants, and bars to be smoke-free, many states and municipalities have been slow to protect all workers from exposure to SHS.¹⁴ Lexington-Fayette Urban County Government's smoke-free law, the first in Kentucky, 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.

This study evaluated the effects of Lexington's smoke-free law on the rate of ED visits for asthma. Asthma events were measured 40 months before and 32 months after enforcement of the smoke-free public places law in Lexington-Fayette County, Ky, on April 27, 2004. It was hypothesized that if SHS was eliminated from public places, the incidence of ED visits for asthma would decrease.

METHODS

All 5 Lexington-Fayette County hospitals were asked to provide de-identified records of ED cases from 2001 to 2006, including primary and secondary discharge diagnoses (International Classification of Diseases, Ninth Revision codes), date of service, sex, age, and county of residence. Patients treated in Fayette but who lived outside the county were excluded from the analysis. Complete data from 1 hospital were not available for this study because their data collection software had changed in 2002 and it was not fully

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Abbreviations used

ED: Emergency department
RR: Relative risk
SHS: Secondhand tobacco smoke

implemented until more than a year into the study period. Asthma ED discharges from this hospital accounted for 13% of the total cases from 2002 to 2006. Data from this hospital were not included in the analysis. The study was approved by the University of Kentucky and the other hospital Institutional Review Boards.

Selection of cases

Primary and secondary diagnoses were reviewed to determine whether the event qualified for inclusion in the study. Selection of cases was limited to those with either a primary or secondary discharge diagnosis of asthma (International Classification of Diseases, Ninth Revision code 493). Discharge diagnosis was chosen as the criterion for inclusion because it is a more accurate reflection of the true condition than the diagnosis at admission. Asthma cases from January 1, 2001, to December 31, 2006, were included in the study: 40 months prelaw and 32 months postlaw. Because the percent increase in cases from 2001 to 2002 was higher than between any other consecutive pair of years, a sensitivity analysis was conducted that excluded data from 2001 to discern whether the difference in rates between the prelaw and postlaw periods was significant for this shorter time frame; for the sensitivity analysis, the prelaw and postlaw periods were 28 and 32 months, respectively.

Statistical methods

Descriptive statistics were used to summarize patient populations before and after the smoke-free law. Yearly totals of cases in Lexington-Fayette County were combined with corresponding population estimates to obtain crude annual rates.¹⁵ These rates were age-adjusted and standardized to the 2000 US Census estimates.

Monthly rates for asthma ED visits over the 6-year study period were modeled using Poisson regression, with the negative binomial distribution specified to allow for overdispersion or underdispersion. The initial regression model included the fixed effects of law status (prelaw vs postlaw), sex, age (with 11 categories corresponding to census data cohorts), and the 2-way and 3-way interactions of these effects. The log of the estimated population size was used as an offset variable in the model, with population estimates specific to the year, sex, and age category of the cases. The model also contained an indicator for time (month of event) to assess secular trends unrelated to law implementation; this variable was treated as continuous in the model, with January 2001 numbered as 1 and December 2006 numbered as 72. The first-order and second-order harmonics were included in the models to account for seasonal variation in rates. The formulas for the j th-order harmonic terms are as follows:

$$S_j = \sin(2 * j * m * \pi / 12) \text{ and } C_j = \cos(2 * j * m * \pi / 12),$$

where j denotes the order of the harmonic and takes values of 1 or 2, and m denotes the month of the year and ranges from 1 (January) to 12 (December).

Interaction terms not significant in the initial model were sequentially removed for ease of interpretation with little change in model fit. Goodness-of-fit of the models was determined by using the deviance statistic.

In addition to Poisson regression, a time series analysis was conducted based on a first-order autoregressive model. Consistent with the findings of Kuhn et al,¹⁶ who evaluated these 2 strategies for quantifying time trends of relatively rare outcomes (eg, asthma ED visits), we found no appreciable difference in the level of significance of any of the predictors between these 2 methods. The Poisson regression results are reported here because this method estimates the relative risk of an event postlaw compared with prelaw, adjusting for demographic, time-trend, and seasonal variables in the model. In addition,

separate regression models were considered for children (age 0-19 years) and adults (age 20 years and above). Actual rates per 100,000 population, weighted by sex and age distribution, were plotted with the predicted rates estimated from the model. Data analyses and graphing were conducted by using SAS for Windows, v. 9.1 (SAS Institute, 2002-03); an α level of .05 was used throughout.

