

Comprehensive Tobacco Control Programs: Economic Review

Study Info	Intervention Characteristics	Population Characteristics	Effect measure	Health effects	Medical Cost and Productivity Loss averted	Summary
<p>Author, Year: Carter, 2000</p> <p>Study design: Cost-effectiveness analysis</p> <p>Perspective: Commonwealth and Healthcare sector</p>	<p>Location: Australia</p> <p>Program scale: National</p> <p>Implementation date: 1997</p> <p>Intervention environment: Existing state and national tobacco control efforts</p> <p>Program funding: Aus97\$8.95 million, largely funded by Commonwealth (7.1 million), but with collaboration from lower-level jurisdictions and non-governmental organizations</p> <p>Program details: Educational campaign (TV, complementary activities, letters/kits to GPs), state/territory Quitlines</p> <p>Comparison: Modeled comparison of estimated 190,000 quitters if they hadn't quit</p>	<p>Study period: 1997 to death of cohort</p> <p>Study population: 190,000 estimated quitters, 37% female and 63% male (estimated from drop in prevalence in NTC survey and applied to Australian population)</p>	<p>Drop in prevalence of 1.4% (see Table 7.1)—assume quitters do not relapse</p>	<p>Potential years of life lost (PYLL) calculated based on reductions in smoking-related diseases:</p> <ul style="list-style-type: none"> • Lung cancer • COPD • Coronary heart disease • Stroke • Peripheral vascular disease • Heart failure • Cardiac dysrhythmias <p>(See Table 7.3)</p> <p>Prevent 920 deaths, save 3,338 potential years of life</p>	<p>Aus1997\$</p> <p>Healthcare costs averted: 24.2 million (Healthcare perspective)</p> <p>10.9 million (Commonwealth perspective)</p> <p>Lung cancer: 650,427 COPD: 1,529,555 CVD: 13,269,222 Stroke: 7,754,558 PVD: 981,176</p>	<p>Aus1997\$</p> <p>Cost-effectiveness ratios:</p> <p>Healthcare persp.: 47/quit 9,783/death averted 3,935/PYLS</p> <p>Commonwealth persp.: 37/quit 7,717/death averted 3,105/PYLS</p>

TABLE 7.1 CHANGE IN SMOKING PREVALENCE ASSUMED DUE TO NTC

Age Band	Male Benchmark	Male F/U	Male % Diff	Female Benchmark	Female F/U	Female % Diff	Total Benchmark	Total F/U	Total % Diff
18-24	31.4	30.4	1.0	27.4	25.1	2.3	29.5	27.9	1.6
25-29	36.6	34.0	2.6	31.3	28.3	3.0	33.8	31.1	2.7
30-34	34.8	32.8	2.0	26.4	24.5	1.9	30.6	28.4	2.2
35-39	29.1	29.2	-	23.3	22.5	0.8	26.0	25.7	0.3
40-59	24.5	22.1	2.4	17.6	17.4	0.2	21.1	19.7	1.4
60+	14.0	12.7	1.3	10.0	10.2	0.2	11.9	11.4	0.5
Total	26.5	24.7	1.8	20.5	19.5	1.0	23.5	22.1	1.4

Source: Data extracted from NTC enumerated data

TABLE 7.3 DEATHS AND PYLL⁷⁵ DUE TO SPECIFIED DISEASES, 1989/90

Cause of death	ICD-9-CM Codes	Deaths	PYLL⁷⁵
Lung Cancer	162	6309	41930
COPD	490-492; 496	5645	17550
Coronary Heart Disease	410-414	32825	127156
Stroke	430-438	12740	32359
Peripheral Vascular Disease	441-444; 440	3139	6592
Heart Failure	428-429	4216	3976
Cardiac Dysrhythmias	426-427	807	2718

