Gatton College of Business and Economics

The Effect of Smoking on Kentucky's Workforce

Prepared for:
Department for Public Health
Cabinet for Health and Family Services

Center for Business and Economic Research
Gatton College of Business and Economics
University of Kentucky

September 10, 2019

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Executive Summary

Smoking has been estimated to increase health care costs in the United States by $167.5 billion annually (Xu et al. 2015). In Kentucky, smoking adds $2.5 billion in health care expenditures each year. Most of these costs were paid by public programs such as Medicaid and Medicare. While these costs are significant, they represent only a portion of the costs that smoking imposes on society. Smoking also leads to poorer labor market outcomes. Smokers are more likely to be unemployed, earn lower wages, and die prematurely than non-smokers. These negative labor market effects reduce economic activity and lower tax revenues, adding to the social costs and fiscal impact that smoking imposes.

Past research shows that smokers generally earn four to eleven percent less than similar nonsmokers. Some of this wage penalty is due to the negative health consequences of smoking. Smoking can reduce workers' health, causing them to be less productive, have higher health insurance costs, and incur greater rates of absenteeism. As a result, smokers tend to earn lower wages. However, the wage penalty might also reflect differences between those who decide to smoke and those who do not rather than being caused directly by smoking.

In Kentucky, there are over 386,000 smokers who work. Smoking is estimated to reduce their annual earnings by $1,268 to $3,488 per worker. This amounts to lost earnings of $489.7 million to $1,346.6 million per year for the state. Assuming a six percent combined effective state sales and income tax rate indicates that Kentucky loses $29.4 million to $80.8 million in tax revenue annually from lower wages among smokers.

Smoking was also estimated to reduce employment in Kentucky by 28,500 workers. This represents an annual loss of $968.2 million to $1,088 million in lost earnings for Kentucky and $58.1 million to $65.3 million in lost tax revenue.

Finally, smoking was estimated to contribute to 3,023 deaths per year among Kentucky residents between the ages of 35 and 64. In the absence of smoking, many of those who died prematurely from smoking-related conditions might have continued to earn an income for many more years. Had these individuals not died prematurely from the diseases associated with smoking, they could have earned between $61.1 million and $77.2 million during the first year after their death. This amounts to lost state tax revenue of $3.7 million to $4.6 million. Smoking-related deaths occurring over the past 10 years reduce Kentucky's earnings by $388.6 million to $492.1 million and its tax revenues by $23.3 million to $29.5 million each year.

Combined, these three effects—reduced wages for smokers who work, reduced employment among smokers, and increased premature deaths for smokers—reduce Kentucky's total earnings by $1.8 billion to $2.9 billion annually and its state tax revenues by $111 million to $176 million annually.

Cessation programs have been shown to be a cost-effective way to help people successfully quit smoking. However, the improvement in quit rates varies substantially across programs, ranging from 2.5 to 22.2 percentage points. While cessation programs might improve employment, the effect is likely to be small. For example, a program serving 1,000 participants is expected to

result in fewer than seven additional workers. This suggests that the main benefit from cessation programs would be improvements in health and reductions in health care expenditures rather than increased employment.

Anti-smoking campaigns have also been shown to discourage smoking. Research has found that these campaigns increase awareness of the health consequences of smoking, reduce the number of people who take up smoking, and motivate current smokers to quit. They generate benefits for society including reduced health care expenditures and improved quality of life. Several studies have found anti-smoking campaigns to be cost-effective ways to achieve these benefits and, in some cases, reduce total costs.

Section 1: Introduction

Smoking has been estimated to increase health care costs in the United States by $167.5 billion annually (Xu et al. 2015). More than 60 percent of these costs were paid by public programs such as Medicaid and Medicare. However, smoking's costs are not limited to treating smoking-related health issues. Smoking also negatively affects labor market outcomes. Smokers are less likely to work, earn lower wages, incur higher rates of absenteeism, and are more likely to die prematurely than non-smokers. These effects reduce economic activity and lower federal, state, and local tax revenues. As a result, smoking can have significant fiscal implications for all levels of government.

In July 2018, the Kentucky Department of Public Health contracted with the University of Kentucky's Center for Business and Economic Research (CBER) to examine how smoking affects the Commonwealth's labor market. This study has three main goals:

1. estimate the effects of smoking on Kentucky's workforce;
2. estimate the effects of smoking on state tax revenues; and
3. examine the potential benefits associated with smoking cessation programs and anti-smoking campaigns.

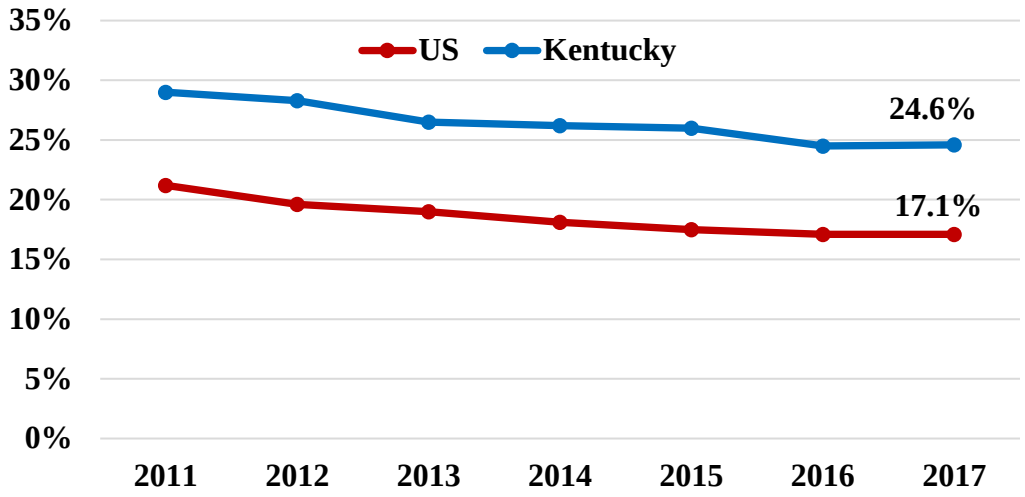
Section 2: Prevalence of Smoking in Kentucky

Smoking rates in both the nation and Kentucky have gradually declined over the past few years. However, smoking remains much more common in Kentucky than the rest of the nation (Figure A). In 2017, approximately 24.6 percent of Kentucky adults smoked compared to 17.1 percent of adults nationally. West Virginia is the only state with a higher smoking rate than Kentucky.

Figures B through E show adult smoking rates for 2017 in Kentucky and the U.S. across demographic groups. Smoking rates were higher for males than females (Figure B), with 26 percent of Kentucky's males and 21.7 percent of Kentucky's females currently smoking. Smoking rates were highest among those aged 25 and 49 (Figure C), but the rate appears to decline with age. In Kentucky, 22.3 percent of African Americans and 23.9 of Whites smoked (Figure D).

