

The Commonwealth of Massachusetts Executive Office of Health and Human Services
Massachusetts Department of Public Health

Smoking-Attributable Mortality, Morbidity, and Economic Costs (SAMMEC)

Massachusetts 2006

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Background

The Division of Research and Epidemiology in the Bureau of Health Statistics, Research and Evaluation in the Department of Public Health used Centers for Disease Control and Prevention's Smoking-Attributable Mortality, Morbidity, and Economic Costs (SAMMEC) application to examine the impact of smoking on Massachusetts residents in 2006. SAMMEC includes an Adult and a Maternal and Child Health (MCH) program that provide the ability to estimate the health and health-related economic consequences of smoking (CDC, SAMMEC, 2006).

SAMMEC calculates annual state and national-level smoking-attributable deaths and years of potential life lost for adults and infants in the United States. The Adult application also calculates medical expenditures and productivity costs among adults. Likewise, Maternal and Child Health (MCH) SAMMEC estimates annual state and national-level smoking-attributable deaths and years of potential life lost for infants (CDC, SAMMEC, 2006).

Major Findings

The 2006 Massachusetts SAMMEC data indicate significant smoking-related loss of life and economic costs despite the recent decline in smoking rates. Much of the smoking-related mortality and economic costs occurring in 2006 are the result of higher smoking prevalence in the past. The 2006 BRFSS data indicate that an average of 17.8% of Massachusetts adults are current smokers. The findings for 2006 may, in fact, underestimate the true impact of cigarette smoking because the SAMMEC application uses the current lower smoking rates in its calculations.

Analyses of SAMMEC data for 2006 indicate that there were 8,045 total deaths attributable to smoking. Overall, approximately 22 Massachusetts residents die each day from smoking-related causes. In terms of economic impact, smoking costs approximately \$1.71 billion in lost productivity due to premature deaths of smokers. Additionally, based on national health care expenditure, in 2006 smoking costs were estimated at \$4.31 billion in personal health care expenditures statewide[§].

The 8,045 smoking-attributable deaths among residents age 35 and over can be classified by four major categories: cancer, heart disease, respiratory disease and smoking fire. Table 1 presents the smoking-attributable deaths associated with each disease. Fire deaths are from the fact sheet, "Massachusetts Fires in 2006," Department of Fire Services Office of the State Fire Marshal. These data do not include any deaths from environmental exposure to tobacco smoke; the SAMMEC program does not calculate deaths or disease from second-hand smoke. Also, these data do not include deaths attributable to pipe, cigar, or smokeless tobacco use. The 8,045 deaths represent 15.7% of all deaths of residents age 35 and over; 19.3% of male deaths, and 12.8% of female deaths.

According to SAMMEC data, eight Massachusetts infants died in 2006 from causes associated with maternal smoking. For 2006, the cause of death are short gestation/low birth weight and sudden infant death syndrome (Figure 1).

In 2006, Massachusetts' residents lost a total of 104,752 years of potential life lost due to smoking-related disease (Table 2). This figure represents, on average, a loss of almost 12.8 years of life for every smoker in the state. Table 2 shows a list of the smoking-attributable years of potential life lost associated with each disease. These figures do not include the 620 years of potential life lost due to infant mortality related to maternal smoking presented in Figure 2.

[§] Estimated from National Health Expenditure Data, 2006, Centers for Medicare and Medicaid Services

Table 1. Smoking-Attributable Mortality, Massachusetts 2006			
Cause of Death	Males	Females	Total
Malignant Neoplasms			
Lip, Oral Cavity, Pharynx	77	32	109
Esophagus	212	48	260
Stomach	40	12	52
Pancreas	70	100	170
Larynx	38	13	51
Trachea, Lung, Bronchus	1671	1216	2887
Cervix Uteri	0	5	5
Urinary Bladder	113	28	141
Kidney and Renal Pelvis	64	5	69
Acute Myeloid Leukemia	23	16	39
Total Malignant Neoplasms	2308	1475	3783
Cardiovascular Diseases			
Ischemic Heart Disease	713	474	1187
Other Heart Disease	274	214	488
Cerebrovascular Disease	97	105	202
Atherosclerosis	18	6	24
Aortic Aneurysm	103	58	161
Other Arterial Disease	9	12	21
Total Cardiovascular Diseases	1214	869	2083
Respiratory Diseases			
Pneumonia, Influenza	151	105	256
Bronchitis, Emphysema	113	131	244
Chronic Airways Obstruction	723	946	1669
Total Respiratory Diseases	987	1182	2169
Fire Deaths			
Smoking-caused fire deaths	6	4	10
All Cause Total			
	4515	3530	8045
Smoking Prevalence	MDPH 2006 MA BRFSS		
Relative Risk	CPS-II (82-88)		
Mortality	MDPH 2006 MA Mortality		
Fire Deaths	Massachusetts Fires in 2006, Department of Fire Services Office of the State Fire Marshal		