Source: DCIS. AIHW / CHPE collaborative project

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<p>Author, Year: Chattopadhyay, 2011</p> <p>Study design: Econometric model using fixed and random effects, cost-benefit analysis</p> <p>Perspective: Societal</p>	<p>Location: USA</p> <p>Program scale: State-level tobacco control funding</p> <p>Implementation date: varies</p> <p>Intervention environment: Existing state and national tobacco control efforts</p> <p>Program funding: Estimates effects of \$million funding above 2007 average: 1, 10, 20, 50, 59.832 (CDC best practice 2007)</p> <p>Program details: Varies</p> <p>Comparison: 2007 average funding levels</p>	<p>Study period: 1991-2007</p> <p>Study population: US population</p>	<p>Reduction in packs per capita:</p> <p>1 million additional funds: 0.19</p> <p>10 million additional funds: 1.90</p> <p>20 million additional funds: 3.75</p> <p>50 million additional funds: 8.97</p> <p>59.832 million additional funds: 10.57</p> <p>(See Table 4)</p>		<p>2008\$ million</p> <p><i>Medical/Productivity/Medicaid</i></p> <p>1 million additional funds: 7/6.8/2.1</p> <p>10 million additional funds: 68.8/66.8/21.1</p> <p>20 million additional funds: 135/132/42</p> <p>50 million additional funds: 324/314/99</p> <p>59.832 million additional funds: 382/371/117</p> <p>(See Table 4)</p>	<p>2008\$ million</p> <p>Total savings/ Benefit-Cost Ratio</p> <p>1 million additional funds: 15.9/15.9</p> <p>10 million additional funds: 157/15.7</p> <p>20 million additional funds: 309/15.4</p> <p>50 million additional funds: 737/14.7</p> <p>59.832 million additional funds: 869/14.5</p> <p>(See Tables 4 & 5)</p>

TABLE 4Total Costs and Benefits under Various Levels of Control Funding (Fixed Effects Model)^a

Additional Funding in a State in 2008 (Million Dollar)	Predicted Per-Capita Packs Reduction in a State in 2008	Average Pack Reduction in a State in 2008 (Million)	Medical Cost Avoided (Million Dollar)	Productivity Cost Avoided (Million Dollar)	Medicaid Cost Avoided (Million Dollar)	Total Cost Avoided (Million Dollars)
1	0.19	1.4	7.0	6.8	2.1	15.9
10	1.90	14.0	68.8	66.8	21.1	157
20	3.75	27.5	135	132	42	309
50	8.97	65.1	324	314	99	737
59.832	10.57	76.5	382	371	117	869

^aThe results are based on the tax-based specifications.**TABLE 5**

Summary of Aggregate Benefits in a State and the Benefit-Cost Ratios

Additional Funding in 2008 (Million Dollar)	Total Cost Avoided (Million Dollars)			Benefit-Cost Ratios		
	Pooled Model	Fixed Effects	Random Effects	Pooled Model	Fixed Effects	Random Effects
Tax-based specification						
1	19.7	15.9	15.6	19.7	15.9	15.6
10	194	157	154	19.4	15.7	15.4
20	380	309	303	19.0	15.4	15.1
50	898	737	724	17.9	14.7	14.5
59.832	1,055	869	853	17.6	14.5	14.3
Price-based specification						
1	20.2	17.1	16.9	20.2	17.2	16.9
10	199	169	167	19.9	16.9	16.7
20	389	333	329	19.5	16.6	16.4
50	919	792	783	18.4	15.8	15.7

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<p>Author, Year: Cutler, 2002</p> <p>Study design: Economic forecast</p> <p>Perspective: Medicaid and societal</p>	<p>Location: MA</p> <p>Program scale: State</p> <p>Implementation date: 1999</p> <p>Intervention environment: Existing state and national tobacco control efforts</p> <p>Program funding: 99\$2.3 billion through 2010, 99\$4.2 billion through 2025</p> <p>Program details:</p> <p>Comparison: MA without MSA funding</p>	<p>Study period: 1999-2025</p> <p>Study population: MA population</p>	<p>45,000 (5%) fewer adult smokers</p> <p>13,000 (8%) fewer youth smokers</p> <p>Assumes no effect of advertising restrictions; assumes counter-advertising responsible for 1.28% decline in smoking for the 5 years public education fund is supported; assumes baseline reduction of 0.42% per year for adults</p>		<p>1999\$ million</p> <p>Medicaid cost averted: 29 through 2010 65 through 2025 (See Table 4)</p> <p><i>Note, this is from smoking-attributable fraction of Medicaid spending from previous work (Cutler et al. 2000)</i></p> <p>Reduced mortality: 37.5-74.9 through 2010 43.3-86.7 through 2025</p> <p><i>Note, assumes value of LYS \$100K-200K</i></p>	<p>1999\$ million</p> <p>Total savings: 37.5-74.9 through 2010 43.4-86.8 through 2025 (See Table 7)</p> <p><i>Note, most of this is from value of lives saved.</i></p>

Table 4. Forecasts of Medicaid spending attributable to smoking and savings under the MSA, net present value in millions of 1999 dollars.

	Baseline Spending through		Savings from MSA through	
	2010	2025	2010	2025
Expenses for:				
Adult acute care	\$2,256	\$4,550	\$6	\$29
Long-term care ¹	1,143	2,581	22	32
LBW babies	27	61	1	3
Total	\$3,427	\$7,192	\$29	\$65
Reduced deadweight loss			9	20

¹To give some idea of the importance of increased life span for computing Medicaid cost savings, results were recomputed assuming that the long-term care population grows at a rate that is 10 percent above the baseline (11 percent per year), beginning in the first year of the MSA. Under this scenario, the present value of total Medicaid savings fall to \$22.7 million and \$30 million in 2010 and 2025, respectively.

