Program, Policy, and Price Interventions for Tobacco Control: Quantifying the Return on Investment of a State Tobacco Control Program

Julia A. Dilley, PhD, MES, Jeffrey R. Harris, MD, MPH, MBA, Michael J. Boysun, MPH, and Terry R. Reid, MSW

Objectives. We examined health effects associated with 3 tobacco control interventions in Washington State: a comprehensive state program, a state policy banning smoking in public places, and price increases.

Methods. We used linear regression models to predict changes in smoking prevalence and specific tobacco-related health conditions associated with the interventions. We estimated dollars saved over 10 years (2000–2009) by the value of hospitalizations prevented, discounting for national trends.

Results. Smoking declines in the state exceeded declines in the nation. Of the interventions, the state program had the most consistent and largest effect on trends for heart disease, cerebrovascular disease, respiratory disease, and cancer. Over 10 years, implementation of the program was associated with prevention of nearly 36 000 hospitalizations, at a value of about $1.5 billion. The return on investment for the state program was more than $5 to $1.

Conclusions. The combined program, policy, and price interventions resulted in reductions in smoking and related health effects, while saving money. Public health and other leaders should continue to invest in tobacco control, including comprehensive programs. (*Am J Public Health.* 2012;102:e22–e28. doi:10.2105/AJPH.2011.300506)

Price increases, policies establishing smoke-free public places, and comprehensive tobacco control programs are all proven strategies for reducing smoking prevalence.[1,2] Furthermore, implementation of comprehensive programs that reduce smoking have been shown to reduce tobacco-related health conditions, such as heart disease[3] and cancer.[4,5] Laws mandating smoke-free air have also been associated with a reduction in health conditions caused by smoking or environmental tobacco smoke exposure.[6–13] A recent review of specific tobacco control interventions found that most are cost effective.[14]

In the face of current economic conditions and limited budgets, policymakers may wonder whether implementing a tax on tobacco can produce revenue and decrease smoking without the cost of a program. Similarly, they may wonder whether a smoke-free policy may improve public health at little cost, while generating revenue.[15] They may also question the return on investment from tobacco control programs. State programs have declined in priority in recent years, and state funding remains substantially lower than levels recommended by the Centers for Disease Control and Prevention.[16]

Washington State has effectively used all 3 cornerstone tobacco control interventions: program, policy, and price. The state has had a well-funded comprehensive tobacco prevention and control program since late 2000, a statewide smoke-free public places law since December 2005,[17] and multiple cigarette tax increases. A previous study reported that significant declines in smoking were achieved by the state's total tobacco control effort.[18]

We examined the relative magnitude of effect on smoking and health from the 3 cornerstone tobacco control interventions and assessed the return on investment (ROI) for the state's tobacco control program after 10 years. Our study was the first that we are aware of to comprehensively examine the association between multiple specific health conditions and multiple proven tobacco control interventions.

METHODS

We used data from Washington State's Behavioral Risk Factor Surveillance System from 1990 to 2009 to describe the state prevalence of adult cigarette smoking.[19] This random telephone survey of adults is the principal source of data for monitoring adult health behaviors in the state. We used data from the National Health Interview Survey from 1990 to 2008 to describe national adult smoking trends.[20] This is the primary survey for monitoring health behaviors in the noninstitutionalized US population. The surveys use comparable questions to define current smoking.

We used Washington State's Comprehensive Hospital Abstract Reporting System from 1990 to 2008 to examine diagnosis and billing information for hospitalizations in the state.[21] We identified hospitalizations for state residents with a first diagnosis of smoking-related conditions, according to *International Classification of Diseases, Ninth Revision (ICD-9)*[22] codes: ischemic heart disease (IHD; *ICD-9* 410–414), cerebrovascular disease (CVD; *ICD-9* 430–438), and respiratory diseases (chronic obstructive pulmonary disease, emphysema, asthma, chronic bronchitis; *ICD-9* 490–496). For comparison, we used national hospitalization data available for 1996 to 2007.[23]

We used Washington State's Cancer Registry data for cancers diagnosed in state residents between 1992 and 2007.[24] We limited exploration to cancers that are at least 60% attributable to smoking[25]: lung, bronchus, and trachea cancer (*ICD-9* 162); lip, oral cavity, and pharynx cancer (*ICD-9* 140–149); larynx cancer (*ICD-9* 161); and esophageal cancer (*ICD-9* 150). As a national comparison, we used data from the Surveillance Epidemiology and End Results registry for 1990 to 2007.[26]