Smoking-attributable lost productivity costs were calculated to be over \$1.71 billion dollars in 2006 (Figure 3). A total of \$1000 million dollars was lost to premature death from smoking-related cancers. An additional \$447 million dollars were due to premature deaths from smoking-attributable heart disease, and \$265 million dollars per year were lost due to premature deaths from smoking-related respiratory diseases. However, these figures do not include any lost productivity costs from deaths related to exposure to second-hand smoke.

Smoking-attributable health care expenditures are the excess personal health care costs of smokers and former smokers. For those residents over 35 years of age, \$4.31 billion dollars were spent on smoking-

related illnesses in 2006 in Massachusetts (Figure 4). This figure represents 9.8% of all health care expenditures in the Commonwealth.

Table 2. Smoking-Attributable Years of Potential Life Lost (YPLL) by Disease, Massachusetts 2006			
Cause of Death	Males	Females	Total
Malignant Neoplasms			
Lip, Oral Cavity, Pharynx	1286	544	1830
Esophagus	3323	661	3984
Stomach	517	135	652
Pancreas	1049	1452	2501
Larynx	569	219	788
Trachea, Lung, Bronchus	23032	19224	42256
Cervix Uteri	0	127	127
Urinary Bladder	871	74	945
Kidney and Renal Pelvis	1152	295	1447
Acute Myeloid Leukemia	327	254	581
Total Malignant Neoplasms	32126	22985	55111
Cardiovascular Diseases			
Ischemic Heart Disease	10718	5422	16140
Other Heart Disease	3021	2130	5151
Cerebrovascular Disease	1369	1646	3015
Atherosclerosis	174	47	221
Aortic Aneurysm	1142	580	1722
Other Arterial Disease	102	112	214
Total Cardiovascular Diseases	16526	9937	26463
Respiratory Diseases			
Pneumonia, Influenza	1342	1026	2368
Bronchitis, Emphysema	1246	1563	2809
Chronic Airways Obstruction	7289	10712	18001
Total Respiratory Diseases	9877	13301	23178
All Cause Total	58529	46223	104752
Smoking Prevalence	MDPH 2006 MA BRFSS		
Mortality	MDPH 2006 MA Mortality		
Relative Risk	CPS-II(82-88)		
Life Expectancy*	US 2001 Life Expectancy		
* Note that , since US life tables are used to calculate YPLL, the MA YPLL may be UNDERESTIMATED because MA, in general, had a longer life expectancy that the US for 5-year age groups.			

Data Collection and Analyses

Data on smoking prevalence are from the 2006 Massachusetts Behavioral Risk Factor Surveillance System (BRFSS). For each year since 1986, the Commonwealth of Massachusetts has collected data on smoking through the BRFSS. This system includes a random-digit-dialed telephone survey of non-institutionalized adults years 18 or older. BRFSS is a cooperative effort between the Centers for Disease Control and Prevention (CDC) and state health departments. In 2006, 12,726 adults completed interviews conducted through the Massachusetts BRFSS. Data on maternal smoking prevalence were obtained from

certificates of live birth from Massachusetts Registry of Vital Records and Statistics for mothers who gave birth in Massachusetts in 2006.

Data on outcomes were provided from several sources. The American Cancer Society's Cancer Prevention Study provided estimates of the relative risks of mortality for smoking related diseases. Massachusetts mortality data were obtained from death certificates from the Registry of Vital Records and Statistics for the year 2006. Smoking prevalence data and relative risk estimates were used to calculate the smoking-attributable fraction (SAF) for each smoking related disease for adult current and former smokers aged 35 years and older. The SAFs were then combined with Massachusetts mortality data to estimate the number of deaths attributable to smoking.