Table 7. Summary of MSA effects in Massachusetts.

	2010	Estimates Through	2025
Reduced Medicaid spending	\$0.0		\$0.1
Reduced mortality	\$37.5–74.9		\$43.3–86.7
Total ¹	\$37.5–74.9		\$43.4–86.8

¹ These estimates summarize the information in Tables 4 and 6. If the authors assumed no response to price by teen smokers, the lower bound of the range would be \$24.5 billion by 2025.

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<p>Author, Year: Dilley, 2007</p> <p>Study design: Pre-post inspection of data</p> <p>Perspective: societal</p>	<p>Location: WA</p> <p>Program scale: State</p> <p>Implementation date: 2000</p> <p>Intervention environment: Existing state and national tobacco control efforts</p> <p>Program funding: \$100 million from MSA, comprehensive tobacco control funding of \$15 million annually</p> <p>Program details: School programs, statewide programs, surveillance/evaluation</p> <p>Comparison: WA before tobacco control program</p>	<p>Study period: 1990-2005 (2000 to 2005 for savings)</p> <p>Study population: WA population</p>	<p>Claim statistically significantly different rate of decline in smoking rates for adults in WA and the US, but do not give statistical information. Decrease in smoking rate from 22.4% to 17.6%, amounting to 205,000 fewer smokers (<i>note, this includes reductions from secular trends and does not isolate effect of program</i>)</p> <p>No statistically significant reduction in smoking rates for 8th graders.</p>		<p>1990\$1.95 billion in medical savings</p>	<p>1990\$1.95 billion in medical savings</p> <p><i>Note, this includes reductions from secular trends and does not isolate effect of program</i></p>

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Study Info	Intervention Characteristics	Population Characteristics	Effect measure	Health effects	Medical Cost and Productivity Loss averted	Summary
<p>Author, Year: Dilley, 2012</p> <p>Study design: Linear regression and extrapolation</p> <p>Perspective: societal</p>	<p>Location: WA</p> <p>Program scale: State</p> <p>Implementation date: 2000</p> <p>Intervention environment: Existing state and national tobacco control efforts, a subsequent smoking ban, and six price increases</p> <p>Program funding: \$259.7 million over 10 years</p> <p>Program details:</p> <p>Comparison: WA before tobacco control program and through other policy changes</p>	<p>Study period: 2000-2009</p> <p>Study population: WA population</p>	<p>Used interaction term of program dummy and time (0 before program, 1 in first year, 2 in second year...)</p>	<p>Smoking prevalence: -0.0097 (0.0035) p=0.2</p> <p>23,000 fewer ischemic heart disease hospitalizations</p> <p>13,000 fewer cerebrovascular disease hospitalizations</p> <p>900 cases of esophageal cancer averted</p>	<p>IHD: \$1.1 billion CVD: \$400 million</p> <p><i>Note, the methodology used in constructing the estimates in this study is non-standard.</i></p>	<p>Savings of \$1.53 billion</p> <p>ROI: 5.73</p>

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<p>Author, Year: Hurley, 2008</p> <p>Study design: Markov simulation model, Cost-benefit analysis, Cost-effectiveness analysis</p> <p>Perspective: societal</p>	<p>Location: Australia</p> <p>Program scale: National</p> <p>Implementation date: 1997</p> <p>Intervention environment: Existing state and national tobacco control efforts</p> <p>Program funding: 2001Aus\$10.1 million</p> <p>Program details: Intensive broadcasting of anti-smoking advertisements, funding for a range of support services, including Quitlines</p> <p>Comparison: Modeled comparison of estimated 190,000 quitters if they hadn't quit</p>	<p>Study period: 1997- death of cohort</p> <p>Study population: Australian population</p>	<p>NTC estimated to have resulted in 190,000 fewer smokers between the ages of 15 and 65</p>	<p><i>Cases averted:</i></p> <p>10,134 Lung cancer</p> <p>11,498 AMI</p> <p>2538 Stroke</p> <p>32,682 COPD</p> <p>56,852 Any</p> <p><i>Deaths averted:</i></p> <p>9,872 Lung cancer</p> <p>11,834 AMI</p> <p>4,087 Stroke</p> <p>26,258 COPD</p> <p>52,050 Any</p> <p>2,2822 Other</p> <p>54,873 Total</p> <p><i>Other measures:</i></p> <p>323,000 LYS</p> <p>407,000 QALYs</p>	<p>2001Aus\$ million</p> <p><i>HC Costs Saved:</i></p> <p>163.24 Lung cancer</p> <p>110.77 AMI</p> <p>91.85 Stroke</p> <p>374.71 COPD</p> <p>740.57 Any</p>	<p>2001Aus\$ million</p> <p>740.57 in healthcare costs averted</p> <p>ROI: 73.32</p>

