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IMPACT OF COMPREHENSIVE SMOKING BANS ON THE HEALTH OF INFANTS AND CHILDREN

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ABSTRACT

As evidence of the negative effects of environmental tobacco smoke (ETS) has mounted, an increasingly popular public policy response has been to impose restrictions on smoking through 100% smoke-free bans. Yet sparse information exists regarding the impact these smoking bans at the state and local levels have on the health of children and infants. A rationale for expansion of smoke-free laws implicitly presumes that potential public health gains from reducing adult cigarette consumption and declines in adult ETS exposure extend to children. However, if smokers compensate by shifting their consumption of cigarettes from public venues that impose a 100% smoke free ban to smoking at home, then these policies may have a harmful effect on children and infants. This study provides comprehensive estimates of how 100% smoke-free regulations impact the venue of smoking, smoking behaviors, and the health of children and infants. Using models that exploit state- and county-level changes to smoking ban legislation over time, estimates suggest that smoking bans have improved the health of both infants and children, mainly through implementation of more comprehensive bans. Further, we find no evidence of compensatory behaviors among smokers (both smokers with and without children in the household), and actually find that the bans had a positive spillover effect in terms of reducing smoking inside the home – an effect which may further explain the improvement in infant and children's health.

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I. Introduction

The effects of smoking are not confined to smokers. In 1992, a report released by the Environmental Protection Agency (EPA) concluded that secondhand smoke (also called passive smoke or environmental tobacco smoke [ETS]) causes lung cancer in adult non-smokers and impairs the respiratory health of children (EPA 1992). The U.S. Surgeon General (U.S. Department of Health and Human Services 2006) concludes that no level of ETS exposure is safe. Even brief exposure to ETS may endanger non-smokers and there are clear adverse health effects of ETS for infants and children. Infants born to women who smoke during pregnancy tend to have lower birthweight and are at a higher risk for sudden infant death syndrome. ETS exposure causes asthmatic children to suffer more frequent and severe attacks. School-aged children exposed to ETS have respiratory symptoms, including cough, phlegm, wheeze, and breathlessness (Colley, et al. 1974a,b; Strachan and Cook 1997; DiFranza and Lew 1996).

ETS exposure is not trivial, with the Centers for Disease Control and Prevention (CDC) noting that it threatens more than 126 million non-smoking Americans, including children. An estimated 150,000 to 300,000 children younger than 18 months of age have respiratory tract infections linked to ETS exposure. Leung and Lam (2003) conclude that 9% of total direct medical costs in the first year of life can be attributed to ETS exposure. The total economic burden of ETS exposure in the U.S. is estimated to be greater than $5 billion in direct medical costs and $4.7 billion per year in lost productivity costs (Bonnie and Wallace, 2007).

The enormity of these economic costs justifies the continued implementation of comprehensive and extensive tobacco control programs comprising excise tax hikes, antismoking educational campaigns, and support for smoking cessation since the 1970s. More recently amid evidence regarding the negative effects of ETS, the public policy response has been to completely ban smoking in public places and worksites and to promote clean indoor air through 100% smoke-free laws (100% SFLs). These laws are substantially more stringent than other clean indoor air laws in that they do not allow smoking anywhere on the premises and do not permit designated smoking areas within the banned places.[1] Typically, 100% SFLs are enacted in three venues: restaurants, bars, and/or private workplaces. As of July 2016, 25 states had banned smoking in all three venues, and 20 states prohibited smoking in private-sector worksites (though small employers are sometimes exempt). In many states, even those without a statewide ban, local 100% smoking ordinances have been legislated at the city or county level. As of July 2016, 1295 municipalities representing 41 states and the District of Columbia had enacted a smoke free ban in one of the three venues described. In 1990, three counties in California enacted the first local 100% smoke-free laws, and today over 3,000 municipalities have local laws in effect that restrict smoking, with 880 of these municipalities having 100% SFLs in at least one of the three venues. Currently, 73% of the U.S. population are protected by a 100% SFL at a workplace (W) and 65% are exposed to a 100% SFL at restaurants (R) and bars (B).[2] Figures 1 and 2 show the prevalence of these state and local 100% SFLs in 2012, and the change in the percent of population covered over the time of study 1990-2012.

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[1] It has been found that in facilities with designated smoking rooms, smoke can escape and get into the non-smoking areas (Campaign for Tobacco Free Kids, 2014; see https://www.tobaccofreekids.org/research/factsheets/pdf/0368.pdf.) Indoor air pollution has also been found to be significantly higher in non-smoking areas within facilities that have designated smoking areas, relative to facilities that are 100% smoke-free (Oklahoma Tobacco Research Center 2010; see http://www.ouhsc.edu/otrc/research/documents/PreliminaryIAQreport.pdf.)

[2] See compilation by the American Nonsmokers' Rights Foundation (http://www.no-smoke.org/goingsmokefree.php?id=519).

Both, the Centers for Disease Control (CDC) and Institute of Medicine (IOM) strongly recommend that states and localities enact 100% SFLs in all non-residential indoor locations, mainly any worksites, restaurants, and bars previously excluded from the clean indoor air acts (USDHHS, 2007a; USDHHS, 2007b; Bonnie, et al, 2007a, Bonnie et al. 2007b). While these recommendations aim to reduce smoking prevalence and ETS exposure for the entire U.S. population, they are based on studies that investigate the impact of less restrictive clean indoor air regulations (i.e., not 100% SFLs) on smoking prevalence, smoking-related morbidities, and ETS exposure *among only adults* (i.e., not all ages). A key and necessary link for a comprehensive evaluation of the effectiveness of 100% SFLs has been missing from the CDC and IOM reports as very few studies have assessed whether and to what extent 100% SFLs at the state and local levels impact the health of children and infants.

The health-promoting effects of 100% SFLs are well documented for adults. The rationale for smoke-free laws implicitly presumes there are public health gains from reducing adult cigarette consumption and declines in adult ETS exposure that extend to children. The presumption that these gains, *a priori*, will extend to infants and children may or may not be correct. For instance, smokers may compensate for the comprehensive restrictions by partly shifting from consuming cigarettes at 100% smoke-free work and other public places to smoking at home (when children, infants, or pregnant women are present). This potential unintended displacement of smoking to the home (or other non-banned places) could raise ETS exposure of children and non-smoking family members (Adda and Cornaglia 2010).

The economics literature provides some evidence of compensatory behaviors and displacement that may partly undermine the original intent of 100% smoke-free laws. Adams and Cotti (2008) find a higher incidence of alcohol related fatal accidents following the imposition of locally enacted 100% SFL for bars. They suggest that the benefit of a 100% SFL from smokers choosing to stay at home or reducing their smoking is partially offset by the increased miles driven by smokers wishing to smoke and drink, netting an increase in alcohol-related accidents. Similarly, Adda and Cornaglia (2010) show that state-level 100% SFLs in bars and restaurants decrease the amount of time that smokers spend at these locations and increase the time spent at home. This study suggests that 100% SFLs raise cotinine levels in children. However, these estimates do not suggest an impact on overall health and the limited sample size creates imprecision in the estimates. Adda and Cornaglia (2006) and Evans and Farrelly (1998) find that smokers compensate for higher cigarette excise taxes by smoking each cigarette more intensively, so as to extract greater nicotine per cigarette, and by smoking cigarettes higher in tar and nicotine content. An international study by Ho et al. (2010) finds some support for compensating smoking behaviors among residents in Hong Kong, which enacted a 100% smoke-free legislation in 2007. The study documents higher rates of self-reported ETS exposure among never-smoking primary school students, both inside and outside the home, after 100% SFL legislation.

Given the potential for displacement of smoking to other venues, it cannot be presumed that the health-promoting effects of 100% SFLs documented for adults will carry over to children and infants in the U.S. In fact, the primary site of ETS exposure for U.S. children is the home from parents or other adults smoking (Klepeis et al. 2001; Yousey

2006), and another common site of exposure is restaurants (McMillen et al. 2003; Skeer and Siegel 2003; Siegel et al. 2004). Due to their inability to choose their environment, children in general are also exposed to more ETS than non-smoking adults (Crawford et al. 1994; Yousey 2006; USDHHS, 2005; USDHHS 2007).

In light of these trends, it is important to investigate how 100% SFLs impact children and infants. The momentum for recommendations for state and local-level 100% SFLs continues, despite very limited prior work regarding how these smoking restrictions have impacted children and infants in the U.S. Our study specifically addresses this gap in the literature and provides key empirical estimates of the impact of state and local 100% SFLs on infant health, based on the census of births from the Vital Statistics, and on ETS-related respiratory problems in U.S. children, based on the National Health Interview Surveys (NHIS). We also provide some of the first analyses informing whether 100% SFLs impact the venue of smoking - that is whether 100% SFLs at worksites, public places, and other locations increase the likelihood of smoking in the home (among households with children present).

II. Background

A large literature has evaluated the effects of clean indoor air laws (prior to the imposition of 100% smoke-free laws) on smoking prevalence and cessation (e.g., Levy and Friend 2003; Evans et al. 1999; Farrelly et al. 1999; Carton et al., 2016). These studies find that comprehensive clean air laws have the potential to reduce smoking prevalence and consumption rates of the entire population, raise cessation rates among current smokers, and reduce ETS-related morbidities. In a meta-analysis of 26 studies, Fichtenberg and Glantz (2002) conclude that a 100% smoke-free workplace reduces smoking prevalence by

5.7 percentage points and average daily cigarette consumption among smokers by 14%. Additionally, restrictions on smoking may also play a role in shifting social norms and altering the perceived social acceptability of smoking, which in turn may induce cessation as well as lower initiation.[3]

A second strand of literature also finds that moving towards 100% SFLs can effectively reduce non-smokers' exposure to ETS in several different settings (Valente et al. 2007; Stillman et al. 1990). Brauer and Mannetje (1998), for instance, find that mean particulate concentrations of ETS were 70% higher in restaurants without smoking restrictions compared with those with partial smoking restrictions. Research also provides evidence of a link from smoking bans to improvements in ETS-related morbidities *for adults*. Eisner et al. (1998) study the respiratory health of bartenders before and after the institution of 100% SFLs in all bars in California. Controlling for personal smoking, they find that the 100% smoke-free law in bars was associated with a rapid improvement of respiratory health. This result has also been noted outside the U.S. (Goodman et al. 2007). Furthermore, several studies confirm a reduced incidence of acute myocardial infarction following public smoking bans in the U.S. as well as in other countries (Shetty, DeLeire, et al. 2011; Meyers et al. 2009; Cesaroni et al. 2008; Seo and Torabi 2007; Glantz, et al., 1991).