RESULTS

From January 2001 through December 2006, there were a total of 14,839 ED visits for asthma events: 7763 prelaw (ie, through April 2004) and 7076 postlaw. The prelaw and postlaw cohorts were very similar in demographic characteristics. The prelaw cohort had an average age of 29.5 years (SD = 21.6) and was 63% female, compared with an average age of 29.7 (SD = 21.3) and 63% female postlaw. Thirty-six percent of prelaw cases were younger than 20 years, equivalent to the percentage of pediatric cases postlaw. As shown in Table I, there is a pattern of increasing frequency of ED visits for asthma over time, which is also reflected in the age-adjusted rates. This steady increase was interrupted in 2004, the year when the law was implemented, with an age-adjusted rate for all cases that was decreased from the previous year. This change in trend is evident in the pediatric and adult subsets as well. The final Poisson regression model based on all cases fit the data well; the ratio of the deviance statistic to the degrees of freedom was 1.1, close to the null value of 1. Significant predictors of the rate of ED visits for asthma in the Poisson regression included the law status indicator (pre vs post), age, sex, and the age by sex interaction; the time-trend variable and 3 of the 4 first-order and second-order harmonic terms were also significant (Table II). Adjusting for these demographic, trend, and seasonal factors, the relative risk (RR) of an asthma ED visit postlaw versus prelaw was 0.78 ($\chi^2 = 26.6$; $P < .0001$); the 95% CI for the RR was 0.71 to 0.86. When children (age 0-19 years) and adults (age 20 years and above) were considered separately, both models fit the data well (with the ratio of deviance to degrees of freedom for the 2 models equal to 1.1 and 1.06, respectively). The decline in the pediatric cohort was significant (RR = 0.82; 95% CI for RR, 0.71-0.96; $\chi^2 = 6.3$; $P = .01$), and the degree of decline in adult cases was even more striking (RR = 0.76; 95% CI for RR, 0.69-0.84; $\chi^2 = 26.3$; $P < .0001$). There was a 22% decline in ED visits for asthma for all ages combined, and an 18% decline among children and a 24% decline in adults.

Consistent with the age-adjusted rates presented in Table I and the significant decline in RR postlaw, Fig 1 illustrates that for the children and adult cases combined, although there was an increasing trend in ED visits for asthma over the 6-year period, there was a drop in rates after the law. The prevalence of ED visits for asthma postlaw was lower than the prevalence projected by the model if the smoke-free law had not been implemented. The models for the pediatric and adult subsets are displayed separately in the Online Repository (see this article's Fig E1 and Fig E2 at www.jacionline.org); both figures illustrate a decline in asthma ED rates after the law, with the larger difference observed for the adult subset.

For the sensitivity analysis, cases from 2001 were omitted. The model based on all cases from 2002 to 2006 had a significant decrease in ED rate between prelaw and postlaw (RR = 0.90; 95% CI, 0.81-0.99; $\chi^2 = 4.6$; $P = .03$; see this article's Table E1 in the Online Repository at www.jacionline.org). The model for pediatric cases from 2002 to 2006 did not have a significant pre/post

TABLE I. Size of the at-risk population, number and rate* of asthma ED visits per year, 2001-2006

Year	All cases			Pediatric (age 0-19 y)			Adult (age 20 y and above)		
	At-risk population	No. of asthma ED visits	Rate*	At-risk population	No. of asthma ED visits	Rate*	At-risk population	No. of asthma ED visits	Rate*
2001	262,186	1680	650.5	65,486	583	250.7	196,700	1097	399.8
2002	262,652	2574	996.4	65,314	917	397.9	197,338	1657	598.5
2003	265,479	2659	1015.4	65,715	957	410.5	199,764	1702	604.9
2004	266,443	2514	951.6	65,779	902	380.8	200,664	1612	570.8
2005	268,076	2594	982.9	66,058	1011	427.5	202,018	1583	555.4
2006	270,935	2818	1058.4	66,764	952	400.3	204,171	1866	658.1

*Age-adjusted rate per 100,000 at-risk population, adjusted to the 2000 US Census.

