The Economic Impact of Secondhand Smoke in Maryland

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Contents

Summary

This study calculates the economic costs of exposure to secondhand tobacco smoke (SHS) in Maryland – for individuals, employers, and society as a whole. The total costs reported in this study for calendar year 2005 are as follows:

- Costs related to childhood illness and death – $73.8 million.

- Costs related to adult illness and premature death – $523.8 million.

This study should be considered as an estimate of the lower limit of the true economic costs due to secondhand smoke in Maryland, for the following reasons:

- This study documents the costs of specific medical conditions that have been conclusively shown to be causally related to exposure to secondhand smoke. For children, these conditions include Respiratory Syncytial Virus (RSV) bronchiolitis, otitis media, asthma, and burns. For adults, the conditions are lung cancer, nasal sinus cancer, cervical cancer, heart attacks, arteriosclerosis, stroke, and asthma. There are additional potential health problems related to SHS that are not included in this study.

- Several categories of costs for medical care are not included – these include outpatient and pharmacy costs, as well as indirect costs related to the opportunity cost of time lost due to illness and medical care. The psychological costs of the negative effects of SHS – pain and suffering – are not included.

Although the costs reported in this study underestimate the true economic costs of secondhand smoke in Maryland, they provide a compelling argument to curtail exposure to secondhand smoke – by limiting smoking in public areas.

1. Introduction

Public awareness of the dangers of secondhand tobacco smoke (SHS) – also known as environmental tobacco smoke, passive smoking, and involuntary smoking – has advanced rapidly since former Surgeon General Jesse Steinfeld presented the health risks of secondhand smoke in 1970.[1, 2] Research in the 1980s found that more than 90 percent of U.S. residents had measurable levels of cotinine – a biological indicator for exposure to SHS – in their bloodstreams.[3]

Today, despite denials from the tobacco industry, exposure to secondhand tobacco smoke has been proven to be a significant health risk.[4, 5, 6] SHS contains several chemicals that are known carcinogens. The Environmental Protection Agency (EPA) has classified SHS as a carcinogen, a cancer causing agent.[7] In a work environment, "passive" smokers – those breathing secondhand smoke – actually inhale higher concentrations of several toxins and carcinogens than primary smokers. For each cigarette smoked by an employee, non-smoking employees exposed to SHS inhale the following estimated amounts of toxic chemicals:

- As much *benzene* as a smoker who has smoked six cigarettes; benzene is a carcinogen linked to leukemia and regulated in the United States as a hazardous air pollutant.[8]

- As much *4-aminobiphenyl* as a smoker who has smoked 17 cigarettes; 4-aminobiphenyl is a bladder carcinogen banned for use in dye manufacturing.

- As much *N-nitrosodimethylamine* as a smoker who has smoked 75 cigarettes.[9, 10]

For adults, SHS is associated with different types of cancer (including lung, nasal sinus, and cervical cancer), myocardial infarction (heart attacks), arteriosclerosis, stroke, and asthma.[11, 12] For infants and children, exposure to SHS has been shown to be causally

related to low birth weight, perinatal death, sudden infant death syndrome, Respiratory Syncytial Virus (RSV) bronchiolitis, otitis media, asthma, and burns.

This study calculates the economic costs of exposure to secondhand tobacco smoke (SHS) in Maryland. These costs include physician visits, visits to the emergency room, hospitalizations, and the economic value of premature deaths. The study closely follows the methodology of a similar study conducted by Terrell Zollinger and colleagues in Marion County, Indiana, in 2002. In addition to changing the population setting from Marion County to the State of Maryland, the calculations in that study have been updated to reflect the most recent economic and epidemiological data available. Our study also adds some components not included in the Marion County study, using state-specific data from Maryland and estimates from the U.S. Centers for Disease Control.

This study provides important data for policy makers in Maryland. In terms of tobacco control policies and related public education programs, the State generally lags behind others. A January 2006 report from the American Lung Association assigns Maryland a grade of "F" for its spending on tobacco prevention and control programs. Maryland's FY 2006 Tobacco Prevention and Control appropriations total $10.7 million; the Centers for Disease Control and Prevention (CDC) suggest that spending in the State should instead be $30.3 million or more.[13]

2. Methodology

This section describes important methodological issues common to studies attempting to assign economic values to illness, productivity losses, and premature mortality – as well as the approach taken in this study for each of these issues.