Comprehensive Tobacco Prevention and Control Program

Washington State launched its Tobacco Prevention and Control Program in Fall 2000. The comprehensive program included specific components recommended by the Centers for Disease Control and Prevention,[1] such as a statewide media campaign, tobacco quit line, and community and school programs (described in detail in a previous study[9]). We created a program effect interaction term as a product of program and year (where year was centered on 2000, such that 1999=–1, 2000=0, and 2001=1, etc.), so that the values of program effect were 0 for years 1990 to 2000 and 1, 2, 3, and so on for 2001 and subsequent years. We obtained total budget figures for the state's comprehensive program from the Washington State Department of Health for state fiscal years 2001 to 2010.

Washington implemented its Smoking in Public Places law, which prohibits smoking inside all workplaces and public spaces and within 25 feet of their doorways, in December 2005. We created a policy effect interaction term, similar to the program effect term, so that policy effect equaled zero for years 1990 to 2005, 1 for 2006, 2 for 2007, and 3 for 2008. We ascertained the average annual price per pack of cigarettes for Washington State from a national annual report.[27] We adjusted total annual cost per pack, in pennies, to 1990 values to account for inflation.[28]

Analysis

We created a theoretically driven linear regression model to estimate the effect of tobacco control predictors (program, policy, and price) on annual smoking prevalence and separately on annual age-adjusted rates (per 100 000) for tobacco-related health outcomes. Model 1 was expressed as

$$(1)\quad (\text{smoking/health outcome})_i = b_0 + b_1(\text{year})_i + b_2(\text{program effect})_i + b_3(\text{policy effect})_i + b_4(\text{price effect})_i + e_i$$

We did not include main effect terms (binary terms) for program and policy because tobacco control interventions would not generally be expected to have an instant effect; we assumed the reductions in outcomes would accumulate over time.

In this model, the coefficient for year represented the average annual change in the health outcome rate (the background trend), and the coefficients for program, policy, and price represented the effects of each tobacco control intervention on the health outcome after accounting for other effects. The program effect coefficient represented the average annual change in the health outcome rate associated with the state's Tobacco Prevention and Control program since it was established in late 2000. The policy effect coefficient represented the average annual change in the health outcome rate associated with the implementation of the state Smoking in Public Places law since it was established in late 2005, and the coefficient for price effect represented the average annual change in the health outcome rate associated with each penny of price increase (after adjustment for inflation). In all cases, a negative coefficient indicated a decrease in the average annual rate of smoking prevalence or health outcome over the period of study.

We also created a second model for each condition that included age-adjusted annual national rates, to control for national trends. Model 2 was expressed as

$$(2)\quad (\text{health outcome})_i = b_0 + b_1(\text{year})_i + b_2(\text{program effect})_i + b_3(\text{policy effect})_i + b_4(\text{price effect})_i + b_5(\text{annual national rate for health outcome}) + e_i$$

We specifically wanted to describe the ROI for the state's comprehensive program. We first estimated the number fewer hospitalizations where the effect of the program on age-adjusted trends was statistically significant ($P<.05$). We used the same model with the counts of hospitalizations as the outcomes to determine the average annual change associated with program implementation. We summed these over the 10-year period of the program. Because hospitalization data were available only through 2008, we used 2008 data to estimate effects in 2009 and 2010; similarly, for cancer incidence data we used data from 2007 to estimate effects from 2008 forward. We discounted the estimates by calculating the relative magnitude of reduction observed for the program coefficients after adding national data to the models. To calculate ROI, we applied year-specific average hospitalization costs by condition to year-specific predicted reductions in the number of hospitalizations from the program alone and compared this to the annual budget for the program during the same 10-year period.

We conducted all analyses with Stata 10.1 (StataCorp LP, College Station, TX). We interpreted findings as significant at the $P<.05$ level.

RESULTS

Figure 1 shows the trends for adult smoking in Washington State and the United States; it also notes when different tobacco control interventions were applied. Table 1 shows the parameters for regression models that describe the association between Washington State tobacco control interventions and adult smoking prevalence, both with and without adjustment for national trends. Program, policy, and price covariates were all negative in the model without national adjustment (model 1), indicating association with smoking prevalence declines, but only program effect was significant in the model ($P=.01$). After adjustment for declining national trends in smoking (model 2), program effect remained significantly associated with declining smoking in Washington State and did not change much in magnitude.