Smoking-attributable years of potential life lost (YPLL) is defined as the sum of the years of life lost from premature deaths caused by smoking. This figure was obtained by multiplying the midpoint estimate of remaining life expectancy (RLE), which was obtained from 2004 National Centers for Health Statistics life tables, for each smoking-related disease, sex, and five-year age by the number of smoking-attributable deaths. Since Massachusetts, in general, had a longer life expectancy than US estimates, the life expectancy data from the 2004 US Life Expectancy tables may underestimate YPLL for Massachusetts residents. Table A. Expectation of Life by Age, Race, and Sex: United States, 2004, in 2004 National Centers for Health Statistics life tables was used for figure 2.

Smoking-attributable productivity costs are calculated as the estimated costs of lost future earnings from paid market and unpaid household labor resulting from premature death due to smoking-related disease. This measure is considered to be an economic parallel to YPLL and is based on the present value of future earnings with an annual 1% increase in labor productivity. SAMMEC uses updated age-specific present value of lifetime future earnings estimates from "Prevention Effectiveness: A Guide to Decision Analysis and Economic Evaluation" by A.C. Haddix et al. 1996. These cost data were combined with smoking-attributable mortality estimates of the year 2006 in Massachusetts to calculate total smoking-attributable productivity costs.

Smoking-attributable health care expenditures are defined as the excess personal health care costs of smokers and former smokers compared to those residents who have never smoked. Figures are obtained by applying the smoking-attributable fraction (SAF) to total health care expenditures for the state of Massachusetts. The SAF of medical expenditures reflects the proportion of annual personal health care expenditures that could be avoided if smoking were eliminated from the population. SAMMEC uses expenditures that could be avoided if smoking were eliminated from the population. SAMMEC uses expenditures SAFs from B.P. Miller et al. "Smoking Attributable Medical Care Costs in the United States" Social Science and Medicine, 1999. The health care expenditure data are for 1998 for the state of Massachusetts as published on CDC's SAMMEC website: http://apps.nccd.cdc.gov/sammec/show_same_data.asp.

The smoking-attributable fraction (SAF) is a critical calculation for the SAMMEC application. The SAF is used to calculate Smoking-Attributable Mortality (SAM) for 19 smoking-related diseases. The SAF is calculated using sex-specific smoking prevalence and relative risk (RR) of death data for adult current and former smokers age 35 and over. Infant mortality SAFs are calculated using maternal smoking prevalence and RR of death estimates for four perinatal conditions caused by smoking. The SAFs for each disease and sex are derived using the following formula:

$$SAF = \frac{p_0 + p_1(RR1) + p_2(RR2) - 1}{p_0 + p_1(RR1) + p_2(RR2)}$$

Where p_0 is the percentage of adult never smokers in the study group (in this case, Massachusetts residents), or with the maternal and child health calculations, the percentage of maternal nonsmokers in the study group.

p_1 is the percentage of adult current smokers in the study group, or with the maternal child health calculations, the percentage of maternal smokers in the study

p_2 is the percentage of adult former smokers in the study group. This figure does not apply to maternal child health calculations.