A study using serum cotinine levels as measured by NHANES from 1988 to 2002 suggests a substantial decline in ETS exposure among non-smoking adults in the U.S. population (Pirkle et al. 2006, 1996). These results varied for cohorts of children and the decline was smaller among the youngest children relative to that for adults. The authors

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[3] See also the CDC and IOM reports which review this literature (USDHHS, 2007a; USDHHS, 2007b; Bonnie, et al, 2007a, Bonnie et al. 2007b).

note that children, especially non-Hispanic whites, had consistently higher cotinine concentrations during each period, and remain at a relatively elevated risk from exposure to secondhand smoke. Other studies have also confirmed that children in the U.S. are exposed to more ETS than non-smoking adults (Crawford et al. 1994; Yousey 2006; USDHHS, 2005; USDHHS 2007). Based on serum cotinine, an estimated 22 million children (ages 3-11) and 18 million youth (ages 12-19) were exposed to ETS in the U.S. in 2000. Children are significantly more likely to live with at least one smoker (USDHHS 2007), and have cotinine levels more than twice as high as non-smoking adults (Caraballo et al., 1998).

In summary, these studies suggest that 100% SFLs have reduced smoking prevalence and cigarette consumption, reduced non-smokers' exposure to ETS, and have improved ETS-related morbidities *among adults*. They also indicate that children, being unable to select their environment, are exposed to more ETS than non-smoking adults, and that ETS exposure among the youngest children appears to have decreased at a slower rate relative to that for adults. However, very little work has directly assessed how 100% SFLs have affected infants and children. According to a 2014 systematic review and meta-analysis, only five North American studies have examined the effects of public smoking bans on child health, and none of these studies analyzes a nationally representative sample (Been at al. 2014). These studies generally support improvements in child health following the introduction of public smoking bans (Rayens et al. 2008; Hade 2010) though the risk for bias may be high due to the use of small samples that are not nationally representative. European studies of public smoking bans and child health are more prevalent, and findings from these studies in addition to the small number of U.S. studies imply that public smoking bans are associated with a significant reduction in the likelihood of a preterm birth and child hospital attendance for asthma.[4]

One notable exception to the few small-scale U.S. based studies is a recent study by Markowitz et al. (2013), which utilizes data for 29 states and New York City, based on the Pregnancy Risk Assessment Monitory System and spanning 1996-2008 to assess how tobacco control policies affect birth outcomes. They consider the effects of state-level cigarette prices and excise taxes, and state-level comprehensive bans on smoking in restaurants and worksites, and find very limited effectiveness of these policies. Higher cigarette taxes and prices are found to elicit a stronger response, in terms of improvements in birth outcomes and particularly in averting preterm births, among teen mothers and mothers with low levels of educational attainment or on Medicaid. Fully banning smoking in restaurants is found to improve birth outcomes among more educated and higher-income mothers.

Our study extends the work by Markowitz et al. (2013) and contributes to the limited literature in several respects. First, in addition to state-level smoke-free laws, we also consider the effects of local ordinances at the municipality and the city/county-level. As noted above, while three counties in California enacted the first local 100% smoke-free laws, today over 3,000 municipalities have local laws in effect that restrict smoking, with

[4] Bhardwaj et al. (2014) study the extension of pre-existing smoking restrictions in Norway to bars and restaurants starting in 2004. Within a difference-in-differences (DD) context, comparing birth outcomes of female workers in restaurants and bars after the policy shift to similar workers in control occupations (female workers in stores), they find that the smoking bans significantly lowered rates of very-low birthweight (<1500 g) and preterm births. Most of these benefits appear to be due to smoking cessation among mothers exposed to the bans. However, to the extent that workers in the control occupation may also benefit from reduced exposure to ETS in restaurants and bars after the extension of the smoking ban to these establishments, the DD estimates may be partly netting out any benefits that may be coming from this channel.

880 of these municipalities having 100% SFLs in at least one of the three venues (worksites, restaurants, and/or bars) by 2012. Thus, even if a given state may not have enacted SFLs, residents of various localities within the state may still be exposed to these smoking bans due to the local ordinances. Omitting these local-level 100% SFLs may therefore lead to measurement error, minimize essential policy variation and statistical power, and potentially understate the effects of the policies. Second, we utilize information on about 86.3 million births over the past 23 years to analyze effects on infant health. This national census of all U.S. births over this period raises the external validity of our estimates, and the large sample size is important for maximizing statistical power in order to reliably detect effect magnitudes which may be potentially small. Third, if 100% SFLs are found to impact infant health, it is not clear whether these effects are realized due to "own-effects", that is a reduction in smoking by a pregnant woman exposed to these restrictions, or external effects, that is a reduction in a non-smoking mother's exposure to ETS because others around her are smoking less. We undertake analyses to inform how much, if any, of the impact of 100% SFLs on infant health is driven by the own-smoking effect versus potential external effects. Fourth, we extend the analysis to consider not just infant health but also children's adverse respiratory health outcomes related to ETS exposure. Finally, we provide the some of the first direct estimates of how 100% SFLs have affected the venue of smoking, informing whether these restrictions have displaced smoking behaviors from banned places to the home, particularly among households with children. Together, these estimates contribute to our understanding of how comprehensive smoking restrictions have impacted infant and child health, and whether

any beneficial effects may have been diminished due to potential displacement of smoking to non-banned places.

III. Data

We use two restricted datasets with geographic identifiers to investigate the effects of both local and state 100% SFLs on the health of children and infants and on the likelihood of smoking at home. Each dataset offers unique advantages, is nationally-representative, and has a large sample size, allowing us to maximize statistical power and assess differential effects across socio-demographic factors.

U.S. Vital Statistics Natality Data

In order to assess the effects of 100% SFLs on infant health we utilize data on individual birth records from the U.S Vital Statistics Natality files. Detailed information on all individual births occurring in the 50 states and D.C. are submitted by hospitals to state vital registration offices, which is then reported to the National Center for Health Statistics (NCHS). Information on each birth includes date and place of birth, along with the demographic characteristics of the mother and father such as age, race, education, marital status, whether born in the U.S., and parity.

We utilize data from 1990 through 2012, representing 86.3 million U.S. births. This period enveloped the first 100% SFLs in three municipalities in CA to the proliferation of these bans over the next two decades (Figure 2) when almost 900 municipalities enacted a 100% SFL in at least one venue and almost two-thirds of the U.S. population were exposed. We measure two categories of infant health: 1) birthweight; and 2) gestation. Birthweight is measured as a continuous outcome and alternately as an indicator for low birthweight (infant was born weighing less than 2,500 grams). Gestational age is measured continuously in weeks, and also as an indicator for whether the infant was born preterm (gestation < 37 weeks).[5]

Self-reported information on maternal smoking during pregnancy is also available.[6] Birth certificates are generally thought to provide a reasonably reliable source of data on prenatal smoking status for large observational studies (Nielsen et al., 2014), although underreporting of smoking status has been suggested for as much as one fifth of smokers (Tong et al, 2013). While underreporting can inflate our variance estimates, there is no a priori indication that underreporting is systematically correlated with the state or local smoking bans in a way that necessarily biases our estimates, conditional on state and time fixed effects and the other controls in our models.

National Health Interview Surveys (NHIS)

The National Center for Health Statistics (NCHS) has used the NHIS to monitor the nation's health since 1957. In order to assess the effects of smoking bans on child health and on the venue of smoking, we utilize information from the NHIS after the sampling plan redesign in 1997, spanning 1998-2013. Because we use the one year lag of the smoking ban policies in this analysis, these data cover policy years 1997-2012. This results in a pooled sample of 167,328 children under the age of 18. The primary child health outcomes of

[5] Prior to 2014, gestational age of a newborn was based on the date of the last normal menses (LNM). Beginning in 2014, there has been a transition to a new standard based on the obstetric estimate due to some concerns that the LNM measure may have weaker validity due to issues with imperfect maternal recall and other forms of misinterpretation. Martin et al. (2015) nevertheless find that the two measures were in agreement for the 2013 birth certificates. The obstetric estimate was within 1 week of the LNM estimate for a total of 83.4% of records, and within 2 weeks for 91.4% of all 2013 records.

[6] These outcomes are not reported by some states (for instance, CA, IN, NY, SD, OK) over all or part of our sample period. We exclude births occurring in these states when analyzing these behaviors. Limiting all analyses to those states with consistent information on smoking does not materially alter our results or conclusions.

interest, obtained via parental reports in the child health files, measure adverse health conditions linked to or which may be exacerbated by ETS: asthma (ever diagnosed; asthma attack in the past year; hospital emergency room visit related to asthma), hay fever (past year), any respiratory allergies (past year), three or more ear infections (past year), whether the child had an emergency room (ER) visit for *any* reason in the past year, and self-reported general health status.

The NHIS also includes a proxy measure for ETS inside the home in the 1998 Health Promotion Supplements and the 2000, 2005, and 2010 Cancer Supplements, yielding 41,096 adults with at least one child under age 18 residing in the home. The ETS exposure data are derived from questions regarding smoking anywhere inside the home.

All NHIS waves include information on maternal and paternal demographic characteristics such as age, race, education, marital status, whether born in the U.S., income and the smoking status of the parents and other adult household members. The restricted NHIS data were accessed through the Census Research Data Center.

Tobacco Policy

To capture information on smoking bans over time, we use the most comprehensive dataset detailing information on 100% SFLs passed and implemented at the local (city and county-level) and state levels compiled by American Nonsmokers' Rights Foundation (ANRF). The data describe the coverage of the 100% SFL (workplaces, restaurants, bars) and the implementation date defined as the date that the provisions became fully effective. Many prior studies used information on clean indoor air legislation or smoking bans at the state level only; our analyses utilize all available information at both the state and local (county and city) levels in order to minimize measurement bias and fully capture an individual's potential exposure to 100% SFLs in their vicinity. We define dichotomous indicators for whether a given county in a given year had enacted each type of smoking ban, and whether this ban is comprehensive or limited. Comprehensive workplace SFLs mandate that all workplaces must be completely smoke-free, with minor exceptions.[7] Limited workplace bans, in contrast, either exempt larger groups of employees, permit smoking in enclosed, separately ventilated smoking rooms, or allow for other exemptions. Comprehensive restaurant SFLs mandate that all restaurants, including attached bars, must be completely smoke-free without exemption. More limited restaurant bans allow for a designated separately-ventilated smoking area, exempt certain restaurants based on number of seats, permit smoking in attached bars that are separately ventilated, or allow for other exemptions. Comprehensive bar SFLs mandate that all freestanding bars must be completely smoke-free without exemption. Limited SFLs as applied to bars allow for various exemptions such as permitting smoking in an enclosed, separately ventilated room.

Information on state-level taxes for cigarettes is obtained from The Tax Burden on Tobacco: Historical Compilation (Orzechowski and Walker 2010 and various years). We match information on the 100% SFLs and cigarette excise taxes to the birth records based on maternal county of residence and the start of pregnancy. The start of pregnancy is imputed based on gestational age and birth month.[8] We match the policy information based on start of pregnancy, rather than date of delivery, since infant health is affected by in utero exposure to ETS over the course of the pregnancy. Furthermore, evidence

[7] Workplaces with only one employee are exempt, as are family-owned business and businesses run by self-employed persons, in which all the employees are related to the owner or the self-employed person and which are not open to the public.
[8] Results are not sensitive to using a standard 40-week gestational period.

suggests that prenatal smoking is most responsive during the first trimester (Colman, Grossman, and Joyce 2003; Colman and Joyce 2003). For the records in the NHIS, we match the 100% SFLs and cigarette excise taxes based on county of residence and the year prior to the interview date, which allows for a one-year exposure lag mirroring the 9-month exposure lag (over the pregnancy period) utilized in the birth certificate data. Since we would expect 100% SFLs to affect adult smoking behavior first and child health second, we do not incorporate a lag when examining the adult outcome (i.e., whether anyone smokes inside the home).