Table 2 shows the model specifications for incidence (hospitalization or cancer diagnosis) for each health condition, with and without national adjustment. Figure 2 illustrates the findings from Table 2 for selected conditions, showing actual and predicted trends without the effects of tobacco control interventions (we used only the year coefficient to predict trends without tobacco control).

For models unadjusted for national trend, program effect was often negative (5 of 7 hospitalization–incidence models) and significant (3 of 7 hospitalization–incidence models). Policy effect was less often negative (4 of 7 hospitalization–incidence models) but infrequently significant (1 of 7 hospitalization–incidence models). Price was often negative (6 of 7 hospitalization–incidence models) but not significant in any models.

The inclusion of national data limited the power of our models by restricting the number of years for analysis by almost half for hospitalizations and by 1 year for cancer

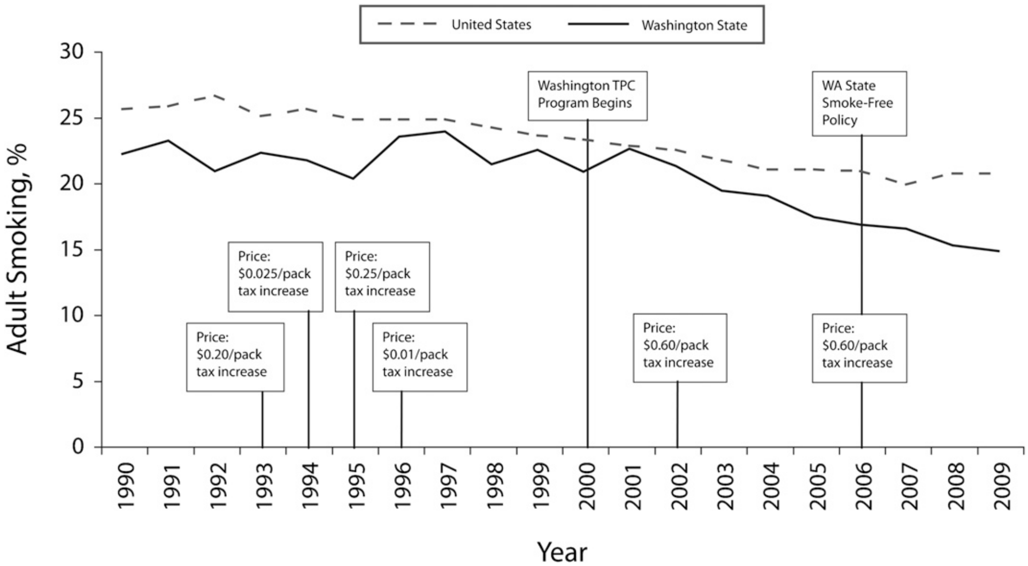

FIGURE 1—Washington State and US adult smoking prevalence trends, 1990–2009.

incidence. However, it also improved the model fit in most cases. Addition of the national trend covariate reduced the magnitude of the program effect coefficient by 38% and 40% for IHD and CVD hospitalizations, respectively. The coefficient for program effect remained significant for CVD and esophageal cancer incidence models, even after national adjustment.

For the 2 conditions with significant reductions in hospitalization associated with program effect, we applied the coefficient for program effect from the same base model, with annual counts as an outcome (IHD count, program effect coefficient=−188.3; P=.006; CVD count, program effect coefficient=−384.2; P<.001). After reducing by 38% in the IHD model and 40% in the CVD model to account for national effects, we calculated nearly 23 000 fewer IHD and nearly 13 000 fewer CVD hospitalizations. We applied the average cost per year for each condition (IHD, range=$25 000–$55 000; CVD, range=$14 000–$35 000 during the study period) to the estimated number of events prevented in each year. In total, the sum was an estimated savings of $1.1 billion for IHD and nearly $400 million for CVD, calculated from the number fewer hospitalizations over the 10-year period of the program.

We employed the same approach to calculate the number of incident esophageal cancer cases prevented: the program coefficient was associated with a significant decline. In total, over the 10-year period of the program about 900 cases were prevented, associated specifically with the program effect.

A total of nearly $259.7 million was spent on the program during this 10-year period. We divided the total savings from hospitalizations by the total budget of the program to calculate an ROI of $5.73 to $1 over the study period.

