Title
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Journal
Tobacco Control, 24(2)

ISSN
0964-4563

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Publication Date
2015-03-01

DOI
10.1136/tobaccocontrol-2013-051253

Peer reviewed

The Cost of Secondhand Smoke Exposure at Home in California

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Keywords: secondhand smoke, economic model, California, cost measures

Word count: 3581

ABSTRACT

Objective. Healthcare and mortality costs of secondhand smoke (SHS) exposure at home among nonsmokers in California were estimated for 2009.

Methods. Costs were estimated with an epidemiological model using California SHS home exposure rates and published relative risks. Healthcare costs included 9 conditions, and mortality was estimated for 4 perinatal and 3 adult conditions. Three mortality related measures were estimated: deaths, years of potential life lost (YPLL), and the value of lost productivity.

Results. SHS-attributable healthcare costs totaled over $241 million. The most costly conditions for children and adolescents were attention deficit hyperactivity disorder ($7.8 million) and middle ear disease ($5.6 million). For adults, the most costly conditions were ischemic heart disease (IHD) ($130.0 million) and asthma ($67.4 million). Deaths of 821 Californians were attributable to SHS exposure in the home, including 27 infants whose mothers smoked while pregnant, and 700 adults who died from IHD. These deaths represented a loss of over 13,000 YPLL and $119 million in lost productivity.

Conclusions. The economic impact of SHS exposure in the home totaled $360 million in CA in 2009. Policies that reduce exposure to SHS at home have great potential for reducing healthcare and mortality costs.

Secondhand smoke (SHS) exposure has been linked to a number of conditions, including lung cancer, respiratory disease, heart disease, breast cancer in young women, and attention deficit hyperactivity disorder (ADHD) in children.(1-3) In addition to disease, exposure to SHS is associated with deaths from perinatal conditions as well as heart disease, lung cancer, and asthma.(1, 2) The health and mortality effects of SHS result in economic costs as well. Estimates of the economic impact of SHS exposure are important for understanding the true impact of smoking, and for getting the attention of the policymakers and legislators who are in a position to make policy changes that can reduce this exposure.

Studies of the economic impact of SHS exposure in the US are limited. State-level studies have been conducted in Maryland,(4) Minnesota,(5) North Carolina,(6) and Indiana.(7) One study that estimated total annual SHS-attributable costs for the US reported medical costs of $6.9 billion.(8) Other studies have focused on children, including the impact of exposure in utero due to smoking by the mother(9, 10) and the impact of exposure on children from parental smoking and living with smokers.(11) Many of these studies also estimated the value of lives lost prematurely from SHS-attributable illness.(4, 7, 8) All these studies report substantial costs associated with exposure to SHS, though they differ in what costs they include and the methodologies used to estimate them.

Secondhand smoke exposure can occur at home, in the workplace, in public places, restaurants and bars, and in many other settings. In recent years, many policies have been adopted that restrict or prohibit smoking in the workplace and in public spaces, some even extending to outdoor spaces. However, restricting smoking at home is more challenging, and thus homes are now the primary site of exposure for many Californians, especially for children. This study will focus on the home as an important source of SHS exposure that public health policy needs to address.

The purpose of this study is to estimate the economic impact of SHS-attributable disease and death for California children (aged under 11), adolescents (aged 12-17), and adults (aged 18+) who were exposed to SHS at home in 2009. This will be the first study to quantify the economic cost of SHS-attributable illness and mortality for California.

METHODS

SHS-attributable healthcare expenditures and mortality were estimated using a prevalence-based annual cost approach. We first estimated the SHS-attributable fraction (SAF_{shs}),

which measures the proportion of costs or deaths that can be attributed to SHS exposure, and then applied it to total healthcare costs or total deaths for the condition of interest.

This study was certified as exempt by the University of California, San Francisco Committee on Human Research.