Table 1 presents means for our analysis sample derived from the Vital Statistics Natality files, and Table 2 presents outcome means for the sample based on the NHIS. Figure 2 shows the substantial increase in the population exposed to 100% SFLs pertaining to worksites, restaurants, and freestanding bars over the past two decades, and particularly since the late 1990s. In 1995, less than 2% of the population resided in a locality or state with a comprehensive smoking ban in each of the three venues. By 2012, over 48% of the population was exposed to a comprehensive worksite ban, over 64% were exposed to full bans in restaurants, and over 60% were exposed to these restrictions in freestanding bars.

IV. Methodology

Our empirical analysis is based on specifications that directly link the 100% SFLs to infant and child health outcomes. The research design is a difference-in-differences (DD) approach focusing on the reduced-form effect of being exposed to smoking bans in workplaces, restaurants, and bars. For each measure of infant and child health, we estimate the following baseline health production function:

$$(1) \qquad H_{icst} = \alpha_{c,s} + \theta_t + SFL_{cst-1}\,\beta + X_{icst}\,\lambda + Tax_{st-1}\,\delta + \nu_{icst}$$

In equation (1), H denotes a specific measure of infant or child health (e.g. birth weight, gestation, respiratory ailments) for a given birth *i* occurring in county *c* in state *s* and year *t* (in the birth records) or for a given child *i* residing in county *c* in state *s* and interviewed in year *t* (in the NHIS). SFL denotes the vector of smoke-free laws effective in the county and/or state (of birth, in the birth records; of residence in the NHIS) at the time of pregnancy (for the birth records) or during the year prior to interview date (in the NHIS). The vector X represents individual characteristics. In models for birth outcomes, X includes maternal characteristics such as age, educational attainment, marital status, and race/ethnicity. In models for child health, based on the NHIS, X includes child characteristics (age, gender, race/ethnicity and birth weight) and maternal characteristics (age, educational attainment, and marital status). All models also control for the state-level cigarette excise tax, which previous studies have found to affect maternal smoking and infant health (Colman, Grossman, and Joyce 2003; Colman and Joyce 2003; Evans and Ringel 1999). Equation (1) further includes year (θ) and state (α_s) fixed effects, which respectively control for any national trends and state-specific time-invariant unobservables such as tobacco sentiment, strength of the tobacco economy in the state (for instance, tobacco growing states), and other fixed state factors such as culture and geography. Standard errors are clustered at the state level and account for any correlation of the errors within state cells.

The parameter of interest is β, which captures the net reduced-form effect of the SFLs on infant and child health, operating through any reinforcing and/or counteracting mechanisms. This effect is identified off the variation in the implementation of SFLs within states over time, and across counties within a given state. These models exploit within-state variation in exposure to the SFLs to identify the effects of the restrictions, which includes both within-county variation over time as well as cross-county within the same state and year. About 15% of the observed variance in the 100% workplace SFL represents such variation, independent of the variation in the other two bans. Similarly, about 25% and 15% of the variance in restaurant and bar bans, respectively, represents such independent within-state variation. Though only about 1-2 percentage points of the within-state variation can be explained by cross-sectional cross-county variation, this could be problematic if correlated with county-specific unobservables. Hence, we also supplement the analyses with county fixed effects (α_c), relying only on within-county variation in SFL enactment (about 14-23% of the observed variance in the 100% SFLs) and accounting for all fixed county-specific heterogeneity.

We extend these specifications further to address specific issues. With respect to infants, prenatal in utero exposure may result from maternal smoking as well as maternal ETS exposure from cigarette consumption of other family members or individuals even if the pregnant woman herself does not smoke. Thus, we also estimate equation (1) alternately controlling for maternal smoking. Comparison of the effect magnitudes between these specifications (excluding and controlling for maternal smoking) can inform on whether, and to what extent, any potential effects on infant health are being driven by the mother's own smoking or by maternal exposure to ETS.

Low birthweight can result from preterm birth or intra-uterine growth restriction (IUGR). Smoking is the leading cause of IUGR, and fetal growth is also affected by prenatal ETS exposure (Windham et al. 2000). The causes of preterm birth are not as well understood (Institute of Medicine 2007), though smoking and ETS exposure are potential risk factors (Windham et al. 2000). Models of birthweight and low birthweight also control for gestational age in order to separate the effects of smoking bans on IUGR versus preterm birth.

We further assess differential effects based on socio-demographics, including the education and marital status of the mother, and the child's age (in models assessing effects on children's health from the NHIS). Finally, we estimate versions of the above specifications directly linking the 100% SFLs to the venue of smoking among adult smokers, based on information from the NHIS. Specifically, we assess whether adults exposed to these comprehensive smoking restrictions in workplaces, restaurants, or bars are more likely to smoke at home.

V. Results

Table 3 presents estimates of equation (1) for infant health outcomes based on the birth records. These models consider the strictest combination of smoking bans, assessing how birth outcomes differ in localities that have enacted comprehensive 100% SFLs in all three venues – worksites, restaurants, and freestanding bars – relative to other localities. The two panels represent the differences in control groups. Panel A compares the strict localities to all other localities whether or not they enact a ban. Panel B compares these strict localities to those which have enacted no bans of any kind (comprehensive or limited) in any venue. This comparison underscores the potential maximal effect by contrasting the two extremes in terms of SFLs, comprehensive bans in all three venues versus no bans in all three venues.

Model (1) in Panel B suggests that comprehensive cumulative bans are associated with a nearly 13 gram increase in mean birthweight ($p<0.10$), which translates to a 0.4%

increase in birthweight relative to the sample mean. The smoking restrictions are also associated with a 0.2 percentage point decline in the likelihood of low birthweight or a 3.3% decrease in relative to the sample average, as documented by model, though this estimate is not statistically significant at conventional levels (model 2). The potentially larger response for low birthweight is consistent with prior studies that also find larger impacts of income-support policies and other transfer programs at the lower tail of the birthweight distribution (Wehby, Dave, and Kaestner 2016; Hoynes, Miller, and Simon 2015; Almond, Hoynes, and Schanzenbach 2011). Again, the estimated responses are for all infants born in localities with bans vs. those without bans. This extreme comparison increases the standard error as localities with limited bans are not part of the control group and the effect is not statistically significant.

For the statistically significant result of higher birthweight, we recognize that this may reflect either an improvement in fetal growth and/or an increase in gestational age (reduction in preterm birth). We consider gestational age and preterm birth in models (3) and (4). Essentially, we find a significant increase in gestational age by about 0.07 weeks (0.2%; model 3), though this increase does not seem to operate at the lower tail of the gestation distribution and we find no significant or meaningful effects on the likelihood of a preterm birth. Model (5) informs whether the cumulative bans have an impact on birthweight conditional on gestational age by presenting estimates for fetal growth, defined as birthweight in grams relative to gestational age in weeks. We find an increase in fetal growth by about 0.21 grams (or 0.2%).

These health-promoting effects of smoking restrictions on birth outcomes capture two potential channels. The first channel represents improvements in infant health from reduced exposure to secondhand smoke by pregnant women, as others around her are incentivized to reduce their smoking behaviors due to the bans. In contrast to this external effect, improvements in infant health may also be realized from a direct reduction in prenatal smoking. In models (6)-(10), we control for prenatal smoking in order to isolate the external effects of smoking restrictions on infant health through reduced exposure to environmental tobacco smoke (ETS). These magnitudes expectedly decline somewhat, suggesting that at least part of the improvements in infant health are driven by a reduction in prenatal smoking. Specifically, comparing models (1) – (5) to models (6)–(10), approximately 15-20% of the effect on birth outcomes is due to a reduction in prenatal smoking (an "own-effect" from the mother reducing her own smoking due to the smoking restrictions), and the remaining 80-85% of the effect may be due to potential reductions in ETS.[9]

Including prenatal smoking in the specification is potentially problematic because the mediator is itself endogenous, and hence would lead to biased estimates (Angrist & Pischke 2009).[10] We also estimate models for samples restricted to mothers who do not smoke, and find similar effects which is validating. Furthermore, in models which treat prenatal smoking as an outcome, we find that cumulative bans reduce the probability of prenatal smoking by about 0.008 (0.8 percentage points). Prior work (Evans and Ringel 1999; Wehby et al. 2013) suggests that prenatal smoking reduces birthweight by about

[9] This decomposition is back-of-the-envelope and should be interpreted with caution.
[10] As an alternative, we also directly estimated the effect of the SFLs on the joint probability between low birthweight and prenatal smoking using multinomial logit models (MNL). The marginal changes in these joint probabilities allow us to pick up potential interactions between infant health and prenatal smoking, and assess both unconditional and conditional (on prenatal smoking) effects of the comprehensive SFLs on infant health. Results from these analyses also suggested that about 20% of the observed effect of smoking bans on low birthweight represents an "own-effect" operating through a reduced probability of the mother smoking during pregnancy.

200-400 grams. In our specification (model 6 in Panel B), the coefficient of prenatal smoking is -214 (p-value = 0.000) also suggesting about a 200 gram decrease in birthweight associated with prenatal smoking. Combining these two estimates [-0.008 * -214 = 1.7] suggests that the mean increase in birthweight in the population, from the channel that operates from cumulative smoking bans to reduced prenatal smoking, would be 1.7 grams. Model 1 in Panel B suggests a mean increase in birthweight of about 12.8 grams. Thus, about 13% of this total effect is due to a reduction in prenatal smoking, and the rest is due to potential decrease in ETS exposure by pregnant women and their unborn children.

Models in Table 3 further indicate that higher state excise taxes on cigarettes are consistently and significantly associated with an improvement in infant health (higher birthweight, reduced likelihood of low birthweight, longer gestation, and higher fetal growth). We find elasticity estimates of birthweight and low birthweight with respect to cigarette taxes that are consistent with the literature (Evans and Ringel 1999).[11]

The specifications in Panel A assess the effects of a combined comprehensive ban on smoking in all three venues (worksites, restaurants, and bars), though this time the reference group includes all other localities. Thus, the reference group is a mixture of all localities that may impose no bans at all, or comprehensive bans in just a few venues (but not all three), or those which impose limited bans. Since the reference group includes localities which also have smoking restrictions, though albeit not 100% smoke-free in all three venues combined, the effect magnitudes are expectedly smaller. Nevertheless, these

[11] Estimates from models (1) and (2) in Table 3 imply a tax elasticity of 0.001 for birthweight and 0.012 for low birthweight.

estimates continue to suggest that cumulative 100% SFLs in all three venues combined are associated with improvements in infant health, and most of the effect is realized through potential decreases in second-hand smoke exposure, comparing models (1)-(5) with models (6)-(10).

