

September 2010

Ad Hoc Report #12: Changes in Smoking-Attributable Mortality and the Economic Burden of Smoking in Florida from 1999 to 2009

Draft Report

Prepared for

Florida Bureau of Tobacco Prevention Program

Division of Health Access and Tobacco
Florida Department of Health
4052 Bald Cypress Way
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INTRODUCTION

In January 2007, the Florida Constitution was amended, as a result of a 2006 ballot initiative, to allocate funds to a comprehensive statewide tobacco education and prevention **program consistent with the Centers for Disease Control and Prevention's (CDC's) *Best Practices***. In general terms, **the program's goal is to** protect people from the health hazards of using tobacco and to discourage tobacco use, with a specific focus on minors and young adults. More specifically, the goals of the program are to:

- prevent initiation of tobacco use among youth and young adults,
- promote cessation of tobacco use,
- eliminate secondhand smoke exposure, and
- reduce tobacco-related health disparities.

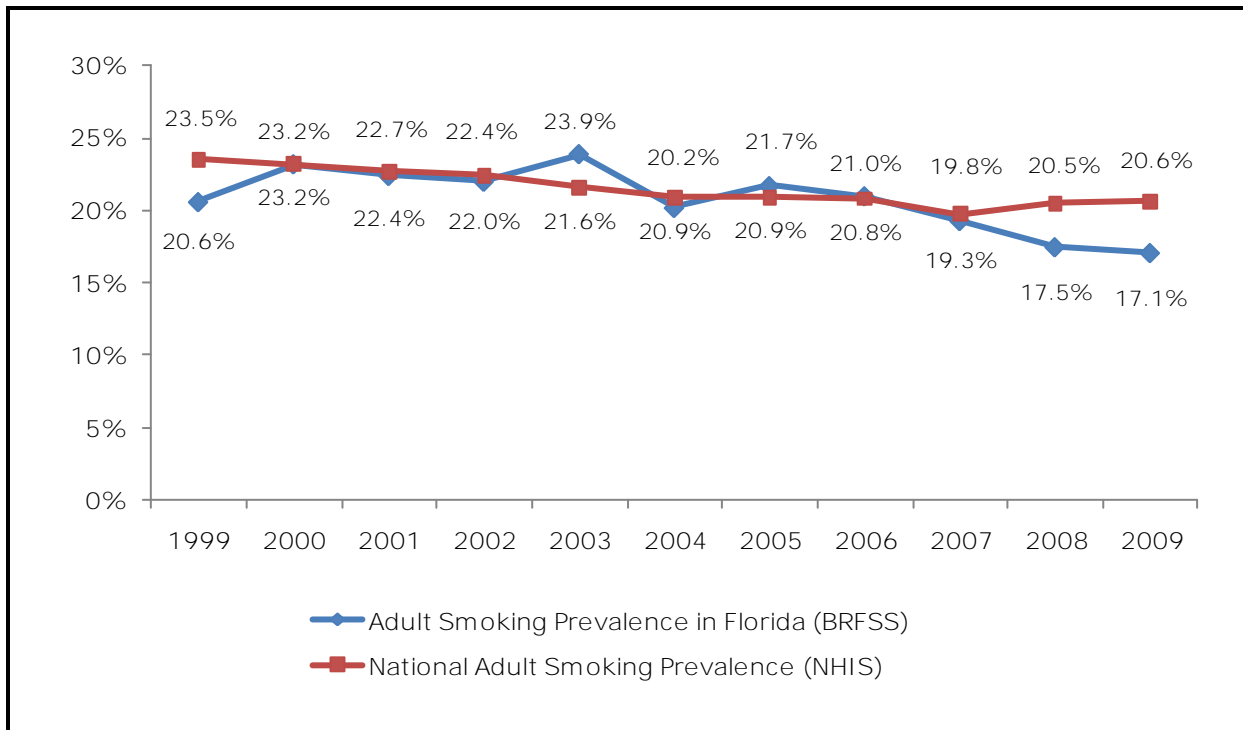
This report is prepared in response to a request from the Florida Bureau of Tobacco Prevention Program (BTPP) for us to answer the following evaluation question: To what extent has the Florida tobacco control program contributed to reductions in smoking-attributable mortality and the economic burden of smoking in **Florida since the program's** re-inception in 2007? At this stage of the evaluation it is not possible to give a direct answer to this evaluation question. Therefore, in this report, we analyze trends in smoking-attributable mortality and the economic burden of smoking in Florida from 1999-2009, focusing specifically on changes in outcomes that have occurred since 2006. This tells us whether or not smoking-attributable mortality and the economic burden of smoking is declining in Florida since the re-inception of the tobacco control program in 2007 but does not answer to what extent the program has been responsible for any of these declines.

CHANGES IN ADULT SMOKING PREVALENCE

Figure 1 presents the trend in adult smoking prevalence in Florida from 1999 through 2009 using data from the Behavioral Risk Factor Surveillance System (BRFSS). The figure also presents the trend in national adult smoking prevalence from the National Health Interview Survey (NHIS). During the period from 1999-2009, adult smoking prevalence in Florida peaked at 23.9% in 2003. Since 2005, adult smoking prevalence in Florida has declined steadily to 17.1% in 2009, while national smoking prevalence has remained relatively stable. Adult smoking prevalence is one of the most significant drivers of estimates of smoking-attributable mortality and economic burden of smoking presented in this report that the FLTCP might impact. The program efforts are aimed at reducing the prevalence of smoking by preventing youth initiation, promoting cessation, and reducing exposure to secondhand smoke. Adult smoking prevalence in Florida has declined substantially since the BTTP's re-inception in 2007, from 21% in 2006 to 17.1% in 2009. In 2009, there were approximately 497,306 fewer adult smokers in Florida than there were in 2006. From 2000-2006, adult smoking prevalence in Florida has been at or above the national average. In 2008 and 2009, adult smoking prevalence was significantly lower than the national average.

In 2009, there were approximately 497,306 fewer adult smokers in Florida than there were in 2006.