Data sources

The California Health Interview Survey (CHIS) was used to estimate SHS exposure at home. The CHIS is a population-based telephone survey of California households that uses a multistage stratified random-digit-dial sampling frame, and oversamples racial/ethnic minority groups. The survey contains information about adult and adolescent smoking and how many days per week someone smokes inside the home. We pooled data from 2007 and 2009 to obtain an adequate sample size for children (n=18,858) and adolescents (n=7,017); the 2009 sample size was large enough to estimate adult exposure (n=47,614).

Pooled data from the 2008-2010 Medical Expenditures Panel Surveys (MEPS) were used to determine the mean healthcare costs per person for each SHS-associated disease for the relevant age group. The MEPS is a nationally representative survey containing detailed information for each episode of healthcare utilization including healthcare expenditures and diagnoses defined by the International Classification of Diseases, Ninth Revision (ICD-9) code.

The number of deaths from SHS-related diseases was determined from the 2009 California Death Statistical Master File, a compilation of all death certificates in the state. The file contains the underlying cause of death. Life expectancy by age and gender were obtained from the most recent California-specific life tables. The present value of lifetime earnings (PVLE) was calculated taking into account survival rates, labor force participation rates, mean earnings, an imputed value for housekeeping services, and a 3% discount rate using a computer program developed and maintained at the University of California, San Francisco.(12)

Study sample. Because it is difficult to separate the impact of active and passive smoking for a smoker, we focused our analyses in this study on nonsmokers. All children were assumed to be nonsmokers. Nonsmoking adolescents were defined as those who have never tried cigarette smoking or who did not smoke in the past 30 days. Nonsmoking adults were defined as those who have never smoked 100 cigarettes in their lifetime or who do not smoke now.

Measures

Secondhand smoke exposure at home. Homes with SHS exposure were identified in the CHIS as those households in which smoking is allowed inside the home and someone smokes inside the home at least one day per week. Adults exposed to SHS at home were defined as nonsmokers who live in a home with SHS exposure. Exposed children and exposed nonsmoking adolescents were identified as those who live in households that allow smoking and where smoking is reported to occur some days or every day. Infants under the age of 1 were considered to be exposed if their mothers smoked while pregnant, and their exposure rate was measured by the smoking prevalence rate among pregnant women from the Maternal and Infant Health Assessment survey.(13)

SHS-associated diseases. Costs were estimated for diseases identified by the California Environmental Protection Agency(1) or the Surgeon General(2) as being causally associated with SHS exposure. We included 9 SHS-associated diseases, and 7 SHS-associated causes of death, as detailed in Table 1.

Relative risks. The relative risks (RR) of illness or death resulting from SHS exposure were taken from published sources, as described in Table 1. The California Environmental Protection Agency(1) and the Surgeon General(2) have reviewed an extensive number of studies of SHS-attributable risks, summarized the quality of the analyses, and made recommendations as to which studies are of highest quality. We relied on their recommendations. Our previous study of SHS-attributable ADHD was the source of the RR for that condition.(3) The RRs of death from the 4 perinatal conditions were obtained from the Maternal Child Health component of the U.S. Centers for Disease Control and Prevention's Smoking-Attributable Mortality, Morbidity, and Economic Costs (SAMMEC) computer program.(14) In some cases, different RRs were available for different age groups. The RRs for each condition for the relevant age groups are shown in Table 1.

Calculation of the SHS-attributable fraction. Once the relative risk and prevalence of home SHS exposure were determined, the SHS-attributable fraction of illness or death, the SAF_{shs}, was calculated using the standard epidemiological fraction (15) as:

$$SAF_{shs} = [P_{shs} * (RR_{shs} - 1)] / [P_{shs} * (RR_{shs} - 1) + 1]$$

where P_{shs} is the prevalence of SHS exposure in the home among nonsmokers;

RR_{shs} is the RR of illness or death from SHS exposed nonsmokers compared to unexposed nonsmokers.