In alternative specifications (not reported),[12] we decomposed the effects of the 100% SFLs into separate effects for bans in each venue and also compared comprehensive bans to limited bans. These estimates are more imprecise than those reported in Table 3 due to the collinearity across the various bans, as suggested by the data in Figures 1 and 2. Nevertheless, the patterns and direction of effects remain consistent. These models suggested that workplace bans generally have larger positive effects on birthweight (about an 8 gram increase) and are associated with a larger decline in the probability of a low birthweight infant (by about 0.11 percentage point) relative to bans in restaurants or bars. Generally, we find weak to nil effects of restaurant bans, and somewhat stronger effects of bans in freestanding bars. When we consider the effects of limited bans in each of the three venues relative to localities that do not impose any restrictions, estimates are weaker and much smaller in magnitude, and generally insignificant in virtually all cases.[13] These results suggest that while comprehensive smoking bans are associated with improved infant health, limited bans are not found to be as effective.

Given data on the prevalence and concurrence of combined 100% SFLs in restaurants and bars (see Figures 1 and 2), in Table 4, we integrate the restaurant ban and

[12] Results are available upon request.

[13] The only statistically significant effect was on the probability of preterm birth, suggesting a 0.28 percentage point change in the probability. Comparing models with and without the measure of maternal smoking suggests this impact is driven by the reduction in maternal smoking

the bar ban into a single combined cumulative measure and assess its effect separately from that of workplace restrictions. This measure is an indicator for whether the locality has enacted a comprehensive ban in both restaurants and freestanding bars. In Panel A, the reference group is all other localities, and in Panel B, the reference group is localities that do not impose any smoking restriction in any venue. Comprehensive workplace bans continue to be associated with improved infant health, as are comprehensive bans in restaurants and bars. The point estimates should be interpreted with caution as they are imprecise, and wide confidence intervals do not allow us to reject the null of equal effect sizes.

The estimates discussed above represent an average effect realized over all births. Table 5 specifically explores these effects for births occurring to mothers with at most a high school education. Lower educated mothers are significantly more likely to smoke during pregnancy (18.8% prevalence rate relative to mothers with some college or higher educational attainment, who have a prevalence rate of 6%), and are also more likely to live in neighborhoods with a higher smoking prevalence in general, thus exposing themselves and their children to ETS. In comparing the estimates in Table 5 (low-educated mothers) those in Table 3 (all mothers), we find that the combined comprehensive smoking bans (100% SFLs in all three venues combined) have significantly stronger health-promoting effects on outcomes for infants born to the low-educated mothers. Specifically, Panel B, which compares the strictest combined comprehensive bans to no bans at all, suggests an increase in birthweight of about 0.6% (18.2 grams), a reduction in the likelihood of a low birthweight infant by about 4.2% (0.3 percentage point), an increase in gestation by 0.2% (0.09 weeks), a decrease in the likelihood of a preterm birth by 2.3% (0.3 percentage points, though this effect is insignificant), and an increase in fetal growth by 0.3% (0.3 grams per gestational week).

As before, most of the improvement in infant health appears to be operating through reduced ETS exposure among pregnant women and their infants as opposed to through a decline in the mother's own prenatal smoking. Estimates in models (6)-(10), which account for prenatal smoking, suggest an increase in birthweight of about 0.5% (16.7 grams) and a reduction in the probability of a low birthweight infant by about 3.8% (0.27 percentage point), along with improvements in gestation and fetal growth.

It should also be noted that all of these estimates presented and discussed above are still "intention-to-treat" (ITT)-type average population effects. That is, these effects are averaged over two groups – those impacted by the smoking bans and those not impacted. Conditioning on prenatal smoking, the improvement in infant health is most likely operating through a reduction in ETS exposure as adults around the pregnant woman and in her locality of residence cut down on their smoking. These bans should not have any major first-order effects on non-smoking mothers who are not exposed to ETS. Data from the NHANES (1999-2000 and 2001-2002), based on serum cotinine levels as a biomarker of exposure, indicate that about 43-51% of non-smokers are exposed to secondhand tobacco smoke (USDHHS 2006). This is the population – those who are being exposed to ETS – that would presumably experience the largest benefits from the 100% SFLs.

We can use this prevalence of the population exposed to ETS (about 50%) to roughly inflate the ITT estimates by a factor of two and derive a ballpark treatment-on-the-treated effect. That is, among the population that is exposed to ETS, 100% SFLs in all three venues are associated with a 1% increase in mean birthweight and a 7.6% reduction in the likelihood of a low birthweight infant.

All of the above estimates exploit within-state variation to identify the effects. One concern may be that within states that have not yet enacted comprehensive SFLs, counties and municipalities that enact these laws at the local level may be systematically different in ways that are also positively associated with infant health; that is, they may be more likely to undertake other public health investments. In Table 6, we present estimates for infants born to low-educated mothers, which account for county-specific heterogeneity by including county fixed effects. While the effect magnitudes decline somewhat by between 10-39%, consistent with the positive selection bias noted above, these estimates continue to indicate non-trivial improvements in infant health. For instance, estimates in Panel B suggest a mean increase in birthweight of about 13 grams (0.4%) and a reduction in the likelihood of delivering a low birthweight or preterm infant by about 0.2 percentage point (2-3%), though the latter effects are not statistically significant. As before, about 15-20% of these infant health effects are driven by an "own-effect" underlying the reduction in prenatal smoking, and remainder represents an average population effect operating through reduced exposure to ETS.

In Tables 7 and 8, we further assess heterogeneity in the infant health effects among low-educated mothers by marital status. Table 7 presents estimates, with state (Panel A) and county (Panel B) fixed effects, for married mothers, and Table 8 presents corresponding estimates for unmarried mothers. While these models suggest improvements in the health infants born to both sets of mothers, results consistently indicate larger and significant effects among married mothers in models with and without county fixed effects. This may reflect complementarity in smoking between both spouses, and reduced exposure to ETS in the home if the husband's smoking is moderated because of the smoking restrictions. Taxes on the other hand have a much larger effect for low-educated unmarried mothers, which may reflect this group's relatively lower income levels. Studies have shown that smoking rates among lower income individuals are generally more responsive to cigarette excise taxes (Colman and Remer 2008).

The estimates from the birth records suggest that comprehensive smoking restrictions are effective in improving infant health, particularly among low-educated mothers. Tables 9 and 10 assess the effects of these bans for children younger than 18 years of age, based on the information from the NHIS. Specifically, we consider respiratory health conditions which have been linked to exposure to ETS. The smaller sample size of the NHIS reduces the precision of these estimates, and so they should be interpreted as suggestive. This limitation notwithstanding, there is indication that comprehensive 100% SFLs are also effective in reducing adverse respiratory health conditions among older children.

Table 9 reports estimates for combined comprehensive bans in worksites, restaurants and freestanding bars, based on DD models with state fixed effects. For each respiratory outcome, we estimate models for four samples: 1) all children ages under 18; 2) children under the age of 18 with a lower educated mother; 3) children under the age of 18 diagnosed with asthma; and 4) combining samples 2 and 3. The fourth sample allows us to investigate whether smoking restrictions affect respiratory events among a group of children who would be especially vulnerable to adverse health effects due to ETS. Each row represents a separate specification.

In general, we find that a comprehensive smoke-free law is associated with a reduction in respiratory allergies, asthma attacks, ER visits, three or more ear infections and reports of fair or poor health. These effects are statistically significant and the size of the effect varies, as expected with the level of vulnerability of the children. For example, among children living with a lower educated mother, there is evidence that comprehensive smoking restrictions in all venues leads to substantial declines in adverse respiratory conditions and ER visits for any reason. The latter effect is especially sizeable at about 5 percentage points (over a 25% decrease). The effects are magnified among children diagnosed with asthma, and among children diagnosed with asthma who are living with a lower educated mother. It should be noted that while children may not be necessarily exposed to ETS directly from worksites, comprehensive smoking bans in workplaces may induce adults to quit smoking or smoke less, thus reducing children's exposure to ETS overall. Smoking restrictions in bars would also be expected to exert their effect in a similar manner, whereas restrictions in restaurants may reduce children's direct exposure to ETS while in restaurants as well as reduce their exposure overall in all places if adults are smoking less in general. These results are robust to the inclusion of county fixed effects (Table 10).

Appendix Table A1 reports effects separately for younger children, ages 0-5 and ages 6-12, and shows that there is some heterogeneity across the age distribution. We generally find larger health effects for the youngest children (ages 0-5), particularly for outcomes related to hay fever and respiratory allergies. Effects on ER visits and self-rated fair/poor health are significantly larger among children ages 6-12. There is also some indication that effects on the incidence of asthma and asthma attacks are larger for children ages 6-12, though the latter effects are not significant.

In models (not reported), we also simultaneously considered the effects of both comprehensive SFLs in workplaces and comprehensive SFLs in a bar or restaurant, for two samples: 1) all children under 18 years old, and 2) children under 18 years old who have been diagnosed with asthma. While restrictions in both venues tend to be associated with health improvements, for some of the outcomes (hay fever, respiratory allergies, and ER visit) we find stronger improvements for bans in restaurants and bars. These effects, as before, are especially pronounced among asthmatic children whose respiratory health is especially sensitive to ETS.

The estimates discussed thus far indicate that, on the net, comprehensive smoke-free laws have the capacity to improve both infant and child health. However, it is not clear whether these improvements are being moderated by any counteracting effect due to adults shifting their smoking to inside their home as result of external smoking bans. That is, if the smoking restrictions are displacing at least some of the smoking behaviors from the banned places to inside the home, where children or expectant mothers may be present, then observed improvements in infant and child health may be smaller than would otherwise be possible. Table 11 directly assesses the displacement hypothesis by estimating models for whether adults (in households with children) are more or less likely to smoke inside the home on one or more days per week, as a result of the SFLs. We consider six groups: 1) all adults (in HH with children); 2) current smokers; 3) current and former smokers; 4) low-educated adults; and 5) low-educated current smokers; and 6) low-educated current and former smokers.

Panel A provides results for a reference group of all states without comprehensive 100% SFLs in all three venues, and Panel B for a reference group of states with no ban of any type. Coefficient estimates in Panel A are generally negative and in many instances, economically meaningful, but not statistically significant. Results shown in Panel B follow a similar qualitative pattern as in Panel A, but as expected, are larger in magnitude and generally statistically significant.

