

Final Progress Report

Smoking Bans and Health: Effects of Exposure on the Job
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List of Terms and Abbreviations

ANRF: American Nonsmokers Rights Foundation

CPS TUS: Current Population Survey Tobacco Use Supplements

ETS: Environmental Tobacco Smoke

SCIALs: State Clean Indoor Air Laws

Abstract

Extensive evidence suggests that exposure to environmental tobacco smoke (ETS) has a negative effect on health. This project investigated the effects of ETS on health behaviors and health, using variation in exposure to ETS induced by workplace smoking bans. Smoking bans have the potential to reduce smoking prevalence and intensity and exposure to ETS for non-smokers and smokers alike.

Existing research on the effects of state imposed workplace smoking bans on population smoking behavior is limited and relies on cross-sectional comparisons. In Bitler, Carpenter, and Zavodny (2009), under revision for resubmission, we use data from the 1992–2003 Tobacco Use Supplements to the Current Population Survey and models including unrestricted area and time effects to examine impacts of state-level laws banning smoking in certain workplaces on reported workplace policy and on smoking behavior for groups of workers who should be directly affected by these bans, controlling for demographics and cigarette taxes in the state. Data on bans are from standard sources in the literature (ImpacTeen and ANRF). Groups of workers who should be directly affected by bans are created by using information in the CPS TUS on occupation, industry, and class of worker. For example, state bans on smoking in government workplaces should affect government workers' reports on workplace smoking restrictions. Results suggest that government workplace smoking restrictions do raise the share of government workers reporting that their workplace has a policy restricting smoking. However, the results also suggest that restrictions at other types of venues do not affect workers in occupation-industry cells likely to be directly affected by such restrictions. For example, policies targeting private workplaces do not seem to significantly affect reports of having a restriction on smoking in the workplace by private-sector workers. Given these initial findings, it is not surprising that we find that sector-specific workplace bans do not affect smoking behavior by these specific types of workers. This suggests that effects of bans on smoking behavior and ETS are not working through changing workers' smoking behavior because of adoption of workplace smoking bans.

The second set of findings related to this grant is preliminary and looks at the link between state-level smoking bans and infant mortality rates. As part of this project, we extended the coding of state-level restrictions further back than the ImpacTeen data (before 1991). Preliminary regressions estimate the effect of bans on infant mortality rates by cause controlling for child and mother characteristics and unrestricted time and state fixed effects.

Highlights and Specific Findings

The results of the paper under revision for resubmission (Bitler, Carpenter, and Zavodny, 2009) suggest that state laws mandating that workplaces restrict or ban smoking have little impact on worker reports that their workplace restricted smoking, with the exception of state restrictions on smoking in government workplaces. This suggests that effects of bans on smoking behavior must work through a channel other than directly affecting worker's behavior due to their perceptions of bans.

Translation of Findings

These results suggest that more research is needed to understand the mechanisms through which smoking bans affect smoking prevalence and intensity, as shown in previous research, since the bans do not operate by changing worker's reports about the presence of bans (except for government workers).

Outcomes/Relevance/Impact

Hopefully, our work can inform research on the effects of workplace bans.

Scientific Report

This final progress report summarizes progress towards the original specific aims, including a list of the results considered significant. It then reports on the inclusion of female and minority study subjects and indicates how children were included. Finally, it contains a list of papers arising from this grant, along with URLs.

Background

While few would dispute that smoking has a negative impact on health, there has been an active and somewhat contentious debate during the past 20 years about the negative health effects of passive smoking, or second-hand smoke. In 1986, the Surgeon General issued a report that portrayed exposure to environmental tobacco smoke (ETS) as a health risk and associated ETS with heightened risk of lung cancer (U.S. Department of Health and Human Services (DHHS, 1986). In the same year, the National Research Council (NRC), relying on many of the same epidemiological studies the Surgeon General's report used, issued a report on the risks associated with ETS, suggesting that non-smokers exposed to ETS face a heightened risk of lung cancer (NRC, 1986). In 1991, the National Institute for Occupational Safety and Health (NIOSH) reviewed the evidence and concluded that living with a smoker increases the risk of lung cancer (NIOSH, 1991). In 1992, the Environmental Protection Agency (EPA) issued a report classifying ETS as a major carcinogen (U.S. EPA, 1992). These reports were followed by a series of actions to ban smoking in the workplace, including a 1989 federal ban on smoking in airplanes, a host of state and local bans on smoking in public spaces and private workplaces, and innumerable company-imposed restrictions on smoking.