A. Calculating Numbers of Cases of Diseases due to Secondhand Smoking

Following Zollinger *et al*, we calculate the numbers of cases of the following diseases – causally related to exposure to secondhand smoke – based on national attributable risk data:

For Children

- Sudden Infant Death Syndrome (SIDS).

- Respiratory Syncytial Virus (RSV) bronchiolitis – this virus usually causes cold-like symptoms including runny nose, sore throat, mild headache, mild cough, and low-grade fever. Bronchiolitis is a respiratory illness that affects the bronchioles, tiny airways that lead to the lungs.

- Acute otitis media – an ear infection, accompanied by fluid in the middle ear, pain, and possible fever.

- Asthma;

- Low birth weight; and

- Perinatal death – from five months before birth to one month after birth.

For Adults

- Lung cancer;

- Nasal sinus cancer;

- Heart disease;

- Stroke; and

- Cervical cancer and asthma.

There are other medical conditions that have been linked to SHS that are not included in this study – including spontaneous abortions and perinatal mortality.[14]

The numbers for Maryland are based on several sources. For child cases, asthma rates are based on data from the National Center for Health Statistics and the Maryland Department of Health and Mental Hygiene.[15, 16] The prevalence of other childhood diseases linked to SHS is based on Zollinger *et al*. For adult cases, hospitalizations due to stroke are based on national numbers compiled by the Agency for Healthcare Research and Quality (AHRQ), through the Healthcare Cost and Utilization Project (HCUP).[17] Asthma emergency department visits and hospitalizations are based on data provided by the National Center for Health Statistics (NCHS). Data on hospitalization and mortality caused by cancers – including lung cancer and nasal sinus cancer – are provided by the Cancer Statistics Working Group within the Department of Health and Human Services.[18] Mortality rates for other conditions linked to SHS come from the Centers for Disease Control and Prevention (CDC).[19]

Population Attributable Risk (PAR) is the proportion of cases of a disease and associated mortality in a given population that can be considered to be causally related to exposure to a risk factor.[20] PAR is calculated as:

$$\frac{(\text{Incidence in total population}) - (\text{Incidence in unexposed group})}{(\text{Incidence in total population})}$$

For example, if the incidence of hospitalization for lung cancer for an entire population of non-smokers is 20.0 percent, and the incidence among those *not* exposed to secondhand smoke is 17.2 percent, the risk attributable to exposure to SHS would be:

$$\frac{(0.2 - 0.172)}{0.2} = \frac{0.028}{0.2} = 0.14 = 14.0\%$$

In this study, attributable risk data are based on published analyses of the relationship between specific diseases, mortality from those diseases, and exposure to SHS.[5, 21] All population-based rates are adjusted to the full Maryland population for 2005, using the results of the Current Population Surveys (CPS) from 2000, 2002, and 2005.[22]

B. Calculating Outpatient and Hospitalization Costs

The costs of physician visits, visits to the emergency room, and hospitalizations for conditions related to SHS are derived from Zollinger *et al*, as well as published analyses of these cases,[5, 23] and – for asthma – a study conducted on this topic by the Maryland, Department of Health and Mental Hygiene. Average hospital charges for several conditions – including lung cancer, nasal sinus cancer, myocardial infarction (heart attack), stroke, cervical cancer, and arteriosclerosis – are provided by the Agency for Healthcare Research and Quality (AHRQ).

C. Calculating Disease Specific Death Rates and Low Birth Weight Rates

National disease-specific mortality rates are available from the Centers for Disease Control and National Center for Health Statistics. Additionally, the Maryland DHMH Cigarette Restitution Fund Annual Cancer Report includes disease specific age-adjusted mortality rates for all types of cancer related to cigarette smoke.

D. Perspective for Costing

There are important differences among health-related costing studies in terms of the perspective from which costs are calculated. This study uses a societal perspective – in other words, all costs are included whether they accrue to the individual, a third party payer, or society at large. Some estimates are provided from employers perspective – specifically, the average additional costs to employers per employee who smokes.

E. Calculating the Cost of a Premature Death

Assigning a monetary value to human life is a controversial task. Among studies that quantify the value of lost human life, there is considerable variation in the monetary value assigned to one life. The value of life is most commonly calculated using estimates of the quality of life and wage premiums for risky jobs.