TABLE II. Poisson regression models for the full sample and adult and child subsets, 2001-2006

Variable	All cases			Pediatric (age 0-19 y)			Adult (age 20 y and above)		
	RR	95% CI for RR	χ^2 (P value)	RR	95% CI for RR	χ^2 (P value)	RR	95% CI for RR	χ^2 (P value)
Month	1.01	1.01-1.01	76.7 (<.0001)	1.01	1.01-1.01	26.8 (<.0001)	1.01	1.01-1.01	67.8 (<.0001)
Age	0.96	0.95-0.97	41.2 (<.0001)	0.84	0.80-0.88	53.8 (<.0001)	0.93	0.91-0.94	67.2 (<.0001)
Male	2.08	1.88-2.30	179.1 (<.0001)	2.39	2.02-2.84	91.2 (<.0001)	0.48	0.37-0.61	33.2 (<.0001)
Age*Male	0.77	0.75-0.78	578.2 (<.0001)	0.75	0.71-0.81	65.7 (<.0001)	0.95	0.92-0.99	6.8 (.009)
Harmonics									
S ₁	1.02	0.99-1.06	1.7 (.2)	1.06	1.00-1.12	4.3 (.04)	0.99	0.95-1.03	0.4 (.5)
C ₁	1.06	1.03-1.10	12.3 (.0005)	1.18	1.11-1.25	32.8 (<.0001)	1.00	0.97-1.04	< 0.1 (.9)
S ₂	0.91	0.88-0.94	29.9 (<.0001)	0.87	0.82-0.92	25.9 (<.0001)	0.93	0.90-0.97	14.1 (.0002)
C ₂	0.94	0.90-0.97	14.9 (.0001)	0.88	0.83-0.92	22.9 (<.0001)	0.97	0.94-1.01	2.5 (.1)
Postlaw indicator	0.78	0.71-0.86	26.6 (<.0001)	0.82	0.71-0.96	6.3 (.01)	0.76	0.69-0.84	26.3 (<.0001)

difference (RR = 0.99; 95% CI, 0.85-1.16; $\chi^2 < 0.1$; $P = .9$), whereas the adult model estimated the RR for this effect to be 0.85 (95% CI, 0.76-0.95; $\chi^2 = 8.1$; $P = .004$). The rate of decline in the adult subset was 15%, whereas the decrease between prelaw and postlaw was 10% when all cases were considered. Although these are more modest decreases than in the analysis of cases from the full study period (2001-2006), the findings underscore the association between the smoke-free law and a decline in asthma ED visits for this more conservative analysis.

DISCUSSION

During the 32 months after implementation of a smoke-free law in Lexington-Fayette County, Ky, there was a significant 22% decline in ED visits for asthma after controlling for seasonality, secular trends, and the demographics of the at-risk population. The rate of decline was greater among adults age 20 years and older compared with pediatric cases 19 years and younger. This age disparity was even more striking in the sensitivity analysis; the rate of decline was significant in adults, but there was no effect among children. Given that children are primarily exposed to SHS in the home¹⁷ and adults are exposed both at home and in the workplace,¹⁸ it is not unexpected that the smoke-free law would be more likely to protect adults than children.

This is the first study to report an association between smoke-free laws and ED visits for asthma. Because Lexington's ordinance covers all public places including restaurants and bars but not all places of employment, the reported decline may be an underestimate of the effect of comprehensive smoke-free laws on asthma.

The overall upward trend in ED visits for asthma during this period is consistent with the national data showing an increase

from 1.6 million ED visits for asthma in 2001 to 1.7 million ED visits for asthma in 2005.¹⁹ From 1992 to 2004, the estimated rate of ED visits for asthma in the United States increased from 57.3 to 63.4 per 10,000 population.²⁰ In the Southern Region, the estimated rate of ED visits for asthma increased from 7.7 in 2001 to 9.1 per 100 persons with asthma in 2004.²⁰ The current asthma prevalence rate for Lexington-Fayette County, Ky, increased during the study period (6.4% in 2001 to 7.1% in 2006).²¹ Given that asthma prevalence increased during this time, we would expect that ED visits would increase. Our findings show that the smoke-free law interrupted the steady increase in ED visits for those with asthma.