Table 1. Relative Risk of Secondhand Smoke-Associated Illness and Death by Condition and Age

Secondhand Smoke-Associated Condition	Age	ICD-9 Code	Source	Relative Risk (95% CI)
Illness				
Low Birth Weight	<1	765	CA EPA (1)	1.38 (1.01-1.87)
Acute Lower Respiratory Tract Infection	<2	466, 480-487	CA EPA (1)	1.75 (1.5-2.0)
Middle Ear Disease	<3	381-382	CA EPA (1)	1.38 (1.21-1.56)
Chronic Respiratory Symptoms	0-17	491,786	CA EPA (1)	1.26 (1.20-1.33)
Attention Deficit Hyperactivity Disorder	4-15	314	Max Sung Shi (3)	1.5 (1.1-2.0)
Asthma	0-17	493	CA EPA (1)	1.32 (1.24-1.41)
	18+	493	CA EPA (1)	1.97 (1.19-3.25)
Lung Cancer	18+	162	CA EPA (1)	1.29 (1.04-1.60)
Ischemic Heart Disease	18+	410-414	Surgeon General Report (2)	1.50 (1.04-1.60)
Breast Cancer (females only)	18-50	174	CA EPA (1)	1.68 (1.31-2.15)
Death				
Short Gestation, Low Birth Weight	<1	765	MCH SAMMEC (15)	1.83 (*)
Sudden Infant Death Syndrome	<1	769	MCH SAMMEC (15)	2.29 (*)
Respiratory Distress Syndrome	<1	770	MCH SAMMEC (15)	1.3 (*)
Respiratory Conditions of Newborn	<1	798	MCH SAMMEC (15)	1.41 (*)
Ischemic Heart Disease	18+	410-414	Surgeon General Report (2)	1.25 (1.12-1.40)
Lung Cancer	18+	162	CA EPA (1)	1.29 (1.04-1.60)
Asthma	18+	493	CA EPA (1)	1.97 (1.19-3.25)

Footnote: ICD, International Classification of Diseases; CA EPA, California Environmental Protection Agency; MCH SAMMEC, Maternal Child Health Smoking- Attributable Mortality, Morbidity, and Economic Costs

*Confidence intervals not available.

Healthcare costs

Mean healthcare cost. For each disease and relevant age group (see Table 2), mean healthcare expenditures per nonsmoker were estimated from the 2008-2010 MEPS data. Included were costs for prescription medications, inpatient care, outpatient care, office-based visits, emergency department services, and home health, which were converted to 2009 dollars using the CPI for medical care. Expenditures by all payers, including out-of-pocket, private insurance, Medicare, and Medicaid, are included.

Table 2: Mean Healthcare Costs, SHS Exposure Rate at Home, SHS-attributable Fraction, and SHS-Attributable Healthcare Costs by Condition and Age Group: CA 2009

	Age	Mean Healthcare Cost per Nonsmoker ($)	SHS Exposure Rate at Home (%)	95%CI of SHS Exposure	SAF_{shs} (%)	SHS-attributable Healthcare Costs ($ 1,000)
Low Birth Weight	<1	489	5.60	4.90 - 6.40	2.1	4,392
Acute Lower Respiratory Tract Infection	<2	54	2.70	1.77 - 3.62	2.0	754
Middle Ear Disease	<3	429	2.44	1.64 - 3.25	0.9	5,571
Chronic Respiratory Symptoms	0-11	11	2.63	2.24 - 3.02	0.7	448
	12-17	19	3.81	3.21 - 4.42	1.0	581
Attention Deficit Hyperactivity Disorder	4-11	84	2.70	2.23 - 3.17	1.3	4,526
	12-15	111	3.01	2.38 - 3.64	1.5	3,283
Asthma	0-11	54	2.63	2.24 - 3.02	0.8	2,711
	12-17	49	3.81	3.21 - 4.42	1.2	1,794
	18+	60	5.01	4.52 - 5.55	4.6	67,409
Lung cancer	18+	27	5.01	4.52 - 5.55	1.4	9,516
Ischemic Heart Disease	18+	220	5.01	4.52 - 5.55	2.4	130,943
Breast cancer (female only)	18-50	60	3.11	2.13 - 4.09	2.1	9,324
TOTAL						241,250