DISCUSSION

We observed significant declines in adult smoking and several smoking-related health conditions associated with tobacco control interventions. Policy and price increases appeared to affect rates of some health conditions, but the effect of the program was larger and more frequently significant. The more than $1.5 billion in total savings we calculated underestimated true overall savings because we did not include hospitalizations for conditions in which tobacco might be a contributing factor (e.g., diabetes complications), physician costs, pharmacotherapy, rehabilitation, loss of work time, and other costs to families. These would more than double the total costs.[29] Furthermore, our calculations did not include savings from declines in cancer

TABLE 1—Model Specifications for Predicting Annual Smoking Prevalence From Effects of Tobacco Control Program, Statewide Smoking Policy, and Price Increases: Washington State, 2000–2009

Smoking Prevalence	Model 1, Coefficient (SE) or R^2	P	Model 2,[a] Coefficient (SE) or R^2	P
Year	0.0007 (0.0020)	.72	−0.0006 (0.0025)	.82
Program effect	−0.0088 (0.0031)	.01	−0.0097 (0.0035)	.02
Policy effect	−0.0003 (0.0066)	.97	0.0014 (0.0071)	.85
Price effect	−0.0000 (0.0002)	.81	−0.0000 (0.0002)	.86
National trend	NA		−0.428 (0.68)	.54
Model fit	0.8576		0.8663	

Note. NA = not applicable.
[a]Adjusted for national trend.

TABLE 2—Model Specifications for Predicting Annual Rate of Health Conditions From Effects of Tobacco Control Program, Statewide Smoking Policy, and Price Increases: Washington State, 2000–2009

Health Condition	Model 1, Coefficient (SE) or R^2	P	Model 2,[a] Coefficient (SE) or R^2	P
Ischemic heart disease hospitalizations				
Year	−9.68 (1.49)	<.001	−18.65 (3.28)	.001
Program effect	−9.51 (2.25)	.001	−5.93 (3.47)	.14
Policy effect	−2.80 (4.85)	.57	−4.41 (5.80)	.48
Price effect	−0.10 (0.14)	.49	0.05 (0.14)	.74
National trend	NA		−0.13 (0.10)	.27
Model fit	0.9934		0.9947	
Cerebrovascular disease hospitalizations				
Year	0.66 (0.88)	.46	−2.02 (2.00)	.35
Program effect	−6.74 (1.32)	<.001	−4.05 (1.53)	.04
Policy effect	9.22 (2.86)	.006	10.49 (2.74)	.009
Price effect	−0.15 (0.08)	.08	−0.09 (0.07)	.28
National trend	NA		0.04 (0.13)	.75
Model fit	0.9557		0.9839	
Chronic respiratory disease hospitalizations				
Year	4.82 (2.40)	.06	7.61 (4.24)	.12
Program effect	−6.33 (3.63)	.1	−7.83 (4.13)	.11
Policy effect	2.13 (7.83)	.79	1.16 (8.10)	.89
Price effect	−0.29 (0.22)	.22	−0.33 (0.20)	.14
National trend	NA		0.21 (0.19)	.31
Model fit	0.5004		0.8088	
Esophageal cancer incidence				
Year	0.18 (0.08)	.04	0.14 (0.07)	.07
Program effect	−0.37 (0.10)	.004	−0.34 (0.09)	.005
Policy effect	0.18 (0.27)	.51	0.28 (0.24)	.28
Price effect	−0.00 (0.01)	.86	−0.00 (0.01)	.91
National trend	NA		0.88 (0.45)	.08
Model fit	0.6552		0.7506	
Larynx cancer incidence				
Year	0.01 (0.08)	.94	0.08 (0.10)	.4
Program effect	0.08 (0.11)	.45	0.07 (0.10)	.52
Policy effect	−0.25 (0.28)	.39	−0.25 (0.27)	.37
Price effect	−0.01 (0.01)	.1	−0.01 (0.01)	.14
National trend	NA		0.81 (0.60)	.21
Model fit	0.7782		0.8126	
Oral cancer incidence				
Year	−0.20 (0.11)	.09	−0.11 (0.14)	.43
Program effect	0.21 (0.14)	.16	0.13 (0.17)	.45
Policy effect	−0.16 (0.37)	.68	−0.11 (0.38)	.78
Price effect	0.00 (0.01)	.94	0.00 (0.01)	.82
National trend	NA		0.54 (0.57)	.37
Model fit	0.6304		0.6609	