It is well known that there is a causal relationship between outdoor air pollution and morbidity and mortality for asthma.²² In an indoor air quality study of Lexington hospitality venues, there was a 91% decline in fine particle air pollution after Lexington's smoke-free law went into effect.²³ Given that there is a positive association between outdoor air pollution and ED visits for asthma²⁴ among both children^{25,26} and adults,^{26,27} it is not surprising that there were fewer asthma ED visits in light of improved indoor air quality after Lexington's smoke-free law. Further study is needed to investigate the interactions among outdoor air pollution, smoke-free legislation, and asthma prevalence and health care outcomes.

Studies show positive health effects of smoke-free laws using a variety of health indicators. Within 3 months after Lexington's smoke-free law took effect, there was a 56% decline in hair nicotine, a biomarker for SHS exposure, and a significant improvement in reported respiratory symptoms among restaurant and bar workers.²⁸ In a population-based study of New York residents, nonsmoking adults showed a 47.4% decrease in saliva cotinine after a comprehensive statewide smoke-free law.²⁹

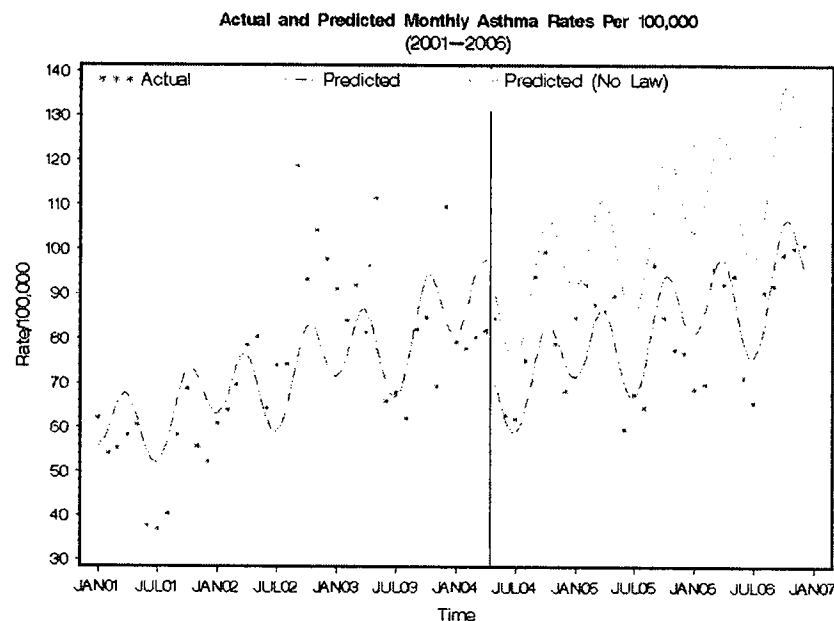


FIG 1. Actual and predicted monthly rates of asthma ED admissions per 100,000 population in Lexington-Fayette County, 2001–2006; the vertical line indicates the division between prelaw and postlaw periods. The Poisson regression model used to determine the predicted rates demonstrated a 19% decrease in ED visits for asthma after the community smoke-free law. The graph contains a second postlaw curve, the projected rate of ED visits had the law not been implemented.