Footnote: SHS, secondhand smoke; SAF_{shs}, SHS-attributable fraction; CI, confidence interval

SHS-attributable healthcare costs. The number of nonsmoking residents was determined as the total number of children, the proportion of nonsmoking adolescents times the total number of adolescents, and the proportion of nonsmoking adults times the total number of adults. This was multiplied by the average healthcare cost per nonsmoker for each SHS-attributable condition and age group to obtain total healthcare costs for each SHS-related condition and age group among nonsmokers. Finally, the SHS-attributable healthcare costs were obtained by multiplying total healthcare costs by the SAF_{shs} separately for each condition and age group.

SHS-attributable mortality analysis

Three mortality-related measures were estimated: SHS-attributable deaths, years of potential life lost, and the value of lost productivity.

SHS-attributable deaths. Deaths attributable to SHS among children from the 4 perinatal conditions were determined as the total deaths from each condition times the SAF_{shs} for that condition. The total number of deaths among adult nonsmokers from the 3 adult conditions was determined using the approach developed by previous studies(16, 17) as follows. First we subtracted the number of deaths attributable to active smoking from the total number of deaths for each condition. The remaining deaths were apportioned into deaths among smokers and nonsmokers according to the proportion of adult smokers and nonsmokers. The total number of deaths among nonsmokers for each condition was multiplied by the SAF_{shs} to determine the SHS-attributable deaths.

SHS-attributable years of potential life lost (YPLL). For each SHS-attributable death, the years of life remaining at the time of death until life expectancy were determined (separately by age and gender) from the California life tables. These were summed across all SHS-attributable deaths to obtain total SHS-attributable YPLL.

SHS-attributable productivity losses. Each SHS-attributable death was multiplied by the PVLE for a person of that age and gender to measure the value of productivity losses due to premature death. These productivity losses were summed to obtain the total SHS-attributable productivity losses, which represent an indirect cost to society from the standpoint of lost human capital.

Statistical analysis

Statistical analyses were conducted using SAS version 9.2,(18) taking into account the complex survey design in the CHIS and MEPS surveys to produce accurate standard errors and

incorporating sampling weights that adjust for unequal probabilities of sample selection and nonresponse to derive unbiased estimates for the California population.

Uncertainty

95% confidence intervals for SHS exposure rates and RRs are shown where available. The number of deaths is based on all death certificates in California rather than a sample-We conducted sensitivity analyses to see how sensitive our healthcare cost estimates are to SHS exposure and the relative risk estimates.

RESULTS

SHS exposure at home

SHS exposure rates are shown in Table 2. Children (0-11) had the lowest rates of SHS exposure at home - 2.63%, followed by adolescents (12-17) - 3.81%, and adults - 5.01%. Thus, nearly 1.7 million nonsmoking Californians, including 160,000 children, 123,000 adolescents, and 1.4 million adults were exposed to SHS in their homes. Among infants under the age of 1, 5.60% (28,000) were exposed to maternal smoking in utero.

SHS-attributable healthcare costs

Healthcare costs attributable to SHS exposure totaled over $241 million in California in 2009, as shown in Table 2. The most costly disease for children and adolescents was ADHD ($7.8 million), followed by middle ear disease ($5.6 million), asthma ($4.5 million), and low birth weight ($4.4 million). For adults, the most costly conditions were ischemic heart disease (IHD -$130.9 million) and asthma ($67.4 million). For nonsmoking adults, the SHS-attributable fraction for asthma was 5%, meaning that the SHS-attributable asthma costs of $67.4 million comprise 5% of total adult asthma costs, a sizeable addition to healthcare costs. For the other conditions, the SHS-attributable fraction was 1-2% of total costs for that condition for nonsmokers.