Table 2 Predicted cases of disease and deaths avoided, and predicted healthcare costs saved, through the NTC*

	Cases of disease avoided	Deaths avoided	Healthcare costs saved†
	Cases (95% CI)	Deaths (95% CI)	
Lung cancer	10 134 (9815 to 10 454)	9872 (9556 to 10 187)	\$163.24 million
AMI	11 498 (11 032 to 11 964)	11 834 (11 416 to 12 251)	\$110.77 million
Stroke	2538 (2067 to 3009)	4087 (3666 to 4509)	\$91.85 million
COPD	32 682 (32 144 to 33 219)	26 258 (25 793 to 26 722)	\$374.71 million
Any of the above four diseases	56 852 (56 154 to 57 531)	52 050 (51 392 to 52 709)	\$740.57 million
Causes other than the above four diseases		2822 (2181 to 3463)	Not considered
Total		54 873 (54 224 to 55 521)	\$740.57 million

*For the remaining lifetime of the 190 000 quitters, censored at age 85 years.

†Costs have been rounded; future costs discounted at 3% per annum.

AMI, acute myocardial infarction; COPD, chronic obstructive pulmonary disease.

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<p>Author, Year: Lightwood, 2008</p> <p>Study design: Cointegrating regression and simulation</p> <p>Perspective: societal</p>	<p>Location: CA</p> <p>Program scale: State</p> <p>Implementation date: 1989</p> <p>Intervention environment: Existing state and national tobacco control efforts</p> <p>Program funding: \$1.8 billion</p> <p>Program details: Intensive media campaign, promotion of smoke-free environments, social "de-norming"</p> <p>Comparison: 38 states which had no tobacco control program before 2000 or cigarette tax increases of \$0.50 or more per pack over study period</p>	<p>Study period: 1989-2004</p> <p>Study population: CA population</p>	<p>Price elasticity in CA: -0.30 to -0.70</p> <p>3.6 billion fewer packs of cigarettes sold (loss to tobacco industry of \$9.2 billion)</p> <p>Increase of one pack per capita per annum consumption of cigarettes is estimated to increase per capital healthcare costs by \$27.00</p>		<p>2004\$</p> <p><i>HC Costs Saved:</i></p> <p>86 billion in personal healthcare expenditures saved</p>	<p>2004\$</p> <p><i>HC Costs Saved:</i></p> <p>86 billion in personal healthcare expenditures saved</p> <p>If funded at same level of purchasing power as it had during first three years, authors estimate total savings would have been 156 billion, requiring an additional 1.2 billion in funding</p>

Cointegrating regression:

$$h_{CA,t} = \alpha_0 + \alpha_1 h_{control,t} + \alpha_2 (s_{control,t} - s_{CA,t}) + v_{1,t} \quad (1)$$

where

$h_{i,t}$ = per capita real total all-payer health care expenditures in i (California or control states) in year t in 2004 US dollars,

$s_{i,t}$ = per capita cigarette consumption in i in year t in 2004 US dollars,

$v_{1,t}$ = stationary residual for year t in Equation 1.
 t = year ($t_0 = 1980$ to $t_{25} = 2004$).

$$(s_{control,t} - s_{CA,t}) = \beta_0 + \beta_1 (E_{CA,t} - E_{control,t}) + \beta_2 p_{CA,t} + \beta_3 p_{control,t} + \beta_4 (t - t_0) + v_{2,t} \quad (2)$$

where

$E_{i,t}$ = cumulative real annual per capita tobacco control expenditures in i (California or the control states) in 2004 US dollars,

$p_{i,t}$ = average real price per pack of cigarettes in i during year t in 2004 US dollars,

$(t - t_0)$ = time, t , elapsed since $t_0 = 1980$, in years,

$v_{2,t}$ = stationary residual for year t in Equation 2.

