THE NATIONAL AND GLOBAL IMPACT OF COPD*

Tina V. Hartert, MD, MPH,† and Mary G. Gabb, MS‡

ABSTRACT

Chronic obstructive pulmonary disease (COPD) is a widespread, under-recognized, and under-diagnosed disease. Underestimates of the prevalence and attributable mortality rates are multifactorial, and include: an asymptomatic disease period, an aging worldwide population that was not previously at risk because the average life expectancy even in smokers was less than age 50, and increasing use of tobacco worldwide. COPD is the forth most common cause of death in the United States and ranges from fifth to 14th worldwide. Mortality from COPD is increasing most rapidly in those areas of the world with the greatest tobacco use, and among women. Of the 10 most common causes of death in the United States, COPD is the only disease with an increasing mortality rate. The impact of this disease on women is also evidenced by attributable mortality, which is increasing at a faster rate in women than men, and is now the fourth most common cause of death among women.

COPD is largely a preventable disease. Primary prevention aimed at preventing smoking initiation and smoking cessation are the most effective and cost-efficient interventions for reducing the risk of developing COPD and stopping its progression. While smoking rates overall are declining in the United States, the fastest growing group of smokers in the United States is teenage girls. Primary prevention efforts should target this vulnerable group who are likely to smoke as adults and during pregnancy. The economic burden of COPD is high, with annual direct and indirect costs comparable to asthma and hypertension. COPD can be both prevented and diagnosed prior to symptom onset if the appropriate risk factors are identified and spirometry is performed in at-risk patients.


DEFINING COPD

Until recently, chronic obstructive pulmonary disease (COPD) has been a disease virtually unknown by the general public. COPD has only very recently been called "the other lung disease" by the lay press. Such lack of awareness is a result of imprecise definitions of the disease, lack of routine screening for this disease and thus, poor estimates of prevalence, morbidity, and mortality. The World Health Organization (WHO) along with the National Heart, Lung and Blood Institute developed a global strategy on the diagnosis, management, and prevention of COPD, termed the Global Initiative for Chronic Obstructive Lung Disease (GOLD), and has published their reports and executive summaries, which are available online (www.goldcopd.com). First published in 2001, these guidelines are updated about every 2 years. The American Thoracic Society and the European Respiratory Society also publish expert guidelines on COPD, including specific strategies for those in primary care (www.thoracic.org/copd).

According to the GOLD guidelines, COPD is defined as "a disease state characterized by airflow limitation that is not fully reversible. The airflow limitation is usually both progressive and associated with an abnormal inflammatory response of the lungs to noxious particles or gases." This definition seeks to dis-
distinguish COPD from asthma. Traditionally, COPD was considered to be a mixture of emphysema, chronic bronchitis, and asthma. However, with an improved understanding of the pathophysiology of COPD, we now realize that while COPD is also an inflammatory disease, it differs from asthma in several important ways: inflammatory mediators (asthma is primarily a disease characterized by eosinophilic inflammation, and COPD is characterized primarily by neutrophilic inflammation), response to treatment, and reversibility (Figure 1).2,4,5 While some patients have both diseases, asthma can usually be distinguished from COPD. COPD comprises 2 major diseases that often coexist—emphysema and chronic bronchitis. Emphysema describes the destruction of gas-exchanging surfaces (alveolae septa) leading to airspace enlargement and loss of elasticity.6 Chronic bronchitis is formally defined as the presence of cough or sputum production for at least 3 months in each of 2 consecutive years, however, most patients have perennial cough and phlegm.7 The contributions of airway obstruction and destruction of lung parenchyma (ie, the gas-exchanging surfaces) to COPD development vary with each patient.7 The key concepts, therefore, for defining COPD are progressive airflow obstruction that is not fully reversible. The extent of reversibility is important not only in distinguishing COPD from asthma, but also in the healthcare practitioner’s approach to treating COPD.

COPD IN THE UNITED STATES: PREVALENCE AND MORTALITY

Because of the prior differences and ambiguities in the definitions for COPD, there is a paucity of reliable epidemiologic data on its prevalence. Nonetheless, recent studies provide a clearer picture on the prevalence and impact of this disease. While COPD has historically been considered to be a disease of older male smokers, a 2001 survey by the National Center for Health Statistics shows that the prevalence of both chronic bronchitis and emphysema were not only widely distributed among all adult age groups, but also more frequent among women (Figures 2 and 3).8 Men are more commonly diagnosed with emphysema, while women are more often diagnosed with chronic bronchitis. Although the annual COPD death rates have been higher in men, the death rates in women are increasing at a much faster rate than in men, and COPD is now the fourth leading cause of death in women (vs fifth in men).9-11 In fact, 2000 was the first year that the total number of COPD deaths was higher in women than in men (Figure 4), and this gender difference is seen in both blacks and whites (Figure 5).9,10 Given the roughly 20-year lag time between the