When we consider all adults (which include current, former, and never smokers) in models (1) and (4) of Panel B, we find negative but insignificant effects. However, this group includes never smokers, who should be minimally impacted by these bans.[14] Hence, we consider the group that should most likely be affected by the bans in terms of their venue of smoking – current smokers – in models (2) and (5) of Panel B. We find consistent evidence that, if anything, comprehensive workplace smoking restrictions in all venues are associated with a reduction in smoking inside the home. The effect is expectedly larger among lower-educated smokers, consistent with the larger improvements in the health of infants and children living in these households. About 60% of smokers in the NHIS have smoked inside the home on at least one day in the past week. The estimates in Table 11 Panel B suggest a sizeable decline of 8-11 percentage points in this prevalence, or about 14-20% relative to the mean prevalence. Effects on the larger end of this range are realized for low-educated adults, consistent with the larger improvements in the health we found for infants and children living in these households. We also expand the sample to include both current and formers smokers (models 3 and 6), as it is possible that smoking bans may

[14] The NHIS question specifically asks "Does ANYONE smoke inside the home?" and is asked of only the sample adults. Never smokers may be impacted if they are living with a former or current smoker.

affect the duration of smoking abstinence and relapse among former smokers. These models do not indicate significant effects; hence we find that the largest effects are expectedly realized among current smokers. Thus, we do not find any evidence of displacement, and our results suggest another positive transmission channel whereby the smoking bans may be further reducing children and pregnant women's exposure to ETS by reducing other adult members' smoking inside the home.

This reduction in smoking inside the home likely reflects a reduction in the overall addictive smoking stock. There is evidence that comprehensive smoking restrictions are associated with reduced smoking participation and a higher likelihood of smoking cessation (USDHHS, 2007a; USDHHS, 2007b; Bonnie, et al, 2007a, Bonnie et al. 2007b, Carton et al. 2016). Thus, if adults are less likely to smoke in general, and if current smokers are smoking less (and less frequently), this would lead to reduced addictive smoking stock and a reduced urge to smoke when at home. Relatedly, as smoking bans reduced smoking participation and consumption, this "blanket" decline also extends to a decline in smoking at home.

That we also find negative effects of a higher cigarette excise tax on smoking inside the home is consistent with this hypothesis. Higher cigarette taxes should not have any first-order effects on the venue of smoking since they do not change the relative cost of smoking at home versus outside. Hence, as higher cigarette taxes reduce smoking in general, this decline – as with the 100% SFLs – also extends to a decline in smoking at home.

VI. Discussion

As evidence of the negative effects of environmental tobacco smoke (ETS) has mounted, an increasingly popular public policy response has been to impose restrictions on smoking through 100% smoke-free bans. The Centers for Disease Control and Prevention (CDC) and the Institute of Medicine (IOM), amidst evidence that smoking bans reduce smoking prevalence and adult non-smokers' exposure to ETS, recommend that states and localities enact complete bans on smoking in all non-residential indoor locations, including worksites, restaurants, and bars. However, a key link necessary for a comprehensive evaluation of the effectiveness of smoking bans has been understudied in the literature including the CDC and IOM reports. Specifically, very few studies have assessed how smoking bans impact the health of children and infants. The rationale for smoke-free laws implicitly presumes there are public health gains from reducing adult cigarette consumption and declines in adult ETS exposure that extend to children. The presumption that these gains, a priori, will extend to infants and children may or may not be correct. On the one hand, decreases in adult smoking prevalence as a result of the smoking bans may reduce ETS exposure among children, infants, and pregnant women. However, if smokers shift from consuming cigarettes at 100% smoke free work and other public places to smoking at home (when children, infants, or pregnant women are present) then these policies may have a harmful effect on children and infants. Such compensatory behavior by smokers can potentially increase the prevalence of smoking at home and lead to higher ETS exposures among children. Without information on the link between smoking bans, potential shifts in smoking to the home, and the impact on child and infant health, either the costs or benefits of interventions banning smoking may be understated, which in turn may skew the proper evaluation of such policies.

Based on the most comprehensive information on SFLs, which includes both state-level bans as well as local county and city-level bans, we find robust evidence that the health benefits of these restrictions, which prior studies have estimated for adults, also extend to children and infants, particularly children in low-educated households . The effects are largest when the restrictions are the most binding and do not allow for any exemptions such as separate designated smoking areas. We find minimal to weak effects of such limited bans which generally have several exemptions and qualifications. The effects are also compounded when all three comprehensive restrictions – in worksites, restaurants, and freestanding bars – are in place in a given locality. Banning smoking in all three venues limits available options for smokers to carry on the habit, thus increasing non-monetary costs, which in turn raises their effectiveness in reducing smoking behaviors and thus ETS. We also find that most of the realized (about 80-85%) health improvements in infant health are driven by a potential reduction in ETS exposure by pregnant women, with the remainder driven by a direct reduction in prenatal smoking.[15]

While these improvements in infant and child health are mostly driven by potentially decreased exposure to ETS, it was also not clear whether these improvements are being moderated by possible displacement of smoking to inside the home as more external places ban smoking. This study provided some of the first direct estimates on this issue. We do not find any evidence that adults are shifting their smoking behaviors to inside the home where children may be present. If anything, we find significant evidence of

[15] Since we control for both smoking restrictions as well cigarette taxes in the models, we are able to gauge the comparative effectiveness of both in leading to improvements in infant health. With respect to the strictest SFLs enacted in all three venues, we find effect magnitudes on low birthweight and preterm birth commensurate with between a $1-$2 increase in the cigarette excise tax. With respect to reducing smoking inside the home among household with children, comprehensive SFLs elicit a response that is commensurate with between a $1-$4 increase in the cigarette excise tax (Panel B in Table 11).

a decrease in the likelihood that smoking occurs inside the home among households with children, consistent with an overall reduction in the addictive stock and an overall reduction in smoking behaviors.

Currently, only 58% of the population resides in localities which have completely banned smoking in worksites, restaurants, and freestanding bars. As our estimates suggest strongest effects for this compounded ban, there still remains considerable room for cumulative smoking restrictions to take hold, which would have positive external spillovers on infant and child health. Furthermore, given that our estimates suggest stronger health improvements for children born in low-educated households, cumulative smoking restrictions may play a role in flattening the socioeconomic gradient in infant and child health.

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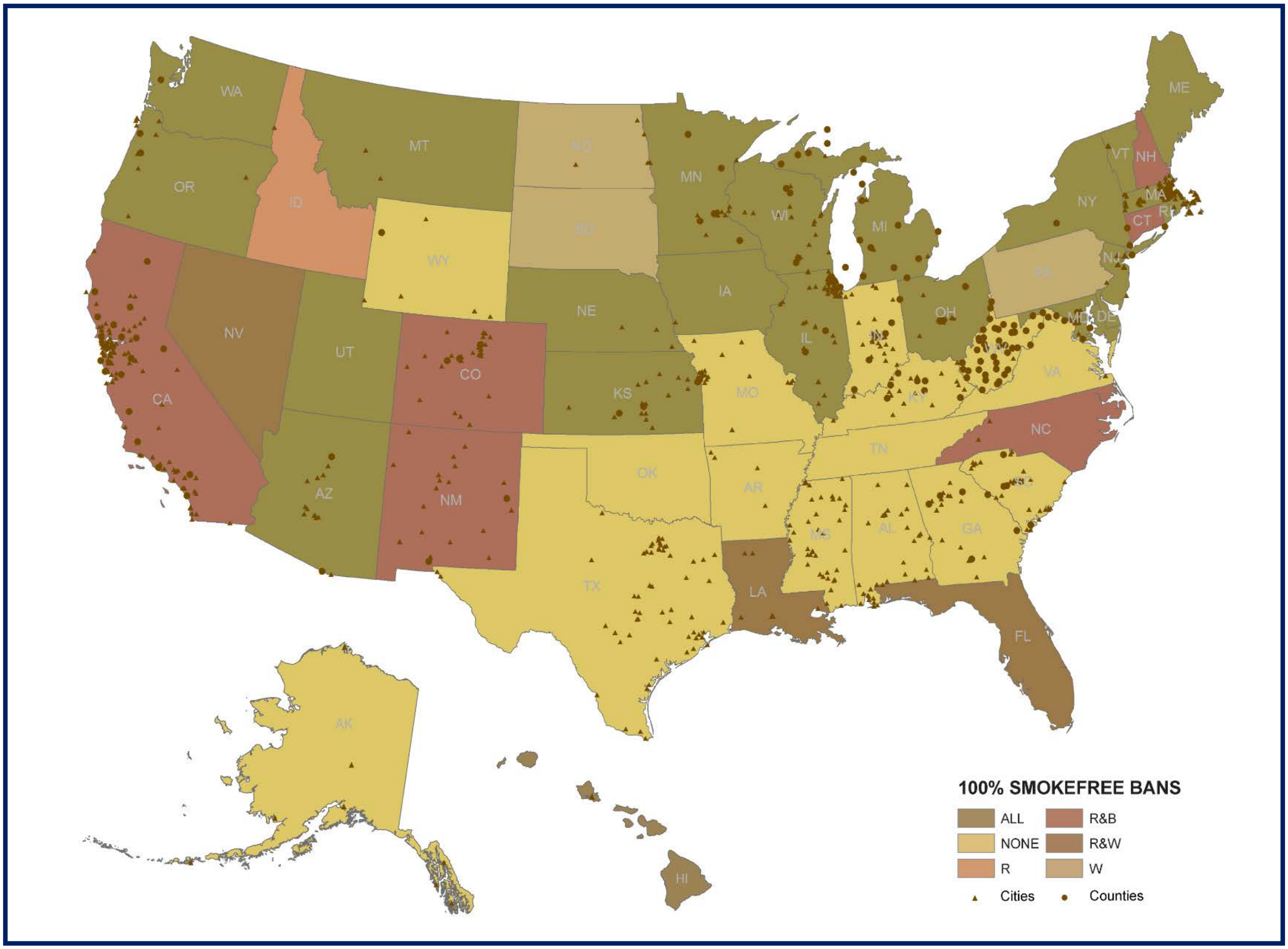
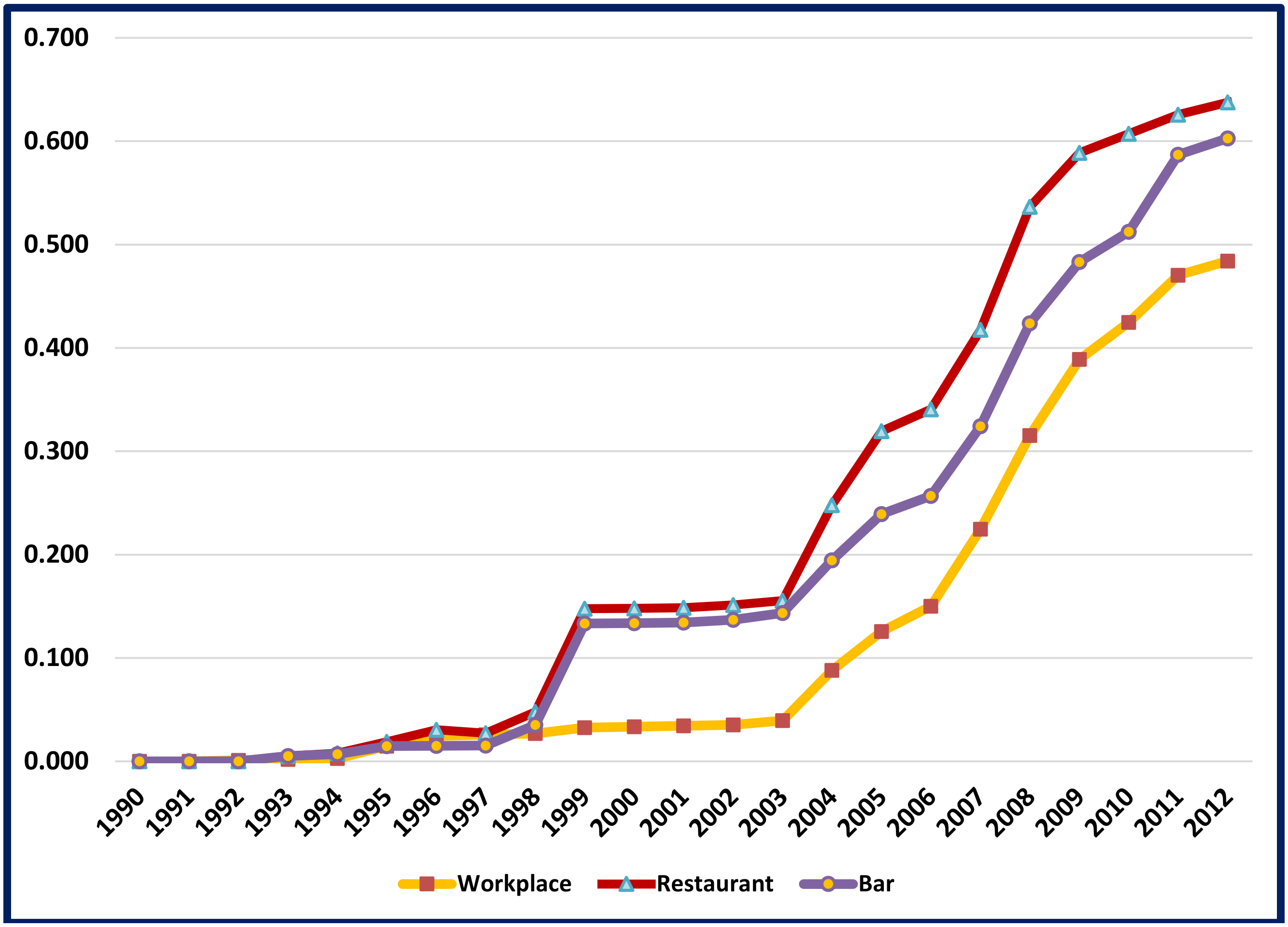
Figure 1
Coverage of 100% Smoke-free Laws 2012



