Study of Secondhand Smoke Exposure in St. Louis City and County Suggests Need for Comprehensive Smoke-free Missouri Law Adoption

by Sarah Moreland-Russell, Julianne Cyr, Peter Benson, Graham Colditz, Deren Pulley & Joaquin Barnoya

Decision makers across Missouri should not further delay the much needed implementation of a comprehensive smoke-free law.

Sarah Moreland-Russell, PhD, MPH, is the Associate Director, at the Center for Public Health Systems Science; Julianne Cyr, MPH, is at the George Warren Brown School of Social Work; Peter Benson, PhD, Assistant Professor, and Deren Pulley are at the School of Arts and Sciences, Department of Anthropology; Graham Colditz, MD, DrPH, Professor, is at the Institute for Public Health; and Joaquin Barnoya, MD, MPH, Assistant Professor, is at the Division of Public Health Sciences, Department of Surgery. All are at Washington University in St. Louis.
Contact: srussell@gwbmail.wustl.edu

Abstract

This cross-sectional study provides information about secondhand smoke exposure across the St. Louis metro area and perceptions and attitudes about tobacco and health within the local hospitality industry. Results from this study support the need for passage and implementation of comprehensive smoke-free laws throughout Missouri, particularly in St. Louis City and County where efforts to pass comprehensive smoke-free laws have been unsuccessful.

Introduction

Secondhand smoke (SHS) is an established cause of death and disease. It causes lung cancer and cardiovascular and respiratory diseases.[1] In 2004, about one-third of the world's population was regularly exposed to SHS, resulting in roughly 600,000 deaths, about two-thirds of which occurred in women and children.[2,3]

Comprehensive smoke-free laws are the only strategy proven to protect from SHS exposure.[4] These laws lead to a decrease in lung cancer and heart disease incidence through a combination of reduced SHS exposure, decreased smoking prevalence, and an environment that makes it easier for smokers to quit.[5,6 7, 8] According to the Institute of Medicine (2010) there is a causal relationship between smoke-free laws and a decrease in acute myocardial infarction incidence.[4] Additionally, they are associated with a reduction in respiratory symptoms and inflammatory markers, signifying improving respiratory function.[9,10]

In the U.S., dozens of cities, municipalities and states have passed legislation mandating smoke-free environments. As of January 2012, nearly half the states (23) have comprehensive statewide policies eliminating smoking in all public places, including restaurants and bars.[11] Public support for smoke-free workplace legislation also continues to increase, even among smokers, once people understand the rationale for implementing these policies and experience their benefits.[7,12]

Disparities in SHS exposure persist, particularly within the workplace and especially in states lacking comprehensive state and local smoke-free laws. Employees in the service and hospitality industries are the most frequently exposed given the lack of comprehensive legislation that includes these services. [13-15]

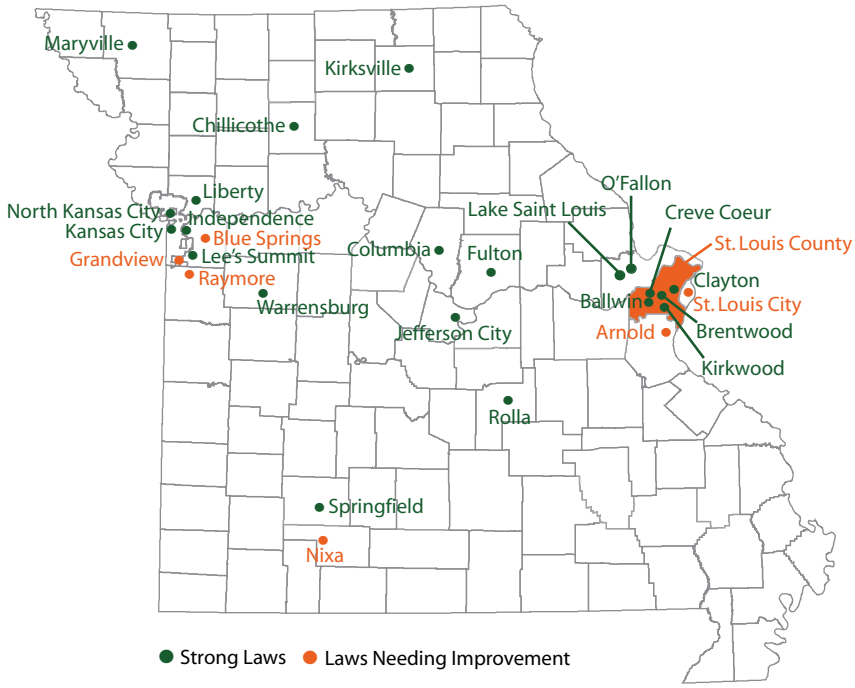
In Missouri, lack of comprehensive smoke-free laws puts many workers and residents at risk of exposure and disease.[16] As a result, it ranks 50th (of the 50 states and the District of Columbia) in the percentage of indoor employees