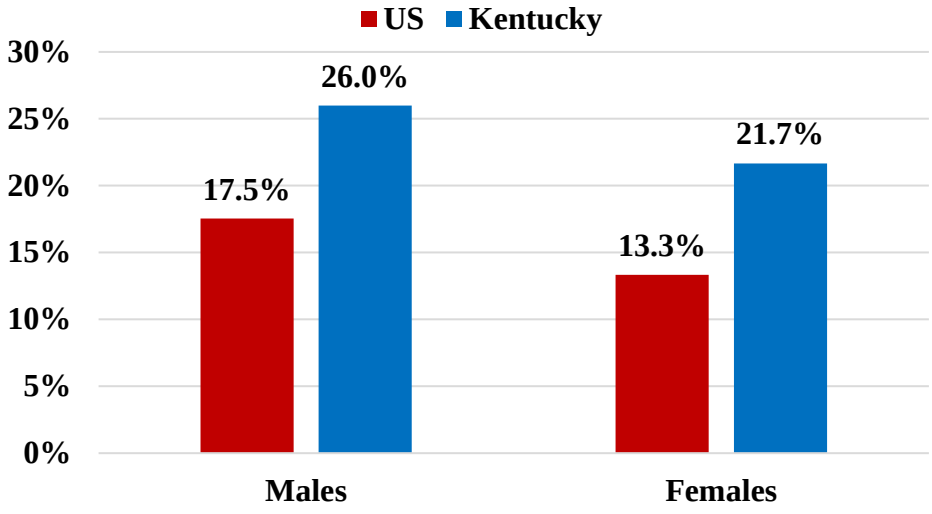
Smoking is more prevalent among those with less education (Figure E). In Kentucky, adults who did not complete high school were more than four times as likely to smoke as those with a bachelor's degree or higher. High school graduates were nearly three times as likely to smoke as those with a bachelor's degree or higher.

Figure A
Adult Smoking Rates
Kentucky and U.S.
2011 to 2017



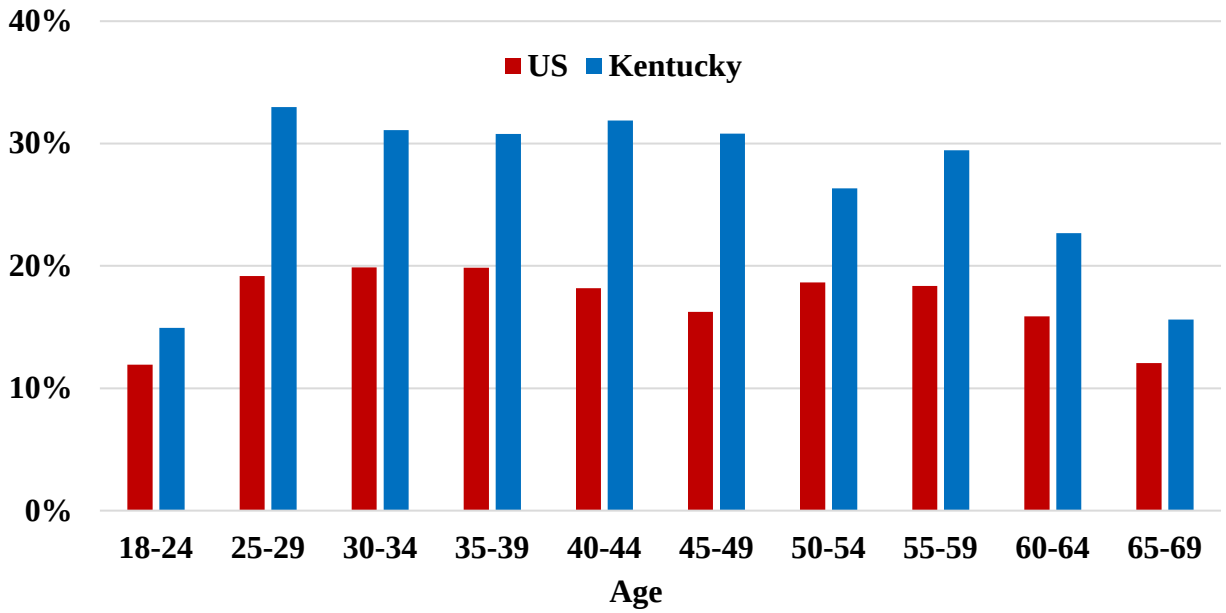
Source: United States Centers for Disease Control and Prevention. National Center for Chronic Disease Prevention and Health Promotion, Division of Population Health. BRFSS Prevalence & Trends Data.

Figure B
Adult Smoking Rates by Gender
Kentucky and U.S.
2017



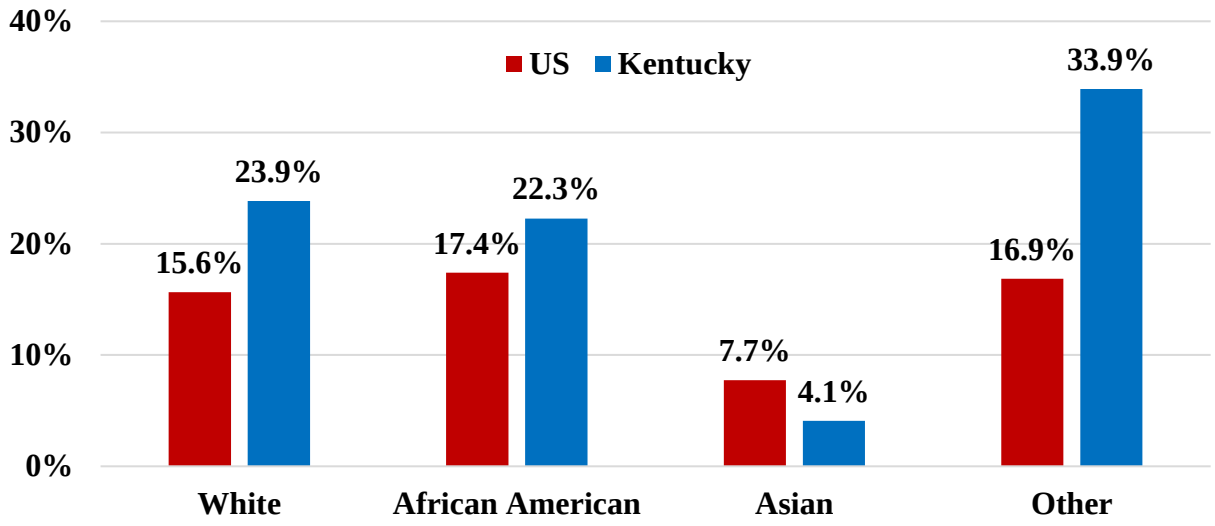
Source: CBER analysis of data from the Kentucky Department of Public Health and the United States Centers for Disease Control and Prevention. Behavioral Risk Factor Surveillance System 2017.