Continued

incidence, other conditions that had not yet reached a threshold of statistical significance, or savings from reductions in health conditions that did not require hospitalization. We made conservative choices for specific conditions in calculating an ROI for this period of more than $5 saved for each $1 invested in the program. Researchers examining the total effect of California's tobacco control efforts, including program, price, and policy interventions over a 15-year period, reported a 50-to-1 return in reduced health care costs.[30] These researchers, employing the same methods they used in California, also reported a 10-to-1 return in reduced health care costs associated with comprehensive tobacco control interventions over an 8-year period in Arizona.[31]

Our predictive models fit best for IHD, CVD, and lung cancer ($R^2 > 0.85$). These conditions are relatively frequent, and a high percentage of these health conditions are directly caused by smoking (83% of lung cancer, 33% of IHD, and 35% of CVD among adults aged 35–64 years)[10]; therefore, it is logical that they would be highly correlated with factors that influence smoking rates. By contrast, other conditions may be more modestly correlated with smoking and related interventions; thus, effects may become measurable only after a longer time.

In addition, the etiologies for these conditions are different. Risk of heart attack is said to decrease within 3 months of quitting smoking and to drop by half within a year. A quitter's risk of stroke is reported to return to that of a nonsmoker within 5 to 15 years.[32] Population-level smoking reductions were observed almost immediately in Washington after the start of the program in late 2000.[10] We therefore reasoned that reductions in heart disease and CVD could be measured after 10 years of program implementation. Esophageal cancer risk has also been shown to decline within 10 years of quitting smoking.[33] Longer disease development or risk recovery periods for other conditions would require more years of data to show measurable results.

We found price effects mostly associated with beneficial health and behavior trends, but none were significant. The immediate effect of price increases on reducing smoking consumption and prevalence is well documented[2]; however, over time, price increases in Washington may have had less influence on smoking

TABLE 2—*Continued*

Lung cancer incidence				
Year	0.26 (0.34)	.47	0.77 (0.36)	.06
Program effect	−0.91 (0.46)	.07	−0.74 (0.40)	.09
Policy effect	−2.49 (1.2)	.06	−1.78 (1.05)	.12
Price effect	−0.02 (0.03)	.5	−0.02 (0.02)	.44
National trend	NA		1.13 (0.48)	.04
Model fit	0.8657		0.9139	

Note. NA = not applicable. Results from linear regression models where model fit was statistically significant ($P < .05$). Intercept values not shown. All rates were age adjusted.
[a]Adjusted for national trend.

because inflation effectively decreases the cost when prices are fixed. In other words, although the nominal average price per pack of cigarettes increased by $1.91, from $3.60 in 2000 to $5.51 in 2008, after accounting for inflation the increase equaled only $0.63. This suggests that to remain effective, continuous and frequent increases of cigarette prices to offset inflation are required.

The effect of the state Smoking in Public Places law was not strong in our models, although clear evidence exists to support expected health benefits. Many Washington communities worked to implement voluntary policies prior to the advent of the state policy; the health benefits of protecting workers and the public may therefore have been partially achieved before our study period.

Policymakers who are convinced of the effectiveness of a tobacco control program may still wonder whether a program can be terminated after some period of success. In fact, recent evidence shows that if a strong state program is removed, progress will be lost. For example, Oregon conducted a well-funded program from 1997 to 2002, defunded it in spring 2003, and refunded it in 2007. State declines in cigarette consumption greater than national declines were observed during the period of initial funding,[34] but consumption began to increase at a rate greater than the national average after defunding, then fell again faster than national declines after refunding (Oregon Department of Public Health, unpublished data). In a separate study, Oregon researchers showed that schools funded by the program, which had shown significantly reduced smoking initiation among youths in intervention than in comparison schools, rebounded after the program was defunded so that most of the progress in smoking prevention was lost.[35] Although programs may seem expensive, our results show that they save money over the relatively short horizon of 10 years.