Source: Authors' calculations based on data from the ANRF. 100% Smokefree Bans as of 2012.

Figure 2
Percent of population exposed to 100% Smoke-free Laws 1990-2012



Source: Authors' calculations based on data from the ANRF.

Table 1
Sample means
U.S. Vital Statistics Births 1990-2012

Variable	**All Births**	**Births to mothers with high school degree or less**	**Births to unmarried mothers with high school degree or less**
Birthweight (grams)	3337.7	3282.6	3207.640
Low birthweight (birth < 2500 grams)	0.060	0.072	0.089
Gestational age (weeks)	38.883	38.824	38.694
Preterm birth (gestation < 37 weeks)	0.100	0.115	0.134
Fetal growth (Birthweight / gestation)	85.593	84.362	82.676
Any prenatal smoking	0.123	0.188	0.230
Maternal age	27.548	25.454	23.788
Maternal race: White	0.789	0.765	0.649
Maternal race: Black	0.149	0.190	0.312
Maternal race: Other	0.062	0.045	0.039
Maternal ethnicity: Hispanic	0.204	0.257	0.265
Maternal educational attainment	12.920	11.024	10.953
Married	0.670	0.524	0.000
Workplace SFL: Comprehensive coverage	0.145	0.114	0.142
Workplace SFL: Limited coverage	0.442	0.397	0.400
Workplace SFL: No coverage	0.413	0.489	0.459
Restaurant SFL: Comprehensive coverage	0.227	0.159	0.189
Restaurant SFL: Limited coverage	0.294	0.263	0.264
Restaurant SFL: No coverage	0.479	0.578	0.547
Freestanding Bar SFL: Comprehensive coverage	0.187	0.133	0.160
Freestanding Bar SFL: Limited coverage	0.065	0.060	0.066
Freestanding Bar SFL: No coverage	0.748	0.808	0.774
Workplace 100% SFL: % population exposed	0.130	0.109	0.133
Restaurant 100% SFL: % population exposed	0.231	0.140	0.170
Bar 100% SFL: % population exposed	0.194	0.166	0.197
Real state cigarette excise tax (2014 $)	0.812	0.760	0.816
Observations	86,273,601	34,912,824	16,607,601

Note: Sample means are reported. Observations represent maximum sample size. For some variables, notably prenatal smoking (n=70,557,124 for all births), sample sizes are smaller due to missing information (see text).

Table 2
Outcome means
National Health Interview Surveys 1998-1998-2013

Outcome	**All children** **Age 0-17**	**Children ever diagnosed with asthma** **Age 0-17**
Hay fever, past year	0.1007	0.2309
Any respiratory allergies, past year	0.1760	0.4261
Ever diagnosed with asthma	0.1297	---
Asthma attack, past year	0.0557	0.4299
ER visit for asthma, past year	0.0186	0.1438
ER visit for any reason, past year	0.2046	0.3173
Three or more ear infections, past year	0.0621	0.0889
Excellent or very good health	0.8376	0.7063
Fair or poor health	0.0184	0.0597

Notes: The sample includes 167,328 children under age 18 (including 22,157 children who have ever received an asthma diagnosis) with complete demographic information interviewed between 1998 and 2013. Estimates incorporated population weights available from the National Center for Health Statistics.

Table 3
Effects of Combined 100% SFLs in all Venues on Infant Health
Births 1990 – 2012

Panel A	**Reference Group: All other**									
Model	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**	**(9)**	**(10)**
Outcome	**Birthweight**	**Low Birthweight**	**Gestation**	**Preterm**	**Fetal Growth**	**Birthweight**	**Low Birthweight**	**Gestation**	**Preterm**	**Fetal Growth**
Comprehensive 100% SFLs in Workplace, Restaurant & Bars	7.9224*	-0.0012**	0.0417**	0.0001	0.1222*	7.3850*	-0.0011*	0.0413**	0.0001	0.1093
	(4.1813)	(0.0006)	(0.0195)	(0.0012)	(0.0731)	(4.3802)	(0.0006)	(0.0194)	(0.0013)	(0.0804)
Cigarette Tax	3.4521**	-0.0008**	0.0238**	-0.0012	0.0422	3.0982*	-0.0007**	0.0235**	-0.0011	0.0336
	(1.5899)	(0.0003)	(0.0113)	(0.0007)	(0.0332)	(1.6139)	(0.0004)	(0.0113)	(0.0008)	(0.0326)
State indicators	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year indicators	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Maternal smoking	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes
Observations	69053313	69053313	69053313	69053313	69053313	69053313	69053313	69053313	69053313	69053313

Panel B	**Reference Group: No bans in any venue**									
Model	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**	**(9)**	**(10)**
Outcome	**Birthweight**	**Low Birthweight**	**Gestation**	**Preterm**	**Fetal Growth**	**Birthweight**	**Low Birthweight**	**Gestation**	**Preterm**	**Fetal Growth**
Comprehensive 100% SFLs in Workplace, Restaurant & Bars	12.8299*	-0.0020	0.0663*	-0.0003	0.2064*	11.1824*	-0.0016	0.0650*	-0.0001	0.1667
	(6.5769)	(0.0015)	(0.0369)	(0.0019)	(0.1071)	(6.4289)	(0.0015)	(0.0364)	(0.0018)	(0.1132)
Cigarette Tax	2.8696**	-0.0009**	0.0318**	-0.0013	0.0131	2.7685	-0.0008*	0.0317**	-0.0013	0.0108
	(1.3469)	(0.0004)	(0.0153)	(0.0008)	(0.0228)	(1.7643)	(0.0005)	(0.0154)	(0.0009)	(0.0307)
State indicators	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year indicators	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Maternal smoking	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes
Observations	35404894	35404894	35404894	35404894	35404894	35404894	35404894	35404894	35404894	35404894

Notes: Coefficients from OLS models are reported. Standard errors are clustered at the state level and reported in parentheses. All models control for maternal age, educational attainment, race, ethnicity, and marital status, as well as state and year of birth fixed effects.
Asterisks denote statistical significance as follows: *** p-value≤0.01; ** 0.01<p-value≤0.05; * 0.05<p-value≤0.10.

Table 4
Effects of Comprehensive Workplace & Combined Restaurant / Bar SFLs on Infant Health
Births 1990 – 2012

Panel A	**Reference Group: All other**									
Model	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**	**(9)**	**(10)**
Outcome	**Birthweight**	**Low Birthweight**	**Gestation**	**Preterm**	**Fetal Growth**	**Birthweight**	**Low Birthweight**	**Gestation**	**Preterm**	**Fetal Growth**
Comp. Workplace SFL	6.5171	-0.0011**	0.0197	-0.0000	0.1232	5.5412	-0.0009	0.0190	0.0001	0.0998
	(5.0607)	(0.0005)	(0.0253)	(0.0015)	(0.0770)	(5.4499)	(0.0005)	(0.0256)	(0.0015)	(0.0863)
Comp. Rest. & Bar SFL	2.3705	-0.0005	0.0316	0.0002	0.0084	2.1679	-0.0004	0.0314	0.0002	0.0035
	(4.0320)	(0.0006)	(0.0220)	(0.0014)	(0.0635)	(4.4017)	(0.0006)	(0.0222)	(0.0015)	(0.0720)
Cigarette Tax	3.5267**	-0.0008**	0.0229**	-0.0012	0.0452	3.2331**	-0.0008**	0.0226**	-0.0011	0.0381
	(1.5892)	(0.0003)	(0.0112)	(0.0007)	(0.0335)	(1.6009)	(0.0004)	(0.0113)	(0.0007)	(0.0324)
State indicators	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year indicators	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Maternal smoking	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes
Observations	69053313	69053313	69053313	69053313	69053313	69053313	69053313	69053313	69053313	69053313

Panel B	**Reference Group: No ban in any venue**									
Model	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**	**(9)**	**(10)**
Outcome	**Birthweight**	**Low Birthweight**	**Gestation**	**Preterm**	**Fetal Growth**	**Birthweight**	**Low Birthweight**	**Gestation**	**Preterm**	**Fetal Growth**
Comp. Workplace SFL	6.4714	-0.0014	0.0153	0.0015	0.1520	2.1170	-0.0004	0.0119	0.0020	0.0469
	(7.0795)	(0.0016)	(0.0411)	(0.0026)	(0.1117)	(6.8185)	(0.0015)	(0.0410)	(0.0027)	(0.0984)
Comp. Rest. & Bar SFL	6.2031*	-0.0006	0.0502**	-0.0021	0.0518	8.9399**	-0.0012*	0.0523**	-0.0024	0.1178*
	(3.3502)	(0.0006)	(0.0235)	(0.0022)	(0.0708)	(3.5828)	(0.0007)	(0.0237)	(0.0023)	(0.0689)
Cigarette Tax	2.9360**	-0.0009**	0.0316**	-0.0012	0.0151	2.7966	-0.0008*	0.0315**	-0.0012	0.0118
	(1.2984)	(0.0004)	(0.0146)	(0.0008)	(0.0214)	(1.7011)	(0.0005)	(0.0147)	(0.0009)	(0.0292)
State indicators	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year indicators	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Maternal smoking	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes
Observations	36862562	36862562	36862562	36862562	36862562	36862562	36862562	36862562	36862562	36862562

Notes: See Table 3.