Table 1. Estimated California Personal Health Expenditure and Per Capita Cigarette Consumption

Dependent Variable	Equation	Results	n	R ²	RMSE	Autocorrelation
California per capita personal health care expenditures (2004\$)	Cointegrating regression	$h_{CA,t} = \$2,736 (\pm \$173) + 0.599 (\pm 0.0519) h_{control,t} - \$27.00 (\pm \$1.82)/(\text{pack per capita}) (s_{control,t} - s_{CA,t}) + v_{1,t}$	25	0.91	46.0	0.09
	Equilibrium correction model	$\Delta h_{CA,t} = -0.759 (\pm 0.390) v_{1,t-1} + 0.481 (\pm 0.221) \Delta h_{CA,t-1} + \varepsilon_{1,t}$	23	0.21	71.9	0.11
Difference in cigarette consumption in California and control states (packs per capita)	Cointegrating regression	$(s_{control,t} - s_{CA,t}) = 30.3 (\pm 2.15) + 0.261 (\pm 0.0780) (\text{packs per capita})/(\$ \text{ per capita}) (E_{CA,t} - E_{control,t}) + 11.3 (\pm 2.20) (\text{packs per capita})/(\$ \text{ per pack}) p_{CA,t} - 22.6 (\pm 2.90) (\text{packs per capita})/(\$ \text{ per pack}) p_{control,t} + 1.69 (\pm 0.187) (\text{packs per capita/year}) (t - 1980) + v_{2,t}$	25	0.98	1.75	-0.23 ^a
	Equilibrium correction model	$\Delta(s_{control,t} - s_{CA,t}) = 0.946 (\pm 0.404) - 0.960 (\pm 0.232) v_{2,t-1} + 0.315 (\pm 0.185) \Delta(s_{control,t-1} - s_{CA,t-1}) + \varepsilon_{2,t}$	23	0.46	1.57	-0.04

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<p>Author, Year: Lightwood, 2011</p> <p>Study design: Cointegrating regression and simulation, Cost-benefit analysis</p> <p>Perspective: societal</p>	<p>Location: AZ</p> <p>Program scale: State</p> <p>Implementation date: 1994</p> <p>Intervention environment: Existing state and national tobacco control efforts</p> <p>Program funding: \$235 million</p> <p>Program details: Concentrates on youth uptake of smoking, avoids public policy and commentary on the tobacco industry</p> <p>Comparison: 38 states which had no tobacco control program before 2000 or cigarette tax increases of \$0.50 or more per pack over study period</p>	<p>Study period: 1996-2004</p> <p>Study population: AZ population</p>	<p>46.4 million fewer packs of cigarettes sold in 2004, 200 million fewer packs smoked from 1996-2004 (loss to tobacco industry of \$500 million)</p> <p>Increase of one pack per capita per annum consumption of cigarettes is estimated to increase per capital healthcare costs by \$19.50</p>		<p>2004\$</p> <p><i>HC Costs Saved:</i></p> <p>724 million in personal healthcare expenditures saved in 2004</p> <p>2.33 billion in cumulative healthcare expenditures saved from 1996 to 2004</p>	<p>2004\$</p> <p><i>HC Costs Saved:</i></p> <p>724 million in personal healthcare expenditures saved in 2004</p> <p>2.33 billion in cumulative healthcare expenditures saved from 1996 to 2004</p> <p>Benefit-Cost ratio: 10</p>

Table 1
 Estimated personal healthcare expenditure, per capita cigarette consumption and tobacco control education expenditures.

Regression	R ² (%)	RMSE	Autocorrelation
Eq. Healthcare Expenditure <i>Cointegrating Regression (Long-Run Relationship)</i>			
1 $h_{AZ,t} = \$1248 + 0.726h_{c,t} - \$19.5(s_{c,t} - s_{AZ,t})$ (/pack per capita) (352) (0.0964) (5.45) $- \$296(A_{c,t} - A_{AZ,t})$ (/proportion of population elderly) $- \$0.143(y_{c,t} - y_{AZ,t})$ (/ \$ personal income per capita) (121) (0.0383)	82	116	0.520*
<i>Equilibrium correction model</i>			
3 $\Delta h_{AZ,t} = -16.1 - 0.471v_{1,t-1} + 0.620\Delta h_{c,t-1}$ (25.6) (0.152) (0.307)	42	80	-0.0371
Difference in Cigarette Consumption <i>Cointegrating Regression (Long-Run Relationship), equation</i>			
2 $(s_{c,t} - s_{AZ,t}) = 70.9 + 0.190(E_{AZ,t} - E_{c,t})$ (packs per capita/\$percapita) $- 16.2(p_{c,t} - p_{AZ,t})$ (packs per capita/\$perpack) (16.2) (0.0780) (3.98) $- 0.00281y_{AZ,t}$ (packs per capita/ \$ personal income per capita) $+ 1.07(t - 1975)$ (packs per capita/ year) (0.000751) (0.194)	89	2.98	0.159
<i>Equilibrium correction model</i>			
4 $\Delta(s_{c,t} - s_{AZ,t}) = 0.456 - 0.955v_{2,t-1} + 0.352\Delta(s_{c,t-1} - s_{AZ,t-1})$ (0.490) (0.182) (0.147)	54	2.48	-0.070

^a Significant first order autocorrelation at the 0.05 significance level.
 Note: dollars in year 2004 dollars.

