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Potential Costs and Benefits of Smoking Cessation for Tennessee

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Executive Summary

Background. Cigarette smoking is the single leading cause of preventable disease and preventable death in the United States (US), leading to more than 400,000 deaths annually. The CDC and the U.S. Department of Health and Human Services have both issued guidelines on smoking cessation to help people to quit smoking that include: access to counseling, access to all FDA-approved over-the-counter and prescription medications; multiple quit attempts; and reduced or eliminated co-pays. However, access to these aids is limited since many payers do not cover these treatments. The objective of this study was to determine whether the cost of making such smoking cessation programs available at the state level could be justified by the benefits.

Methods. We performed a cost-benefit analysis of access to smoking cessation programs using a societal perspective using state specific data. Smoking cessation programs based on three treatment alternatives were studied: nicotine replacement therapy (NRT), bupropion, and varenicline. Each approach was evaluated with and without individual counseling. Benefits were estimated as reductions in medical expenditures, premature deaths and increased workplace productivity. Costs were estimated as direct cost of the smoking cessation programs, the lost tax revenue to the public sector and the lost revenue to retailers and distributors, since smokers who quit will no longer purchase cigarettes. Other model parameters included how many smokers take advantage of the programs and the programs' effectiveness in helping smokers to quit. The cost-benefit model was parameterized using data from CDC, and various national surveys, including the Behavioral Risk Factors Surveillance Survey and the Current Population Survey.

Results. Results from our model suggested that in Tennessee the annual direct costs to the economy attributable to smoking were in excess of \$7.9 billion, including workplace productivity losses of \$1.6 billion, premature death losses of \$3.6 billion, and direct medical expenditures of \$2.6 billion. While the retail price of a pack of cigarettes in Tennessee is on average \$4.84, the combined medical costs and productivity losses attributable to each pack of cigarettes sold are approximately \$20.32 per pack of cigarettes. The ratio of benefits to cost varies from \$0.90 to \$2.90 saved per dollar spent on smoking cessation programs, depending upon the type of intervention. Nicotine replacement therapies had a break-even benefits to costs ratio across the range of treatment effectiveness percentages. Generic bupropion and varenicline showed substantial benefits to costs from the societal perspective. Only brand name bupropion did not have a positive benefits to cost ratio at the low end of the range and just over breakeven at the mid-point of the range. Detailed results can be found in Tables 1-8, which are attached.

Conclusions. For most smoking cessation treatments, the benefits of smoking cessation programs statewide greatly outweigh the cost to implement them.

Tables

Table 1: Baseline data on smokers and smoking in Tennessee.

Variable	Total
Resident Smokers in TN ¹	1,199,048
Visiting Smokers in TN ²	115,831
Total Smokers	1,314,879
Total Packs Sold to Residents	390,296,420
Total Packs Sold to Visitors	37,703,580
Total Packs Sold ³	428,000,000
Average Packs Per Resident Smoker Per Year	326

¹ Data from the Behavioral Risk Factor Surveillance System, Tennessee Calculated Variable Data Report, 2005. Retrieved on October 19, 2009 from:

http://apps.nccd.cdc.gov/s_broker/htmsql.exe/weat/freq_analysis.hsqli?survey_year=2005

² Data from <http://www.tnvacation.com/media/industry/TennesseeTravelBarometer2008.pdf>, 2007 Visitor Profile.

³ Data from <http://www.tobaccofreekids.org/research/factsheets/pdf/0099.pdf>, Campaign for Tobacco Free Kids.

Table 2: Total productivity losses attributable to smoking. Includes productivity losses due to premature death, and workplace productivity losses due to absenteeism and the net loss of productive work time.

Component	Total	Per Pack	Per Smoker
Premature Death¹			
Men	\$2,358,413,532	\$11.52	\$3,750.39
Women	\$1,258,218,051	\$6.78	\$2,206.62
Combined	\$3,616,631,583	\$9.27	\$3,016.25
Workplace Productivity²			
Current Smokers ³	\$1,144,605,624	\$2.93	\$954.60
Former Smokers ⁴	\$538,568,539	\$1.38	\$449.16
Combined	\$1,683,174,164	\$4.31	\$1,403.76
Total Productivity Losses	\$5,299,805,747	\$13.58	\$4,420.01

Adjusted for inflation to 2009

¹. SAMMEC. Adult Smoking-Attributable Mortality, Morbidity, and Economic Costs Calculator. Atlanta, GA: CDC; 2008.