exposed to SHS - 12% compared with 7.3% nationwide.[17] Only 20 localities have implemented comprehensive smoke-free workplace laws, covering all workplaces including restaurants and bars (See Figure 1).

St. Louis, the second largest city in Missouri, has been unsuccessful in passing a comprehensive smoke-free law. Efforts were initiated in 2005 when a county councilman, Kurt Odenwald, proposed the Indoor Clean Air code. The code was dismissed by the county council before going to a formal vote. Attempts in 2009 were more successful in St. Louis County and St. Louis City. However, these laws have several exemptions. In St. Louis County "drinking establishments" (bars that make a quarter or less of their sales from food), bars that are less than 2,000 square feet, private residences and clubs, stage performances where smoking is said to be required as part of the production, private and semi-private rooms in nursing homes and long-term facilities, and casino floors are excluded.[18] While some establishments have welcomed the law, others have expanded their bar areas to include outdoor space in order to provide an area for smokers in compliance with the law.[19] In 2012, of the nearly 1,750 bars in St. Louis City and County, about 15% have exemptions.[20] The number of exemptions is more than the legislature had expected. As of January 1, 2011, 95 exemptions were made prior to the implementation of the ban the next day.[20] Therefore, even though there has been forward movement in establishing smoke-free workplaces in St. Louis, these policies are still far from being comprehensive and run drastically short of protecting all workers from SHS exposure.

This study provides information about SHS exposure across the St. Louis metro area and perceptions and attitudes about tobacco and health within the local hospitality industry. We sought to provide data to support the passage and implementation of smoke-free laws throughout Missouri, particularly relevant as St. Louis County considers the adoption of a comprehensive law.

Figure 1
Map of Current Smoke-Free Laws in Missouri



Methods

This is a cross-sectional study in 10 bars and 10 restaurants in St. Louis City and County to determine:
1) Levels of SHS exposure using airborne nicotine concentrations;
2) employees' exposure to SHS using hair nicotine levels; and
3) employees' knowledge and attitudes regarding smoke-free policies.

Secondhand Smoke Exposure

Exposure was assessed using airborne nicotine concentrations and employees' hair nicotine. The former yields information about nicotine levels in the environment while the latter evaluates personal exposure to SHS. Airborne nicotine was collected using a passive sampler containing a sodium bisulfate treated filter. The filter was extracted and analyzed at the Exposure Assessment Laboratory of the Institute for Global Tobacco Control at the Johns Hopkins Bloomberg School of Public Health via gas chromatography with nitrogen-selective detection. The seven-day time-weighted average concentration of nicotine in micrograms (μg) per effective volume of air sampled (m^3) was estimated. Volume sampled was calculated by multiplying the sampling time in each location by the effective sampling rate of the sampler (25 ml/min). For quality control, one duplicate and blank monitor was

Table 1. Employee characteristics

Personal Characteristic	All Participants N=78 n (%)
Sex	
Male	35 (44.9)
Female	43 (55.1)
Education	
Less than high school	3 (3.8)
High school or GED	19 (24.4)
College	56 (71.8)
Hours worked	
10-20	12 (15.6)
21-30	17 (22.1)
31-40	26 (33.8)
41 or more	22 (28.6)
Currently smoker	
No	32 (41.6)
Yes	45 (58.5)
Position	
Other	26 (33.3)
Bartender/Waiter	52 (66.7)
Cigarettes per day	
10 or less	52 (67.5)
11-20	19 (24.7)
21 or more	6 (7.8)

placed for every 10 venues recruited. Blanks were used to determine the blank-corrected nicotine concentrations and to calculate the nicotine detection limit in $\mu g/m^3$ for a seven day monitoring.