The values used among studies commonly cited in the literature range from $3.3 to $7.1 million U.S. dollars per life.[24] A review of 29 cost-benefit studies and found that the mean value given to a human life in these studies was $4.2 million (all estimates in 2005 dollars).[25] A separate review of 21 studies and found a range of $3.1 million to $13.7 million.[26] Most of these studies base the value of life on lost productivity; a different approach – using wage-risk trade-offs – places the value of life between $4.0 million and $9.4 million.[27]

The current study takes a conservative approach. To assign an economic value to the death of children, we use a value from the lower limit of estimates in the literature – $2.5 million. For premature death for adults, we use the values assigned by Zollinger *et al*, which are specific to the cause of death. These values are also conservative – generally in the range of $50,000 per lost year of life.

F. Adjustments for Inflation

U.S. dollar values from previous years are converted to 2005 U.S. dollars using the U.S. consumer price index (CPI). Costs of medical care – including hospitalizations and physician visits – are adjusted to 2005 dollars using the U.S. CPI for medical services.[28]

3. Results

A. Smoking Rates and Exposure to SHS in Maryland

The Maryland Department of Health and Mental Hygiene (DHMH) provides estimates of exposure to secondhand smoke – derived from the 2001 and 2003 Maryland Tobacco Surveys. A high proportion of under-age youth are still being subjected to secondhand smoke – 55.4% of under-age youth reported were exposed to secondhand smoke during the week preceding a survey conducted in 2002. This rate was higher – over 73% – for youth who live with smokers.

For adults in Maryland, the rate of exposure to secondhand smoke in the workplace was 22.8% in 2002. The highest rate of exposure was to adults without a high school education (35.6%); the lowest rate was for college-educated adults (15.5%) – see Figure 1.

Figure 1. Adult Exposure to Secondhand Smoke in Maryland
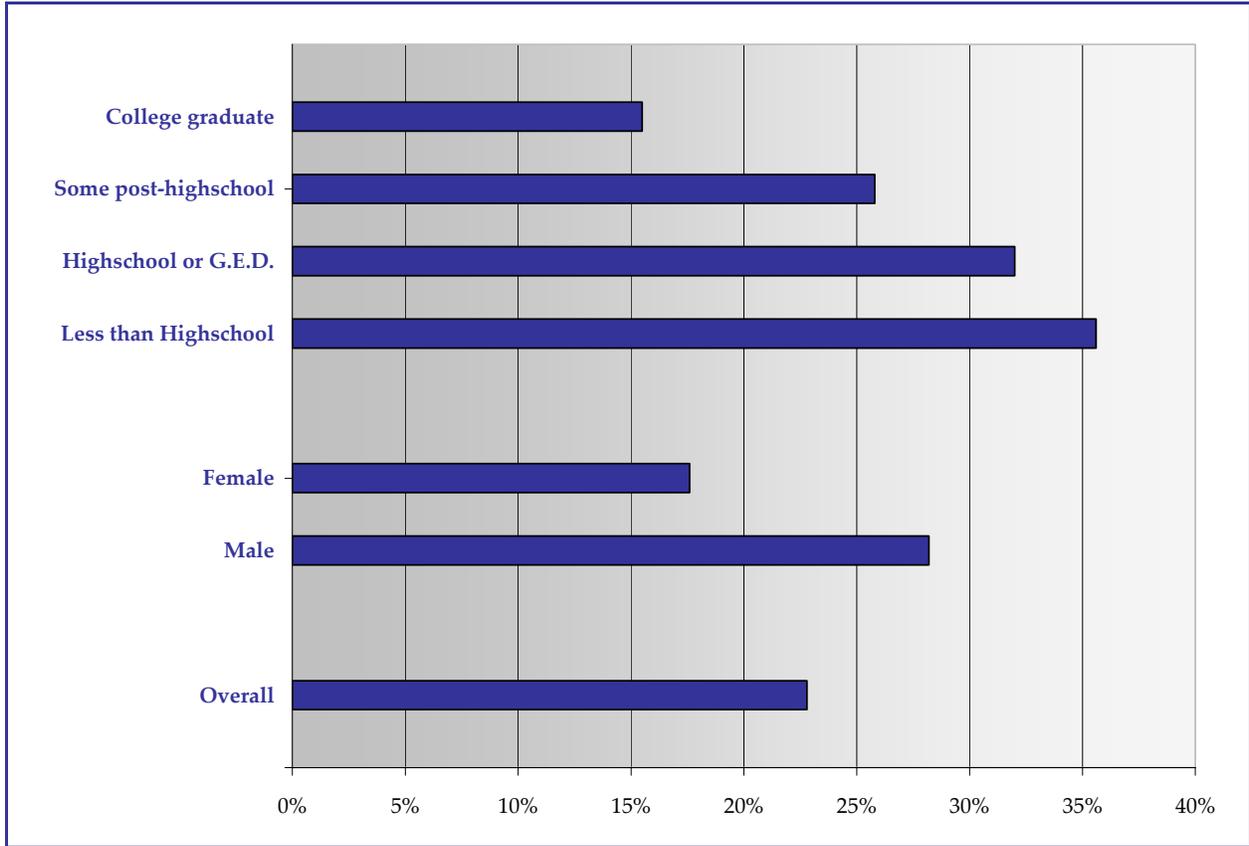
In terms of place of employment, by far the highest rate of exposure was for adults employed in bars and taverns (97.8%) – compared with adults employed in schools and universities, who had the lowest rate of exposure (12.8%) – see Figure 2.[29]