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<p>Author, Year: Lightwood, 2013</p> <p>Study design: Regression and simulation, Cost-benefit analysis</p> <p>Perspective: societal</p>	<p>Location: CA</p> <p>Program scale: State</p> <p>Implementation date: 1989</p> <p>Intervention environment: Existing state and national tobacco control efforts</p> <p>Program funding: \$2.4 billion</p> <p>Program details: Intensive media campaign, promotion of smoke-free environments, social "de-norming"</p> <p>Comparison: 38 states which had no tobacco control program before 2000 or cigarette tax increases of \$0.50 or more per pack over study period</p>	<p>Study period: 1989-2004</p> <p>Study population: CA population</p>	<p>In 2008, prevalence was 3.46 percentage points lower, and cigarette consumption per capita was 96.3 pack/year lower than predicted without program.</p> <p>Reduction of one percentage point prevalence associated with \$35.4 reduction in per capita healthcare expenditure.</p> <p>Reduction of one pack per smoker in cigarettes smoked associated with \$3.14 reduction in healthcare expenditure.</p>		<p>2010\$</p> <p><i>HC Costs Saved:</i></p> <p>411 in per capita healthcare expenditures saved in 2008</p> <p>134 billion in cumulative healthcare expenditures saved from 1989 to 2008</p>	<p>2004\$</p> <p><i>HC Costs Saved:</i></p> <p>411 in per capita healthcare expenditures saved in 2008</p> <p>134 billion in cumulative healthcare expenditures saved from 1989 to 2008</p> <p>(Using CMS data instead, total savings of 234 billion)</p>

Table 1. Estimated California smoking prevalence, cigarettes per capita, and per capita healthcare expenditures.

Eq.	Sample Period	Dependent Variable	Statistic	Estimate	dimension
1	1985–2008, 24 obs	$(prev_{c,t} - prev_{CA,t})$	α_0	6.30 (0.610)	
			α_1	0.0497 (0.00347)	/ \$ per capita
			α_2	-1.00 (0.477)	/ \$ per pack
			α_3	0.416 (0.0730)	/ \$1000 per capita
			R^2 (%)	77	
			r_1	0.154	
			2	1985–2008, 24 obs	$(cps_{c,t} - cps_{CA,t})$
β_1	1.39 (0.132)	/ \$ per capita			
β_2	-26.6 (6.80)	/ \$ per pack			
β_3	2.97 (1.21)	/ \$1000 per capita			
R^2 (%)	81				
r_1	0.148				
3	1985–2008, 24 obs	$n_{CA,t}$			
			γ_1	1.15 (0.180)	
			γ_2	-35.4 (9.85)	\$/%point
			γ_3	-3.14 (0.786)	\$ pack per smoker
			γ_4	-108 (6.79)	\$/ \$1000 per capita
			R^2 (%)	80	
			r_1	0.262	

3*	1985–2008, 24 obs	$h_{CA, t}$	γ_0	1056 (112)	\$
			γ_1	0.847 (0.0542)	
			γ_2	–67.8 (7.31)	\$/%point
			γ_3	–5.48 (0.928)	\$ pack per smoker
			γ_4	–107 (22.3)	\$/\$1000 per capita
			R^2 (%)	89	
			r_1	0.486 [†]	
3*	1985–2004, 20 obs	$h_{CA, t}$	γ_0	1001 (967)	\$
			γ_1	0.856 (0.227)	
			γ_2	–69.8 (12.6)	\$/%point
			γ_3	–5.59 (1.77)	\$ pack per smoker
			γ_4	–112 (17.5)	\$/\$1000 per capita
			R^2 (%)	78	
			r_1	0.483 [†]	

*Equation 3 with $h_{CA, t}$ as dependent variable instead of $n_{CA, t}$ and $h_{C, t}$ as explanatory variable instead of $n_{C, t}$.

[†]significant at the 5% level.

r_1 : first order autocorrelation coefficient.

$prev_{j, t}$: Prevalence of current smoking in population j , for California and control states in year t , (percentage points).

$cps_{j, t}$: Cigarettes consumption per current smoker in population j , for California and control states in year t , (packs/year per smoker).

$EC_{j, t}$: Cumulative per capita funding in population j , for California and control states in year t , (dollars).

$p_{j, t}$: Price per pack of cigarettes in population j , for California and control states in year t , (dollars).

$y_{j, t}$: Per capita personal income in population j , for California and control states in year t , (thousands of dollars).