Bars and restaurants were randomly chosen from 2,792 registered venues in the Metropolitan area. Out of 68 venues contacted, 38 refused to participate (response rate 44.1%). Twenty venues were included (10 bars and 10 restaurants), 16 allowed smoking and 4 (2 bars and 2 restaurants) had voluntarily gone smoke-free. Informed consent was obtained for all of the locations. Data collection took place from June to August 2009 in metropolitan St. Louis. Two nicotine monitors were placed in each venue. Permission to place nicotine monitors was obtained from the owner and/or manager. Monitors where placed and removed before opening hours. Sampling locations in each venue were selected on a convenience basis, without any prior knowledge of the extent of smoking taking place in each site to represent areas where people frequently work. At the time the monitors were placed, restaurant/bar square footage was estimated and confirmed by the restaurant owner. Information about occupancy, windows, doors, and mechanical ventilation and/or air conditioning systems were assessed through observation and interviewing the manager/owner. The nicotine monitors remained in each venue for seven working days. One visit was conducted during peak business hours in each venue over the course of the seven days to verify monitor placement, calculate occupancy, count the number of smokers, and estimate proximity of smokers to monitors.

Hair samples were collected from two-three employees at each of the participating venues to assess nicotine concentrations. Compared to other methods to assess personal exposure to SHS, hair nicotine gives information over a longer duration of time than blood, saliva, or urinary cotinine levels.[21] Furthermore, hair is easier and less expensive to sample, store, and transport than blood, saliva, or urine. Approximately 30-50 hair strands were cut near the hair root from the back of the scalp where there is the most uniform growth pattern between individuals. We aimed to collect samples from at least one smoker and one non- smoker in each venue. However, due to the high smoking prevalence among hospitality workers (38.4% compared to 24.1% across all occupations) this was not always possible. Samples were collected from 45 smokers and 32 non-smokers (See Table 1).

Assessment of Knowledge and Attitudes

To assess the knowledge that the restaurant and bar employees had about the new law and its perceived consequences, a survey (adapted from Stillman et al[22]), was administered to 20 restaurant and bar employees from June – August 2009 (prior to law implementation). The survey inquired about smoking behavior, SHS exposure (workplace and personal), attitudes regarding smoking in bars and restaurants, and preferences regarding smoke-free workplaces.

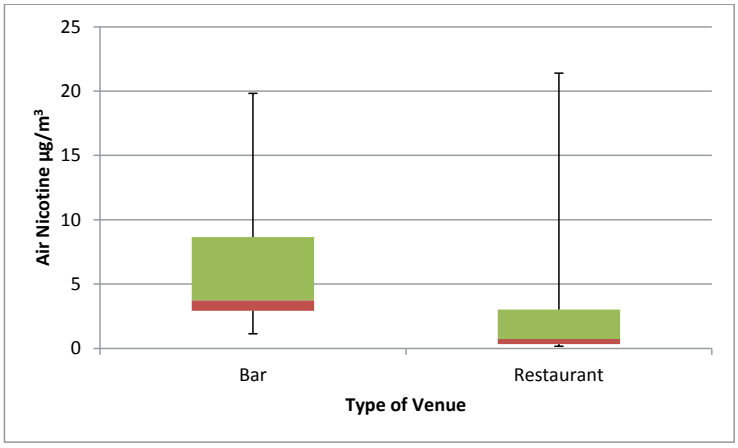
Analysis

We used descriptive statistics to summarize venue and employee characteristics. Venue characteristics taken into account included air nicotine concentration, presence of ventilation, occupancy, likelihood of going voluntarily smoke-free, sale of cigarettes, presence of tobacco advertising, and acceptance of tobacco company sponsorship (See Table 2). Employee characteristics include gender, age, educational level, work position, hours worked per week, whether they were living with a smoker, and whether they treated their hair. The employees' questionnaires were analyzed using percentages and chi-squared test and medians and interquartile ranges for hair