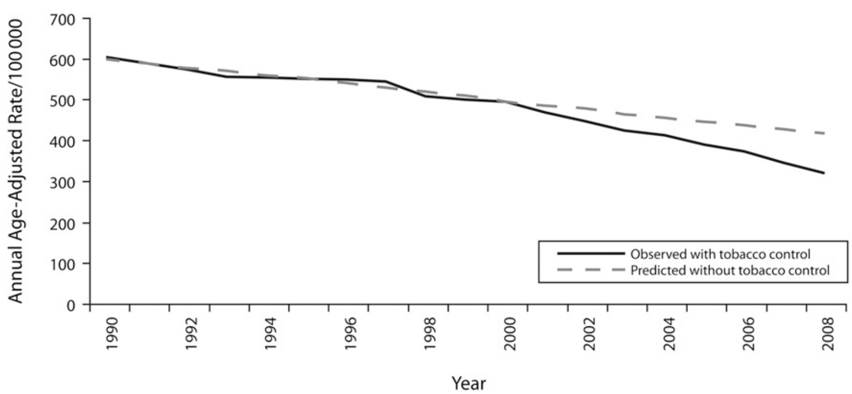

FIGURE 2—Influence of tobacco control on trends for heart disease hospitalization, 1990–2008.

Our study adds to the growing body of research that supports the effectiveness of all 3 cornerstone tobacco control interventions. A recent study showed that the more funding states dedicate to comprehensive tobacco control programs, and the longer the states invest, the greater the magnitude of return in decreasing smoking.[36] Our data suggest that increased returns in health care savings from decreases in smoking-related conditions would reasonably be expected to follow increased program investment. Conversely, as states have reduced their funding for comprehensive tobacco control programs, and national smoking declines among adults have subsequently stalled,[37] costs for smoking-related diseases should be expected to increase.

Limitations

National data were not available for the entire period for which we had Washington State data; this limited the power of our nationally adjusted models. The national comparisons we used included data from Washington and other states with strong, long-standing tobacco control programs (e.g., California, with 12% of the US population). This factor would have reduced the magnitude of our reported effects. We used the most current data (values for 2008) as a proxy for 2009 and 2010 rates when calculating hospitalizations averted and dollars saved over the 10-year period. This would lead to an underestimation of effect because of expected population growth and medical cost inflation during 2009 to 2010. Also, we were not able to include hospitalizations for Washington residents who received treatment in other states or in military hospitals. We calculated, from our inspection of years for which these data were available, that inclusion would have increased hospitalization numbers (and cost savings) by about 5%.

Our predictive variables (program, smoking policy, and cigarette price) were not completely independent. For example, the state's tobacco control program was partially funded by a cigarette tax increase after 2002. However, this should not have biased our results but only have created larger standard errors for the independent variables. Ours was the first study we are aware of that described the magnitude of price, policy, and program interventions specifically on health outcomes and costs. We did not have sufficient power to explore the potential interaction between the 3 interventions. If these interventions work synergistically, the impact reported here for the individual interventions might be greater than the impact of any 1 intervention applied alone.

Conclusions

Cornerstone tobacco control interventions in Washington State have prevented hospitalizations and saved dollars. The significant declines in smoking generated by Washington's Tobacco Prevention and Control Program over the past 10 years have resulted in fewer tobacco-related health conditions such as heart attack, stroke, and cancer. After we accounted for the effect of national declines in smoking, Washington's Smoking in Public Places policy, and price increases, we found that the state program has saved an estimated $1.5 billion in hospitalizations alone. In comparison with funding required to support the program during the same period, the ROI was greater than $5 to $1. Each additional year of program implementation produces growing returns. Policymakers and public health leaders should continue to invest in tobacco control interventions, including comprehensive programs. ■

About the Authors

Julia A. Dilley is with Program Design and Evaluation Services, Multnomah County Health Department and Oregon Health Authority, Portland. Jeffrey R. Harris is with the Health Promotion Research Center and the Health Services, University of Washington, Seattle. Michael J. Boysun and Terry R. Reid are with the Tobacco Prevention and Control Program, Washington State Department of Health, Olympia.

Correspondence should be sent to Julia A. Dilley, PhD, MES, Multnomah County Health Department and Oregon Health Authority Public Health Division, 827 NE Oregon St, Suite 250, Portland, OR 97232 (e-mail: julia.dilley@state.or.us). Reprints can be ordered at http://www.ajph.org by clicking the "Reprints/Eprints" link.

This article was accepted September 2, 2011.

Contributors

J.A. Dilley led the design and analysis. J.R. Harris assisted with the design. M.J. Boysun assisted with the analysis. All authors contributed to the writing.

Acknowledgments

We thank Clyde Dent for his assistance with statistical model development and interpretation.

Human Participant Protection

No protocol approval was required because only secondary, aggregated, and de-identified data were used.