SHS-attributable mortality

The deaths of 821 Californians were attributable to SHS exposure at home in 2009 (Table 3). 27 infants died as a result of being exposed to tobacco smoke in utero. Among adults, the leading cause of SHS-attributable death was ischemic heart disease (IHD), which resulted in 700 deaths. Lung cancer and asthma accounted for 81 and 13 deaths respectively. These deaths were responsible for over 13,000 years of potential life lost, and $119 million of lost productivity. For infants, SHS-attributable YPLL per death averaged 81.3 years, and SHS-attributable lost

Table 3. SHS-Attributable Deaths, Years of Potential Life Lost (YPLL), and Value of Lost Productivity by Cause of Death: CA, 2009

	Deaths			SHS-attributable YPLL		Smoking-attributable Value of Lost Productivity	
Cause of Death	Number	SHS-Attributable	SAF_{shs} (%)	Number	Per Death	Total ($000)	Per Death
Infants	**6 85**	**27**	**3.9**	**2,19 6**	**81.3**	**35,198**	**1,304,000**
Short Gestation, Low Birth Weight	3 49	13	3.8	1,06 8	81.4	17,135	1,306,000
Sudden Infant Death Syndrome	1 86	11	6.0	91 3	81.4	14,585	1,301,000
Respiratory Distress Syndrome	57	1	1.3	6 1	81.0	993	1,322,000
Respiratory Conditions of Newborn	93	2	2.0	15 4	81.3	2,485	1,311,000
Adults	**53,8 31**	**794**	**1.5**	**11,10 9**	**14.0**	**83,311**	**105,000**
Lung Cancer	13,0 58	81	0.6	1,45 7	18.0	15,104	186,000
Ischemic Heart Disease	40,3 58	700	1.7	9,31 4	13.3	61,384	88,000
Asthma	4 15	13	3.1	33 8	26.0	6,823	525,000
TOTAL from SHS-Related Causes	**54,5 16**	**821**	**1.5**	**13,30 5**	**16.2**	**118,509**	**144,000**

Footnote: SHS, secondhand smoke; YPLL, years of potential life lost; SAF_{shs}, SHS-attributable fraction.

productivity per death averaged over $1.3 million. Adult total SHS-attributable YPLL and lost productivity were greatest for IHD, but YPLL per death and lost productivity per death were greatest for asthma, indicating that those who died of SHS-attributable asthma died at younger ages than those who died of other causes.

Sensitivity analysis

Healthcare costs ranged from $212 million to $270 million using the lower and upper bounds of the 95% confidence intervals for SHS exposure, with the point estimate of $241 million (as reported in Table 2). Costs were more sensitive to the relative risk estimates, and ranged from $40 million to $379 million, using the lower and upper 95% confidence intervals.

DISCUSSION

The economic impact of SHS exposure at home is substantial, totaling nearly $360 million in California in 2009. Given the 2009 state population of 37 million, this amounts to $9.70 for every resident of the state, including $6.50 for healthcare costs and $3.20 for lost productivity. The cost per exposed nonsmoker is much greater - $143 for healthcare costs and $70 for lost productivity resulting from premature death – for a total SHS-attributable cost of $213 for every nonsmoker exposed to SHS in California.

Our estimates of SHS-attributable costs are lower than those published for other states.(4-7) First, these studies do not focus on nonsmokers, but include smokers as well. While smokers also suffer health effects from exposure to SHS, most of the studies in the literature that report relative risk or population-attributable risk are based on nonsmokers. Thus it is appropriate to limit the estimates to nonsmokers. Second, California has a much lower rate of home exposure to SHS for all age groups than other states,(16,19,20) and this is reflected in the low SHS-attributable fractions (SAFs) that we estimated. The one study that reports SHS-attributable costs for the entire US is a report done for the Society of Actuaries.(8) The reported costs for the US were $6.9 billion in medical costs and $5.6 billion in lost productivity due to premature death for 2008. This study used the same relative risk measures that we used, but it estimated SHS exposure rates using data from the National Health and Nutrition Examination Survey that report serum cotinine measurement. Biomarker-measured exposure is known to lead to much greater estimates of SHS exposure.(19) The difference in exposure rates also explains why our estimates of SHS-attributable costs for children are low compared to several published studies. Adams and colleagues estimated the neonatal healthcare cost of maternal smoking during pregnancy in