Critics of these studies have charged that they do not conclusively show that exposure to ETS causes adverse health consequences. Research findings for humans are not based on experiments or random assignment (for obvious ethical reasons); thus, selection may account for differential health impacts. Research may also suffer from omitted variable bias, with studies failing to control for other factors that may contribute to differential outcomes. In addition, impacts tend to occur only over a long time and with substantial lags. Moreover, ETS exposure is difficult to measure, especially at the workplace. Given the possibility of substantial health risks from ETS as well as from smoking itself and given the large number of policies enacted to restrict smoking in public places, further investigation of the effect of ETS on health outcomes is warranted. If ETS does have negative health effects, an important question is whether smoking bans can reduce these adverse impacts.

Much of the early literature on the impacts of ETS relied on evidence of the impact of ETS on the health of non-smoking family members who live with smokers. More recent studies (reviewed in U.S. DHHS, 2001), which combine workplace exposure with household and social exposure, find that workplace exposure is generally associated with higher risk of lung cancer for women, although again, much of the evidence comes from case-control studies that match smokers with non-smokers. In contrast, we identified impacts of exposure to ETS at the workplace by using variation induced by state and local workplace bans on smoking. We compared smoking and self-reports of

whether one's workplace has an official smoking policy for workers in various different sector-industry-occupation groups, before and after implementation of smoking bans specific to that sector-industry-occupation group. We had planned to also make comparisons of worker health, but no longer plan to do so as discussed below.

Specific Aims of Original Proposal

This proposal's specific aims were to determine the following:

- 1) How do workplace smoking bans affect workers' propensity to smoke and their exposure to ETS? Does this effect vary by occupation and industry?
- 2) Do smoking bans reduce maternal exposure to ETS and maternal smoking and improve infant health outcomes?
- 3) What is the impact of smoking bans on adult health and on death rates from causes tied to ETS exposure?

Progress by specific aim

Specific aim 1: How do workplace smoking bans affect workers' propensity to smoke and their exposure to ETS? Do effects vary by occupation and industry?

Together with Christopher Carpenter (UC Irvine), Bitler and Zavodny have written a paper that examines the effect of state-level clear indoor air laws on smoking behaviors and potential ETS exposure. The study is currently under revision for resubmission to *Health Economics*. The paper combines data on smoking behaviors and workplace smoking restrictions from the 1992–2003 Tobacco Use Supplements to the Current Population Survey with data on state-level restrictions from MayaTech (the ImpacTeen smoking restrictions data). The project also utilized data from the American Nonsmokers Rights Foundation (ANRF) on local-level smoking restrictions. The paper's premise is to thoroughly examine whether adoption of state laws affects workplace smoking restrictions. Finding such an effect (which we term a "compliance effect") is a necessary precondition for finding any causal effect of state laws on actual smoking behaviors or ETS exposure at workplaces. The paper looks at laws aimed at several specific sectors (termed "venues" in the paper), such as the government sector, the private sector, K-12 schools, and eating/drinking place workers. The paper then examines whether adoption of state laws affected smoking prevalence and intensity in a plausible way, given the results for effects on workplace smoking restrictions.