$n_{j, t}$: Per capita healthcare expenditures in population j , for California and control states in year t , (thousands of dollars).

$h_{j, t}$: Per capita healthcare expenditures in population j , for California and control states in year t , (thousands of dollars).

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Comprehensive Tobacco Control Programs: Economic Review

Study Info	Intervention Characteristics	Population Characteristics	Effect measure	Health effects	Medical Cost and Productivity Loss averted	Summary
<p>Author, Year: Max, 2013</p> <p>Study design: Vector autoregression & simulation</p> <p>Perspective: societal</p>	<p>Location: CA</p> <p>Program scale: State</p> <p>Implementation date: Various</p> <p>Intervention environment: Existing state and national tobacco control efforts</p> <p>Program funding: Tobacco control funding cut in half (\$0.025 per pack); tobacco control funding increased to CDC recommended level (\$12.12 per capita—would cost \$403 million per year, \$2.01 billion over 5 years)</p> <p>Program details: CTCP</p> <p>Comparison: Tobacco control funding kept the same (\$0.05 per pack)</p>	<p>Study period: 2012-2016</p> <p>Study population: CA population</p>	<p>Prevalence forecast:</p> <p>Base case: 12.7%</p> <p>Funding cut: 12.9%</p> <p>CDC funding: 10.6%</p> <p>(See Table 1)</p>		<p>2009\$</p> <p><i>HC Expenditures:</i></p> <p>Funding cut: 307 million more than in base case</p> <p>CDC funding: 4.7 billion less than in base case</p> <p>(CDC funding works better than a modeled tax increase due to reduction in heavy smoking)</p> <p>(See Table 2)</p>	<p>2004\$</p> <p><i>HC Costs Saved:</i></p> <p>4.7 billion in savings if increase funding to CDC recommended levels</p>

Table 1 Forecasts of smoking prevalence under four scenarios of tobacco control funding: 2010–2016 (%)

	2010	2011	2012	2013	2014	2015	2016
Scenario 1: base case							
Current smoker	12.1	12.2	12.3	12.4	12.5	12.5	12.7
Former smoker	24.7	24.7	24.7	24.6	24.6	24.5	24.4
Never-smoker	63.2	63.1	63.1	63.0	63.0	62.9	62.9
Scenario 2: funding cut in half							
Current smoker	12.1	12.2	12.3	12.4	12.5	12.7	12.9
Former smoker	24.7	24.7	24.6	24.6	24.5	24.5	24.4
Never-smoker	63.2	63.1	63.1	63.0	62.9	62.9	62.8
Scenario 3: \$1.00 tobacco tax							
Current smoker	12.1	12.2	10.7	10.6	10.5	10.4	10.4
Former smoker	24.7	24.7	25.4	25.5	25.5	25.6	25.6
Never-smoker	63.2	63.1	63.9	63.9	64.0	64.0	64.0
Scenario 4: CDC recommended funding							
Current smoker	12.1	12.2	11.8	11.5	11.1	10.8	10.6
Former smoker	24.7	24.7	24.9	25.0	25.2	25.4	25.5
Never-smoker	63.2	63.1	63.3	63.5	63.6	63.8	63.9

Assumes that changes in current smoking are allocated equally to former and never smoking.

Smoking prevalence rates are calibrated to the 2007 California Health Interview Survey rates.

CDC, Centers for Disease Control and Prevention.

Table 2 Smoking-attributable healthcare expenditures under four scenarios of tobacco control funding: 2010–2016 (\$ millions, 2009)

	Smoking-attributable healthcare expenditures							Savings in smoking-attributable healthcare expenditures compared to base case					
	2010	2011	2012	2013	2014	2015	2016	2012	2013	2014	2015	2016	2012–2016
Scenario 1: base case													
Current smokers	3498	3546	3657	3787	3940	4098	4315						
Former smokers	2812	2828	2872	2932	3006	3083	3166						
Ever-smokers (current + former)	6309	6374	6529	6719	6947	7181	7481						
Scenario 2: funding cut in half													
Current smokers	3498	3546	3677	3833	4006	4191	4435	–21	–45	–65	–93	–119	–344
Former smokers	2812	2828	2870	2927	2999	3073	3153	2	5	7	10	13	37
Ever-smokers (current + former)	6309	6374	6547	6759	7005	7264	7588	–18	–40	–58	–83	–107	–307
Scenario 3: \$1.00 tobacco tax													
Current smokers	3498	3546	3131	3133	3151	3170	3237	526	654	789	927	1079	3975
Former smokers	2812	2828	2964	3040	3132	3226	3327	–92	–108	–125	–143	–162	–631
Ever-smokers (current + former)	6309	6374	6095	6173	6283	6396	6564	434	546	664	785	917	3345
Scenario 4: CDC recommended funding													
Current smokers	3498	3546	3312	3099	2906	2715	2566	345	688	1035	1383	1750	5201
Former smokers	2812	2828	2907	3003	3114	3228	3351	–35	–71	–108	–145	–185	–544
Ever-smokers (current + former)	6309	6374	6219	6102	6020	5943	5916	310	617	927	1238	1565	4657

Expenditures are excess expenditures compared to healthcare expenditures of never-smokers.
 CDC, Centers for Disease Control and Prevention.