Figure 1. Adult Smoking Prevalence, 1999-2009



METHODS FOR ESTIMATING CHANGES IN SMOKING-ATTRIBUTABLE MORTALITY AND THE ECONOMIC BURDEN OF SMOKING

One option for quickly estimating how changes in smoking prevalence affect the health and economic consequences of smoking in Florida is to use the Centers for Disease Control and Prevention's Smoking-attributable Mortality, Morbidity, and Economic Costs (SAMMEC) model (CDC, 2007). SAMMEC is an online software program that produces estimates of the health and economic consequences of smoking based on data inputs provided by the user and several predefined measures of relative risk. SAMMEC has been used successfully by other states, including the Massachusetts Tobacco Control Program (Huang et al., 2008), the Louisiana Tobacco Control Program and Chronic Disease Epidemiology Unit (1999), and the Wisconsin Tobacco Surveillance and Evaluation Program (2006). CDC has been using SAMMEC since 1987 to estimate the health and economic impacts of smoking in the United States. First developed in 1987 by the Office on Smoking and Health and the Division of Reproductive Health within the National Center for Chronic Disease Prevention and Health Promotion at CDC, SAMMEC has been updated periodically, the most recent of which is from 2004.

SAMMEC uses widely accepted epidemiological methods and published risk estimates that have been thoroughly vetted by the CDC. It also produces conservative estimates of smoking-attributable mortality and the economic burden of smoking. Using methods similar to those used by SAMMEC, we calculated estimates of smoking-attributable mortality (SAM), years of potential life lost (YPLL) due to smoking-attributable mortality, smoking-attributable productivity losses (SAPL), and smoking-attributable personal health care expenditures (SAE). RTI worked with the BTPP to obtain Florida-specific data inputs necessary to calculate the estimates presented in this report.

To estimate SAM, YPLL, productivity losses, and health care expenditures we utilized the smoking-attributable fraction methodology, whereby *current* smoking prevalence and relative risk of death (obtained from previously published epidemiological studies) are combined to yield the smoking-attributable fraction of deaths in the *current* year. However, most smoking related deaths are the result of smoking in previous years and decades, when smoking rates were higher than they are today. As a result, our estimates may understate the number of deaths caused by smoking, and therefore also understate years of potential life lost, productivity losses, and personal health care expenditures due to smoking.

Utilizing the SAMMEC methodology does have some notable limitations. First, the CDC does not endorse SAMMEC for predictive or evaluative purposes such as we are presenting in this report. This may or may not be a problem with respect to the suitability of using these calculated estimates in official BTPP publications. Second, it will be necessary to use caution when interpreting the results and to make sure appropriate language is used to describe

them. The SAMMEC methodology is not intended to yield predictive estimates. The relationships between smoking history, morbidity, mortality, and economic costs are complicated and dynamic and not fully captured by the static relative risk methodology used by SAMMEC. Results based on this approach are best thought of as indicative of the improvements in health and well-being that are probably experienced by Floridians as a result of reductions in adult smoking prevalence rather than as firm, tangible benefits that are unquestionably the result of reductions in smoking.

The SAMMEC methodology does not provide a mechanism for estimating changes in smoking-attributable personal health care expenditures as a result of changes in smoking prevalence. More sophisticated methods, such as those used by Trogdon & Pais (2007) or Lightwood, Dinno, and Glantz (2008) would be necessary to estimate smoking-attributable medical expenditures in Florida. However, for this analysis, we estimated changes in smoking-attributable medical expenditures by assuming that changes in the smoking-attributable fraction of health care costs from 1999-2009 were proportional to changes in the adult smoking prevalence in Florida. First, we used the smoking-attributable fraction for health care expenditures in Florida reported by SAMMEC for 1998, based on previously published estimates (Miller et al., 1998). We then adjust the 1998 smoking attributable fraction based on year over year percentage changes in adult smoking prevalence. A limitation with this approach is that the smoking-attributable fraction of health care expenditures in Florida may not have changed exactly in proportion to changes in adult smoking prevalence. If the smoking-attributable fraction changed by more than the percentage change in smoking prevalence, then our estimates of smoking-attributable health care expenditures will be underestimated. Similarly, if the smoking-attributable fraction changed by less than the percentage change in smoking prevalence, then our estimates of smoking-attributable health care expenditures will be overestimated. Estimates of smoking-attributable health care expenditures presented in this report should be interpreted with caution.

CHANGES IN SMOKING-ATTRIBUTABLE MORTALITY

Figure 2 shows smoking-attributable mortality in Florida for 1999-2009. **Table 1** provides a breakdown of smoking-attributable mortality by disease category in 2006 and 2009.

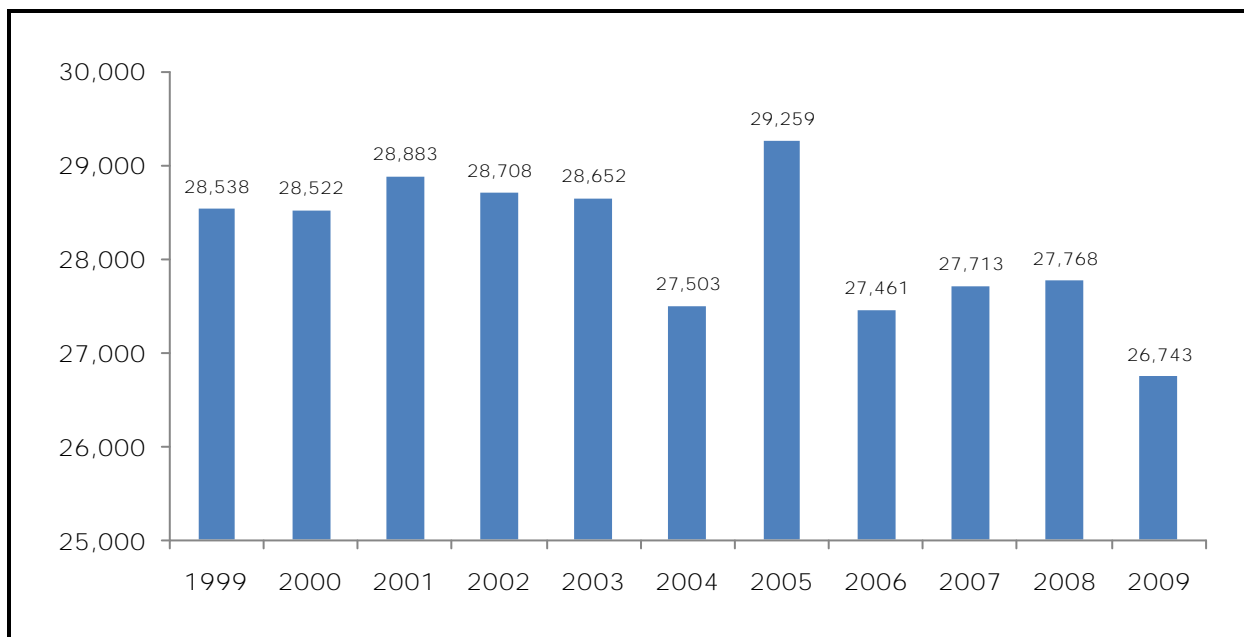
Overall, smoking-attributable deaths decreased by 2.6% from 27,461 in 2006 to 26,743 in 2009. **Figure 3** shows the age-adjusted smoking-attributable mortality rate per 100,000 adults ages 35 and older in Florida for 1999-2009.