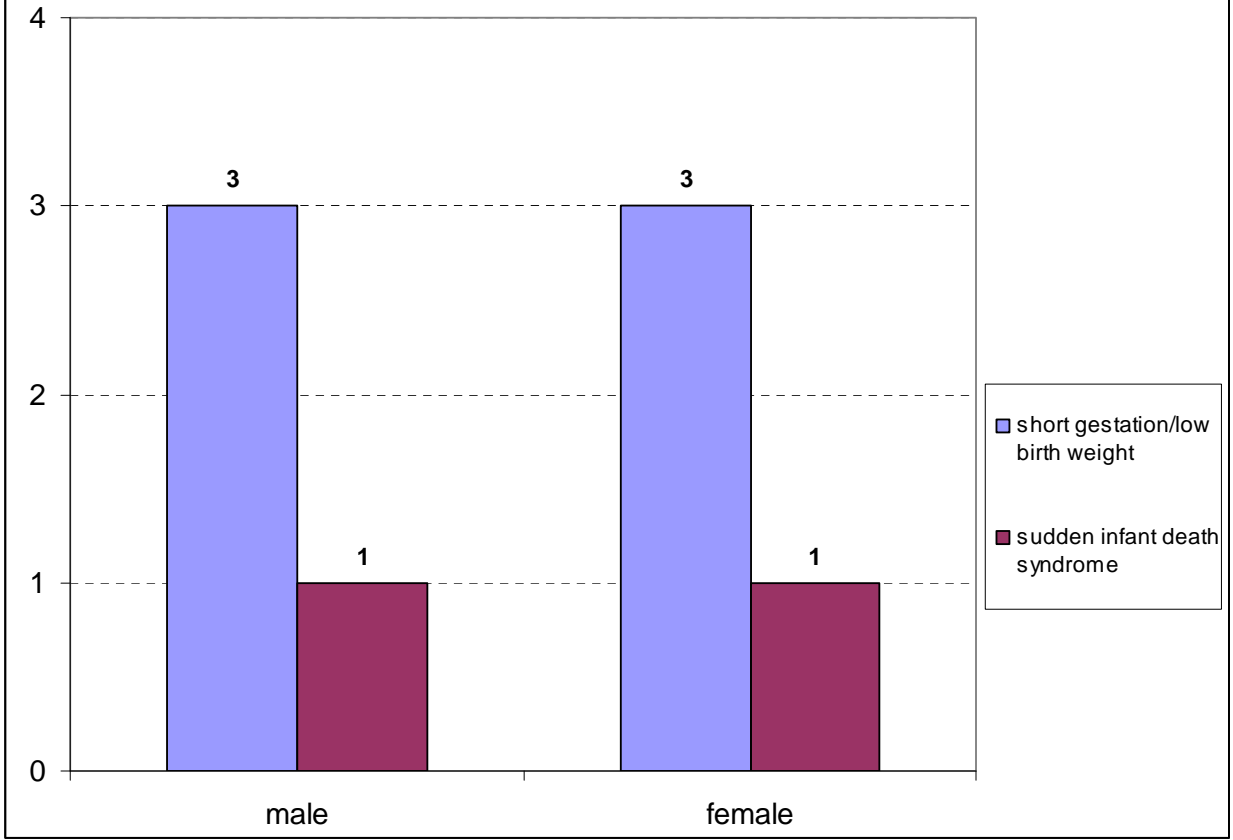
RR1 is the relative risk of death for adult current smokers relative to adult never smokers, or with the maternal and child health calculations, the relative risk of death for infants of maternal smokers relative to infants of maternal nonsmokers.

RR2 is the relative risk of death for adult former smokers relative to adult never smokers. This figure does not apply to maternal child health calculations.

Relative Risk estimates for persons 35 and older were obtained from the second wave of the American Cancer Society's Cancer Prevention Study (CPS-II), and six-year follow-up (Thun et al. 1997. ACS published). Relative risk estimates for short-gestation/low birth weight, Sudden Infant Death Syndrome (SIDS), Respiratory Distress Syndrome (RDS) and other infant conditions were obtained from a meta-analysis of the epidemiological literature conducted by Gavin et al. (2001).

All relative risk data are pre-set by the SAMMEC computer software package; death data and smoking prevalence data are Massachusetts-specific data and are input into the computer software programs to generate data for the above analyses.

Figure 1. Maternal and Child SAMMEC Infant Mortality (MA 2006)