Table 2. Air nicotine levels in bars and restaurants by characteristic

Characteristics	Venues	Median (Interquartile ranges)	p
Overall	20	1.71 (0.20-4.23)	-
Smoking Status			.003
Non-smoking	4	0.09 (0.03-0.17)	
Smoking	16	2.83 (0.57-4.56)	
Venue Type			.112
Restaurant	10	2.66 (0.15-2.29)	
Bar	10	3.19 (1.39-4.92)	
Mechanical Ventilation			.597
Yes	10	2.22 (0.33-4.15)	
No	10	0.73 (0.14-4.92)	
Occupancy			.805
<120 (median)	6	2.32 (0.14-7.10)	
≥120 (median)	14	1.71 (0.22-3.55)	
Voluntarily smokefree in 12 months			.308
Very/somewhat likely	2	1.59 (0.16-1.59)	
Somewhat/very unlikely	13	3.36 (0.99-5.17)	
Cigarettes sold			.021
Yes	6	4.19 (2.78-8.09)	
No	14	0.38 (0.15-2.74)	
Tobacco advertising			.315
Yes	3	4.11 (1.05-4.11)	
No	17	1.63 (0.18-3.82)	

Figure 2. Air nicotine levels in bars and restaurants



nicotine levels. Analyses were done using SPSS 19.0 (IBM).

Results

Airborne nicotine levels

Table 2 highlights the results of airborne nicotine levels in bars and restaurants. Airborne nicotine levels ranged from 0.015 to 25.14 ug/m^3. The median (interquartile range, IQR) airborne nicotine levels in venues that allowed smoking was 2.83 μg/m^3 (IQR 0.57 - 4.56 μg/m^3) compared to 0.09 μg/m^3 (0.03 - 0.17 μg/m^3) in smoke-free venues ($p = 0.003$). Bars had higher median airborne nicotine (3.19 μg/m^3) levels than restaurants (0.38 μg/m^3) ($p=0.1$) (Figure 2). Bars that allowed smoking indoors had significantly higher levels ($p=.046$) than smoking restaurants [3.73 μg/m^3 (2.74 - 5.43 μg/m^3) in bars vs. 0.73 μg/m^3 (0.27 - 3.61 μg/m^3) in restaurants]. There was no significant difference in airborne nicotine by occupancy level (2.32 μg/m^3 in bars vs. 1.71 μg/m^3 in restaurants) between venues. Though not significantly different, venues where owners/managers reported they were unlikely to voluntarily adopt a smoke-free policy also had higher concentrations of airborne nicotine [3.36 μg/m^3 (unlikely) compared to 1.59 μg/m^3 (likely)($p=0.3$)].

In the venues with ventilation systems, median airborne nicotine levels were higher compared to those without a ventilation system [2.22 (0.33 - 4.15) with ventilation vs. 0.73 μg/m^3 (0.14 - 4.92 μg/m^3) without ventilation ($p=0.597$)]. To determine if the number of smokers in the room was a confounder, we performed further analysis and determined that there was no significant difference in the density of smokers between venues with or without a ventilation system.

Hair Nicotine Levels

Seventy-eight participants were included in the study. Most were female (55.1%), had some college education (71.8%), and worked on average 36.9 (IQR 12 - 77) hours per week (See Table 3). Average age was 30.6 years (range 20 - 55). The majority (52.6%) worked in restaurants and

Table 3. Hair Nicotine Concentrations among St. Louis Non-Smokers working in bars and restaurants

Characteristics	No. Employees	Median (Interquartile Range)	p
Overall	78	1.45 (0.63-5.11)	-
Venue Type			.191
Restaurant	41	5.48 (0.65-3.35)	
Bar	37	5.33 (0.59-8.70)	
Smoking policy			.885
Nonsmoking	13	1.27 (0.54-7.65)	
Smoking	63	1.47 (0.66-4.85)	
Occupancy			.782
<120 (median)	27	2.55 (0.30-6.98)	
≥120 (median)	49	1.42 (0.70-4.54)	
Mechanical ventilation			.771
Yes	36	1.69 (0.83-4.78)	
No	40	1.35 (0.56-6.91)	
Gender			.012
Female	43	1.03 (0.56-3.08)	
Male	33	2.55 (0.87-9.56)	
Age			.440
18-29	45	1.79 (0.65-6.83)	
30+	31	1.22 (0.48-4.50)	
Education			.017
<College	21	4.78 (0.79-8.83)	
College and more	55	1.27 (0.48-3.63)	
Current position in bar/restaurant			.189
Other	24	0.99 (0.37-6.43)	
Bartender/waiter	52	1.75 (0.81-5.11)	
Hours per week worked			.693
<40	55	1.68 (0.67-5.19)	
≥40	20	1.45 (0.27-7.80)	
Do other household members smoke			.027
No	30	1.02 (0.53-1.84)	
Yes	34	2.67 (0.74-6.85)	
Hair treatment			.002
No	44	2.41 (0.79-8.78)	
Yes	29	0.89 (0.47-2.01)	