---

**Figure 1. Asthma and COPD: A Comparison of Definitions**

<table>
<thead>
<tr>
<th>ASTHMA</th>
<th>COPD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensitizing agent</td>
<td>Noxious agent</td>
</tr>
<tr>
<td>Asthmatic airway inflammation</td>
<td>COPD airway inflammation</td>
</tr>
<tr>
<td>CD4+ T-lymphocytes</td>
<td>CD8+ T-lymphocytes</td>
</tr>
<tr>
<td>Eosinophils</td>
<td>Macrophages</td>
</tr>
<tr>
<td>Neutrophils</td>
<td></td>
</tr>
</tbody>
</table>


**Figure 2. Percentage of US Population with Emphysema or Chronic Bronchitis by Age (2001)**

![Graph showing percentage of US population with emphysema or chronic bronchitis by age (2001)]

REVIEW

initiation of smoking and resultant lung damage, the rapid rise of COPD death rates in women over the last 20 to 25 years may be related in part to advertising targeting young women smokers during these years.

In 2000 and 2001, COPD was the fourth leading cause of death in the United States, behind heart disease, cancer, and cerebrovascular diseases (Table 1), and, like its companions in the top 4 list, it is largely preventable. In fact, COPD, the major cause of which is smoking, is the number one preventable cause of death in the United States. While the United States has made great strides in reducing the death rates of these other diseases, COPD remains the only major disease for which death rates are increasing, and at an alarming rate (Figure 6).

For primary care practitioners, COPD represents a large percentage of their patient population. COPD is at least as prevalent (24 cases per 1000 person-years) as many other chronic diseases treated in primary care, such as diabetes (18.2), hypertension (50), obesity (59), and cardiovascular disease (64.4). Because COPD is frequently not recognized until the clinically advanced stages of disease, these estimates represent only the tip of the proverbial iceberg, with many millions more experiencing subclinical lung disease or who are at risk of COPD from smoking. A prospective study of 153 patients admitted to a general medical service at an urban hospital showed that up to 70% to 90% of those with mild, moderate, or severe airway obstruction were not diagnosed with obstruc-

tive lung disease during their hospital stay, and only 40% were receiving a bronchodilator at hospital admission or discharge. Only those with very severe airway obstruction fared better, with 89% having the diagnosis of obstructive lung disease at discharge. Thus, COPD is underrecognized both in the community and in hospital settings. Also, prevalence estimates most likely underestimate the total disease burden and

Figure 3. Percentage of US Population with Emphysema or Chronic Bronchitis by Sex and Age (2001)


Figure 4. COPD Death Rates in Women and Men (United States, 1980-2000)

US, 1960-1998


Figure 5.Age-Adjusted COPD Death Rates by Race and Gender (United States, 1960-1998)

COPD = chronic obstructive pulmonary disease.
attributable mortality because COPD is not only underdiagnosed, but also often cited as a contributory rather than underlying cause of death.18

COPD, THE ECONOMIC BURDEN

It is not surprising, given the enormity of its prevalence, that COPD exacts a large toll, both economically and functionally. Recent estimates show that

Table 1. Rank of Death Rates for the 10 Leading Causes of Death (United States, 2000-2001)*

<table>
<thead>
<tr>
<th>Rank</th>
<th>Cause</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Heart disease</td>
</tr>
<tr>
<td>2</td>
<td>Cancer</td>
</tr>
<tr>
<td>3</td>
<td>Cerebrovascular disease</td>
</tr>
<tr>
<td>4</td>
<td>Chronic lower respiratory diseases</td>
</tr>
<tr>
<td>5</td>
<td>Accidents (unintentional injuries)</td>
</tr>
<tr>
<td>6</td>
<td>Diabetes mellitus</td>
</tr>
<tr>
<td>7</td>
<td>Influenza and pneumonia</td>
</tr>
<tr>
<td>8</td>
<td>Alzheimer’s disease</td>
</tr>
<tr>
<td>9</td>
<td>Nephritis, nephrotic syndrome, and nephrosis</td>
</tr>
<tr>
<td>10</td>
<td>Septicemia</td>
</tr>
</tbody>
</table>


Figure 6. Percentage Change in Age-Adjusted US Death Rates from COPD and Other Major Diseases (1990-2000)

Table 2. Estimated Annual Cost of COPD in the United States: A Comparison of Direct and Indirect Costs with Other Major Diseases