Figure 2. Adult Exposure to SHS in Maryland, by Occupation
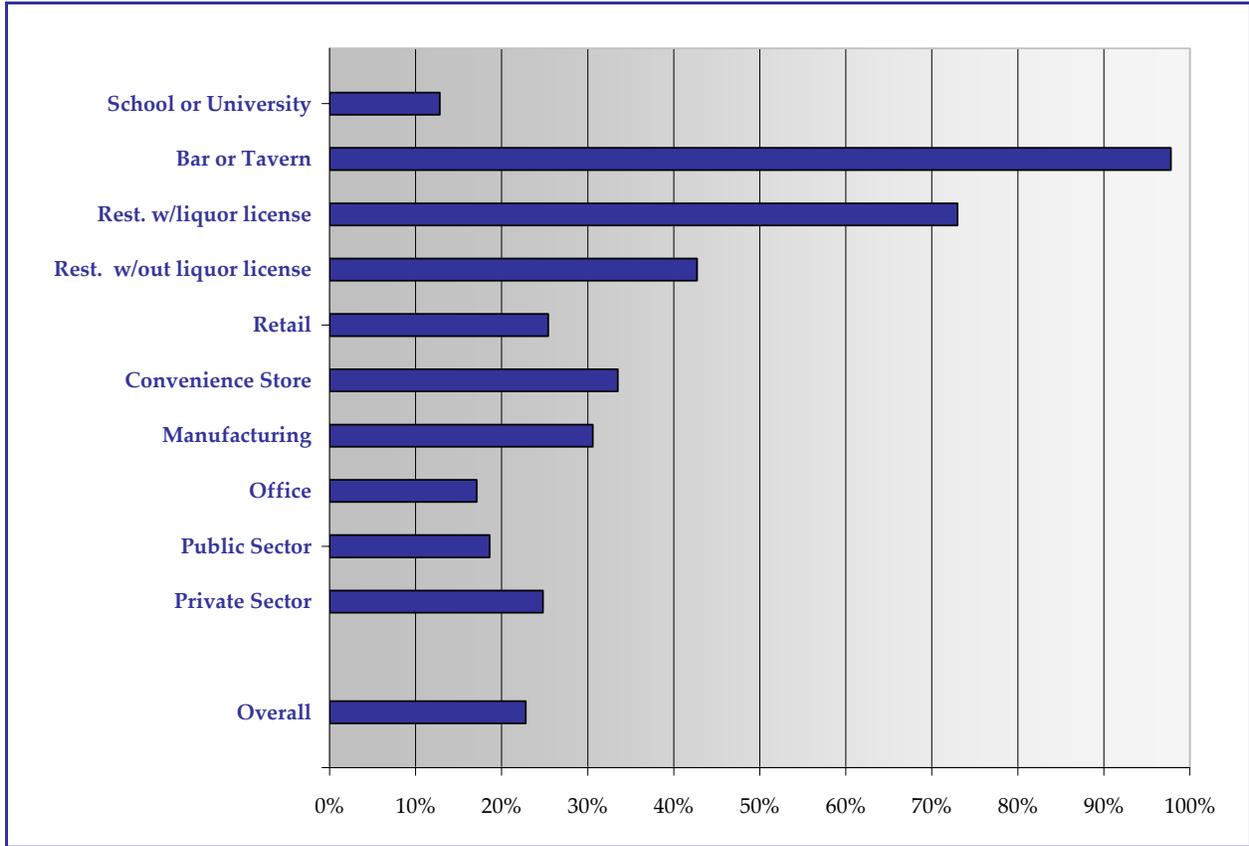
B. Costs Related to Childhood Illness and Death