Figure C
Smoking Rates by Age Groups
Kentucky and U.S.
2017



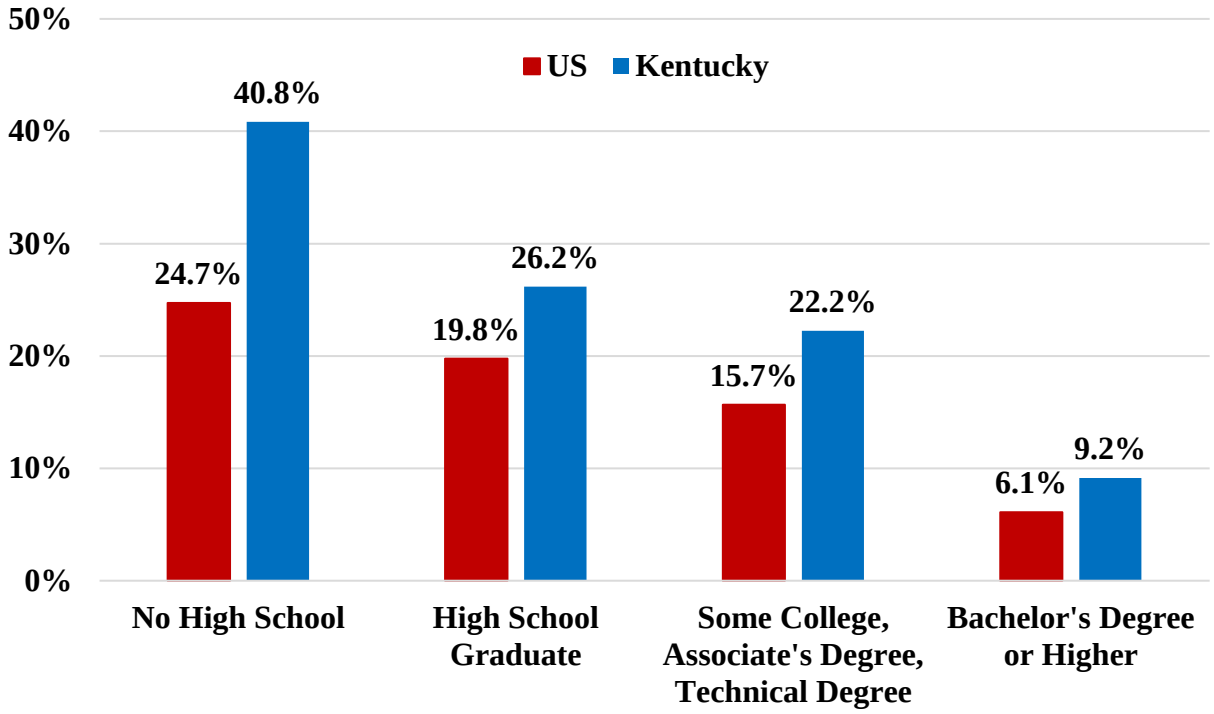
Source: CBER analysis of data from the Kentucky Department of Public Health and the United States Centers for Disease Control and Prevention. Behavioral Risk Factor Surveillance System 2017.

Figure D
Adult Smoking Rates by Race
Kentucky and U.S.
2017



Source: CBER analysis of data from the Kentucky Department of Public Health and the United States Centers for Disease Control and Prevention. Behavioral Risk Factor Surveillance System 2017.

Figure E
Smoking Rates by Educational Attainment
Kentucky and U.S.
2017

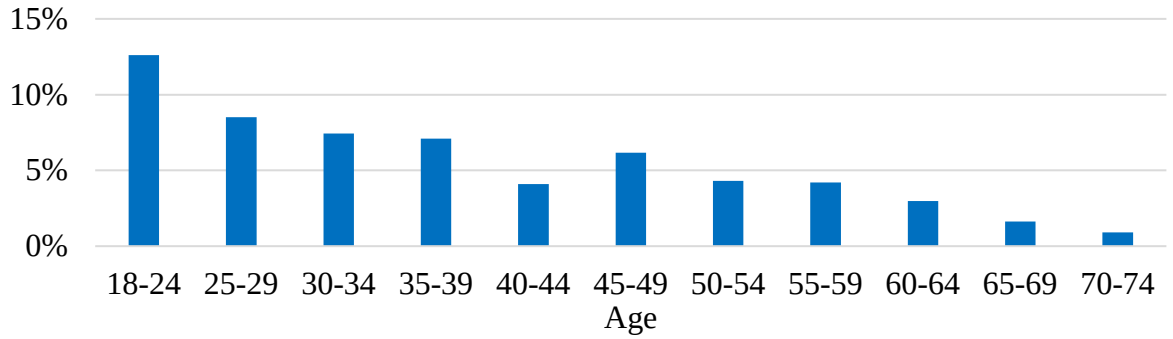


Source: CBER analysis of data from the Kentucky Department of Public Health and the United States Centers for Disease Control and Prevention. Behavioral Risk Factor Surveillance System 2017.

E-cigarette Use

Although the economic costs of e-cigarettes are not addressed in this report, e-cigarettes are becoming a more commonly used product. Currently, 5.8 percent of Kentucky adults use e-cigarettes compared to 4.1 percent of adults nationally. E-cigarette use is most prevalent among younger adults in Kentucky (Figure F), with 12.6 percent of individuals between the ages of 18 and 24 using them.

Figure F
E-cigarette Use by Age
Kentucky
2017



Source: CBER analysis of data from the Kentucky Department of Public Health and the United States Centers for Disease Control and Prevention. Behavioral Risk Factor Surveillance System 2017.

Section 3: Impact of Smoking on Employment and Earnings

Research has long demonstrated that smokers tend to have poorer labor market outcomes than non-smokers. Smokers are more likely to be unemployed, earn lower wages, and experience higher rates of absenteeism than similar individuals who do not smoke. Smokers are also more likely to exit the labor force early and die prematurely. These poorer outcomes lead to lower economic productivity, earnings, and tax revenue. This section reviews the research on how smoking affects labor market outcomes and then discusses how these outcomes affect Kentucky.

Research on the Effects of Smoking on Wages

Past researchers have generally found that smokers earn four to eleven percent less than non-smokers (Levine et al. 1997; Grafova and Stafford 2009). However, this wage penalty appears to vary across different groups. For example, Auld (2005) found that younger workers and workers with more education incurred large smoking-related wage penalties, but those with less than a college education incurred no wage penalty for smoking. Another study found that smoking reduced wages for males but not females (van Ours 2004). While most studies find that smokers earn less, not all studies have concluded that smoking reduces wages. Yuda (2011) found no statistically significant differences between the wages of smokers and non-smokers.

The degree to which smoking causes lower wages among smokers is not entirely clear. Grafova and Stafford (2009) explain that there are both causal and non-causal reasons for why smokers might earn less. One way smoking might lower wages is that it can reduce workers' health,

making them less productive. Some have also suggested that smoking causes lower wages because it results in higher health insurance costs and greater rates of absenteeism (Levine et al. 1997; van Ours 2004). As a result, employers might pay smokers lower wages.

