

1. Introduction

With the U.S. population expected to age rapidly over the next half century, environmental health effects among older Americans are becoming an increasingly important public health concern. Forecasts suggest that the elderly population is likely to grow to 70 million people by 2030, and the number of individuals over 85 years is expected to increase to 19 million by 2050—an almost fivefold increase between 2000 and 2050.

For several reasons, a rapidly growing elderly population presents unique challenges in the area of environmental health. First, because of diminished immunity associated with aging, older adults are often more susceptible than younger adults to environmental hazards. Second, the prevalence of diseases that can further compromise immunity, such as Alzheimer’s and diabetes, tend to be highest among the elderly. Finally, older persons have accumulated a lifetime of exposures that persist in the body and may manifest as health problems long after the time period of exposure.

The U.S. Environmental Protection Agency’s (EPA’s) Aging Initiative has been established precisely to address these challenges. EPA launched the Aging Initiative in 2002 to “prioritize and study environmental health hazards to older persons and examine the effect that a rapidly growing aging population will have on our environment” (EPA, 2003). Through this initiative, the Agency is developing a national agenda on the environment and aging, with efforts focused on research that could lead to developing and implementing policies to better protect older Americans from the health effects of environmental exposures. One such research effort is to develop a better understanding of the burden of disease associated with environmental exposures among the elderly.

The purpose of this report is to contribute to this research effort by assessing the economic burden of specific illnesses among the elderly. The analysis focuses on health conditions for which environmental exposure are known or suspected to be an important contributing factor. In particular, we analyzed costs for specific health conditions within the following six illness categories:

- chronic respiratory disease
- heart disease
- stroke
- lung cancer
- pneumonia
- gastrointestinal illness

In Section 2, we provide a more detailed description of the specifically selected health conditions, and we also discuss the main reasons for selecting these conditions. The discussion in Section 2 includes a summary of the evidence linking these conditions with environmental exposures.

To assess the economic burden of the selected illnesses among the elderly, we applied a cost-of-illness (COI) approach. This approach is well established in the field of health valuation and has been widely applied to assess losses for a variety of illnesses. In Section 2 we describe the conceptual framework underlying COI and the primary issues associated with conducting this type of analysis. We also summarize the evidence from previous COI research related to these conditions. Although we identified over 20 articles published since 1990 that have estimated costs for these (or related) conditions, the methods and results of these studies varied widely and few of them specifically focused on health effects in older Americans. Our analysis was designed to address the limitations and gaps in this literature.

By applying a consistent set of COI methods, data sources, and disease classifications and by limiting our attention to older Americans, our analysis provides estimates of the burden of illness that are directly comparable across conditions and are targeted to the population of interest for EPA’s Aging Initiative. Based on available data, we estimated the main health care costs (direct costs) and productivity losses (indirect costs) associated with the prevalence of the six conditions among adults 65 years and older in 2000. In Section 3, we describe the data and the methods we used to construct our cost estimates. To estimate direct costs associated with each condition, we primarily relied on Medicare claims data from a nationally representative sample of Medicare fee-for-service beneficiaries. We supplemented these direct cost estimates using national survey data to estimate incremental prescription drug (self-

administered) and nursing home costs. To estimate indirect costs, we combined national health and earnings data to estimate both morbidity and mortality related productivity losses for the 65 and older population. Section 3 also describes the main limitations and caveats associated with these data and methods, which must be kept in mind when interpreting the results.

It is important to emphasize that the cost estimates developed with these approaches should not be interpreted as those specifically attributable to environmental exposures. Unfortunately, the science and empirical evidence regarding the epidemiological links between environmental exposures and these health outcomes are not sufficiently advanced to reliably estimate this attributable fraction. Consequently, the results are more appropriately interpreted as upper-bound estimates of environmentally related costs of illness for these conditions.

Section 4 describes the results separately for each of the six health categories. We break down medical costs by type of medical service (e.g., inpatient, physician visits, hospital outpatient) and by age and gender category. Estimates of prescription drug and nursing home costs are separately reported by age and gender category. The indirect costs are divided into losses associated with morbidity and those due to mortality, and they are also subdivided according to age and gender category.

Table 1-1 summarizes our results by reporting estimated aggregate direct and indirect costs for each of the six illness categories. Comparisons of these aggregate cost estimates across illness categories must be made with caution. Due to data limitations, certain components of direct and indirect costs could not be reliably estimated for different illnesses (see footnotes to Table 1-1). Nevertheless, the results clearly suggest that chronic lung disease and ischemic heart disease are the two categories of illness with the largest aggregate costs in 2000. The point estimate for chronic lung disease exceeds \$35 billion and, even without nursing home costs included, the point estimate for ischemic heart disease is close to \$52 billion. Gastrointestinal illness is estimated to impose the lowest aggregate cost of the six conditions, but even without estimates of nursing home or morbidity related productivity losses, its aggregate costs are estimated to exceed \$1 billion. For each of the six conditions, direct medical costs comprise the largest component of estimated aggregate costs.

The numbers reported in Table 1-1 represent our best point estimates of aggregate costs for the selected illnesses; however, these estimates are best interpreted as midpoints within a range of uncertainty. This uncertainty arises from several different sources and for several different reasons which are discussed throughout the report and summarized in the concluding section (Section 6). To partially quantify this uncertainty, the results described in Section 4 also include confidence intervals for several of the key values that went into constructing the aggregate cost estimates.

Table 1-1. Estimated Aggregate Annual Costs of Illness Among Older Americans for Selected Health Conditions in 2000 (in millions of 2000\$)

	Chronic Lung Disease	Ischemic Heart Disease	Stroke
Direct Costs	27,294	42,239	11,840 ^a
Indirect Costs	6,605	7,913	6,292
Total Costs	33,898	50,152	18,133
	Lung Cancer	Pneumonia	Gastrointestinal Illness
Direct Costs	4,277 ^b	10,936	1,006 ^a
Indirect Costs	173 ^c	4.7 ^d	0.039 ^d
Total Costs	4,450	10,941	1,006

^aDoes not include nursing home costs.

^bDoes not include self administered prescription drug or nursing home costs.

^cDoes not include lost household productivity for morbidity.

^dDoes not include any morbidity related productivity losses.