After combining the 1992–2003 CPS TUS data with the data from ImpacTeen on state laws restricting smoking by venue and data on cigarette taxes and other state by time characteristics, we estimated regression models using weighted least squares. We modeled several dependent variables, including whether or not the individual was a current smoker, the natural log of the number of cigarettes smoked in the last month, as well as for indoor workers in various industry/occupation cells whether their workplace had a policy on smoking. Other controls included unrestricted survey month, year, and state fixed effects as well as real excise taxes on cigarettes and important demographic

and state characteristics. First, we show that using the CPS-TUS data, there is a correlation for all adults between being a current smoker and a strength weighted index combining the various venue restrictions (restrictions in private workplaces, government workplaces, public schools, private schools, restaurants, bars, child care centers, health care facilities, recreational facilities, cultural facilities, public transit, and shopping malls), using the coding produced by ImpacTeen. This establishes that our findings with the CPS TUS match some from the previous literature.

Then, we turn to an examination of indoor worker's reports of whether their workplace has an official policy and the bans by venue for all workers, and for samples we think should be affected by specific types of bans. For example, state bans on smoking in government workplaces should affect reporting about restrictions for government workers if the effect of these bans is to change smoking behavior by workers. The results indicate that state clean indoor air laws that target government workplaces do indeed raise the share of government workers who report workplace smoking restrictions. Oddly, however, such laws also appear to raise the share of workers at other (non-government) venues who report workplace smoking restrictions. This suggests that laws are not exogenous or that other venues respond to laws covering the government sector, perhaps in anticipation of future restrictions on their own venue. Restrictions at other venues do not have predictable effects on workplace smoking restrictions. In short, the results give little reason to expect that state-level workplace smoking restrictions have a causal impact on smoking behaviors and ETS exposure. This evidence suggests that workers in these specific workplaces are unlikely to have changed their smoking behavior in response to these policies. Our next exercise is to see if this is the case in the data. Consistent with this, the results find no systematic effect of venue-specific state clear indoor air laws on actual smoking behaviors for workers in the affected venues. This paper currently is being revised for invited resubmission to *Health Economics*.

Other analysis not included in the paper suggests that local bans also may not have a substantive impact on overall smoking behavior using the same CPS TUS data, although these findings are limited in their usefulness by the fact that the CPS TUS only identify large local areas in the public use data and the typical source of local restrictions—ANRF codings—may not include all local ordinances restricting smoking. We also spent considerable effort to cross check various codings of state-level restrictions (ImpacTeen, ANRF, NCI's State Cancer Legislative Database) and the results described above are consistent across these different sources.

Given these non-findings for national data and state level bans, we are not planning to analyze data from the California Tobacco Surveys.

Specific Aim 2: Do smoking bans reduce maternal exposure to ETS and maternal smoking and improve infant health?

Bitler and Zavodny are completing a paper on the effects of state-level smoking laws on infant mortality using Detailed Natality Data and U.S. Linked Cohort and Period Birth/Infant Death Data for the period 1981-2001 (not including 1992-1994, for which data are not available). The U.S. Linked Cohort and Period Infant Death Data contain

information from all birth certificates for a given cohort or period with data on all infants who die and can be linked to the birth certificates. So, death rates can be constructed by summing the number of deaths due to a specific cause of infants born in a given state and year and dividing it by the number of births in that state and year. To conduct this analysis over this time span required that we compile and cross-check a list of state-level restrictions adopted prior to 1991 (when the ImpacTeen data begin). Creating that database of early state-level restrictions was a major undertaking that is now complete.

These data on state-level smoking restrictions were merged with data on infant mortality rates by cause for infants, the state's real excise tax on cigarettes, and other data on important policies and characteristics varying at the state and year level. Other policies we controlled for are those known to affect infant health such as the income eligibility cutoff for a pregnant woman to obtain Medicaid/SCHIP coverage, employment growth and unemployment rates, state real average income, real maximum AFDC benefit levels, and a control for whether the state refuses to cover abortions with Medicaid funds. The least squares regressions are weighted to be population representative, allow for arbitrary correlations of the error term within state, and include unrestricted state and year effects as well as controls for race/ethnicity of the mother, whether she was unmarried, her age, her education (when available) whether the father's information was missing from the birth certificated, gender of the child, 5-Minute APGAR score from the birth, whether the infant was part of a multiple birth, and whether the mother initiated prenatal care after the first trimester.