California for 1996.(9) Their estimate of $35 million is greater than our estimate of $4 million for low birth weight among infants aged < 1 year for several reasons. They report smoking prevalence during pregnancy of 18.4%, more than 3 times our reported prevalence of 5.6%. This reflects the reduction in exposure to SHS that has occurred in California over the last few decades. Four other studies of healthcare costs resulting from childhood SHS exposure also are based on much higher exposure rates than those in California: a New York City study of developmental delay used prenatal exposure of 40%,(10) a national study of respiratory illness used 25-30% exposure (depending on age),(21) a study of childhood illness in the state of Maine was based on exposure rates from pregnant mothers smoking of 26%,(22) and a study of SHS-attributable costs for all US children under age 18 used a maternal smoking while pregnant rate of 28% and an exposure rate for children of 42%.(23) Third, the study by Adams and colleagues (9) did not limit their estimate to specific diseases that are causally linked with exposure to maternal smoking in utero; rather they compared the probability of being admitted into the neonatal intensive care unit (NICU) for any reason, and the length of stay in the NICU for those newborns admitted, between exposed and unexposed newborns.

Our healthcare cost estimates were greatest for adults, dominated by IHD ($130.9 million) and asthma ($67.4 million), but also substantial for lung cancer ($9.5 million) and breast cancer ($9.3 million). 1.4 million California adults continue to be exposed to SHS at home, and they bear a considerable burden in terms of ill health and associated healthcare costs.

The value of lost productivity resulting from SHS-caused premature death totaled $35 million for infants and $83 million for adults. While the number of deaths among children was relatively small at 27, the years of life lost per death and value of lost productivity per death was large, reflecting the many years of life remaining for each of these young victims. Adult deaths from SHS exposure were greatest by far for IHD (700 of the 794 deaths), but the years of life lost per death and the value of productivity lost per death was greatest for asthma, because victims are often younger adults.

While it was beyond the scope of our study to estimate SHS-attributable costs by payer, it is likely that the costs would be relatively large for public programs. We know that smoking is more likely among low income people, and SHS exposure at home is also likely to be greater for this group.(20) Thus the healthcare cost burden of SHS exposure is likely to be relatively large for the MediCal and other public programs. Also, because heart disease has a cumulative impact

on health and increases in prevalence with age, the burden to the Medicare program would be large.

The estimates we present here almost certainly underestimate the economic burden of SHS exposure. First, we were only able to estimate costs for a limited number of conditions and for limited age groups. Many more conditions are known to be negatively impacted by SHS exposure, but because the evidence isn't widely accepted and relative risk measures are not available, we did not include them in our analyses. Second, our estimates are based on self-reported exposure in the home. It has been shown that reported exposure greatly underestimates actual exposure. Third, many people are exposed to SHS in settings other than their homes. An analysis of the 2002-2005 California Tobacco Surveys found that 2.9% of nonsmoking California adults who worked in indoor settings outside the home were exposed to SHS in the workplace, including 11.2% of those whose workplaces were supposed to be smoke-free.(20) Others may be exposed in outdoor settings, parks, and other locations, but this is very difficult to measure. Fourth, our study was limited to healthcare costs and the value of lost productivity from premature death. SHS-attributable illness results in other economic impacts as well, such as lost productivity for people who are ill, and costs to the education system for children who miss school or require special education due to conditions like ADHD and other behavioral and cognitive impacts. Family members may become caregivers to people ill with SHS-attributable conditions. We were unable to include these costs. Fifth, we estimated costs only for nonsmokers, but smokers also experience negative health effects from SHS exposure. Sixth, our estimates are based on current reported SHS exposure at home and do not consider exposure that may have occurred in the past. Finally, people living in multi-unit housing may be exposed in their homes to drifting smoke from neighboring smokers. We were unable to account for this, but future research should address this important issue.