Table 1, on the next page, shows the costs of secondhand smoke in terms of childhood morbidity and mortality. These costs total $73.8 million. The most common health care conditions related to secondhand smoke for children are office visits for acute otitis media (9,112 estimated visits) and asthma (13,382 estimated visits).
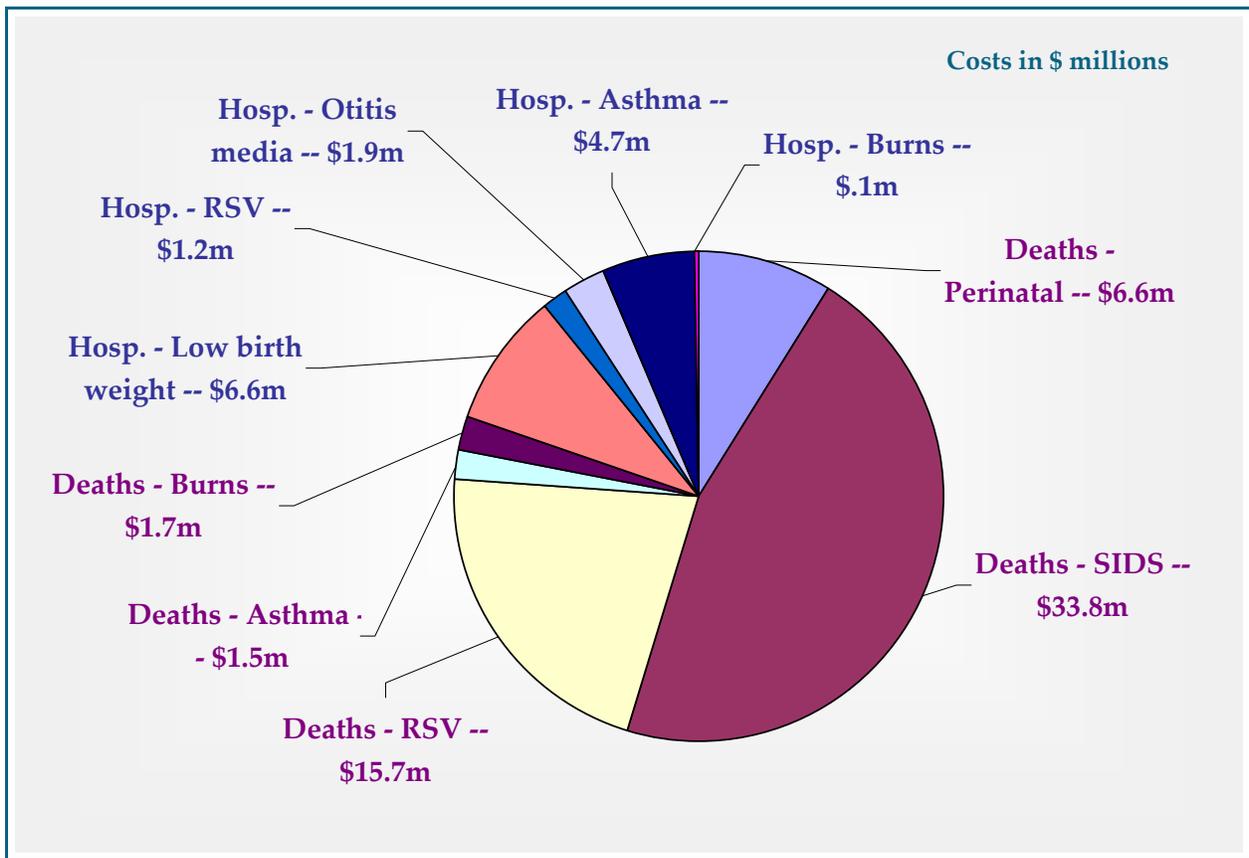
Table 1. Costs Related to Child Illness and Mortality