Table 2 provides a breakdown of the age-adjusted smoking-attributable mortality rate per 100,000 adults ages 35 and older by disease category in 2006 and 2009.

The age-adjusted smoking-attributable mortality rate per 100,000 adults ages 35 and older decreased by 8.3% from 216.7 in 2006 to 198.6 in 2009. This translates to roughly 300 fewer adult deaths from smoking.

In 2009, there were approximately 300 fewer deaths directly attributable to smoking among adults ages 35 and older in Florida than there were in 2006 resulting from the decline in adult smoking prevalence.

Figure 2. Smoking-Attributable Mortality in Florida, 1999-2009



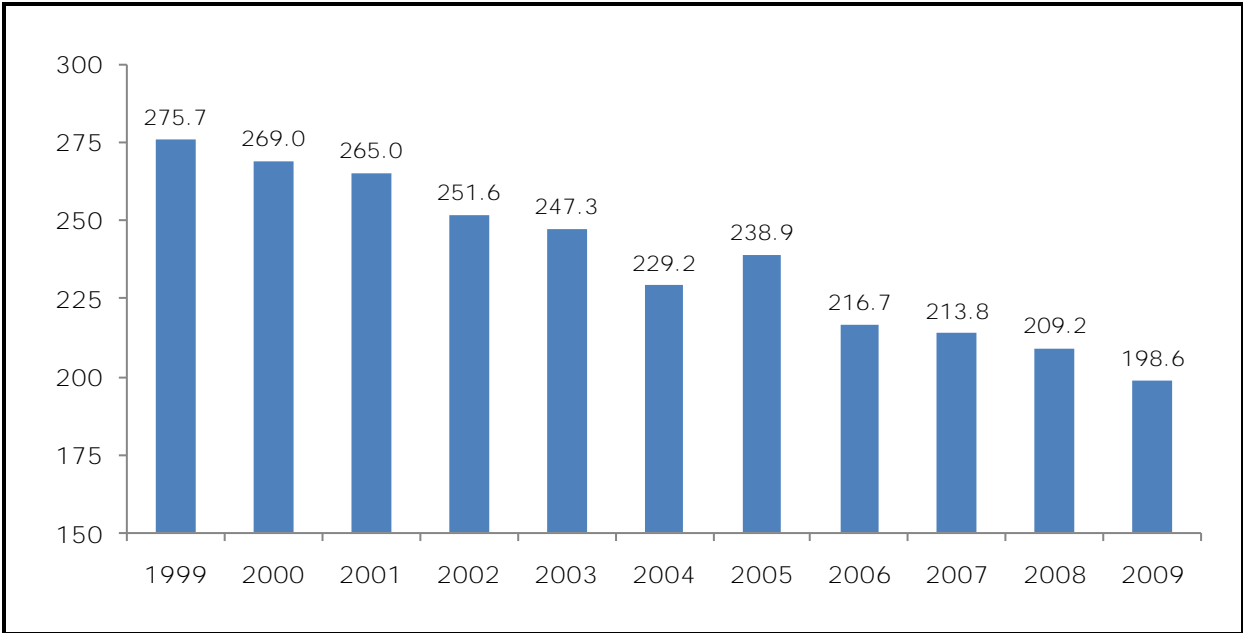
Notes: Among adults aged 35 and older. Does not include deaths from burns or second hand smoke exposure.

Table 1. Smoking-Attributable Mortality in Florida by Disease Category, 2006 and 2009

Disease Category	2006	2009	Percent Change
Lung Cancer			
Female	3,627	3,589	-1.0%
Male	5,950	5,559	-6.6%
Total	9,577	9,148	-4.5%
Other Smoking-Related Cancers			
Female	747	707	-5.4%
Male	1,992	1,956	-1.8%
Total	2,739	2,663	-2.8%
Ischemic Heart Disease			
Female	1,970	1,584	-19.6%
Male	3,245	2,835	-12.6%
Total	5,215	4,419	-15.3%
Other Cardiovascular Diseases			
Female	1,131	1,035	-8.5%
Male	1,594	1,462	-8.3%
Total	2,725	2,497	-8.4%
Respiratory Diseases			
Female	3,650	4,043	10.8%
Male	3,555	3,973	11.8%
Total	7,205	8,016	11.3%
Total			
Female	11,125	10,958	-1.5%
Male	16,336	15,785	-3.4%
Total	27,461	26,743	-2.6%

Notes: Among adults aged 35 and older. Does not include deaths from burns or second hand smoke exposure.

Figure 3. Age-Adjusted Smoking-Attributable Mortality Rate per 100,000 Adults Ages 35 and Older in Florida, 1999-2009



Notes: Among adults aged 35 and older. Does not include deaths from burns or second hand smoke exposure.