The lower wages paid to smokers might also reflect differences in the individuals rather than being a direct cause of smoking (Grafova and Stafford 2009). For example, some individuals place a higher value on their current well-being than their future well-being. These individuals might be more likely to smoke because they tend to discount the future health costs associated with smoking. They might also be less likely to invest in education and training because they discount the higher wages they could earn in the future with these investments. These individuals are both more likely to smoke and earn less, but the lower earnings reflect the individuals' underlying preferences rather than being caused by smoking.

Grafova and Stafford (2009) used data collected from 1989, 1999, and 2001 to examine the effects of smoking on wages. They compared the wages of three groups: those who never smoked; those who smoked but were known to have quit in the future; and those who smoked persistently. They found that those who smoked, but would eventually quit in the future, earned similar wages to those who never smoked. That is, these individuals seemed to suffer no wage penalty while they were still smokers. These results suggest that much of the wage gap may be due to non-causal factors. This is an important distinction for policymakers to consider when examining policies to address smoking. Programs designed to reduce smoking might improve health. However, they might be less effective at increasing smokers' wages if their lower wages are actually due to underlying characteristics of the individuals who smoke rather than being caused directly by smoking.

Research on the Effects of Smoking on Employment

Smokers also are less likely to work, more likely to retire early, and face a higher risk of disability compared to nonsmokers (Bengtsson and Nilsson 2016; Claessen et al. 2010; Haukenes et al. 2013; Husemoen et al. 2004; Koskenvuo et al. 2011; Korhonen et al. 2015). Prochaska et al. (2016) showed that unemployed smokers in California were less likely to be rehired than their non-smoking counterparts. They noted that smokers can be more costly to employ. As a result, firms may be less willing to hire smokers or may adopt anti-smoking policies that could be less attractive to smokers. Brook et al. (2014) showed that individuals who smoked in their youth were more likely to be unemployed later in life.

Effects of Smoking on Kentucky's Employment and Earnings

Lost earnings from smokers who continue to work. Data from the 2017 Behavioral Risk Factor Surveillance System (BRFSS) indicate that over 693,000 Kentucky residents between the ages of 25 and 64 smoked and 386,000 of these individuals were employed. The BRFSS does not provide detailed information on their earnings. However, their earnings in the absence of smoking can be predicted using data from the American Community Survey. The predictions were based on each smoker's age, race, gender, and education. The lost earnings reflect the wage penalty smokers face relative to similar non-smoking workers. Past research suggests this wage penalty ranges from four to eleven percent. Therefore, low and high estimates of lost earnings

were provided to reflect this range. As shown in Table 1, smoking reduces earnings for Kentucky workers who smoke by $489.7 million to $1,346.6 million per year. This represents lost earnings of $1,268 to $3,488 annually per worker. Assuming a six percent combined effective state sales and income tax rate indicates that Kentucky loses $29.4 to $80.8 million in tax revenue annually from lower wages among smokers.

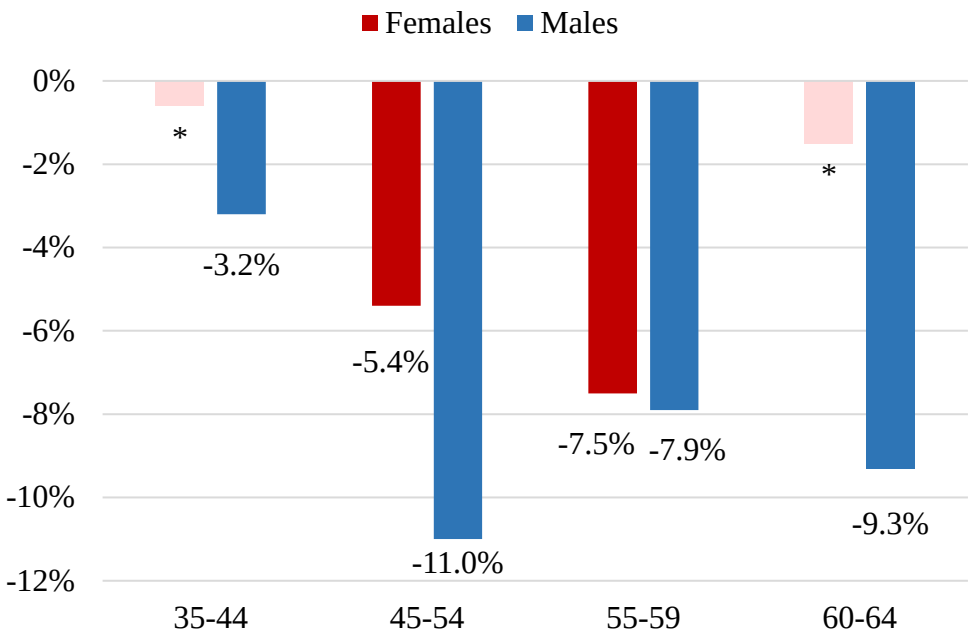
Table 1
Reduction in Annual Earnings and State Tax Revenue
Kentucky

	Low Estimate	High Estimate
Number of Workers Affected (aged 25 to 64)	386,000	386,000
Lost Earnings	$489.7 million	$1,346.6 million
Lost State Tax Revenue	$29.4 million	$80.8 million

Lost earnings from smokers who do not work. In Kentucky, 52 percent of smokers between the ages of 35 and 64 were employed. This compares to 68 percent for similar non-smokers. This difference is not entirely due to smoking. It may reflect other factors such as differences in education levels of smokers and non-smokers. Individuals with less education are both more likely to smoke and less likely to work. Therefore, the difference in employment between smokers and non-smokers may be partially due to smokers having less education. A logistical regression analysis was used to better isolate the effects that smoking has on employment from these other factors. The analysis used national data from the BRFSS and accounts for age, gender, education, race, state of residence, and the presence of health conditions.

Figure G summarizes results of the analysis. Smoking was associated with a lower probability of working; however, the relationship differed based on gender and age. A non-smoking male aged 35 to 44 had an 87.8 percent probability of being employed. A similar smoker had an 84.6 percent probability of being employed, 3.2 percentage points less than the non-smoker. For males, smoking was associated with a lower probability of working between the ages of 35 to 64. For women, smoking was associated with a lower probability of working between the ages of 45 to 59. Smoking did not appear to significantly affect employment among women between the ages of 35 to 44 and 60 to 64.

Figure G
Percentage Point Difference in the Probability of Employment between Smokers and Non-smokers



Source: Analysis of data from the United States Centers for Disease Control and Prevention, Behavioral Risk Factors Surveillance Survey.
* Not statistically significant at the 5 percent level.

Applying the estimates from Figure G to the number of smokers in Kentucky provides an indication of how many workers might have worked in the absence of smoking. Table 2 shows that in the absence of smoking, 28,500 individuals might have worked and could have earned over $38,000 on average. This represents $1,088 million in lost earnings and $65.3 million in lost state sales and income tax revenue. These estimates assume that if smokers had never smoked, they would have earned similar amounts as non-smokers. A more conservative estimate assumes they would have still incurred a wage penalty of four to eleven percent. Using a wage penalty of eleven percent suggests lost earnings totaling $968 million per year and lost state tax revenues totaling $58 million per year.