Table 5
Effects of Combined 100% SFLS in all Venues on Infant Health
Low-educated Mothers (High school graduate or below)
Births 1990 – 2012

Panel A	**Reference Group: All other**									
Model	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Outcome	**Birthweight**	**Low Birthweight**	**Gestation**	**Preterm**	**Fetal Growth**	**Birthweight**	**Low Birthweight**	**Gestation**	**Preterm**	**Fetal Growth**
Comprehensive 100% SFLs in Workplace, Restaurant & Bars	11.3873**	-0.0020**	0.0548**	-0.0007	0.1842**	10.8746**	-0.0018**	0.0544**	-0.0006	0.1720*
	(4.5292)	(0.0007)	(0.0211)	(0.0013)	(0.0748)	(4.8759)	(0.0008)	(0.0211)	(0.0014)	(0.0860)
Cigarette Tax	6.0697***	-0.0016***	0.0309**	-0.0017*	0.0963**	5.3522**	-0.0015***	0.0303**	-0.0016*	0.0788*
	(2.0876)	(0.0005)	(0.0134)	(0.0009)	(0.0427)	(2.1037)	(0.0005)	(0.0134)	(0.0009)	(0.0419)
State indicators	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year indicators	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Maternal smoking	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes
Observations	34655278	34655278	34655278	34655278	34655278	34655278	34655278	34655278	34655278	34655278

Panel B	**Reference Group: No bans in any venue**									
Model	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**	**(9)**	**(10)**
Outcome	**Birthweight**	**Low Birthweight**	**Gestation**	**Preterm**	**Fetal Growth**	**Birthweight**	**Low Birthweight**	**Gestation**	**Preterm**	**Fetal Growth**
Comprehensive 100% SFLs in Workplace, Restaurant & Bars	18.1501**	-0.0030*	0.0930**	-0.0026	0.2836**	16.6842**	-0.0027	0.0919**	-0.0024	0.2482*
	(7.5713)	(0.0018)	(0.0393)	(0.0023)	(0.1242)	(7.5967)	(0.0018)	(0.0391)	(0.0023)	(0.1299)
Cigarette Tax	5.2336**	-0.0017***	0.0389*	-0.0018*	0.0591*	4.6970*	-0.0016**	0.0385*	-0.0017	0.0462
	(2.3012)	(0.0005)	(0.0201)	(0.0010)	(0.0346)	(2.6923)	(0.0007)	(0.0202)	(0.0011)	(0.0443)
State indicators	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year indicators	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Maternal smoking	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes
Observations	18156650	18156650	18156650	18156650	18156650	18156650	18156650	18156650	18156650	18156650

Notes: See Table 3.

Table 6
Effects of Combined 100% SFLS in all Venues on Infant Health
Low-educated Mothers (High school graduate or below) with County Fixed Effects
Births 1990 – 2012

Panel A	**Reference Group: All other**									
Model **Outcome**	(1) **Birthweight**	(2) **Low Birthweight**	(3) **Gestation**	(4) **Preterm**	(5) **Fetal Growth**	(6) **Birthweight**	(7) **Low Birthweight**	(8) **Gestation**	(9) **Preterm**	(10) **Fetal Growth**
Comprehensive 100% SFLs in Workplace, Restaurant & Bars	6.5172*	-0.0015	0.0394*	0.0005	0.1005	5.1039	-0.0012	0.0383*	0.0007	0.0666
	(3.6550)	(0.0009)	(0.0208)	(0.0011)	(0.0615)	(3.6560)	(0.0009)	(0.0206)	(0.0011)	(0.0663)
Cigarette Tax	6.9733***	-0.0019***	0.0341**	-0.0022**	0.1126***	5.7844***	-0.0016***	0.0331**	-0.0020**	0.0839**
	(2.0664)	(0.0005)	(0.0131)	(0.0008)	(0.0421)	(2.0789)	(0.0005)	(0.0132)	(0.0009)	(0.0412)
County indicators	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year indicators	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Maternal smoking	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes
Observations	34655278	34655278	34655278	34655278	34655278	34655278	34655278	34655278	34655278	34655278

Panel B	**Reference Group: No bans in any venue**									
Model **Outcome**	**(1)** **Birthweight**	**(2)** **Low Birthweight**	**(3)** **Gestation**	**(4)** **Preterm**	**(5)** **Fetal Growth**	**(6)** **Birthweight**	**(7)** **Low Birthweight**	**(8)** **Gestation**	**(9)** **Preterm**	**(10)** **Fetal Growth**
Comprehensive 100% SFLs in Workplace, Restaurant & Bars	12.5871*	-0.0024	0.0841***	-0.0019	0.1652	10.5024	-0.0019	0.0826**	-0.0016	0.1148
	(6.3315)	(0.0017)	(0.0311)	(0.0018)	(0.1077)	(6.6304)	(0.0018)	(0.0312)	(0.0019)	(0.1173)
Cigarette Tax	6.2166***	-0.0021***	0.0458**	-0.0025**	0.0713***	4.5232*	-0.0017**	0.0445**	-0.0023**	0.0304
	(1.9605)	(0.0005)	(0.0181)	(0.0009)	(0.0258)	(2.3969)	(0.0007)	(0.0183)	(0.0010)	(0.0349)
County indicators	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year indicators	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Maternal smoking	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes
Observations	18156650	18156650	18156650	18156650	18156650	18156650	18156650	18156650	18156650	18156650

Notes: See Table 3.

Table 7
Effects of Combined 100% SFLS in all Venues on Infant Health
Differential Effects by Marital Status, Low-educated Married Mothers
Births 1990 – 2012

Panel A	**Reference Group: No bans in any venue**									
Model	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Outcome	**Birthweight**	**Low Birthweight**	**Gestation**	**Preterm**	**Fetal Growth**	**Birthweight**	**Low Birthweight**	**Gestation**	**Preterm**	**Fetal Growth**
Comprehensive 100% SFLs in Workplace, Restaurant & Bars	20.4937***	-0.0034**	0.0922***	-0.0028	0.3474***	16.2905***	-0.0026**	0.0890***	-0.0023	0.2456**
	(6.2903)	(0.0013)	(0.0316)	(0.0020)	(0.1096)	(5.6636)	(0.0012)	(0.0308)	(0.0019)	(0.1038)
Cigarette Tax	2.0335	-0.0007*	0.0288	-0.0011	-0.0022	0.7995	-0.0005	0.0278	-0.0010	-0.0320
	(2.5587)	(0.0004)	(0.0179)	(0.0008)	(0.0493)	(3.0416)	(0.0005)	(0.0183)	(0.0008)	(0.0568)
State indicators	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year indicators	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Maternal smoking	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes
Observations	9712442	9712442	9712442	9712442	9712442	9712442	9712442	9712442	9712442	9712442

Panel B	**Reference Group: No bans in any venue**									
Model	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**	**(9)**	**(10)**
Outcome	**Birthweight**	**Low Birthweight**	**Gestation**	**Preterm**	**Fetal Growth**	**Birthweight**	**Low Birthweight**	**Gestation**	**Preterm**	**Fetal Growth**
Comprehensive 100% SFLs in Workplace, Restaurant & Bars	15.2821***	-0.0028**	0.0918***	-0.0026*	0.2199**	11.0036**	-0.0019	0.0887***	-0.0021	0.1162
	(5.4140)	(0.0013)	(0.0228)	(0.0015)	(0.1037)	(5.2257)	(0.0013)	(0.0225)	(0.0015)	(0.1011)
Cigarette Tax	2.9617	-0.0010**	0.0344**	-0.0017**	0.0104	1.0133	-0.0006	0.0330**	-0.0015*	-0.0366
	(1.9703)	(0.0004)	(0.0153)	(0.0007)	(0.0376)	(2.3789)	(0.0005)	(0.0156)	(0.0008)	(0.0422)
County indicators	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year indicators	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Maternal smoking	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes
Observations	9712442	9712442	9712442	9712442	9712442	9712442	9712442	9712442	9712442	9712442

Notes: See Table 3.

Table 8
Effects of Combined 100% SFLS in all Venues on Infant Health
Differential Effects by Marital Status, Low-educated Unmarried Mothers
Births 1990 – 2012

Panel A	**Reference Group: No bans in any venue**									
Model	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Outcome	**Birthweight**	**Low Birthweight**	**Gestation**	**Preterm**	**Fetal Growth**	**Birthweight**	**Low Birthweight**	**Gestation**	**Preterm**	**Fetal Growth**
Comprehensive 100% SFLs in Workplace, Restaurant & Bars	17.2773*	-0.0035	0.0904*	-0.0023	0.2720*	14.9858*	-0.0029	0.0885*	-0.0020	0.2168
	(9.4118)	(0.0025)	(0.0467)	(0.0028)	(0.1592)	(8.7411)	(0.0024)	(0.0462)	(0.0028)	(0.1424)
Cigarette Tax	6.9667**	-0.0027***	0.0463*	-0.0024	0.0913**	6.6459**	-0.0026**	0.0461*	-0.0024	0.0837*
	(3.1138)	(0.0010)	(0.0242)	(0.0017)	(0.0418)	(3.0583)	(0.0010)	(0.0241)	(0.0017)	(0.0425)
State indicators	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year indicators	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Maternal smoking	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes
Observations	8444208	8444208	8444208	8444208	8444208	8444208	8444208	8444208	8444208	8444208

Panel B	**Reference Group: No bans in any venue**									
Model	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**	**(9)**	**(10)**
Outcome	**Birthweight**	**Low Birthweight**	**Gestation**	**Preterm**	**Fetal Growth**	**Birthweight**	**Low Birthweight**	**Gestation**	**Preterm**	**Fetal Growth**
Comprehensive 100% SFLs in Workplace, Restaurant & Bars	10.8162	-0.0028	0.0719*	-0.0012	0.1514	7.7233	-0.0019	0.0694*	-0.0009	0.0767
	(7.4242)	(0.0023)	(0.0366)	(0.0024)	(0.1272)	(7.1930)	(0.0023)	(0.0364)	(0.0024)	(0.1221)
Cigarette Tax	7.6090***	-0.0029***	0.0512**	-0.0030*	0.0990***	6.0442**	-0.0025***	0.0499**	-0.0029*	0.0613
	(2.8155)	(0.0009)	(0.0225)	(0.0016)	(0.0364)	(2.9479)	(0.0009)	(0.0225)	(0.0016)	(0.0401)
County indicators	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year indicators	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Maternal smoking	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes
Observations	8444208	8444208	8444208	8444208	8444208	8444208	8444208	8444208	8444208	8444208

Notes: See Table 3.