References

1. National Center for Chronic Disease Prevention and Health Promotion, Office on Smoking and Health. *Best Practices for Comprehensive Tobacco Control Programs—2007*. Atlanta, GA: Centers for Disease Control and Prevention; 2007.

2. Task Force on Community Preventive Services. Strategies for exposure to environmental tobacco smoke, increasing tobacco-use cessation, and reducing initiation in communities and health-care systems. A report on recommendations of the Task Force on Community Preventive Services. *MMWR Recomm Rep*. 2000;49(RR-12):1–11. Available at: http://www.thecommunityguide.org/tobacco. Accessed October 27, 2010).

3. Fichtenberg CM, Glantz SA. Association of the California Tobacco Control Program with declines in cigarette consumption and mortality from heart disease. *N Engl J Med*. 2000;343(24):1772–1777.

4. Barnoya J, Glantz S. Association of the California tobacco control program with declines in lung cancer incidence. *Cancer Causes Control*. 2004;15(7):689–695.

5. Cowling DW, Yang J. Smoking-attributable cancer mortality in California, 1979–2005. *Tob Control*. 2010;19(suppl 1):i62–i67.

6. Herman PM, Walsh ME. Hospital Admissions for Acute Myocardial Infarction, Angina, Stroke, and Asthma After Implementation of Arizona's Comprehensive Statewide Smoking Ban. *Am J Public Health*. 2011;101(3):491–496.

7. Sims M, Maxwell R, Bauld L, Gilmore A. Short term impact of smoke-free legislation in England: retrospective analysis of hospital admissions for myocardial infarction. *BMJ*. 2010;340:c2161.

8. Naiman A, Glazier RH, Moineddin R. Association of anti-smoking legislation with rates of hospital admission for cardiovascular and respiratory conditions. *CMAJ*. 2010;182(8):761–767.

9. Institute of Medicine. *Secondhand Smoke Exposure and Cardiovascular Effects: Making Sense of the Evidence*. Washington, DC: National Academies Press; 2010.

10. Lightwood JM, Glantz SA. Declines in acute myocardial infarction after smoke-free laws and individual risk attributable to secondhand smoke. *Circulation*. 2009;120(14):1373–1379.

11. Mackay DF, Irfan MO, Haw S, Pell JP. Meta-analysis of the effect of comprehensive smoke-free legislation on acute coronary events. *Heart*. 2010;96(19):1525–1530.

12. Pell JP, Haw S, Cobbe S, et al. Smoke-free legislation and hospitalizations for acute coronary syndrome. *N Engl J Med*. 2008;359(5):482–491.

13. Mackay D, Haw S, Ayres JG, Fischbacher C, Pell JP. Smoke-free legislation and hospitalizations for childhood asthma. *N Engl J Med*. 2010;363(12):1139–1145.

14. Kahende JW, Loomis BR, Adhikari B, Marshall L. A review of economic evaluations of tobacco control programs. *Int J Environ Res Public Health*. 2009;6(1):51–68.

15. Boles M, Dilley JA, Maher JE, Boysun MJ, Reid T. (2010). Smoke-free law associated with higher-than-expected taxable retail sales for bars and taverns in Washington State. *Prev Chronic Dis*. 7(4):A79. Available at: http://www.cdc.gov/pcd/issues/2010/jul/09_0187.htm. Accessed October 27, 2010.

16. Campaign for Tobacco-Free Kids, American Heart Association, American Cancer Society, American Lung Association, and Robert Wood Johnson Foundation. A broken promise to our children: the 1998 state tobacco settlement 12 years later. 2010. Available at: http://www.tobaccofreekids.org/what_we_do/state_local/tobacco_settlement. Accessed August 11, 2011.

17. Washington State Legislature. Chapter 70.160 Regional Code of Washington (RCW) Smoking in public places (formerly Washington clean indoor air act). Citizens' Initiative Measure No. 901, approved November 8, 2005. Available at: http://apps.leg.wa.gov/RCW/default.aspx?cite=70.160. Accessed May 22, 2011.

18. Dilley JA, Rohde K, Dent C, Boysun MJ, Stark MJ, Reid T. Effective tobacco control in Washington State: a smart investment for healthy futures. *Prev Chronic Dis*. 2007;4(3):A65. Available at: http://www.cdc.gov/pcd/issues/2007/jul/pdf/06_0109.pdf. Accessed October 27, 2010.