Event	Age Group	Number Events U.S. 2000	Number Events Maryland 2005	Population Risk Attributable to SHS	Events Maryland Attributable to SHS	Cost per Event (2005 $)[†]	Costs Maryland Attributable to SHS (2005 $)
Illness							
Low birth weight	Births	46,000	864	18%	156	$42,160	$6,556,270
RSV bronchiolitis -- hospitalizations	< 3 years	22,000	503	25%	126	$9,560	$1,203,024
Acute otitis media -- office visits	< 15 years	3,400,000	65,083	14%	9,112	$72	$655,310
Otitis media -- tympanostomies	< 18 years	110,000	2,106	14%	295	$4,375	$1,289,618
Asthma -- ER visits	< 18 years	1,800,000	1,801	14%	252	$716	$180,577
Asthma -- office visits	< 18 years	1,800,000	95,585	14%	13,382	$160	$2,140,571
Asthma -- hospitalizations	< 18 years	194,457	3,757	14%	526	$4,532	$2,383,500
Burns -- outpatient visits	< 15 years	10,000	191	14%	27	$3,660	$98,097
Burns -- hospitalizations	< 15 years	590	11	14%	2	$3,660	$5,788
Total Illness			**169,902**		**23,876**		**$14,512,755**
Deaths							
Perinatal deaths	< 1 month	2,800	53	5%	3	$2,500,000	$6,573,458
SIDS	< 1 year	2,000	38	36%	14	$2,500,000	$33,806,357
RSV bronchiolitis	< 3 years	1,100	25	25%	6	$2,500,000	$15,729,259
Asthma	< 18 years	216	4	14%	1	$2,500,000	$1,460,908
Burns	< 15 years	250	5	14%	1	$2,500,000	$1,674,936
Total Deaths			**124**		**24**		**$59,244,919**
Grand Total							**$73,757,674**

[†] Costs include physician visits, visits to the emergency room, hospitalizations, and costs of premature deaths (see Section 2B of this study).

However, the costs related to deaths – most of which are caused by Sudden Infant Death Syndrome and Respiratory Syncytial Virus (RSV) bronchiolitis – are considerably greater than the corresponding hospitalization and health care utilization costs. The costs of burns – which caused an estimated one child death in Maryland in 2005 – are relatively minor compared to the other categories of costs. Figure 3, below, the relative values of children's costs related to hospitalizations and deaths.