Table 2. Age-Adjusted Smoking-Attributable Mortality Rate per 100,000 Adults Ages 35 and Older in Florida by Disease Category, 2006 and 2009

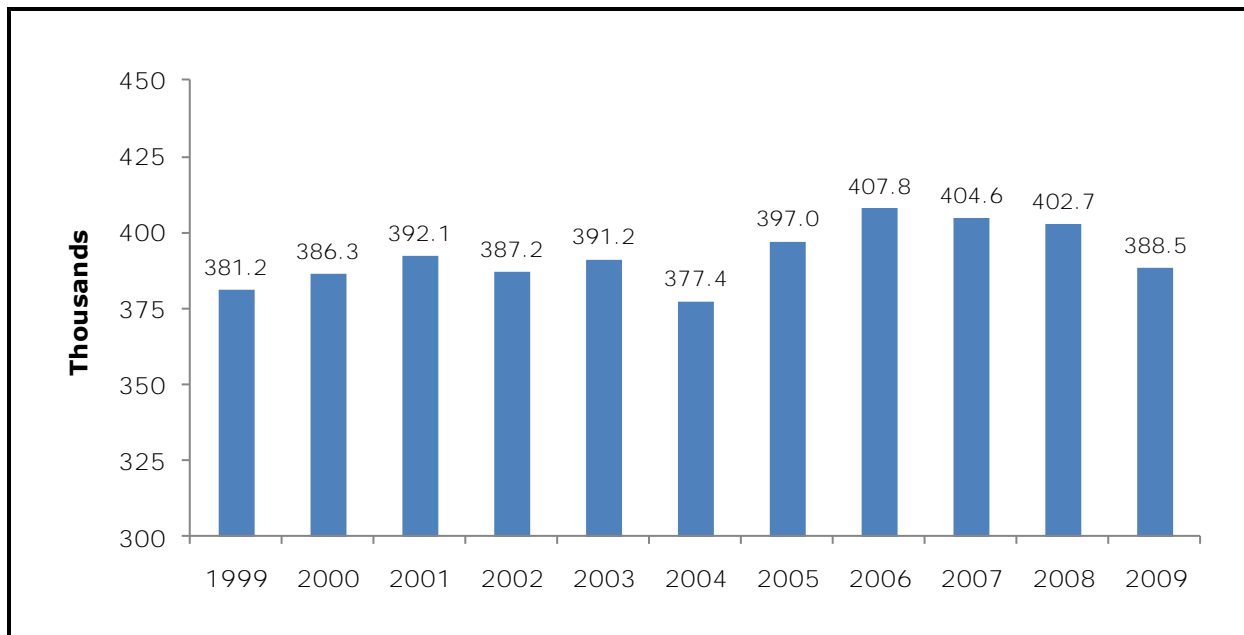
Disease Category	2006	2009	Percent Change
Lung Cancer			
Female	52.7	50.0	-5.2%
Male	107.1	94.6	-11.7%
Total	76.9	70.0	-9.0%
Other Smoking-Related Cancers			
Female	10.8	9.6	-11.1%
Male	36.0	33.1	-8.1%
Total	22.4	20.5	-8.5%
Ischemic Heart Disease			
Female	25.8	19.5	-24.4%
Male	59.3	47.7	-19.6%
Total	41.1	32.4	-21.2%
Other Cardiovascular Diseases			
Female	15.6	13.4	-14.3%
Male	29.1	24.6	-15.7%
Total	21.5	18.3	-14.9%
Respiratory Diseases			
Female	48.0	50.7	5.5%
Male	63.5	66.1	4.1%
Total	54.7	57.4	4.9%
Total			
Female	152.9	143.2	-6.4%
Male	295.1	266.0	-9.9%
Total	216.7	198.6	-8.3%

Notes: Among adults aged 35 and older. Does not include deaths from burns or second hand smoke exposure.

CHANGES IN YEARS OF POTENTIAL LIFE LOST

Figure 4 presents estimates of years of potential life lost due to premature death from smoking from 1999-2009. **Table 3** provides a breakdown of years of potential life lost by disease category. Overall, years of potential life lost due to smoking-attributable mortality decreased by 4.7% from 407,766 in 2006 to 388,452 in 2009. **Figure 5** presents estimates of the age-adjusted years of potential life lost rate per 100,000 adults ages 35 and older due to smoking-attributable mortality in Florida from 1999-2009. **Table 4** provides a breakdown of the age-adjusted years of potential life lost rate per 100,000 adults ages 35 and older by disease category. Overall, the age-adjusted years of potential life lost rate per 100,000 adults ages 35 and older due to smoking-attributable mortality declined by 9.7% from 3,447 in 2006 to 3,112 in 2009. This means that in 2009, total potential years of life remaining for Floridians ages 35 and older was nearly 20,000 years more than in 2006 because of reductions in smoking-attributable mortality between 2006 and 2009. The potential years of life saved represent the long-term savings in total life years resulting from reductions in smoking-attributable mortality. These savings are not realized instantly, but rather over many years into the future.

Figure 4. Years of Potential Life Lost Due to Smoking-Attributable Mortality in Florida, 1999-2009



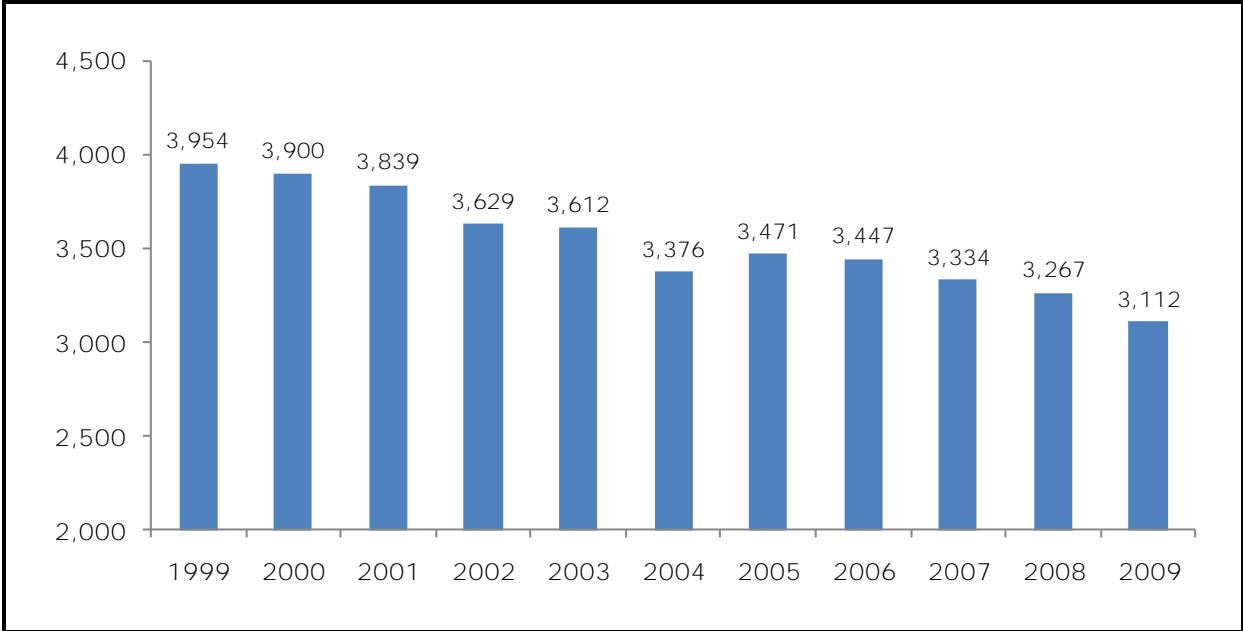
Notes: Among adults aged 35 and older. Does not include years of potential life lost associated with burns or second hand smoke deaths.