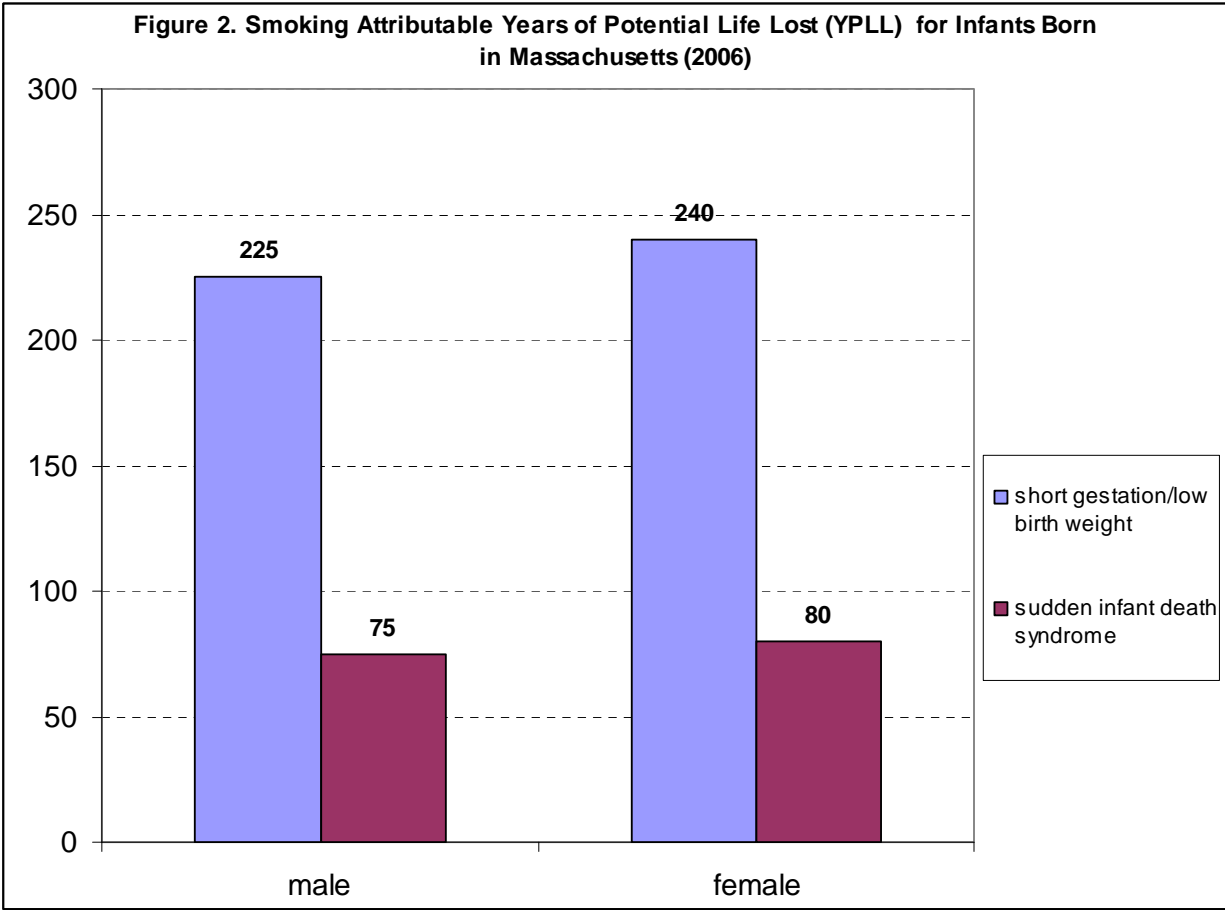


Figure 3. Smoking Attributable Productivity Costs in Massachusetts 2006 (age 35+)