Figure 3. Children: Costs Attributable to SHS = $73.8 Million

Costs in $ millions

Hosp. - Otitis media -- $1.9m

Hosp. - Asthma -- $4.7m

Hosp. - Burns -- $.1m

Hosp. - RSV -- $1.2m

Deaths - Perinatal -- $6.6m

Hosp. - Low birth weight -- $6.6m

Deaths - Burns -- $1.7m

Deaths - SIDS -- $33.8m

Deaths - Asthma - $1.5m

Deaths - RSV -- $15.7m

C. Costs Related to Adult Illness and Death

Table 2, on the next page, presents the costs of secondhand smoke in terms of health care and mortality for adults. As is to be expected, these costs – totaling $523.7 million – are much greater than for children. However, most of the costs for adults come from hospitalization, rather than from deaths. This is partly due to the conservative approach taken here for valuing the "cost" of death – following Zollinger *et al*, we have considered only the lost years of life for premature death without assigning a premium for loss of life as is typically the case in cost-benefit analyses involving the valuation of human life.
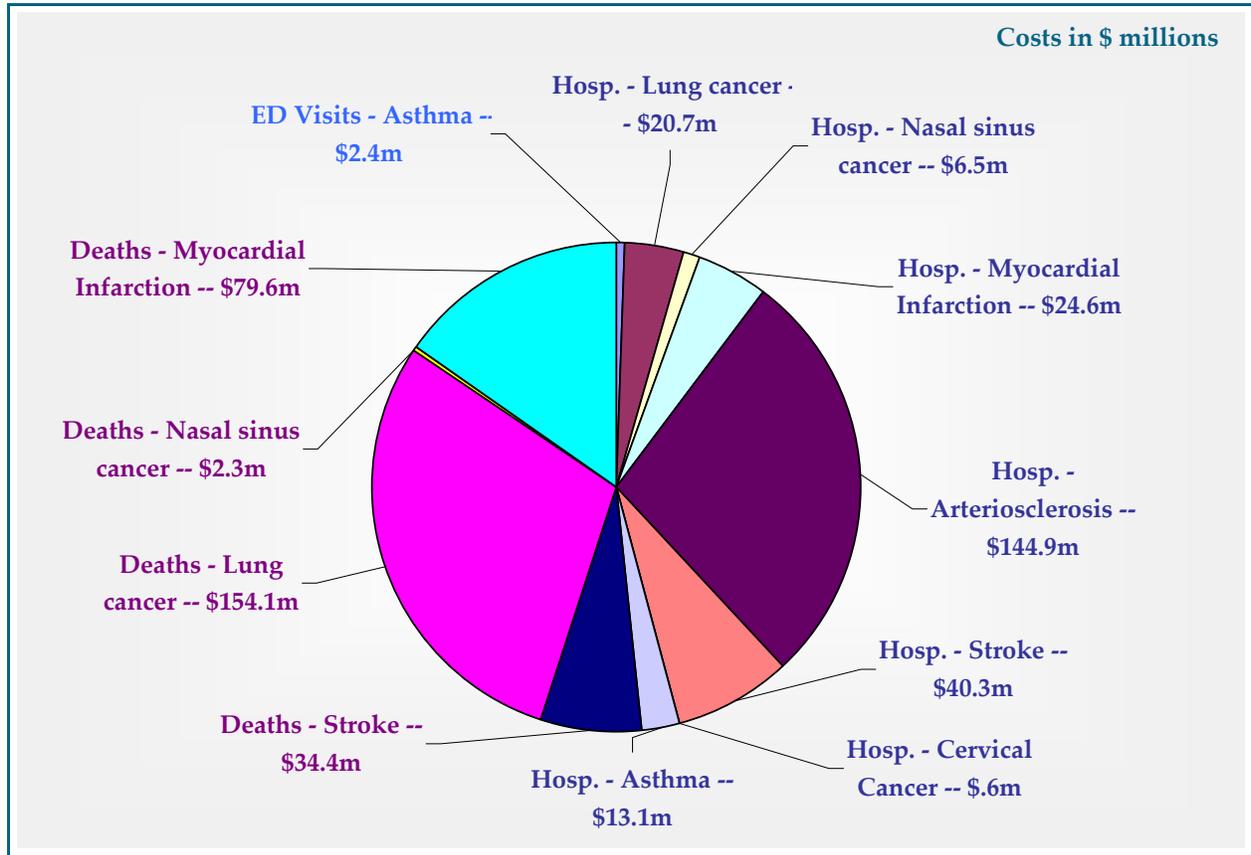
Nonetheless, premature deaths from lung cancer represent a considerable economic burden – an estimated $154.1 million. Hospitalizations due to Arteriosclerosis are the next largest cost category, accounting for $144.9 million in terms of health care costs in 2005. Other significant sources of costs include hospitalizations and deaths caused by stroke, accounting for $40.3 and $34.4 million, respectively (Figure 4).

Table 2. Costs Related to Adult Illness and Mortality

Event	Number Events Maryland 2005	Population Risk Attributable to SHS	Events Maryland Attributable to SHS	Cost per Event (2005 $)†	Costs Maryland Attributable to SHS (2005 $)
Emergency Department Visits					
Asthma	10,346	33%	3,414	$716	$2,444,608
Total ED Visits			**3,414**		**$2,444,608**
Hospitalizations					
Lung cancer	4,170	14%	580	$35,753	$20,727,531
Nasal sinus cancer	602	29%	172	$37,796	$6,509,279
Myocardial Infarction	15,168	4%	592	$41,655	$24,640,507
Arteriosclerosis	25,656	17%	4,285	$33,823	$144,918,686
Stroke	11,198	13%	1,445	$27,921	$40,332,325
Cervical Cancer	587	6%	32	$18,841	$608,113
Asthma	5,604	33%	1,849	$7,073	$13,080,656
Total Hospitalizations			**8,954**		**$250,817,096**
Deaths					
Stroke -- deaths	2,623	13%	338	$101,680	$34,411,667
Lung cancer -- deaths	3,252	14%	452	$340,957	$154,138,910
Nasal sinus cancer -- deaths	12	29%	3	$685,000	$2,263,256
Myocardial Infarction -- deaths	11,350	7%	783	$101,680	$79,633,972
Total Deaths			**1,577**		**$270,447,805**
Grand Total					**$523,709,509**

† Costs include physician visits, visits to the emergency room, hospitalizations, and costs of premature deaths (see Section 2B of this study).

Figure 4. Adults: Costs Attributable to SHS = $523.7 Million

Costs in $ millions

- Hosp. - Lung cancer -- $20.7m
- ED Visits - Asthma -- $2.4m
- Hosp. - Nasal sinus cancer -- $6.5m
- Deaths - Myocardial Infarction -- $79.6m
- Hosp. - Myocardial Infarction -- $24.6m
- Deaths - Nasal sinus cancer -- $2.3m
- Hosp. - Arteriosclerosis -- $144.9m
- Deaths - Lung cancer -- $154.1m
- Hosp. - Stroke -- $40.3m
- Deaths - Stroke -- $34.4m
- Hosp. - Cervical Cancer -- $.6m
- Hosp. - Asthma -- $13.1m

4. Limitations

A. Costs Not Included

This study should be considered as an estimate of the lower limit of the true economic costs due to secondhand smoke in Maryland. There are several reasons why this is true:

- Other diseases and conditions may be causally related to secondhand smoke (SHS). We have taken a conservative approach to linking diseases with SHS, based on proven epidemiological links, published in peer-reviewed journals. There are likely to be other, as yet undocumented, links between human health and exposure to SHS.