Table 3. Years of Potential Life Lost Due to Smoking-Attributable Mortality in Florida by Disease Category, 2006 and 2009

Disease Category	2006	2009	Percent Change
Smoking-Related Cancers			
Female	75,337	72,601	-3.6%
Male	122,359	113,815	-7.0%
Total	197,696	186,416	-5.7%
Cardiovascular Diseases			
Female	44,327	37,727	-14.9%
Male	77,179	65,744	-14.8%
Total	121,506	103,471	-14.8%
Respiratory Diseases			
Female	46,479	52,085	12.1%
Male	42,085	46,480	10.4%
Total	88,564	98,565	11.3%
Total			
Female	166,143	162,413	-2.2%
Male	241,623	226,039	-6.4%
Total	407,766	388,452	-4.7%

Source: CDC SAMMEC. Among adults aged 35 and older. Does not include years of potential life lost associated with burns or second hand smoke deaths.

Figure 5. Age-Adjusted Years of Potential Life Lost Due to Smoking-Attributable Mortality Rate per 100,000 Adults Ages 35 and Older in Florida, 1999-2009



Notes: Among adults aged 35 and older. Does not include years of potential life lost associated with burns or second hand smoke deaths.

Table 4. Age-Adjusted Years of Potential Life Lost Due to Smoking-Attributable Mortality Rate per 100,000 Adults Ages 35 and Older in Florida by Disease Category, 2006 and 2009

Disease Category	2006	2009	Percent Change
Smoking-Related Cancers			
Female	1,189	1,096	-7.8%
Male	2,246	1,973	-12.2%
Total	1,687	1,513	-10.3%
Cardiovascular Diseases			
Female	684	559	-18.3%
Male	1,457	1,168	-19.8%
Total	1,049	847	-19.3%
Respiratory Diseases			
Female	668	718	7.5%
Male	759	794	4.6%
Total	711	752	5.8%
Total			
Female	2,541	2,373	-6.6%
Male	4,462	3,935	-11.8%
Total	3,447	3,112	-9.7%

Notes: Among adults aged 35 and older. Does not include years of potential life lost associated with burns or second hand smoke deaths.

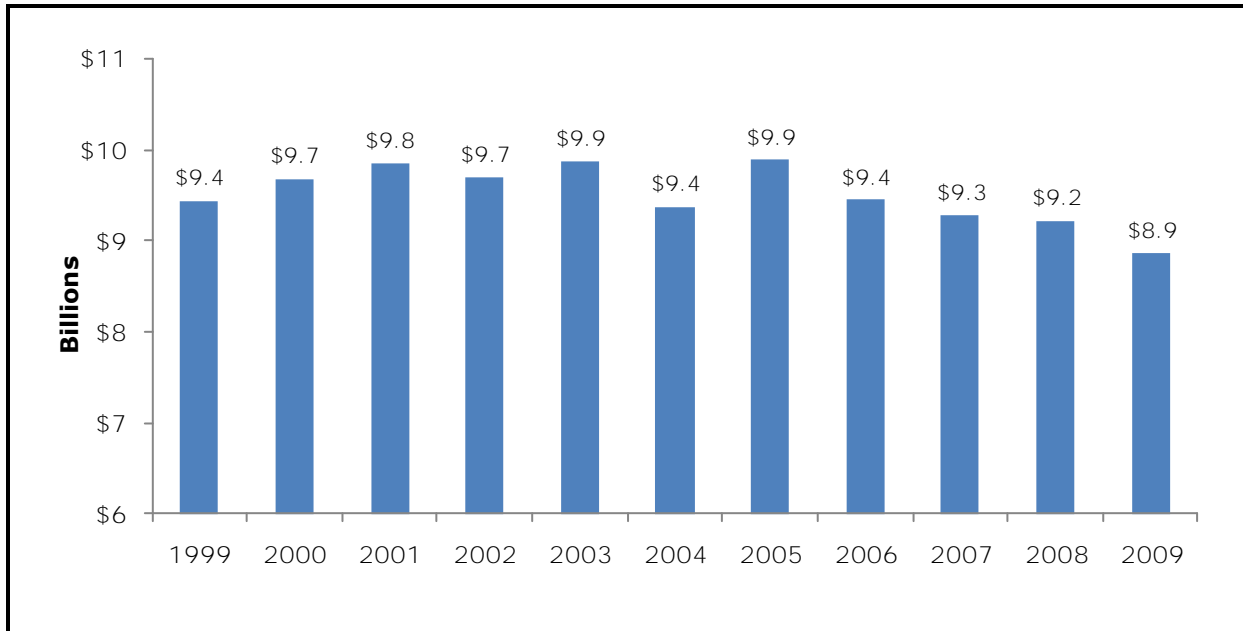
CHANGES IN SMOKING-ATTRIBUTABLE PRODUCTIVITY LOSSES

Figure 6 shows the smoking-attributable productivity losses from 1999-2009, expressed in inflation-adjusted 2009 dollars. Smoking-attributable productivity losses are the discounted present value of future earnings from paid labor and the estimated value of household production that are lost because of premature smoking-attributable mortality. **Table 5** provides a breakdown of smoking-attributable productivity losses by disease category for the years

From 2006 to 2009, the discounted present value of future earnings from paid labor and the estimated value of household production lost because of smoking-attributable mortality in Florida decreased by an estimated \$583 million.