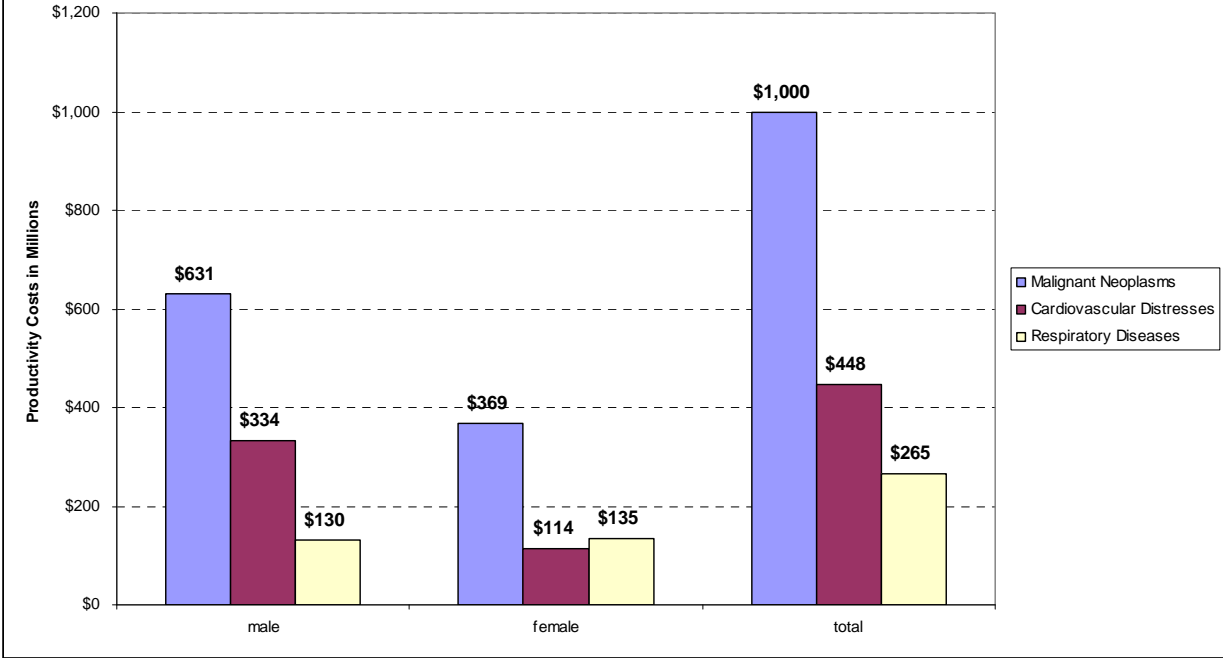
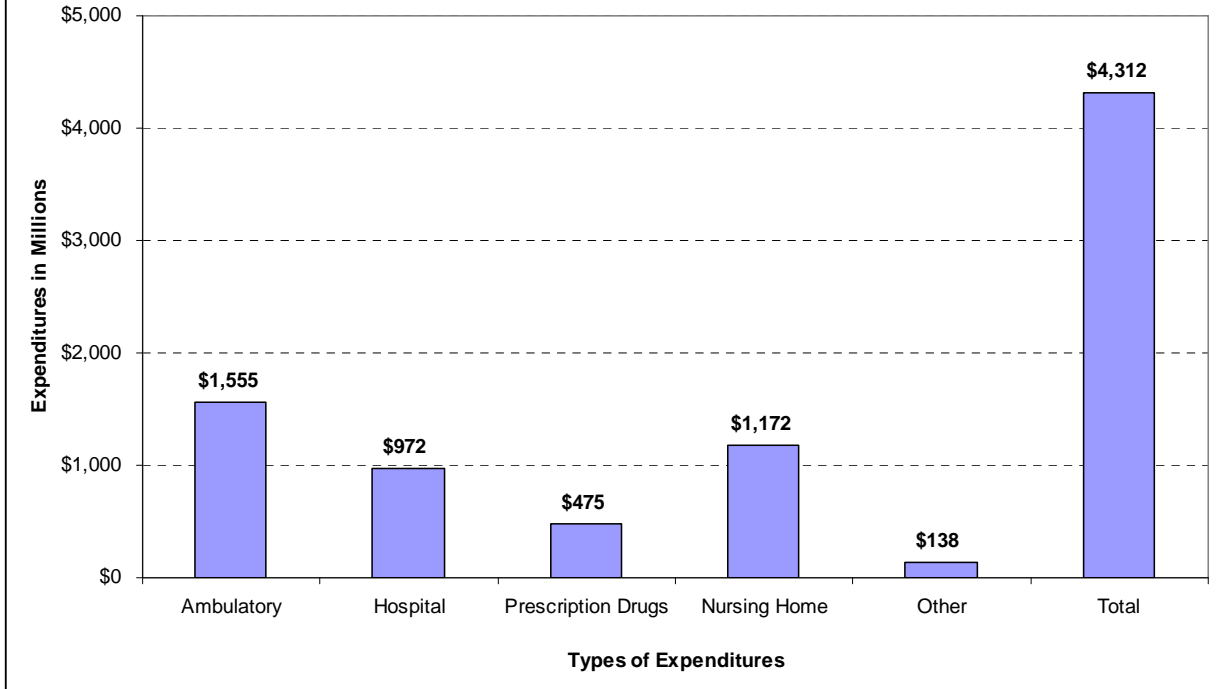


Figure 4. Smoking Attributable Health Care Expenditures in Massachusetts 2006 (age 35+)



Data based on National Health Expenditure 2006

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