66.7% were waiters or bartenders. Fifty-eight percent were current smokers. Daily smokers reported smoking on average 14.1 cigarettes/day and non-daily smokers smoking 4.3 cigarettes/day. Hair nicotine was assessed in order to account for nicotine as a result of only SHS exposure (See Table 3). Median hair nicotine levels were 3.08 ng/mg (IQR 0.89 - 8.42 ng/mg) in smoking employees compared to 0.92 ng/mg (IQR 0.29 -1.83 ng/mg) for non-smoking employees (p=.001). Also, median hair nicotine for nonsmokers working in bars and restaurants that allowed smoking was 1.19 ng/mg (IQR 0.43 -1.91 ng/mg).

Employee position was also associated with hair nicotine levels. Bartenders and waiters had median hair nicotine levels almost twice as high than other employees [bartenders/waiters = 1.75 (0.81-5.11) vs. other = 0.99 ng/mg (0.37-6.43 ng/mg), p=0.1].

Support for Smoke-free Environments

Most respondents who preferred to work in a smoke-free establishment thought that tobacco smoke was harmful to one's health (76.0%). However, only 42.1% of respondents agreed that all workplaces should be smoke-

free (31.8% of current smokers, 70.0% of former smokers, and 50.0% of never smokers). When asked about their own workplace, most (58.4%) preferred that their workplace be smoke-free (44.4% of smokers, 80.0% former and 77.3% of never smokers). In addition, 52.4% of the smokers believed that a smoke-free law would help them quit.

According to our results airborne nicotine levels are significantly higher in bars and restaurants that allow smoking indoors. This finding is important since bars (along with casinos and gaming areas) are most often exempted from smoke-free laws and also are exempted under the St. Louis City and County laws. Furthermore, our results yield that none of the venues were below the level of detection. This, in part, reflects the "voluntary" smoke-free status of the non-smoking venues. Although such business-specific voluntary policies might help, our findings suggest that they should not be relied on as a solution for SHS exposure.

Our findings also demonstrate that ventilation systems are ineffective in eliminating SHS exposure and therefore should not be considered as an option when implementing a smoke-free workplace law. This finding is consistent with other studies, namely those completed by Repace et al[23] in bars and restaurants in Mesa Arizona and Johnnson et al in Finland.[24] Conclusions from these studies suggest that the higher airborne nicotine levels in establishments with ventilation systems may be a result of ventilation systems that were improperly designed, installed, operated, or maintained.

We also found that all employees, regardless of smoking status were exposed to SHS and had detectable levels of hair nicotine. Neither venue size nor ventilation systems were associated with lower levels of hair nor airborne nicotine levels among nonsmoking employees. While customers can choose to go to a smoke-free venue, employees have to go to work and no one should have to choose between their life and their livelihood. Thus, restricting smoking in all workplaces is the most important element of a comprehensive smoke-free law.

Regarding employees' knowledge and attitudes, even though most employees thought tobacco smoke was harmful to one's health, less than half of them felt that all workplaces should be smoke-free. Therefore, tobacco control advocates in the St. Louis area should provide employees (regardless of smoking status) with the facts about smoke-free environments to increase support for a comprehensive smoke-free workplace law.

Limitations

Given that this is a cross-sectional study, we do not have longitudinal data to assess SHS exposure overtime. Also, respondents were asked to recall their daily exposure to SHS outside the workplace. This limits our ability to adequately report SHS exposure outside of the workplace and could influence hair nicotine levels in non-smokers.