². Data from Bunn WB, 3rd, Stave GM, Downs KE, Alvir JM, Dirani R. Effect of smoking status on productivity loss. J Occup Environ Med 2006 Oct;48(10):1099-108.

³. Per Bunn et al. total cost per current smoker in the labor force is \$4430, with a net effect of lost productivity of \$1807.

⁴. Per Bunn et al. total cost per former smoker in the labor force is \$2623, with a net effect of \$623.

Table 3: Direct expenditures on medical care attributable to smoking and smoking-related events in Tennessee. Total expenditures per pack for both medical care and productivity losses are \$20.32 per pack.

Cost Component¹	Total	Per Pack	Per Smoker
Adult Expenditures			
Ambulatory Care	\$453,012,777	\$1.16	\$377.81
Hospital Care	\$1,275,461,106	\$3.27	\$1,063.73
Rx	\$512,364,718	\$1.31	\$427.31
Nursing Home	\$202,281,106	\$0.52	\$168.70
Other Care ²	\$180,478,352	\$0.46	\$150.52
Total	\$2,623,598,059	\$6.72	\$2,188.07
Neonatal Expenditures	\$6,057,035	\$0.02	\$5.05
Total Expenditures	\$2,629,655,094	\$6.74	\$2,193.12

Adjusted for inflation to 2009

¹. SAMMEC. Adult Smoking-Attributable Mortality, Morbidity, and Economic Costs Calculator. Atlanta, GA: CDC; 2008.

². Other Care includes home health, nonprescription drugs, and nondurable medical products.

Table 4: Components of cigarette prices, including taxes, distributor markups, and retailer markups.

Component	Price
Factory Price ¹	\$2.36
Total Taxes	\$1.95
Federal Tax ²	\$1.01
State Tax ²	\$0.62
State Sales Tax ³	\$0.32
Distributor & Retailer Mark-ups ¹	\$0.54
Final Retail Price	\$4.84

Adjusted for inflation to 2009

¹ Economic Research Service, U.S. Department of Agriculture, Tobacco Briefing Room, "Most Frequently Used Tables," Number 9, <http://www.ers.usda.gov/Briefing/tobacco>, downloaded January 23, 2007 (adjusted to reflect Philip Morris price cuts to four of its major brands).

² Data from <http://www.tobaccofreekids.org/research/factsheets/pdf/0099.pdf>, Campaign for Tobacco Free Kids.

³ Data from <http://www.rjrt.com/StateMsaPayments.aspx>, State MSA Payments.

Table 5: Costs for smoking cessation treatments. Costs are for a full course of treatment, which varies by treatments.

Treatment	Alone	With Counseling
NRT	\$231	\$371
Bupropion (Brand)	\$354	\$494
Generic Bupropion	\$203	\$343
Varenicline	\$300	\$440

Source: Treatment costs are at national retail pricing from Drugstore.com (2009). Prices were adjusted to 2009 dollars.

Table 6: Marginal treatment effectiveness, including baseline values and ranges used in sensitivity analysis.

Treatment Option	Marginal Treatment Effectiveness		
	Baseline	Low	High
NRT ¹	5.8%	5.0%	6.6%
Bupropion (Brand) ²	7.0%	5.4%	8.6%
Generic Bupropion ²	7.0%	5.4%	8.6%
Varenicline ³	14.9%	10.2%	20.4%
NRT Plus Counseling	8.0%	7.1%	8.9%
Bupropion (Brand) Plus Counseling	9.3%	7.6%	11.3%
Generic Bupropion Plus Counseling	9.3%	7.6%	11.3%
Varenicline Plus Counseling	18.5%	13.0%	24.8%

¹. Silagy C, Lancaster T, Stead L, Mant D, Fowler G. Nicotine replacement therapy for smoking cessation. Cochrane Database Syst Rev 2004(3):CD000146.

². Hughes JR, Stead LF, Lancaster T. Antidepressants for smoking cessation. Cochrane Database Syst Rev 2007(1):CD000031.

³. Cahill K, Stead LF, Lancaster T. Nicotine receptor partial agonists for smoking cessation. Cochrane Database Syst Rev 2007(1):CD006103.

