

Early Evidence on the Effectiveness of Clean Indoor Air Legislation in New York State

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In July 2003, New York State implemented the Clean Indoor Air Act (CIAA) to reduce exposure to environmental tobacco smoke (ETS). In this cross-sectional study, workers (n = 168) completed an interview assessing ETS exposure and provided urine for cotinine analysis. Hospitality workers recruited after implementation of the CIAA had significant reductions in ETS exposure and urine cotinine, compared with those recruited before implementation. The New York State CIAA yielded measurable reductions in ETS exposure for hospitality workers. (*Am J Public Health*. 2006;96:XXX-XXX. doi:10.2105/AJPH.2004.055012)

Exposure to environmental tobacco smoke (ETS) has been linked with a variety of health conditions, including lung cancer, heart disease, stroke, and asthma.¹⁻⁴ Recently, there has been increased emphasis at the state level on implementing policies that reduce tobacco smoke exposures, especially among persons employed in the hospitality industry. The objective of this study was to examine differences in sources and levels of ETS exposure among hospitality and nonhospitality workers in western New York before and after passage of the statewide Clean Indoor Air Act (CIAA) on July 24, 2003, which eliminated smoking in nearly all indoor public places.

METHODS

Study participants were recruited from the western New York community via newspaper advertisements and posters. Participant re-

cruitment began 2 months before the New York State CIAA took effect and continued for 5 months after implementation of the law. More than 300 people expressed interest in this study, and 168 nonsmoking currently employed adults participated.

A structured interview was used to identify ETS exposures on each of the 4 previous days and on the date of the interview. For each reported exposure, participants indicated location (i.e., home, work, other) and number of hours exposed. Measures of exposure included number of exposures, number of days exposed, and total duration of exposure. Nonsmoking status was bioverified with a carbon monoxide breath test (<8 parts per million carbon monoxide in expired breath).

We also collected a 50-mL urine sample to assess cotinine, a biomarker of ETS exposure. Liquid chromatography-electrospray ionization tandem mass spectrometry was used to measure cotinine values.⁵ The method had a limit of detection of 0.3 ng/mL on the basis of a validation curve.

Because participant recruitment began before implementation of the New York State CIAA, we compared exposures before (*prelaw*) and after enactment of this law (*postlaw*) and among employment groups: (1) *noncasino hospitality workers*—employed in bars, restaurants, bingo halls, or bowling alleys; (2) *casino workers*; and (3) *nonhospitality workers*. Casino workers were considered separately from other hospitality workers because all casino workers in this study were employed at American Indian-owned casinos that are exempt from the New York State CIAA. Noncasino hospitality workers represent more than 55 different workplaces covered by the New York State CIAA.

Statistical analyses were completed with SPSS 11.0 (SPSS Inc, Chicago, Ill). The χ^2 test was used to determine whether significant differences in demographic variables existed between the prelaw and postlaw groups. We calculated geometric means and medians for total hours exposed to ETS and cotinine, and we used the Mann-Whitney test to test for significance.

RESULTS

Of the 168 study participants, 14 were casino workers, 63 were noncasino hospital-

ity workers, and 91 were nonhospitality workers. The study population was predominantly female (60%), White (78%), and never smokers (83%). We recruited 107 participants prelaw and 61 participants postlaw. Ethnicity and education were significantly different ($P < .05$) between the prelaw and the postlaw groups; more Hispanics (13.1% vs 4.7%) and fewer college graduates (34.4% vs 44.4%) were recruited postlaw.

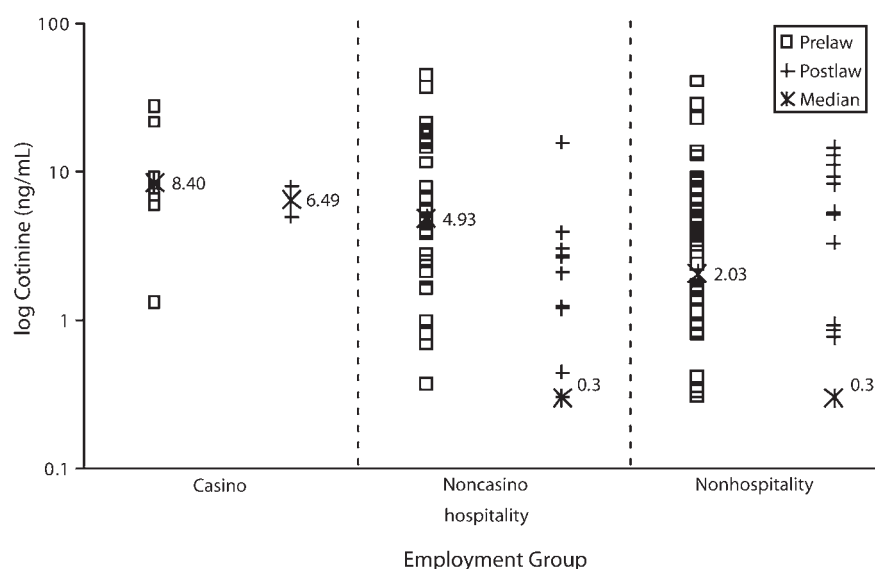
Among noncasino hospitality workers, a 71% reduction in reported exposures to ETS occurred during the 4 days prior to the interview following implementation of the CIAA (median of 20.8 hours exposed prelaw vs 6.0 hours postlaw; $P < .05$), which was generally attributable to lessened ETS exposure at work. No significant change in reported exposures was seen among casino workers (median of 18.0 hours exposed prelaw vs 19.8 hours postlaw) or nonhospitality workers (3.0 hours vs 2.3 hours). Duration and sources of ETS exposure during the 4 days preceding the interview are summarized in Table 1.