Table 2
Potential Annual Reduction in Employment Due to Smoking
Kentucky

	Potential Impact Due to Smoking	
	Low Estimate	**High Estimate**
Number of Workers	28,500	28,500
Lost Earnings	$968.2 million	$1,088 million
Lost State Tax Revenue	$58.1 million	$65.3 million

Employment and Earnings Lost to Smoking-related Deaths

Smoking increases the risk of developing various forms of cancer and heart disease and leads to premature deaths. In addition to the loss of life, these premature deaths represent an economic loss. In the absence of smoking, many of those who died prematurely from smoking-related conditions might have continued to earn an income for many more years. To estimate this economic cost, this section examines the number of smoking-related deaths in Kentucky and the income the decedents might have earned if they lived out the rest of their natural lives.

Smoking Attributable Deaths. The CDC provides data on the number of deaths due to specific health conditions or diseases. However, it does not report how many are due to smoking. To determine the number of smoking-related deaths, researchers have typically estimated the fraction of deaths related to specific health conditions that can be attributed to smoking. The CDC provides a methodology for calculating these fractions (United States. Centers for Disease Control and Prevention. Tobacco Use Data Portal). The methodology uses the relative risk of developing each disease for current smokers, former smokers, and non-smokers and the prevalence of smoking in an area. For this analysis, relative risks by age and gender were obtained from the U.S. Surgeon General report on the health consequences of smoking (2014). Smoking rates by age and gender for Kentucky were calculated using data from the BRFSS.

Table 3 shows estimates of the fraction of deaths that can be attributed to smoking in Kentucky by disease. For example, smoking contributes to approximately 64 percent of deaths related to COPD among females age 45 to 49 in Kentucky. Applying these fractions to the number of deaths associated with disease provides estimates of the number of deaths due to smoking. Tables 4 and 5 show the average number of smoking-related deaths per year by disease in Kentucky from 2013 through 2017.

Table 3
Fraction of Deaths Attributable to Smoking
Kentucky

	Females					
Disease	**35 to 39**	**40 to 44**	**45 to 49**	**50 to 54**	**55 to 59**	**60 to 64**
COPD & Influenza-Pneumonia-TB	67%	68%	64%	60%	78%	74%
Coronary Heart Disease	62%	62%	58%	56%	42%	35%
Lung Cancer	82%	82%	80%	77%	87%	83%
Other Cancers	13%	12%	11%	11%	29%	24%
Cardiovascular Diseases	33%	34%	31%	26%	24%	19%
	Males					
Disease	**35 to 39**	**40 to 44**	**45 to 49**	**50 to 54**	**55 to 59**	**60 to 64**
COPD & Influenza-Pneumonia-TB	62%	58%	61%	59%	85%	85%
Coronary Heart Disease	57%	53%	56%	54%	46%	45%
Lung Cancer	86%	83%	85%	84%	88%	87%
Other Cancers	27%	24%	26%	25%	28%	27%
Cardiovascular Diseases	37%	32%	35%	33%	40%	39%

Source: Analysis of data from the United States Centers for Disease Control and Prevention and the Behavioral Risk Factor Surveillance Survey, U.S. Surgeon General.

Table 4
Average Number of Smoking-related Deaths per Year
by Gender and Age
Kentucky

Females

Disease	35-39	40-44	45-49	50-54	55-59	60-64	Total
COPD & Influenza-Pneumonia-TB	4	9	18	38	90	121	279
Coronary Heart Disease	7	18	28	50	53	56	213
Lung Cancer	-	10	23	66	124	153	376
Other Cancers	1	3	4	8	30	31	78
Cardiovascular Diseases	9	14	22	28	39	39	153
Subtotal Females	21	55	96	189	337	400	1,098

Males

Disease	35-39	40-44	45-49	50-54	55-59	60-64	Total
COPD & Influenza-Pneumonia-TB	4	7	14	35	103	147	312
Coronary Heart Disease	16	32	67	117	145	168	545
Lung Cancer	3	10	30	91	172	230	536
Other Cancers	3	6	14	29	56	68	175
Cardiovascular Diseases	14	20	34	56	104	129	357
Subtotal Males	40	75	159	327	580	743	1,924
Total Females and Males	**61**	**130**	**255**	**517**	**917**	**1,143**	**3,023**

Source: Analysis of data from the United States Centers for Disease Control and Prevention and the Behavioral Risk Factor Surveillance Survey, U.S. Surgeon General.
Note: Numbers might not match totals due to rounding.

Table 5
Average Number of Smoking-related Deaths per Year by Disease
Age 35 to 64
Kentucky

Disease	Deaths
COPD & Influenza-Pneumonia-TB	591
Coronary Heart Disease	757
Lung Cancer	912
Other Cancers	252
Cardiovascular Diseases	510
Total	**3,023**

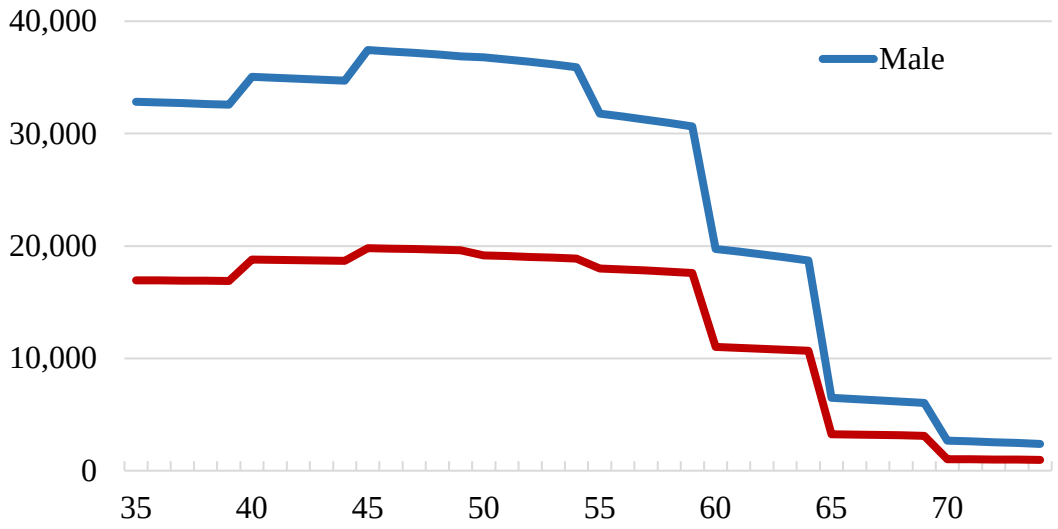
Note: Numbers might not match totals due to rounding.

Lost Lifetime Earnings. The economic losses associated with smoking-related deaths were estimated based on the amounts that each person who died might have earned had they been able to live out a natural life. These lost earnings were based on three estimates for each decedent given their age and gender: the probability they would be alive; the probability they would work; and the average income they would earn in each of the following years had they not died. The probability that they would be alive each year was calculated from standard actuarial life tables (U.S. Social Security Administration, 2005).