Multiple studies have linked smoke-free workplace and public places legislation to significant declines in hospitalizations for acute myocardial infarction in the general population.^{30–34}

Limitations

There was the potential for underestimation of asthma cases, given the migration of workers both in and out of Lexington. Health outcomes of those who work in the county but who live elsewhere were not investigated because place of work was unavailable. Likewise, Lexington-Fayette County residents who work elsewhere may have visited an ED in a noncounty hospital during work hours and were not included in the analysis. In addition, we may have underestimated the asthma cases because of potential differences in coding by physicians or hospitals. Another limitation is that we did not have a matched control group, and we were not able to monitor trends in a population without a smoke-free law. Although we included a control for changes in case frequency over time because of secular trends, we were not able to measure changes in these trends specifically, including rate of asthma diagnosis and changes in treatment regimen. We cannot infer causation; rather, we can say that there was an association between Lexington's smoke-free law and ED visits for asthma. Although an association was observed, there are other explanations that could account for the observations. This study presumes that exposure to SHS declined after implementation of the law, but an additional limitation is that actual exposure of individuals was not measured.

Conclusion

There was a 22% decline in ED visits after Lexington's smoke-free public places law when controlling for seasonality, secular

trends, and the demographics of the at-risk population. Because there is no risk-free level of SHS,¹⁷ eliminating SHS exposure is essential to respiratory health. The National Heart, Lung, and Blood Institute Expert Panel on the diagnosis and management of asthma recently updated guidelines for the management of asthma, identifying SHS as a major trigger in asthma morbidity and recommending that clinicians advise their patients who have asthma not to smoke and to avoid involuntary exposure to SHS.³⁵ SHS is difficult to avoid unless legislation is passed to create smoke-free workplaces and public places in all communities. This study is the first to find an association between smoke-free laws and reductions in ED visits for asthma in the general population. More research is needed to explore further the relationship between smoke-free legislation and health care use related to asthma.

We thank the 4 Lexington-Fayette County hospital systems for providing the database for this study.

Clinical implications: Eliminating SHS, an environmental risk factor for asthma exacerbation, by enacting smoke-free legislation can decrease ED visits for asthma.

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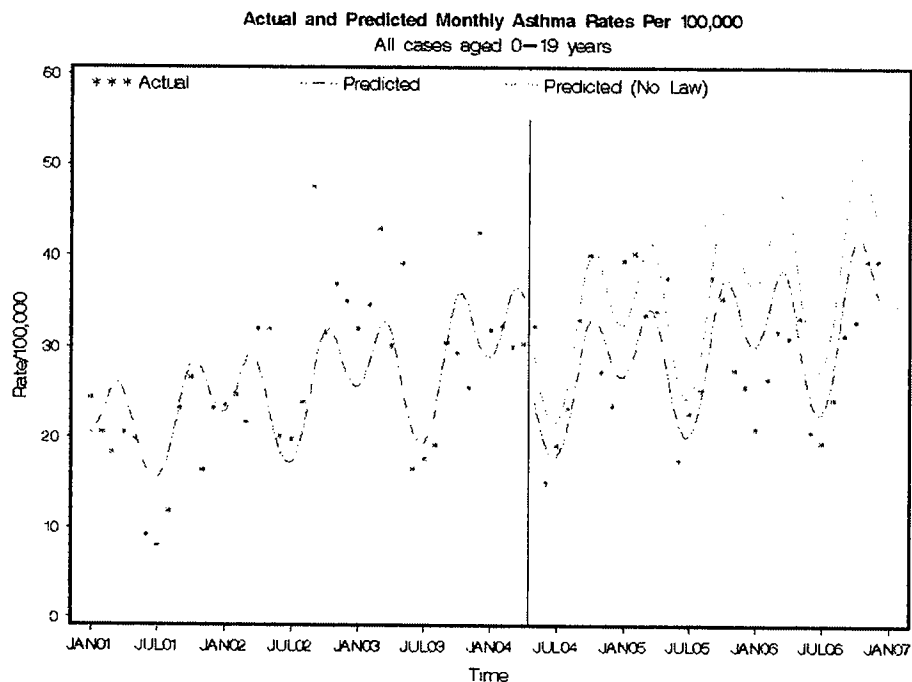


FIG E1. Actual and predicted monthly rates of pediatric asthma ED admissions per 100,000 population in Lexington-Fayette County, 2001 to 2006. The vertical line indicates the division between prelaw and postlaw periods. The Poisson regression model used to determine the predicted rates demonstrated an 18% decrease in ED visits for asthma among children after the community smoke-free law. The graph contains a second postlaw curve, the projected rate of ED visits had the law not been implemented.