Urine cotinine values ranged from nondetectable to greater than 100 ng/mL. Subjects with urinary cotinine values greater than 50 ng/mL (n = 7; 4%) were eliminated from further analyses given the likelihood of being active users of nicotine products.⁶ The proportion with nondetectable urine cotinine levels increased significantly following implementation of the CIAA among noncasino hospitality (3% prelaw vs 62% postlaw; $P < .01$) and nonhospitality workers (20% prelaw vs 63% postlaw; $P < .01$).

Additionally, urine cotinine values decreased significantly following implementation of the CIAA among noncasino hospitality workers (median = 4.93 ng/mL prelaw vs 0.30 ng/mL postlaw; $P < .01$) and nonhospitality workers (median = 2.03 ng/mL prelaw vs 0.30 ng/mL postlaw; $P < .01$) (Figure 1). Numbers of exposures and numbers of days exposed were significantly related to measured cotinine levels among study participants; however, correlation coefficients were relatively modest.

DISCUSSION

More than 75% of white-collar workers are protected by smoke-free workplace policies,



^aA limit of detection of 0.3 ng/mL for cotinine.

FIGURE 1—Individual and median urine cotinine levels,^a by employment group.

TABLE 1—Mean Number of Hours of Environmental Tobacco Smoke Exposure, by Location, on the Basis of a 4-Day Recall

Employment Group	Location	Prelaw	Postlaw	<i>P</i> ^a
		Mean ± SD	Mean ± SD	
Noncasino hospitality		(n = 36)	(n = 27)	
	Home	5.3 ± 12.6	2.4 ± 6.9	.30
	Work	12.3 ± 9.2	1.4 ± 3.9	<.01
	Other locations	3.2 ± 4.0	3.0 ± 5.4	.53
Casino		(n = 10)	(n = 4)	
	Home	0.5 ± 1.6	0.3 ± 0.5	.56
	Work	16.7 ± 12.1	19.1 ± 13.7	.67
	Other locations	1.3 ± 1.7	0.0 ± 0.0	.10
Nonhospitality		(n = 61)	(n = 0)	
	Home	1.9 ± 6.2	5.3 ± 9.9	<.05
	Work	1.0 ± 4.2	0.0 ± 0.0	.08
	Other locations	2.5 ± 3.2	2.2 ± 4.1	.41

^a*P* value relative to prelaw level.

decreased by 91% and that carcinogens decreased by 95% postlaw. In our study, cotinine served as a biomarker specific to ETS exposure among these nonsmoking participants and showed decreases consistent with self-report measures.

Educational level was significantly associated with law enactment and with ETS exposure (any vs none; $P < .05$). Participants with less education were more likely to have been recruited after the CIAA took effect and also were significantly more likely to report ETS exposure (62% of those with some college or less education vs 38% with at least a college degree; $P < .05$). Any bias introduced into these analyses because of the differences between groups by education leads to understating the effect of the CIAA on exposure estimates.

Data from this study show marked reductions in self-reported exposures to ETS among subjects employed in the hospitality industry, including an 89% decrease for ETS exposures at work. In addition, levels of urinary cotinine offer confirmatory support for reduced exposures to ETS. The CIAA in New York State appears to be achieving its intended objective of protecting workers from exposure to ETS, although these results must be confirmed in a statewide representative sample of hospitality workers. ■

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Contributors

S.M. Abrams managed data collection, completed the analyses, and led the writing of the brief. M.C. Mahoney, A. Hyland, and K.M. Cummings originated the study and obtained funding support. M.C. Mahoney supervised study implementation and data analysis. W. Davis and L. Song developed the cotinine detection methodology and conducted sample analysis. All au-

whereas only 31% of food service workers benefit from smoke-free policies.⁷ Smaller studies examining the New York State CIAA have reported decreased ETS exposures and salivary cotinine levels among hospitality workers (Hyland A, PhD, written communication, March 2004) and improvements in measures of indoor air quality in bars since implementation of the CIAA.^{8,9} A study mea-

suring changes in levels of respirable suspended particles in 20 hospitality venues in western New York reported that respirable suspended particles decreased by 84% after the CIAA took effect.⁹ These results are similar to findings by Repace,¹⁰ who examined changes in indoor air quality following implementation of a CIAA in Delaware in 2002 and found that respirable suspended particles

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Human Participant Protection

The Roswell Park Cancer Institute institutional review board approved this study.

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