- Several categories of costs for medical care are not included – these include outpatient and pharmacy costs, as well as indirect costs related to the opportunity cost of time lost due to illness and medical care. The psychological costs of the negative effects of SHS – pain and suffering – are not included. Together, these costs could be substantial.

B. The Value of Life

The value for a lost life is calculated in a very conservative fashion in this study. For adults, the costs related to deaths caused by secondhand smoke are based on an assigned value – approximately $50,000 – per lost year of life for premature death. However, most studies of the economic impact of health interventions assign a premium value to the loss of life – based on pain and suffering, lost quality of life, and lost income – ranging from $3.1 to $9.4 million. If this approach were to be taken in this study, the overall costs calculated to be due to secondhand smoke would be larger by several orders of magnitude.

C. Time Frame

This study uses a one year time frame, and has not taken account of any costs that occur in future years. Nearly all studies that calculate costs and benefits beyond a one year time frame use some kind of discount rate to discount future costs and benefits – based on the principle that humans value consumption and quality of life in the present more than they do an equivalent amount of consumption in the future. This concept is rooted in uncertainty about the future – making it more desirable to consume or benefit from life in the short-run than to wait for the equivalent amount of consumption in the future.

5. Conclusions and Recommendations

The total costs directly attributable to secondhand smoke for Maryland for calendar year 2005 are as follows:

- 1,577 adult deaths.

- 24 child deaths.

- Costs related to childhood illness and death – $73.8 million.

- Costs related to adult illness and premature death – $523.8 million.

How do these numbers compare to national estimates? 1,577 adult deaths caused by secondhand smoke is equivalent to 0.028% of the State's population. This number is compatible with the Centers for Disease Control and Prevention (CDC) estimate that 50,000 passive smokers die on an annual basis in the U.S. – 0.017% of the national population.[14, 30]

The costs related to childhood and adult illness and death are based on conservative estimates of the population attributable risk due to secondhand smoke for specific diseases and do not include additional potential health problems related to SHS. Also, several categories of costs for medical care are not included – including outpatient and pharmacy costs, and indirect costs related to the opportunity cost of time lost due to illness and medical care. The psychological costs of the negative effects of SHS – pain and suffering – are not included.

These estimated costs are therefore likely to underestimate the true economic costs of secondhand smoke in Maryland.   Still, the estimates provide a compelling argument to curtail exposure to secondhand smoke – by limiting smoking in public areas.

There are especially strong arguments for curtailing smoking in restaurants and bars. Nationwide, food service workers have a 50 percent greater risk of dying from lung cancer than the general public, in part because of their continuous exposure to secondhand smoke in the workplace. Only 43 percent of food service workers are covered by smoke-free policies, compared to 76 percent of white-collar workers. In restaurants, the levels of secondhand smoke are 1.6 to 2.0 times higher than levels in office worksites. Levels of secondhand smoke in bars are 3.9 to 6.1 times higher than levels in offices.[31]

The results of this study should be used to educate the public and inform policymaking related to limitations on smoking in public areas and publicly accessible areas – including bars, businesses, schools, colleges and universities, day care centers, and restaurants. There is ample evidence that legislation to limit smoking is effective:

- The percentage of hospitality workers (in restaurants, bars, and hotels) exposed to secondhand smoke declined from 91 percent to 14 percent one year after New York's law banning smoke in public areas went into effect. The amount of time that hospitality workers were exposed to secondhand smoke on the job decreased by 98 percent – from 12.1 hours to 0.2 hours.[32]

- Cotinine concentrations among New York City hospitality workers had decreased by 83% one year after banning smoke in public areas.

- One month after California's bars were required to go smoke-free, 78 percent of bartenders with prior sensory irritation symptoms (eye, nose, or throat irritation) reported no symptoms.[33]

Most importantly, as seen in this report, banning smoking in bars and restaurants will reduce workers' long-term risk of lung cancer and cardiovascular disease.[34, 35, 36, 37, 38]

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