2006 and 2009. Overall, smoking-attributable productivity losses declined by 6.2% from \$9.4 billion in 2006 to \$8.9 billion in 2009. This represents a savings of an estimated \$583 million in smoking-attributable productivity losses between 2006 and 2009. However, this estimated savings represents the discounted present value of long-term savings resulting from reductions in smoking-attributable mortality. These savings are not realized instantly.

Figure 6. Smoking-Attributable Productivity Losses, 1999-2009



Notes: Among adults aged 35 and older. Does not include costs associated with burns or second hand smoke deaths. Numbers are expressed in real, inflation-adjusted, \$ 2009.

Table 5. Smoking-Attributable Productivity Losses in Florida by Disease Category, 2006 and 2009

Disease Category	2006	2009	Percent Change
Smoking-Related Cancers			
Female	\$1,581,412,152	\$1,509,767,294	-4.5%
Male	\$2,953,074,374	\$2,711,256,368	-8.2%
Total	\$4,534,486,526	\$4,221,023,662	-6.9%
Cardiovascular Diseases			
Female	\$1,008,979,769	\$862,865,607	-14.5%
Male	\$2,113,198,075	\$1,773,121,133	-16.1%
Total	\$3,122,177,844	\$2,635,986,740	-15.6%
Respiratory Diseases			
Female	\$874,242,560	\$987,430,429	12.9%
Male	\$918,268,472	\$1,021,558,486	11.2%
Total	\$1,792,511,032	\$2,008,988,915	12.1%
Total			
Female	\$3,464,634,481	\$3,360,063,330	-3.0%
Male	\$5,984,540,921	\$5,505,935,987	-8.0%
Total	\$9,449,175,402	\$8,865,999,317	-6.2%

Notes: Among adults aged 35 and older. Does not include costs associated with burns or second hand smoke deaths. Numbers are expressed in real, inflation-adjusted, \$ 2009.

CHANGES IN SMOKING-ATTRIBUTABLE PERSONAL HEALTH CARE EXPENDITURES

Figure 7 shows the total personal health care expenditures in Florida from 1999-2009. Data for the years 1999-2004 were obtained from the Centers for Medicare & Medicaid Services (CMS). Estimates for the years 2005 through 2009 were extrapolated based on the linear trend in CMS total personal health care expenditures data for Florida from 1991 through 2004. The numbers presented in Figure 7 were adjusted for inflation using the Consumer Price Index for medical care and are expressed in constant 2009 dollars. Figure 7 also presents estimates of the smoking-attributable fraction of total personal health care expenditures in Florida. To obtain the estimates of the smoking-attributable fraction of total personal health care expenditures presented in Figure 7, we assume that changes in the smoking-attributable fraction of total personal health care expenditures from 1999-2009 were proportional to changes in the adult smoking prevalence in Florida. First, we use the smoking-attributable fraction for health care expenditures in Florida reported by SAMMEC for 1998, based on previously published estimates (Miller et al., 1998). We then adjust the 1998 smoking attributable fraction based on year over year percentage changes in adult smoking prevalence.

Figure 7. Total Personal Health Care Expenditures and Smoking-Attributable Fraction of Total Personal Health Care Expenditures in Florida, 1999-2009

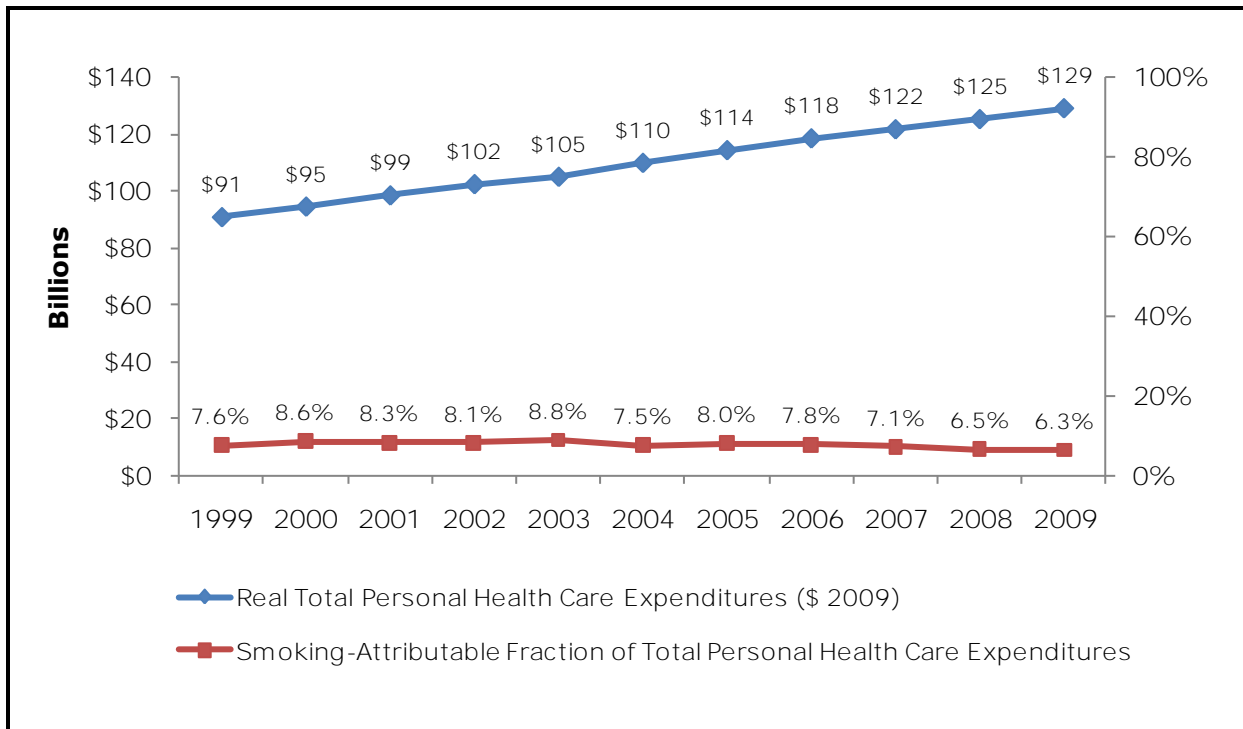
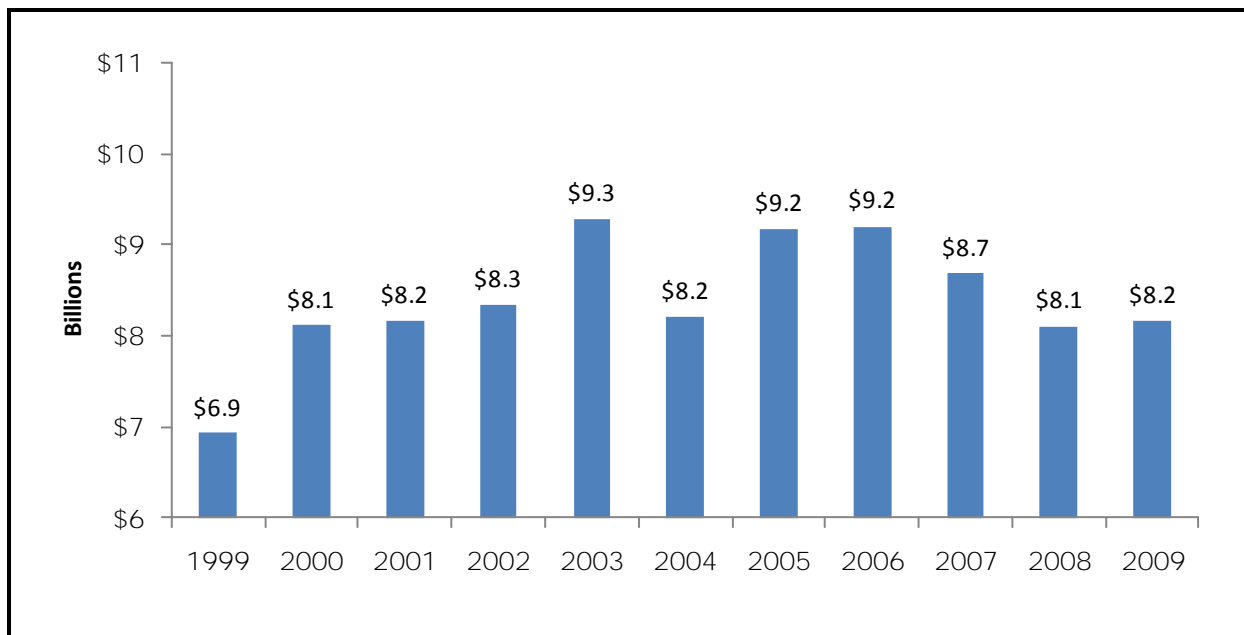