Discussion

Several studies in other communities in the U.S. and worldwide have utilized airborne and hair nicotine to examine SHS exposure. Studies in which findings are most compelling in confirming the need for smoke-free policy adoption are those that document airborne and/or hair nicotine levels pre and post smoke-free policy implementation. Hahn et al examined hair nicotine levels among bar and restaurant employees pre and post smoke-free policy adoption in Lexington, Kentucky, and found the level of nicotine in hair decreased by more than half just three months after the smoke-free law went into effect.[25] In Guatemala, Barnoya et al, documented an 87% decrease in median airborne nicotine concentrations in bars and a 95% decrease in restaurants just six months after the implementation of smoke-free legislation.[7] In Ireland, only six weeks after the ban had been implemented, air nicotine levels in bars had decreased by 83%.[26] Similarly, in Uruguay, air nicotine concentrations in bars and restaurants decreased 81% one year after the implementation of the smoke-free legislation in public places in a five-year gap study.[27] Most importantly, it is well documented that in countries without legislation or with partial legislations, there are no noticeable changes in SHS levels over time, including a study in Chile with a six-year gap before and after the passing of an incomplete smoking ban.[28-30] Such findings confirm the need for statewide comprehensive smoke-free legislation.

Recommendations

Taken in conjunction with findings from other studies, our results should aid in the implementation of a comprehensive smoke-free law to reduce SHS exposure and protect all workers and customers from the harmful effects of SHS. We therefore have three recommendations. First, in concordance with the 2007 Centers for Disease Control and Prevention *Best Practices for Comprehensive Tobacco Control Programs*,[31] smoke-free workplace policies must be comprehensive and without exemption. Many states and counties still place exemptions on their SHS laws, resulting in a large numbers of workers unprotected. All people, no matter where they are employed, should be given a safe work environment completely free from the harmful effects of SHS. Second, to observe the benefits from smoke-

free laws, it is not feasible to have individual businesses to voluntarily adopt smoke-free policies. Third, our results (as others have) show that ventilation systems are not effective in removing SHS from the air. Therefore, no policy should be adopted that exempts establishments based on the presence of ventilation systems.

Conclusions

Decision makers across Missouri should not further delay the much needed implementation of a comprehensive smoke-free law. The St. Louis area in particular has an opportunity to follow in the footsteps of other large Missouri cities like Kansas City, Springfield, Independence, and Lee's Summit and strengthen their smoke-free laws.