Data on average income and the probability of working for each age and gender were estimated using data from the American Community Survey (ACS) and the BRFSS. The ACS – which provides detailed data on the employment and earnings of respondents living in Kentucky but does not indicate whether respondents smoke – was used to develop models of the probability that individuals work and their earnings if employed. The model accounts for gender, race, age, and education. The resulting models were applied to data for Kentucky respondents in the BRFSS, which does indicate whether respondents smoked. This provides estimates of the probability of employment and earnings for each Kentucky respondent who smokes in the BRFSS data. These estimates reflect the age, gender, racial characteristics, and educational attainment of smokers in Kentucky. The predicted earnings for each year were multiplied by the probability of employment and the probability of surviving each year.

Figure H shows the amount a 35-year-old male and female smoker might have earned in the absence of smoking. The earnings assume they would have earned similar wages and had a similar likelihood of working as non-smokers, and not died prematurely due to smoking. The average male smoker who dies at age 35 could have earned an additional $1 million in the absence of smoking. Given a discount rate of four percent, the present value of these lost earnings is $606,000.

Figure H
Profile of Average Annual Earnings



Source: CBER analysis of the American Community Survey and the Behavioral Risk Factors Surveillance System.

The earnings profiles represent an upper-bound estimate of the earning lost to smoking-related deaths, because they assume smokers would be as likely to work and earn similar wages as non-smokers. However, as noted, smokers do generally earn less on average than similar non-smokers and are less likely to work. While a portion of these difference may be caused by smoking, a portion may be due to unobserved characteristics of smokers, such as their preferences. Even if these individuals never smoked, they still might have been less likely to work and earned less than typical non-smokers. To the extent this is the case, the estimates from Figure H could overstate the earnings lost to premature smoking-related deaths.

To reflect this, a second set of lifetime earnings profiles was estimated reflecting the lower probability of employment among smokers and an eleven percent wage penalty. These earnings profiles represent a lower-bound estimate of the earnings lost due to smoking-related deaths.

Table 6 summarizes the estimates of lost earnings. From 2013 through 2017, there were on average 3,023 smoking-related deaths between the ages of 35 and 64 in Kentucky. Had these individuals not died from the diseases associated with smoking, they could have earned between $61.1 million and $77.2 million during the first year after their death. Assuming an effective state income and sales tax rate of six percent suggests that the lost state tax revenue for this year would be $3.7 million to $4.6 million. The present value of lifetime earnings lost to these smoking-related deaths in Kentucky during 2017 totaled between $461.3 million to $585.5 million.[1] The present value of lost state tax revenues would have been $27.7 million to $35.1 million.

[1] Present value of lifetime earnings was calculated using a four percent discount rate.

Table 6
Lost Earnings from Smoking-related Deaths
Kentucky

Age at Death	Average Number of Deaths per Year	1st-year Lost Earnings (millions) Lower Bound	1st-year Lost Earnings (millions) Upper Bound	Present Value Lost Earnings (millions) Lower Bound	Present Value Lost Earnings (millions) Upper Bound
35 to 39	61	1.4	1.7	24.7	30.3
40 to 44	130	3.2	3.7	44.5	55.5
45 to 49	255	6.3	8.0	74.1	94.2
50 to 54	517	12.8	16.3	114.3	145.3
55 to 59	917	20.8	26.2	128.4	163.4
60 to 64	1,143	16.5	21.3	75.2	96.9
Total	3,023	61.1	77.2	461.3	585.5
State Tax Revenue		3.7	4.6	27.7	35.1

Note: Estimates of state tax revenues are based on a total effective state sales and income tax rate of six percent.

The estimates in Table 6 represent losses for deaths that occur in one year. So, the 3,023 deaths that occur in one year result in lost tax revenues of $3.7 million to $4.6 million during the next year. However, the total losses for any single year reflect deaths that have occurred over the past several years. Therefore, the total losses associated with smoking in any single year would be substantially higher. Table 7 shows estimates of the losses associated with smoking-related deaths occurring over the past 10 years. These deaths cost Kentucky between $388.6 million to $492.1 million in lost earnings. The lost earnings reduce Kentucky's state tax revenue by $23.3 to $29.5 million per year.

Table 7
Annual Lost Earnings and State Tax Revenue
from Smoking-related Deaths Occurring over the Past Ten Years
Kentucky

	Lower Bound	Upper Bound
Lost Earnings	$388.6 million	$492.1 million
Lost State Tax Revenues	$23.3 million	$29.5 million

Note: Estimates of state tax revenues were based on a total effective state sales and income tax rate of six percent.

Absenteeism and Presenteeism

Several studies have documented higher rates of absenteeism and presenteeism among smokers (Berman et al. 2014; Halpern et al. 2001). Presenteeism refers to reduced productivity while working. Bunn et al. (2006) estimated that smokers missed 18.4 more hours of work than non-smokers and lost the equivalent of 33.7 hours of productivity due to presenteeism. Given the 386,000 smokers who work in Kentucky and simply assuming a wage of $15 per hour indicates that smoking-related absenteeism and presenteeism would cost Kentucky approximately $302 million in lost productivity. The reduced productivity may partially explain why smokers earn less than non-smokers and may be reflected in losses due to lower wages.

Section 4: Health Care Costs

Xu et al. (2015) estimated that the national health care expenditures attributable to smoking among non-pregnant adults totaled $167.5 billion annually. They also estimated that smoking accounts for 15.2 percent of Medicaid's total health care expenditures.

Table 8
Health Care Expenditures
Attributable to Smoking by Payer
United States
2015

Payer	Share of Expenditures Attributed to Smoking	Expenditures ($ billions)
Medicare	9.6%	45.0
Medicaid	15.2	39.6
Other Federal	32.8	23.8
Private Insurance	5.4	33.6
Out-of-Pocket	3.4	7.9
Others	11.8%	17.5
Total		167.5

Source: Xu et al. (2015).

The CDC estimated the smoking-related health care expenditures occurring in each state in 2009. Adjusting its estimates for medical inflation indicates that smoking accounts for $2.5 billion in health care expenditures in Kentucky annually (Table 9).

Table 9
Annual Health Care Expenditures
Attributable to Smoking
Kentucky
(Stated in 2019 Dollars)

Category	Expenditures ($ millions)
Hospital	1,355.9
Prescription Drugs	476.2
Nursing Home	203.9
Other	133.3
Total	2,486.8

Source: United States Centers for Disease Control and Prevention. Smoking-Attributable Mortality, Morbidity, and Economic Costs.
Note: The 2009 expenditures reported by the CDC were adjusted for inflation using the Consumer Price Index for all urban consumers, medical care component.

Section 5: Smoking Cessation Programs and Anti-Smoking Media Campaigns

In 2014, the CDC listed cessation programs and anti-smoking media campaigns as two of the main components that states can use to form a comprehensive tobacco control program. Both have been shown to reduce smoking rates, and as a result, could also improve labor market outcomes. This section reviews the research on these components and examines the potential impact these programs could have on Kentucky's labor market.