Our most recent estimates of the healthcare and mortality costs of active smoking for California are $19.3 billion (in 2010 dollars), including $11.5 billion for healthcare and $7.8 billion for mortality costs.(24) Compared to these estimates, the cost of SHS exposure at home is relatively small, adding about 2% to the total cost of tobacco use. However, this amounts to over $143 in healthcare costs and an additional $70 in lost productivity for each exposed nonsmoker in California. This is a large cost to bear for exposing nonsmokers to SHS, especially given that many interventions to reduce this exposure are known.

There is good news as well. We found that California children have lower SHS exposure rates than adults. We have found this consistently using several datasets for the state and hope it reflects the efforts at protecting children in the state. However, studies at the national level have found that adults have the lowest home exposure rates (19). Further research needs to be conducted that allows the comparison of California SHS exposure rates with rates from other states using a consistent source of data. The cost of SHS exposure in California is relatively low compared to estimated costs for several other states. This reflects many years of success for California's Tobacco Control Program, which has been a national leader in encouraging the prohibition of smoking in public spaces, workplaces, and even some outdoor spaces. Not only have these programs helped many smokers to quit, but they have reduced exposure to SHS among smokers and nonsmokers alike. While the costs of SHS exposure in California are not huge, they are avoidable. And in many other states as well as in other countries, these avoidable costs may be relatively larger.

Exposure to SHS in the home is an important public health issue, particularly for children. Policies that mandate smokefree workplaces, restaurants, and other public places have been successful in reducing illness and healthcare utilization, and have also been shown to result in reduced home exposure by changing social norms.(25) Efforts are needed that educate households about the importance of adopting voluntary smokefree policies.

A second area for policy focus is multi-unit housing. Here, drifting smoke from one person's home may impact the health of neighbors. Studies have shown that residents in multi-unit housing are more likely to have ill health effects than residents of other types of housing, including asthma and heart disease, resulting from SHS drifting from neighboring units.(26) Only 4 counties and 24 cities in California have passed smokefree MUH; there is clearly much more need for policy here. While it is difficult to mandate behavior in people's homes, multi-unit housing policies should be promoted. Thus, greater emphasis should be placed on passing smokefree multi-unit housing policies.

Reducing exposure to SHS has great potential to reduce illness, save lives, and reduce economic costs. We have made great strides in reducing exposure in workplaces and public spaces. It is now time to turn the policy focus to the home, an important source of SHS exposure for nearly 2 million Californians.

Acknowledgements: We appreciate the helpful advice and suggestions of Stan Glantz, Neal Benowitz, and the members of the FAMRI Bland Lane Center for Excellence in Secondhand Smoke Research. We also greatly appreciate the comments of 3 anonymous reviewers.

Competing Interests: None of the authors have any competing interests to report.

Funding: This research was funded by grants from the California Tobacco-Related Disease Research Program (Grants #16RT-0075 and #20CA-0102) and the Flight Attendants Medical Research Institute (FAMRI).

What this paper adds: Studies of the economic impact of secondhand smoke exposure on healthcare costs and the value of lost productivity from mortality are few, particularly at the state level in the US where many tobacco control policies are implemented. No studies have quantified the economic burden for California, a state that has played an important role in passing smoke-free policies. This study is the first to estimate the economic costs of secondhand smoke exposure at home in California. We estimate costs for all age groups, and show that costs per exposed nonsmoker are lower in California than in the other states for which estimates exist. This is further evidence of the success of tobacco control policies that have reduced smoking as well as exposure of nonsmokers.

Contributorship statement: Max obtained the funding and provided oversight on all aspects of analysis and interpretation of the data. She drafted the manuscript and approved the final version. Sung helped design and conduct the analyses, interpret the data, prepare and revise the manuscript, and approved the final version. Shi managed the data, conducted the analyses, helped design the tables and interpret the data, and revised and approved the final manuscript.

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