References

1. U.S. Department of Health and Human Services (USDHHS). The Health Consequences of Involuntary Exposure to Tobacco Smoke: A Report of the Surgeon General.," U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, Office on Smoking and Health, Atlanta, GA2006.
2. Öberg M, Jaakkola MS, Woodward A, Peruga A, Prüss-Ustün A. Worldwide burden of disease from exposure to second-hand smoke: a retrospective analysis of data from 192 countries. The Lancet. 2011;377(9760):139-146.
3. Wipfli HL, Samet JM. Second-hand smoke's worldwide disease toll. The Lancet. 2011;377(9760):101-102.
4. IOM (Institute of Medicine). Secondhand smoke exposure and cardiovascular effects: Making sense of the evidence. Washington, DC2010.
5. Ong MK, Glantz SA. Cardiovascular health and economic effects of smoke-free workplaces. The American Journal of Medicine. 2004;117(1):32-38.
6. Barnoya J, Glantz S. Secondhand smoke and cardiologists: the missing link. Int J Cardiol. Feb 2004;93(2-3):331; author reply 333.
7. Barnoya J, Arvizu M, Jones M, Hernandez J, Breysse P, Navas-Acien A. Secondhand smoke exposure in bars and restaurants in Guatemala City: before and after smoking ban evaluation. Cancer Causes and Control. 2011;22(1):151-156.
8. Barnoya J, Glantz SA. Cardiovascular Effects of Secondhand Smoke: Nearly as Large as Smoking. Circulation. May 24, 2005 2005;111(20):2684-2698.
9. Hahn EJ, Rayens MK, York N, et al. Effects of a Smoke-Free Law on Hair Nicotine and Respiratory Symptoms of Restaurant and Bar Workers. Journal of Occupational and Environmental Medicine. 2006;48(9):906-913 910.1097/1001.jom.0000215709.0000209305.0000215701.
10. Menzies D, Nair A, Williamson PA, et al. Respiratory symptoms, pulmonary function, and markers of inflammation among bar workers before and after a legislative ban on smoking in public places. JAMA. Oct 11 2006;296(14):1742-1748.
11. Americans for Nonsmokers' Rights. Overview List - How many smokefree laws. January 2012; http://www.no-smoke.org/pdf/mediaordlist.pdf. Accessed March 14, 2012.
12. Hyland A, Higbee C, Borland R, et al. Attitudes and beliefs about secondhand smoke and smoke-free policies in four countries: Findings from the International Tobacco Control Four Country Survey. Nicotine & Tobacco Research. June 1, 2009 2009;11(6):642-649.
13. Barbeau EM, Krieger N, Soobader M-J. Working Class Matters: Socioeconomic Disadvantage, Race/Ethnicity, Gender, and Smoking in NHIS 2000. Am J Public Health. February 1, 2004 2004;94(2):269-278.
14. Gerlach KK, Shopland DR, Hartman AM, Gibson JT, Pechacek TF. Workplace smoking policies in the United States: results from a national survey of more than 100,000 workers. Tobacco Control. September 21, 1997 1997;6(3):199-206.
15. Shopland DR, Anderson CM, Burns DM, Gerlach KK. Disparities in Smoke-Free Workplace Policies Among Food Service Workers. Journal of Occupational and Environmental Medicine. 2004;46(4):347-356.
16. Harris JK, Geremakis C, Moreland-Russell S, Carothers BJ, Kariuki B, Shelton SC, Kuhlenbeck M. Demographic and geographic differences in exposure to secondhand smoke in Missouri workplaces, 2007-2008. Preventing Chronic Disease. 2011;8(6):A 135.
17. Centers for Disease Control and Prevention. Tobacco Control State Highlights, 2010. . In: U.S. Department of Health and Human Services CfDCaP, National Center for Chronic Disease Prevention and Health Promotion, Office on Smoking and Health, ed. Atlanta, GA2010.
18. St. Louis County Health Department, Chapter 605 INDOOR CLEAN AIR CODE, (2010).
19. Olson B. St. Louis Joins Other Cities with Indoor Smoking Ban.January 2011.
20. Hunn D. As smoking bans approach, some bars change their ways. St. Louis Today. December 2010, 2010.
21. Okoli CTC, Hall LA, Rayens MK, Hahn EJ. Measuring Tobacco Smoke Exposure Among Smoking and Nonsmoking Bar and Restaurant Workers. Biological Research For Nursing. July 1, 2007 2007;9(1):81-89.
22. Stillman FA, Hantula DA, Swank R. Creating a smoke-free hospital: attitudes and smoking behaviors of nurses and physicians. Am J Health Promot. Nov-Dec 1994;9(2):108-114.
23. Venmar. Ventilation blows away smoking in restaurants. http://www.sheltersupply.com/faq/blackdogloungesmoke.pdf; 1999. Accessed 2012
24. Johnsson, T., et al. 2006. "Environmental tobacco smoke in Finnish restaurants and bars before and after smoking restrictions were introduced." Annals of Occupational Hygiene 50(4):331 – 341.
25. Hahn EJ, Rayens MK, York N, Okoli CT, Zhang M, et al. Effects of a smoke-free law on hair nicotine and respiratory symptoms of restaurant and bar workers. J Occup Environ Med 2006:48: 906–913.
26. Mulcahy M, Evans DS, Hammond SK et al (2005) Secondhand smoke exposure and risk following the Irish smoking ban: an assessment of salivary cotinine concentrations in hotel workers and air nicotine levels in bars. Tob Control. 2005:14(6):384–388
27. Blanco-Marquizo A, Goja B, Peruga A. Reduction of secondhand tobacco smoke in public places following national smoke-free legislation in Uruguay. Tob Control. 2010;19(3):231–234
28. Erazo M, Iglesias V, Droppelmann A. Secondhand tobacco smoke in bars and restaurants in Santiago, Chile: evaluation of partial smoking ban legislation in public places. Tob Control. 2010. Online first doi:10.1136/tc.2009.035402
29. Gorini G, Moshammer H, Sbrogio L.Italy and Austria before and after study: second-hand smoke exposure in hospitality premises before and after 2 years from the introduction of the Italian smoking ban. Indoor Air. 2008;18(4):328–334
30. Lopez MJ, Nebot M, Albertini M. Secondhand smoke exposure in hospitality venues in Europe. Environ Health Perspect 2008; 116(11):1469–1472.
31. Centers for Disease Control and Prevention. Best Practices for Comprehensive Tobacco Control Programs–2007. Atlanta, GA: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, Office on Smoking and Health; October, 2007.

Disclosure

None reported.

MM