Figure 8 shows the smoking-attributable personal health care expenditures in Florida from 1999-2009. The numbers presented in Figure 8 were adjusted for inflation using the Consumer Price Index for medical care and are expressed in constant 2009 dollars. From 2006 to 2009, annual smoking-attributable personal health care expenditures declined by \$1 billion (11.3%), from \$9.2 billion in 2006 to \$8.2 billion in 2009.

From 2006 to 2009, annual smoking-attributable personal health care expenditures in Florida decreased by an estimated \$1 billion.

Figure 8. Smoking-Attributable Personal Health Care Expenditures in Florida, 1999-2009



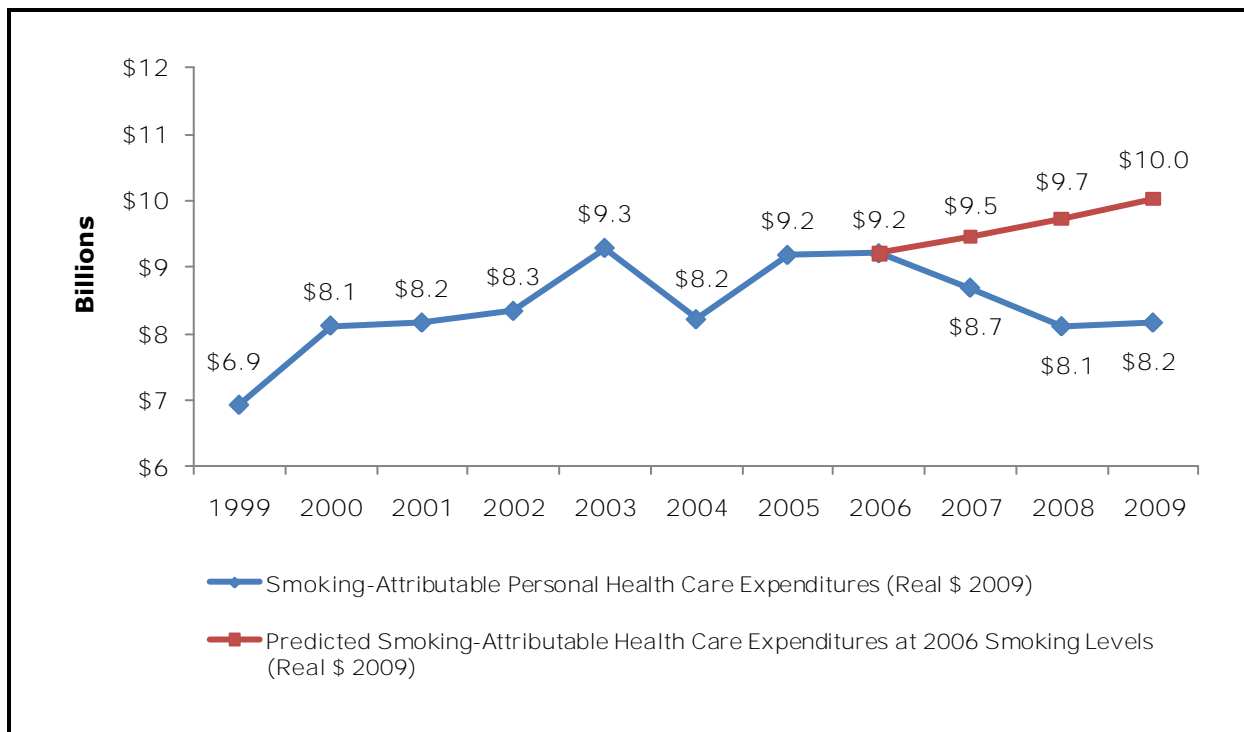
Notes: Among adults aged 35 and older. Does not include costs associated with burns or second hand smoke deaths. Numbers are expressed in real, inflation-adjusted, \$ 2009.