Table 9
Effects of 100% SFLs on Children's Health
Children Ages < 18
NHIS 1998 – 2013

Outcome	**Panel A: Reference Group All others**				**Panel B: Reference Group No Bans**			
Hay fever, past year	0.0076	0.0127	0.0207	0.0318	-0.0062	-0.0125	-0.0407	-0.0396
	(0.0065)	(0.0079)	(0.0212)	(0.0256)	(0.0077)	(0.0145)	(0.0322)	(0.0451)
Any respiratory allergies, past year	-0.0000	0.0041	-0.0061	-0.0112	-0.0194	-0.0379**	-0.0658**	-0.1132**
	(0.0090)	(0.0111)	(0.0230)	(0.0315)	(0.0130)	(0.0177)	(0.0321)	(0.0434)
Ever diagnosed with asthma	-0.0019	-0.0000	---	---	-0.0091	-0.0125	---	---
	(0.0069)	(0.0081)			(0.0106)	(0.0164)		
Asthma attack, past year	-0.0069*	-0.0088*	-0.0455***	-0.0556***	-0.0127*	-0.0173**	-0.0545**	-0.0580*
	(0.0040)	(0.0051)	(0.0143)	(0.0163)	(0.0070)	(0.0085)	(0.0266)	(0.0322)
ER visit for asthma, past year	-0.0019	-0.0005	-0.0144	-0.0023	-0.0052	-0.0027	-0.0254	0.0008
	(0.0012)	(0.0020)	(0.0086)	(0.0198)	(0.0035)	(0.0065)	(0.0186)	(0.0319)
Any ER visit, past year	-0.0025	-0.0125	-0.0260*	-0.0194	-0.0184*	-0.0486***	-0.0756**	-0.0785*
	(0.0047)	(0.0091)	(0.0147)	(0.0218)	(0.0106)	(0.0143)	(0.0300)	(0.0459)
Three or more ear infections, past year	-0.0013	-0.0010	-0.0100*	0.0030	-0.0111***	-0.0169**	-0.0079	-0.0056
	(0.0033)	(0.0052)	(0.0055)	(0.0100)	(0.0040)	(0.0066)	(0.0129)	(0.0140)
Excellent or very good general health	0.0080	0.0135	0.0096	0.0070	0.0060	0.0109	0.0185	-0.0061
	(0.0060)	(0.0086)	(0.0163)	(0.0261)	(0.0070)	(0.0125)	(0.0167)	(0.0341)
Fair or poor general health	-0.0020	-0.0037	-0.0075	-0.0087	-0.0043*	-0.0070*	-0.0149	-0.0160
	(0.0013)	(0.0024)	(0.0067)	(0.0131)	(0.0024)	(0.0039)	(0.0109)	(0.0220)
Sample	All children	Low educ.	Asthma	Asthma Low educ.	All children	Low educ.	Asthma	Asthma Low educ.
N	167,328	74,193	22,157	9,674	63,535	28,370	8,645	3,894

Linear probability models were used to regress each outcome against sex, age, age squared, birthweight, race/ethnicity, mother's education, mother's age, the cigarette excise tax in 2014 dollars, interview year and state fixed effects. Survey weights were used in all analyses to produce nationally representative estimates, and errors were clustered at the state level. Smoking ban regulations were lagged by one year. * p<0.10, ** p<0.05, *** p<0.01.

Table 10
Effects of 100% SFLs on Children's Health with County Fixed Effects
Children Ages < 18
NHIS 1998 – 2013

Outcome	**Panel A: Reference Group All others**				**Panel B: Reference Group No Bans**			
Hay fever, past year	-0.0043	0.0016	0.0021	0.0073	-0.0104	-0.0098	-0.0180	-0.0337
	(0.0060)	(0.0072)	(0.0173)	(0.0261)	(0.0084)	(0.0110)	(0.0220)	(0.0340)
Any respiratory allergies, past year	-0.0195***	-0.0138	-0.0472***	-0.0556*	-0.0444***	-0.0427**	-0.0877***	-0.1229***
	(0.0063)	(0.0093)	(0.0153)	(0.0296)	(0.0139)	(0.0160)	(0.0264)	(0.0422)
Ever diagnosed with asthma	-0.0067	-0.0028	---	---	-0.0087	-0.0112	---	---
	(0.0048)	(0.0068)			(0.0074)	(0.0099)		
Asthma attack, past year	-0.0108***	-0.0132***	-0.0564***	-0.0743***	-0.01594**	-0.0204**	-0.0797***	-0.1024**
	(0.0026)	(0.0035)	(0.0113)	(0.0136)	(0.0061)	(0.0081)	(0.0247)	(0.0385)
ER visit for asthma, past year	-0.0028**	-0.0028	-0.0154**	-0.0147	-0.0065***	-0.0073*	-0.0366***	-0.0354
	(0.0012)	(0.0025)	(0.0072)	(0.0165)	(0.0023)	(0.0041)	(0.0128)	(0.0240)
Any ER visit, past year	-0.0050	-0.0188**	-0.0265**	-0.0093	-0.0175*	-0.0426**	-0.0705***	-0.0368
	(0.0064)	(0.0079)	(0.0126)	(0.0203)	(0.0088)	(0.0171)	(0.0159)	(0.0332)
Three or more ear infections, past year	-0.0045	-0.0073	-0.0151*	-0.0137	-0.0114***	-0.0193***	-0.0260**	-0.0334*
	(0.0031)	(0.0046)	(0.0077)	(0.0102)	(0.0036)	(0.0051)	(0.0114)	(0.0183)
Excellent or very good general health	0.0041	0.0063	0.0111	0.0162	0.0114	0.0175	0.0362*	0.0557*
	(0.0057)	(0.0093)	(0.0149)	(0.0210)	(0.0086)	(0.0119)	(0.0195)	(0.0291)
Fair or poor general health	-0.0006	-0.0018	-0.0059	-0.0109	-0.0058***	-0.0099***	-0.0228***	-0.0436***
	(0.0013)	(0.0022)	(0.0064)	(0.0116)	(0.0018)	(0.0034)	(0.0082)	(0.0141)
Sample	All children	Low educ.	Asthma	Asthma Low educ.	All children	Low educ.	Asthma	Asthma Low educ.
N	167,328	74,193	22,157	9,674	63,535	28,370	8,645	3,894

Linear probability models were used to regress each outcome against sex, age, age squared, birthweight, race/ethnicity, mother's education, mother's age, the cigarette excise tax in 2014 dollars, interview year and county fixed effects. Survey weights were used in all analyses to produce nationally representative estimates, and errors were clustered at the state level. Smoking ban regulations were lagged by one year. * p<0.10, ** p<0.05, *** p<0.01.

Table 11
Effects of SFLs on Smoking Venue
Conditional on having children in the household
NHIS 1998 – 2010

Outcome	Smoking inside the home on one or more days per week					
Panel A	Reference Group: All others					
Sample	All adults			Adults with a high school degree or below		
	All	Current smokers	Current and former smokers	All	Current smokers	Current and former smokers
Model	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Comprehensive 100% SFLs in Workplace, Restaurant &Bars	0.0010	-0.0357	-0.0119	-0.0005	-0.05289	-0.0246
	(0.0062)	(0.0233)	(0.0136)	(0.0114)	(0.0318)	(0.0187)
Real Cigarette Tax	-0.0130	-0.0012	-0.0068	-0.0228*	0.0013	-0.0114
	(0.0078)	(0.0155)	(0.0117)	(0.0117)	(0.0249)	(0.0168)
Observations	41,096	9,389	15,963	20,160	5,884	8,761
Outcome	Smoking inside the home on one or more days per week					
Panel B	Reference Group: No Bans					
Sample	All adults			Adults with a high school degree or below		
	All	Current smokers	Current and former smokers	All	Current smokers	Current and former smokers
Model	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Comprehensive 100% SFLs in Workplace, Restaurant &Bars	-0.0195	-0.0797***	-0.0272	-0.0163	-0.1127***	-0.0191
	(0.0129)	(0.0275)	(0.0242)	(0.0242)	(0.0301)	(0.0285)
Real Cigarette Tax	-0.0155***	-0.0228	-0.0278***	-0.0282***	-0.0322**	-0.0433***
	(0.0054)	(0.0156)	(0.0102)	(0.0093)	(0.0156)	(0.0100)
Observations	15,819	3,714	6,201	7,903	2,394	3,493

Notes: Coefficients from linear probability models are presented. Models are estimated for 1998, 2000, 2005, and 2010 data from the NHIS, for which information on the venue of smoking is available. Standard errors, clustered at the state level, are below estimates in parentheses. * p<0.10, ** p<0.05, and *** p<0.01.

Appendix Table A1
Effects of 100% SFLs on Children's Health
Children Ages 0-5, 6-12
NHIS 1998 – 2012

Outcome	**Reference Group: No Bans**		**Reference Group: All Else**	
Hay fever, past year	-0.0221***	0.0011	0.0027	0.0043
	(0.0066)	(0.0015)	(0.0074)	(0.0075)
Any respiratory allergies, past year	-0.0230***	-0.0017	0.0000	-0.0029
	(0.0001)	(0.0207)	(0.0062)	(0.0109)
Ever diagnosed with asthma	-0.0083	-0.0112	0.0051	-0.0083
	(0.0111)	(0.0123)	(0.0071)	(0.0057)
Asthma attack, past year	-0.0080	-0.0135	0.0026	-0.0098*
	(0.0101)	(0.0092)	(0.0037)	(0.0028)
ER visit for asthma, past year	-0.0009	-0.0045	-0.0006	-0.0022
	(0.0006)	(0.0031)	(0.0022)	(0.0022)
Any ER visit, past year	-0.0113	-0.0211***	0.0042	-0.0026
	(0.0119)	(0.0103)	(0.0074)	(0.0046)
Three or more ear infections, past year	-0.0050	-0.0203	0.0001	-0.0051
	(0.0080)	(0.0053)	(0.0060)	(0.0038)
Excellent or very good general health	-0.0060	0.0053	0.0040	0.0053
	(0.0080)	(0.0093)	(0.0080)	(0.0068)
Fair or poor general health	0.0060*	-0.0112***	-0.0001	-0.0021
	(0.0035)	(0.0040)	(0.0017)	(0.0022)
Sample	**0-5**	**6-12**	**0-5**	**6-12**
N	73,764	22,841	60,284	60,027

Linear probability models included child characteristics (age, age squared, sex, race/ethnicity, and birth weight), mother characteristics (age, education, marital status, and insurance status), state, year and month fixed effects. The independent variables of interest were binary indicators for state/county-level comprehensive workplace smoking bans and comprehensive restaurant/bar smoking bans. The indicator for comprehensive restaurant/bar smoking bans was equal to one if comprehensive restaurant & bar smoking bans were in place and zero otherwise. Observations for states/counties with limited smoking, restaurant, OR bar bans in place were excluded from the sample. Smoking ban policies were lagged by one year. Errors were clustered at the state level and all estimates incorporated population weights available from the National Center for Health Statistics. Age group 13-18 was also estimated, there were no estimated effects on this age group for models with either reference group.