Table 7: Results of cost-benefit analysis at baseline marginal effectiveness

Costs/Benefits	No Counseling			
	<i>NRT</i>	<i>Bupropion (Brand)</i>	<i>Generic Bupropion</i>	<i>Varenicline</i>
Medical Expenditures Avoided Plus Productivity Gains	\$45,892,133	\$55,250,074	\$55,250,074	\$118,188,555
Costs of Cessation Program	\$27,698,009	\$42,483,470	\$24,293,912	\$35,916,284
Lost Tax Revenue	\$4,397,776	\$5,294,534	\$5,294,534	\$11,325,837
Lost Business Revenue	\$1,215,367	\$1,463,194	\$1,463,194	\$3,130,002
Benefit/Cost Ratio	1.38	1.12	1.78	2.35

Costs/Benefits	Counseling			
	<i>NRT</i>	<i>Bupropion (Brand)</i>	<i>Generic Bupropion</i>	<i>Varenicline</i>
Medical Expenditures Avoided Plus Productivity Gains	\$63,242,842	\$74,004,473	\$74,004,473	\$146,383,727
Costs of Cessation Program	\$44,484,681	\$59,270,142	\$41,080,584	\$52,702,956
Lost Tax Revenue	\$6,060,469	\$7,091,741	\$7,091,741	\$14,027,739
Lost Business Revenue	\$1,674,868	\$1,959,869	\$1,959,869	\$3,876,698
Benefit/Cost Ratio	1.21	1.08	1.48	2.07

Adjusted for inflation to 2009

Table 8: Sensitivity analysis of cost-benefit analysis at low values of marginal effectiveness

Costs/Benefits	No Counseling			
	<i>NRT</i>	<i>Bupropion (Brand)</i>	<i>Generic Bupropion</i>	<i>Varenicline</i>
Medical Expenditures Avoided Plus Productivity Gains	\$39,695,987	\$43,089,688	\$43,089,688	\$80,831,480
Costs of Cessation Program	\$27,698,009	\$42,483,470	\$24,293,912	\$35,916,284
Lost Tax Revenue	\$3,804,008	\$4,129,222	\$4,129,222	\$7,745,963
Lost Business Revenue	\$1,051,274	\$1,141,149	\$1,141,149	\$2,140,670
Benefit/Cost Ratio	1.22	0.90	1.46	1.76

Costs/Benefits	Counseling			
	<i>NRT</i>	<i>Bupropion (Brand)</i>	<i>Generic Bupropion</i>	<i>Varenicline</i>
Medical Expenditures Avoided Plus Productivity Gains	\$56,117,273	\$60,020,029	\$60,020,029	\$103,423,091
Costs of Cessation Program	\$44,484,681	\$59,270,142	\$41,080,584	\$52,702,956
Lost Tax Revenue	\$5,377,636	\$5,751,632	\$5,751,632	\$9,910,884
Lost Business Revenue	\$1,486,161	\$1,589,518	\$1,589,518	\$2,738,966
Benefit/Cost Ratio	1.09	0.90	1.24	1.58

Adjusted for inflation to 2009

Table 9: Sensitivity analysis of cost-benefit analysis at high values of marginal effectiveness

Costs/Benefits	No Counseling			
	<i>NRT</i>	<i>Bupropion (Brand)</i>	<i>Generic Bupropion</i>	<i>Varenicline</i>
Medical Expenditures Avoided Plus Productivity Gains	\$51,976,945	\$68,551,335	\$68,551,335	\$161,597,259
Costs of Cessation Program	\$27,698,009	\$42,483,470	\$24,293,912	\$35,916,284
Lost Tax Revenue	\$4,980,875	\$6,569,174	\$6,569,174	\$15,485,629
Lost Business Revenue	\$1,376,512	\$1,815,453	\$1,815,453	\$4,279,600
Benefit/Cost Ratio	1.53	1.35	2.10	2.90

Costs/Benefits	Counseling			
	<i>NRT</i>	<i>Bupropion (Brand)</i>	<i>Generic Bupropion</i>	<i>Varenicline</i>
Medical Expenditures Avoided Plus Productivity Gains	\$70,240,375	\$89,300,923	\$89,300,923	\$196,303,736
Costs of Cessation Program	\$44,484,681	\$59,270,142	\$41,080,584	\$52,702,956
Lost Tax Revenue	\$6,731,033	\$8,557,577	\$8,557,577	\$18,811,500
Lost Business Revenue	\$1,860,184	\$2,364,967	\$2,364,967	\$5,198,736
Benefit/Cost Ratio	1.32	1.27	1.72	2.56

Adjusted for inflation to 2009