Using estimates of total personal health care expenditures and the smoking-attributable fraction of total personal health care expenditures shown in Figure 7, we estimated what smoking-attributable personal health care expenditures would have been in Florida for the years 2007-2009 if adult smoking prevalence in Florida had remained at the 2006 level. Had adult smoking prevalence not declined any from 2006 to 2009, we assume that the smoking-attributable fraction of total personal health care expenditures in Florida would have remained at the 2006 level of 7.8% for the years 2007-2009 (see Figure 7). **Figure 9** shows estimates of smoking-attributable personal health care expenditures in Florida for the years 1999-2009 as well as estimates of what smoking-attributable personal health care expenditures would have been in 2007-2009 if adult smoking prevalence in Florida had not declined any from 2006 to 2009. We estimate that smoking-attributable personal health

care expenditures in Florida would have been approximately \$10 billion in 2009 if adult smoking prevalence in Florida had not declined any from 2006 to 2009 and the smoking-attributable fraction of total personal health care expenditures remained at the 2006 level of 7.8% for the years 2007-2009. These estimates suggest that smoking-attributable personal health care expenditures were \$1.8 billion (18%) lower in 2009 than they would have been if adult smoking prevalence in had not declined since 2006. Between 2007 and 2009, total savings from reductions in smoking-attributable personal health care expenditures are an estimated \$4.2 billion.

Between 2006 and 2009, reductions in adult smoking prevalence in Florida resulted in an estimated total savings of \$4.2 billion in smoking-attributable personal health care expenditures in Florida. This savings is equal to roughly 1% of total personal health care expenditures in Florida from 2007-2009 (\$376 billion).

Figure 9. Estimated Smoking-Attributable Personal Health Care Expenditures in Florida and Estimated Smoking-Attributable Personal Health Care Expenditures in Florida Assuming that Adult Smoking Prevalence in Florida Remained Unchanged from 2006 to 2009, 1999-2009



Notes: Among adults aged 35 and older. Does not include costs associated with burns or second hand smoke deaths. Numbers are expressed in real, inflation-adjusted, \$ 2009. Estimates may not sum to the total due to rounding.

There are several limitations with our approach. The first is that we estimated total personal health expenditures in Florida for the years 2005 through 2009 by extrapolating from the linear trend in CMS data for Florida from 1991 to 2004. Actual personal health care

expenditures in Florida for the years 2005-2009 may not have followed the linear trend from 1991 through 2004. A second limitation with our approach is that the smoking-attributable fraction of health care expenditures in Florida may not have changed exactly in proportion to changes in adult smoking prevalence. If the smoking-attributable fraction changed by more than the percentage change in smoking prevalence, then our estimates of smoking-attributable health care expenditures are underestimated. Similarly, if the smoking-attributable fraction changed by less than the percentage change in smoking prevalence, then our estimates of smoking-attributable health care expenditures are overestimated. As a result, the estimates of smoking-attributable health care expenditures and savings in personal health care expenditures resulting from declines in smoking prevalence from 2007 to 2009 presented in this report should be interpreted with caution.

CONCLUSIONS

This report presents annual estimates of smoking-attributable mortality and the economic burden of smoking in Florida from 1999-2009. We specifically focused on changes from 2006 to 2009 in order to evaluate changes in smoking-attributable mortality and economic burden outcomes that have occurred since the BTPP was re-instated in 2007.

Data presented in this report show that:

- Since the BTPP was re-instated in 2007, adult smoking prevalence has declined, resulting in approximately 497,306 fewer adult smokers in Florida.
- Declines in adult smoking prevalence in Florida, from 2007 to 2009, outpaced changes in the national average. In 2008 and 2009, adult smoking prevalence in Florida was significantly below the national average.

The results presented in this report show that, as a result of declines in adult smoking prevalence, there have been reductions in smoking-attributable mortality and the economic burden of smoking in Florida. Since the BTPP was re-instated in 2007:

- the age-adjusted smoking-attributable mortality rate per 100,000 adults ages 35 and older in Florida declined by 18.1 (8.3%), resulting in an estimated 300 fewer smoking-related deaths each year among adults ages 35 and older in Florida;
- the discounted present value of future earnings from paid labor and the estimated value of household production lost because of smoking-attributable mortality in Florida decreased by approximately \$583 million (6.2%);
- annual smoking-attributable personal health care expenditures in Florida declined by \$1 billion (11.3%); and
- reductions in adult smoking prevalence resulted in a total estimated savings of as much as \$4.2 billion in personal health care expenditures in Florida between 2007 and 2009.

While declines in adult smoking prevalence, smoking-attributable mortality, and the economic burden of smoking are good news for tobacco control in Florida, it is not possible to determine if the changes observed since 2007 are a result of the program. Although it is likely that the program may have had some effect on declines in adult smoking prevalence which ultimately determine smoking-attributable mortality and economic burden outcomes, reductions in adult smoking prevalence, smoking-attributable mortality, and economic burden outcomes cannot be directly attributed to the BTPP at this time. It should also be noted that the potential years of life saved and savings in lost productivity due to smoking represent the long-term savings resulting from reductions in smoking-attributable mortality and morbidity. These savings are not realized instantly. Finally, our estimates of smoking-

attributable personal health care expenditures are based on a previously-published estimate of the smoking-attributable fraction of health care costs that we adjusted based on year over year changes in adult smoking prevalence in Florida. If the actual smoking-attributable fraction of health care costs declined by more than the year over year percentage changes in smoking prevalence, then our estimates of smoking-attributable health care expenditures are understated. However, if the smoking-attributable fraction of health care expenditures did not decline proportionally to changes in smoking prevalence, then our estimates of smoking-attributable health care expenditures are overstated. The estimates of smoking-attributable personal health care expenditures and the savings associated with reductions in smoking-attributable personal health care expenditures presented in this report should be interpreted with caution.

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