19. Washington State Department of Health, Center for Health Statistics. Behavioral Risk Factor Surveillance System. Available at: http://www.doh.wa.gov/EHSPHL/CHS/CHS-Data/brfss/brfss_homepage.htm. Accessed April 28, 2011.

20. Centers for Disease Control and Prevention, National Center for Health Statistics. National Health Interview Survey. Available at: http://www.cdc.gov/nchs/nhis/about_nhis.htm. Accessed April 28, 2011.

21. Washington State Department of Health, Center for Health Statistics. Comprehensive Hospital Abstract Reporting System. Available at: http://www.doh.wa.gov/EHSPHL/hospdata/Chars.htm. Accessed April 28, 2011.

22. *International Classification of Diseases, Ninth Revision*. Geneva, Switzerland: World Health Organization; 1980.

23. Centers for Disease Control and Prevention. National Center for Health Statistics. National Hospital Discharge Survey. Available at: http://www.cdc.gov/nchs/nhds.htm. Accessed April 28, 2011.

24. Washington State Department of Health, Cancer Control Program. Washington State Cancer Registry. Available at: https://fortress.wa.gov/doh/wscr. Accessed April 28, 2011.

25. Centers for Disease Control and Prevention. Smoking-Attributable Mortality, Morbidity, and Economic Costs (SAMMEC): Adult SAMMEC and Maternal and Child Health (MCH) SAMMEC software. 2007. Available at: http://apps.nccd.cdc.gov/sammec. Accessed November 17, 2011.

26. Surveillance Epidemiology and End Results (SEER) Program—SEER 9, National Cancer Institute, DCCPS, Surveillance Research Program, Cancer Statistics Branch. Available at: http://seer.cancer.gov/faststats/selections.php?series=cancer. Accessed December 23, 2010.

27. Orzechowski and Walker. *The Tax Burden on Tobacco: Historical Compilation*. Vol. 44. Arlington, VA: Tobacco Institute; 2009. Available at: http://www.tobaccoissues.com/getobject.aspx?folder=root/tobaccoissues/PDF&name=tax_burden. Accessed September 9, 2010.

28. US Department of Labor, Bureau of Labor Statistics. Consumer price index history table. October 15, 2010. Available at: ftp://ftp.bls.gov/pub/special.requests/cpi/cpiai.txt. Accessed October 25, 2010.

29. US Department of Health and Human Services, Centers for Medicare and Medicaid Services. 2008. National health expenditure data overview. Available at: http://www.cms.gov/NationalHealthExpendData. Accessed September 14, 2010.

30. Lightwood JM, Dinno A, Glantz SA. Effect of the California tobacco control program on personal health care expenditures. *PLoS Med*. 2008;5(8):e178.

31. Lightwood JM, Glantz SA. Effect of the Arizona tobacco control program on cigarette consumption and healthcare expenditures. *Soc Sci Med*. 2011;72(2):166–172.

32. National Center for Chronic Disease Prevention and Health Promotion, Office on Smoking and Health. *The Health Consequences of Smoking: A Report of the Surgeon General*. Atlanta, GA: Centers for Disease Control and Prevention; 2004. Available at: http://www.surgeongeneral.gov/library/smokingconsequences. Accessed October 27, 2010.

33. Cook MB, Kamangar F, Whiteman DC, et al. Cigarette smoking and adenocarcinomas of the esophagus and esophagogastric junction: a pooled analysis from the international BEACON consortium. *J Natl Cancer Inst*. 2010;102(17):1344–1353.

34. Centers for Disease Control and Prevention (CDC). Decline in cigarette consumption following implementation of a comprehensive tobacco prevention and education program—Oregon, 1996–1998. *MMWR Morb Mortal Wkly Rep*. 1999;48(7):140–143.

35. Pizacani BA, Dent CW, Maher JE, et al. Smoking patterns in Oregon youth: effects of funding and defunding of a comprehensive state tobacco control program. *J Adolesc Health*. 2009;44(3):229–236.

36. Farrelly MC, Pechacek TP, Chaloupka FJ. The impact of tobacco control program expenditures on aggregate cigarette sales: 1981–2000. *J Health Econ*. 2003;22(5):843–859.

37. Centers for Disease Control and Prevention (CDC). Vital signs: current cigarette smoking among adults aged ≥18 years—United States, 2009. *MMWR Morb Mortal Wkly Rep*. 2010;59(35):1135–1140.