The analysis examines the probability that an infant dies during the first year of life, for any reason and by causes potentially related to ETS (such as respiratory-related causes and SIDS). The focus is on a variable measuring the strictness and prevalence of state-level smoking restrictions. Preliminary results indicate that state-level smoking restrictions have a small, negative effect on infant mortality, although we are not done with the analysis. We are still working on this paper and hope to submit to a health journal within the next few months.

Efforts to obtain Detailed Natality Birth Certificate data with information on mother's occupation from California were unsuccessful, and we have not yet obtained the data from Texas with the occupations linked to the birth certificate data. We have not yet linked the data on detailed state smoking restrictions to the national Detailed Natality data (this can only be done for the period after 1989 through 2004 with public use data; data on mother's smoking was not collected before 1989 and state of birth is not available on the public use data after 2004). We still plan to carry out this analysis of smoking behavior using the Detailed Natality Data..

Specific Aim 3: What is the impact of smoking bans on adult health and on death rates from causes tied to ETS exposure?

We have downloaded the Vital Statistics Detailed Mortality Data (which include subsets of information from death certificates for all deaths in the US), and have created consistent extracts for each year of the data. Given our findings in the paper discussed above with specific aim 1, we no longer plan to conduct analysis which makes use of death rates by occupation and industry (since our results above suggest that there is likely

to be little impact of the bans on morbidity of workers at workplaces covered by them as there is no consistent impact on workers' own smoking). We had still planned to conduct a national analysis not using the occupational information.

However, right after this initial work was completed but before we merged the restrictions into the raw data set or had run any specifications, we became aware of two existing working papers using a similar methodology to the one we proposed. The first paper, "The Short Term Impact of Smoke-Free Workplace Laws on Fatal Heart Attacks," by Scott Adams, Chad Cotti, and Daniel Fuhrmann (2009), finds that bans are associated with a reduction in heart attack related fatalities for adults 25–54. The second, a 2009 NBER working paper entitled "Changes in U.S. Hospitalization and Mortality Rates Following Smoking Bans," by Kanaka Shetty, Thomas DeLeire, Chapin White, and Jayanta Bhattacharaya, finds that workplace bans are not associated with statistically significant short-term declines in mortality or hospital admissions. These competing findings suggest that a national level analysis by us would add little to the existing literature.

References

Adams, S, Cotti, C, and Fuhrmann, D. [2009] The Short Term Impact of Smoke-Free Workplace Laws on Fatal Heart Attacks. Mimeo.

Shetty, K, DeLeire, T, White, C, and Bhattacharaya, J. [2009] Changes in U.S. Hospitalization and Mortality Rates Following Smoking Bans. NBER Working Paper 14790.

Inclusion of gender and minority study subjects

This project includes data on females and minorities. Some datasets used in this project, such as the Current Population Survey, are samples that are representative of the general adult worker population. Other datasets, such as the Natality and infant deaths data, are not samples but rather nearly-complete universes of births and deaths and thus include females and minorities. None of the data for this project to date are stratified or selected based on sex or racial/ethnic status with the exception that we must use a sample of mothers to look at maternal smoking.

Inclusion of children

This project includes data on children. The data excerpts from the Detailed Natality Data and U.S. Linked Cohort and Period Birth/Infant Death Data include children born alive of all races/ethnicities and both sexes born in 1981-2001 (not including 1992-1994) to a mother who resides in the U.S.

Papers

Bitler, Marianne, Christopher Carpenter and Madeline Zavodny, "Venue-Specific State Clean Indoor Air Laws and Occupation-Specific Outcomes," under revision for resubmission. Available at http://www.socsci.uci.edu/~mbitler/papers/bitler_carpenter_zavodny_9_5.pdf