

## Smoky, and they banned it! Lessons learned from smoking bans and their effects on public health

Nathan Rabinovitch, MD *Denver, Colo*

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Over the past century, there have been remarkable improvements in our nation's health, with life expectancy increasing by 30 years since 1900. Of these 30 years, improvement in medical treatment accounts for 3.7 years, and clinical preventative services (such as immunizations and screening tests) account for 1.5. The remaining 25 years can be traced to various public health initiatives, including improvements in nutrition, sanitation, workplace, and environmental quality.<sup>1</sup> These impressive achievements suggest that broad interventions targeting health determinants on a population basis can be extremely effective in controlling disease.

Through these efforts during the late 19th and early 20th centuries, infectious diseases came under increasing control, and chronic diseases such as cancer and cardiovascular disease emerged as major causes of mortality. The recognition that smokers were at higher risk for morbidity and mortality from many of these diseases led to the implementation of population-based strategies designed to decrease levels of smoking. Government-sponsored or government-regulated public relations efforts informed the public of the dangers of smoking, advertising was restricted, and taxes were imposed on tobacco products. These and other smoking control efforts were successful in decreasing smoking prevalence from 42.4% in 1965 to 24.7% in 1998.<sup>2</sup> Concurrently, steep declines in mortality from smoking-related diseases occurred. As an example, the age-adjusted death rate for heart disease decreased by approximately 50% from 1980 through 2000, resulting in 341,745 fewer coronary deaths in 2000. Less than 50% of this decline has been attributed to advances in medical treatment, with the rest a result of reductions in smoking as well as other risk factors such as cholesterol, blood pressure, and physical inactivity.<sup>3</sup>

More recently, it has been shown that second-hand smoke (SHS) exposure is also associated with health severity for many diseases including asthma.<sup>4</sup> As such, limiting SHS exposure has become an important focus of public health efforts. Part of this effort includes the widespread adoption of local and statewide

regulations banning smoking in public places. The study by Rayens et al<sup>5</sup> is an important contribution to the growing evidence that smoking bans effectively improve health outcomes including asthma. In this context, the authors examined the effect of a public smoking ban enacted by the city of Lexington, Ky, in April 2004. They compared asthma-related emergency department (ED) rates 40 months before with rates 32 months after the ban and observed a 25% decrease in the risk of asthma-related ED visits. Their conclusion was that decreased SHS exposure after the smoking ban had resulted in decreased rates of ED visits for asthma.

Although the authors statistically controlled for some important covariables, the study design was not without some key limitations. The ecologic model used is considered the weakest type of evidence for causation, because changes in exposures (in this case SHS) are not measured but assumed. A second major limitation is that there was no comparison of ED visit trends with a population unaffected by the smoking ban. The absence of a control group leaves open the possibility that changes in ED visit rates were a result of confounding variables (ie, secular trends) that may have occurred in the years after the ban such as increased use of long-acting  $\beta$ -agonists as combination therapy with inhaled corticosteroids.

A third design limitation is the inclusion of an outlier year (2001) in which ED visits were substantially lower than in any of the subsequent years for no apparent reason. Inclusion of this data may have produced a spuriously steep rate of ED visit increases in years before the ban compared with rates postban. As such, the authors performed a sensitivity analysis without the outlying year to test the robustness of the results. This analysis demonstrated that preban to postban differences in childhood ED visits were entirely related to the inclusion of data from the outlier year, because odds ratios were essentially 1 when data from 2002 to 2006 alone were assessed. In contrast, rates in adult patients with asthma remained significantly attenuated in this restricted analysis, yielding a 15% decreased risk after the ban. The results of this sensitivity analysis suggest that although the smoking ban may have led to a decrease in adult ED visits, it did not significantly affect children with asthma.

On the basis of a number of supporting factors, one could infer causation despite the limitations in design. The study results are supported by previous studies that have reported improvements in cardiovascular and respiratory disease morbidity after smoking ban enactments in multiple venues.<sup>6-8</sup> The temporal pattern observed in this and other studies is also indicative of an abrupt change in exposure because declines in disease severity rates are typically observed almost immediately after the ban is enacted. Although decreased SHS exposures were assumed for the population, previous studies in Lexington by this group had measured drops in hair nicotine levels and decreased respiratory

From the Department of Pediatrics, National Jewish Health.

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Reprint requests: Nathan Rabinovitch, MD, Department of Pediatrics, National Jewish Health, 1400 Jackson Street, Denver, CO 80206. E-mail: rabinovitchn@njc.org.

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symptoms after the ban among nonsmoking restaurant workers and bartenders.<sup>9</sup> On the basis of these findings, it could be inferred that those who benefited most from the ban were nonsmokers with occupations in which they could not easily avoid SHS exposures in the workplace. Some of the benefit may also have occurred in restaurant patrons or workers who smoke because of lower SHS exposures and/or decreased smoking.<sup>9,10</sup> In contrast to adults, changes in urine cotinine levels after public smoking bans are slight among children with substantial SHS exposure because these exposures occur predominantly at home.<sup>11</sup> In this context, the pediatric population could be considered an informal control group largely unaffected by the smoking ban. As such, the disparate health results observed between children and adults add additional weight to the conclusion that adult ED declines were indeed related to decreased SHS exposures rather than to a confounding variable.

Taken together, these studies offer convincing evidence that public smoking bans improve health in a number of diseases including asthma. Aside from the public health implications, there are other important lessons to be drawn from these findings. Because eliminating or greatly reducing SHS exposures can effectively decrease asthma exacerbations, the value of a concerted effort by clinicians to inform and counsel patients on avoidance of asthma triggers inside and outside the home is strongly reinforced. As such, these results highlight the need for effective tools to allow clinicians to identify and easily track the presence of environmental risk factors and underscore the importance of developing strategies designed to help families implement environmental controls using effective, low-cost, and low-burden techniques.

In the end, more doctors, more clinics, and more sophisticated diagnostic and treatment advances may not by themselves alleviate the high levels of asthma morbidity, which have persisted over the past 20 years. In an age in which targeted medicine is the rage, it is important to realize that this individualized approach may be limited if disease severity is closely tied to socioeconomic, environmental, and behavioral circumstances

that are beyond the patient's ability to control. The effectiveness of smoking bans reinforces the notion that, in such circumstances, public health initiatives that broadly affect populations can be very powerful. Considering that for many patients with asthma, especially children, household exposures predominate, one would think that innovative public health initiatives aimed at improving home environments and decreasing household exposures may be even more effective.

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