Cessation Programs

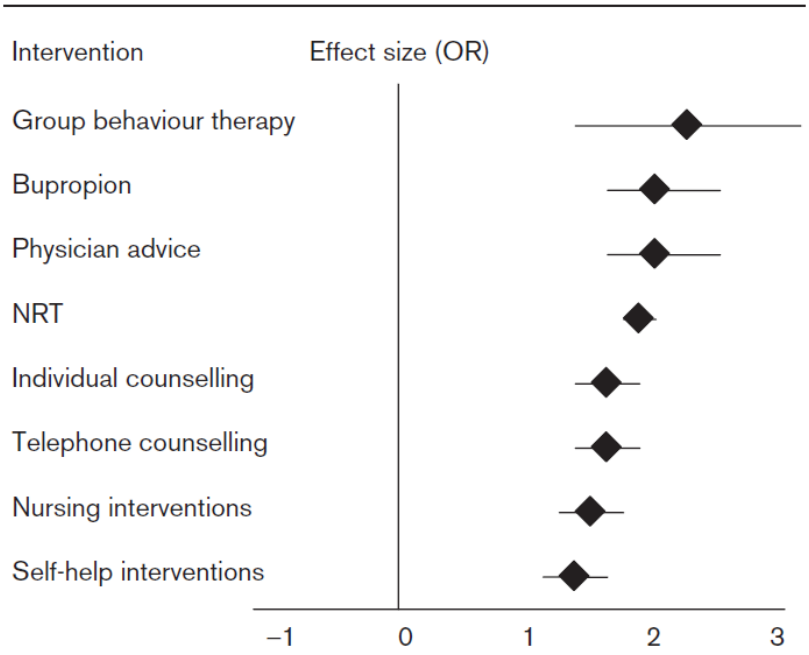
Cessation programs have generally been shown to help smokers quit, but the services they provide vary considerably across programs (West et al. 2018; Kotz et al. 2014; Cahill and Lancaster 2014; and Lemons et al. 2008). They often include advice from a health care professional, individual or group support, or medication such as nicotine replacement therapy (NRT), bupropion, or varenicline.

Lemmens et al. (2008) reviewed the research on cessation programs. Figure I reproduces the authors' summary of their findings. They showed how cessation programs with different components affect the odds that a participant successfully quits relative to the odds of a non-participant. For example, the odds of successfully quitting was twice as high for smokers who received group behavioral therapy compared to smokers not receiving treatment. Cessation programs that included group behavior therapy, bupropion, physicians' advice, and NRT as part of the treatment provided the largest improvements in odds of quitting.

In another study, Kotz et al. (2014) found that the odds of quitting were 2.58 times higher among smokers who received prescription medication and behavioral support compared to those who received no assistance. The odds of quitting among smokers who received prescription

medication and brief advice from a health care professional was 1.55 times higher. Cahill and Lancaster (2014) reported similar results. In their analysis, smokers who received pharmacological interventions, self-help interventions, individual counselling, or group therapy showed greater odds of quitting. Barnett et al. (2015) found that 18.75 percent of psychiatric patients who received smoking cessation services quit smoking compared to 6.8 percent of those who received standard care.

Figure I
Summary of Odds Ratios by Cessation Intervention as Reported by Lemmons et al. (2008)



Graphic overview of effect sizes of interventions for smoking cessation. NRT, nicotine replacement therapy; OR, odds ratio.

Source: Lemmons et al. 2008
Notes: The black diamonds indicate the mean odds ratio and the lines represent the 95 percent confidence interval.

Several studies have shown that cessation programs can be cost-effective (Faulkner et al. 2006). Among health care programs, cost-effectiveness is often measured by calculating the ratio of additional cost of the program to the incremental improvements in Quality Adjusted Life Years (QALY). QALYs represent the number of years that a program or treatment is expected to increase one's life with the additional years weighted by the quality of life during those years. For example, a program that increases life expectancy by two years with a high quality of life during the first year and a low quality of life during the second year might represent 1.5 QALYs. A cost-effectiveness ratio of $20,000 per QALY indicates that each additional year of life in perfect health gained by participating in a program would cost an additional $20,000.

While cost-effectiveness ratios do not clearly indicate whether a program should be implemented, they do provide a method to compare alternative programs. Generally, programs with lower cost-effectiveness ratios are preferred. Several studies cited $50,000 per QALY as a common standard for determining whether a program is cost-effective (Faulkner et al. 2006; Warner 1997; Tengs and Wallace 2000). Although this appears to be a common benchmark, there are some concerns that it might be too low and not reflect the value people place on improvements in quality of their lives (Neumann et al. 2014).

Barnett et al. (2015) estimated that a cessation program for psychiatric patients had a cost-effectiveness ratio of $464 per QALY.[2] Javitz et al. (2004) evaluated the cost-effectiveness of a program providing bupropion and behavioral interventions. They estimated the average cost-effectiveness ratio ranged from $1,091 to $1,608 per QALY.[3] Results varied based on age and sex with cost-effectiveness decreasing for older individuals.

Examining the employment of former smokers provides an indication of how cessation programs could affect employment and earnings. Table 10 describes how a hypothetical cessation program serving 1,000 people aged 35 to 44 could affect employment. The effects are driven by three main factors: sustained quit rates, the difference in employment between current and former smokers, and lifetime earnings. Table 10 provides low and high estimates based on different assumptions about quit rates and lifetime earnings.

Past research has demonstrated that cessation program are a cost-effective method for helping smokers quit. However, the effect on quit rates varies across studies and programs depending on the type of services provided and the population studied. For this analysis, the improvement in quit rates at 12 months was assumed to range from 2.5 (Faulkner et al. 2006) to 22.2 percentage points (Javitz et al. 2004). The wide range reflects the variation in cessation programs. Not all individuals who would be able to quit for 12 months will quit permanently. West et al. (2018) noted that approximately 70 percent of smokers who abstain for 12 months were able to remain smoke free for several years. These estimates suggest that out of 1,000 participants, approximately 18 to 155 would successfully quit long-term.

The analysis discussed in Section 2 indicated that current smokers were less likely to work than those who have never smoked. However, former smokers were 4.6 percentage points more likely to work than current smokers and had a similar probability of working as those who never smoked. Therefore, successfully quitting could improve smokers' employment prospects and earnings. The higher probability of working among former smokers suggests that among the 18 to 155 individuals who successfully quit, there would be one to seven additional workers on average.

The former smokers who work are estimated to earn a total of $458,000 to $579,000 on average over the remainder of their careers. Both figures are stated as present values, which were

[2] Adjusted for inflation using the CPI-U for medical care.
[3] Adjusted for inflation using the CPI-U for medical care.

calculated using a discount rate of four percent. The lower estimates reflect an 11 percent wage penalty for smokers. The higher figure assumes they could earn similar wages as non-smokers.

In total, a cessation program serving 1,000 smokers could potentially increase employment by roughly one to seven workers, increase present value earnings by $366,400 to $4.17 million, and increase present value tax revenues by $22,000 to $250,100. While these represent wide ranges, the magnitudes are mostly driven by the success rate of the cessation programs.