Comprehensive Tobacco Control Programs: Economic Review

Study Info	Intervention Characteristics	Population Characteristics	Effect measure	Health effects	Medical Cost and Productivity Loss averted	Summary
<p>Author, Year: Miller, 2010</p> <p>Study design: Dynamic simulation</p> <p>Perspective: societal</p>	<p>Location: CA</p> <p>Program scale: State</p> <p>Implementation date: 1989</p> <p>Intervention environment: Existing state and national tobacco control efforts</p> <p>Program funding: \$1.2 billion over first decade, then assumes constant initiation/cessation rates (note: assumes some level of continued funding)</p> <p>Program details:</p> <p>Comparison: CA in absence of CTCP</p>	<p>Study period: 1990-2079</p> <p>Study population: CA males</p>	<p>Built factual and counterfactual initiation and cessation rates from a model based on other states' initiation and cessation rates, a program dummy, and a time trend</p>		<p>1990\$</p> <p><i>Healthcare Costs Saved:</i></p> <p>1.438 billion saved in healthcare costs (gross)</p> <p>-0.144 billion saved, accounting for longevity costs (net)</p>	<p>1990\$</p> <p><i>Healthcare Costs Saved:</i></p> <p>1.438 billion saved in healthcare costs (gross)</p> <p>-0.144 billion saved, accounting for longevity costs (net)</p> <p>107.418 billion total savings, including net healthcare savings and value of life saved</p> <p><i>Note, this is only for men. The authors speculate that the economic effects for women would be on the order of 2/3 the size of these effects for men.</i></p>

Table 1 Estimated economic impact of the California Tobacco Control Program (CTCP) over a 90-year evaluation period from 1990 through 2079

Outcome measures	Predicted value	SE
A. Years of life saved (person-years)	712966*	60590
B. Years of treatment saved (person-years):		
High relative risk smoking-related diseases	141426*	5903
Low relative risk smoking-related diseases	16240	13617
C. Healthcare expenditures saved (in billions):		
Algorithm 1: 'gross' healthcare savings without accounting for the impact of prolonged years of life due to the CTCP	\$1.438*	\$0.227
Algorithm 2: 'net' healthcare savings after adjusting for additional healthcare expenditures associated with prolonged years of life due to the CTCP	-\$0.144	\$0.217
D. Total economic value of 'net' healthcare savings and years of life saved, assuming a year of life is valued at \$100 000 with adjustments for disease treatment and health status (in billions):		
Algorithm 3: present value of life years discounted at 3%	\$22.443*	\$1.118
Algorithm 4: present value of life years discounted at 2% for current smokers, 1.5% for former smokers and 1% for never smokers	\$107.418*	\$1.629

All monetary values are in 1990 dollars.

*Statistically significant at p value <0.05, two-tailed test.

Comprehensive Tobacco Control Programs: Economic Review

Study Info	Intervention Characteristics	Population Characteristics	Effect measure	Health effects	Medical Cost and Productivity Loss averted	Summary
<p>Author, Year: Rhoads, 2012</p> <p>Study design: Regression analysis (probit for smoking participation and OLS for cigarette consumption per day) & simulations</p> <p>Perspective: societal</p>	<p>Location: USA</p> <p>Program scale: National</p> <p>Implementation date: Varies</p> <p>Intervention environment: Existing state and national tobacco control efforts; model controls for cigarette tax, smoke-free laws, demographics, lower tax in neighboring state, major tobacco producing state, Utah, geographic division, time</p> <p>Program funding: Varies</p> <p>Program details: State level tobacco control funding (current and cumulative)</p> <p>Comparison: Other states</p>	<p>Study period: 1991-2006</p> <p>Study population: USA population</p>	<p>Regression parameters:</p> <p>Smoking participation: current TC: -0.0084 cumulative TC: -0.0057 to -0.0060 (depending on discount rate)</p> <p>Natural log of cigarette consumption per day: current TC: -0.0229 cumulative TC: -0.0135 to -0.0157 (depending on discount rate)</p>			<p>2011\$ (assumed)</p> <p>1655/one fewer smoker</p> <p>1120/life year saved</p> <p>840/QALY</p>