Table 10
Potential Employment Effects of a Smoking Cessation Program Serving 1,000 Smokers

	Low	High
Participants	1,000	1,000
Incremental 12-month Quit Rate	2.5%	22.2%
Long-term Abstinence for Those Quitting	70%	70%
Number of Long-term Quits	18 Individuals	155 Individuals
Percentage Point Difference in Probability of Employment between Former and Current Smokers	4.6%	4.6%
Number of Additional Workers	0.8 Workers	7.2 Workers
PV Lifetime Earnings per Person	$458,000	$579,000
PV Lifetime Earnings Total	$366,400	$4,168,800
PV Lifetime State Taxes	$22,000	$250,100

Notes: Present values were calculated using a 4 percent discount rate. An effective total state sales and income tax rate of 6 percent was assumed.

Quitting smoking might also improve productivity for smokers who are already working. As discussed, several studies have shown that smokers incur lower productivity due to higher rates of absenteeism and presenteeism than non-smokers. Baker et al. (2018) found that productivity losses due to absenteeism and presenteeism were 23 percent lower among workers who quit smoking during the past four years compared to current smokers. On average, the annual cost of absenteeism and presenteeism is approximately $1,328 less per worker among former smokers than for current smokers. Baker et al. (2017) also provided similar findings, but the authors cautioned that they could not establish a causal link between smoking and productivity.

Javitz et al. (2004) estimated that employer-sponsored cessation programs could yield $651 to $1,148 per enrollee in net benefits to employers.[4] The benefits come from reduced health care costs, reduced absenteeism, and increased productivity. However, employers may be concerned that workers who participate in the cessation program may leave, thus limiting the benefits to the employers that sponsor the programs (Faulkner et al. 2006).

[4] Figures from Javitz et al. (2004) were adjusted for inflation using the CPI-U.

Anti-smoking Media Campaigns

A considerable body of research has examined the potential benefits of anti-smoking campaigns. These campaigns have been shown to increase awareness of the health consequences of smoking, reduce the number of people taking up smoking, and motivate current smokers to quit (Davis et al. 2012; Duke et al. 2015; Dunlop et al. 2013; Durkin et al. 2012; Emery et al. 2012; Farrelly et al. 2009). By reducing the number of smokers, they generate significant benefits for society including reduced health care expenditures and improved quality of life. Several studies have found anti-smoking campaigns to be cost-effective ways to achieve these benefits and, in some cases, reduce total costs (Atusingwize et al. 2014; Fishman et al. 2005).

The American Legacy Foundation's "truth" campaign, which began in 2000, was designed to discourage youth from smoking by showing television ads with information about the health consequences of smoking as well as images of teens rejecting cigarettes. Farrelly et al. (2005) estimated that the campaign reduced smoking rates among U.S. youth by 1.5 percentage points and resulted in 300,000 fewer smokers. Following up on this work, Holtgrave et al. (2009) calculated that 300,000 fewer smokers could reduce lifetime medical costs by $1.9 billion, more than offsetting the $324 million cost of the media campaign.

The American Legacy Foundation also developed a campaign aimed at adults. Villanti et al. (2012) calculated that the campaign, which ran television and radio ads in eight market areas during 2008, cost between $37,355 to $81,301 per QALY gained. The authors' estimates were considerably higher than estimates from other studies. The limited market area might be one reason for this. Campaigns developed for larger areas may benefit from economies of scale as the fixed costs of developing a campaign can be utilized in a wider market.

In 2012, the CDC began its Tips from Former Smokers (Tips) campaign, in which former smokers graphically describe the health consequences of smoking and how they live with their disabilities. Evaluations found that the campaign increased the number of people attempting to quit by 12 percent, and 5.7 percent of them were still not smoking after six months (McAfee et al. 2013; Neff et al. 2016). Neff et al. (2016) concluded that Tips was associated with 104,000 sustained quits. Murphy-Hoefer et al. (2018) estimated that the campaign resulted in 522,000 sustained quits from 2012 to 2015. Assuming Kentucky experienced a similar increase in quits, approximately 10,570 more Kentucky adults quit smoking due to the Tips campaign.[5] Xu et al. (2016) estimated that the Tips campaign cost $48 million but saved 179,009 QALYs and prevented 17,109 premature deaths. They estimate that the campaign cost $2,819 per premature death avoided and $268 per QALY.

Because anti-smoking campaigns reduce smoking rates and former smokers and nonsmokers are more likely to work, the campaigns may also improve labor market outcomes. Former smokers were 4.3 percentage points more likely to work than current smokers. Applying this figure to the

[5] Kentucky accounts for approximately two percent of US smokers. Applying two percent to the 522,000 additional quits that was estimated by Murphy-Hoefer et al. (2018) suggests 10,570 additional quits in Kentucky.

estimate that the Tips campaign contributed to 10,570 additional quits in Kentucky suggests that the campaign could have added approximately 455 people to the state's workforce.

Conclusions

Smoking has three main effects on Kentucky's employment and earnings. First, smoking is associated with reduced wages of smokers who work. Smokers earn four to eleven percent less than similar non-smokers, which amounts to $1,268 to $3,488 in reduced earnings per worker annually. In Kentucky, there are 386,000 workers between the ages of 25 and 64 who smoke. Second, smokers are less likely to work. On average, smokers between the ages of 35 and 64 are 4.3 percentage points less likely to work than similar non-smokers. This suggests that smoking reduces employment in Kentucky by 28,500 workers, or 1.4 percent of the state's labor force. Finally, smoking contributes to premature deaths. It is estimated that approximately 3,023 smoking-related deaths occur in Kentucky per year among those aged 35 to 64. In the absence of smoking, many of those who die prematurely would have continued working for several years.

Table 11 summarizes the lost earnings associated with these three effects. In total, it is estimated that smoking reduces Kentucky's earnings by $1.9 billion to $2.9 billion per year. This amounts to 1.5 to 2.3 percent of the state's total earnings. The lost earnings result in reduced tax revenues of $110.8 million to $175.6 million annually.

The larger estimates assume that smokers would be just as likely to work as those who never smoked and earn similar wages. However, as discussed, there are a number of reasons why those who choose to smoke might experience poorer labor market outcomes even if they never smoked. Therefore, the smaller estimates are likely to provide a more accurate reflection of the losses associated with smoking.

Table 11
Annual Earnings and State Tax Revenue Lost to Smoking
Kentucky

	Earnings ($ millions)		State Tax Revenue ($ millions)	
	Low	**High**	**Low**	**High**
Reduced Wages	490	1,346	29.4	80.8
Reduced Employment	986	1,088	58.1	65.3
Premature Deaths from 2008 to 2017	389	492	23.3	29.5
Total	1,865	2,927	110.8	175.6

Past research finds that cessation programs and anti-smoking campaigns are both cost-effective methods to reduce smoking. Since former smokers are more likely to work than smokers, these programs might also improve employment, earnings, and tax revenues. While the additional tax revenues would not likely be large enough cover the cost of these programs, they would help offset a portion of their costs.

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