<table>
<thead>
<tr>
<th>Disease</th>
<th>Direct ($ billion)</th>
<th>Indirect ($ billion)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diabetes</td>
<td>91.8</td>
<td>31.8</td>
</tr>
<tr>
<td>Heart disease</td>
<td>72</td>
<td>20.6</td>
</tr>
<tr>
<td>COPD</td>
<td>18</td>
<td>14.1</td>
</tr>
<tr>
<td>Asthma</td>
<td>5.9</td>
<td>5.1</td>
</tr>
<tr>
<td>Hypertension</td>
<td>5.5</td>
<td>7.2</td>
</tr>
</tbody>
</table>

COPD currently ranks as the fifth leading cause of death in the world (ranging from fifth to 14th worldwide), behind cardiovascular and cerebrovascular dis-
eases, acute lower respiratory infections, and HIV/AIDS (Table 4). COPD was estimated to be responsible for 2.5 million deaths worldwide in 2000. Almost 15 years ago, COPD was ranked as the 12th leading cause of disease burden (measured by disability-adjusted life-years) worldwide. By 2020, it is projected to rank fifth as a burden of disease and to become the third leading cause of death in the world.

Many factors contribute to the rising prevalence of COPD, namely the growing proportion of elderly in the general population and the increasing use of tobacco in some areas of the world. Worldwide, the number of persons over the age of 60 is projected to triple by 2050. Those in the “oldest old” group (80+ years) will increase more than 5-fold. The population aged 60 years or older accounts for 19% of the total population in more developed countries and 8% in less developed regions; by 2050, those proportions are expected to increase to 32% and 20%, respectively. Projections from the US Census Bureau indicate that the percentage of people over age 65 will nearly double in the next 50 years and that the subgroup of those over 85 years of age is growing most rapidly. This latter group is expected to experience a nearly 400% increase in percentage of the US population by mid-century. Currently, 1 in 8 persons in the United States is at least 65 years of age; by 2020, that proportion will be 1 in 5. Unfortunately, the fastest growing group of smokers (at least in the United States) is teenage girls, and most people who start smoking as teenagers will continue to smoke as adults.

As with the US prevalence estimates, the worldwide estimates are not precise, but important trends are noted. COPD is most prevalent in countries or societies with the highest tobacco use. In the United States, 47.2 million people smoke (28% of men, 23% of women). Worldwide, the WHO estimates there are 1.1 billion smokers, with an expected increase to 1.6 billion by 2025. The fast-growing rates are found in low- and middle-income countries—ie, those that can least afford the toll on their healthcare system that COPD will eventually take. Lastly, in underdeveloped countries, indoor air pollution (particularly the use of biomass fuels) represents another important but less commonly recognized risk factor for COPD.

**CONCLUSION**

COPD is a widespread and often underrecognized and underdiagnosed disease. Underestimates of its prevalence and attributable mortality are multifactorial. Yet, 2 important trends emerge: COPD is a growing cause of morbidity and mortality in the United States and worldwide, and the rates of COPD-attributable deaths are growing most rapidly in those areas of the world with the greatest tobacco use. In the United States, while deaths related to the top 10 most common causes of death are decreasing, COPD is the only major disease with an increasing mortality rate. Prevalence of COPD is increasing at a faster rate in women than in men. Even though it is underrecog-

---

**Table 3. Breakdown of Direct Costs of COPD versus Asthma**

<table>
<thead>
<tr>
<th>Cost ($ billion)</th>
<th>COPD</th>
<th>Asthma</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hospital care</td>
<td>7.3</td>
<td></td>
</tr>
<tr>
<td>Prescription drugs</td>
<td>3.7</td>
<td></td>
</tr>
<tr>
<td>Physician services</td>
<td>3.4</td>
<td></td>
</tr>
<tr>
<td>Nursing home care</td>
<td>2.7</td>
<td></td>
</tr>
<tr>
<td>Home healthcare</td>
<td>0.8</td>
<td></td>
</tr>
</tbody>
</table>

COPD = chronic obstructive pulmonary disease.

**Figure 7. COPD Competes for the Physician’s Attention and Resources**

Data for ED visits for diabetes and heart disease are not available.
COPD = chronic obstructive pulmonary disease; ED = emergency department.
Data from Mannino et al; and the Centers for Disease Control and Prevention.
nized, COPD consumes a substantial amount of the primary care practitioner’s resources. Yet, it can be diagnosed early if the appropriate risk factors are identified and spirometry is performed in at-risk patients.

REFERENCES

15. Centers for Disease Control and Prevention web site. Frequently asked questions on overweight and obesity. Available at: www.cdc.gov/ncdphp/dnpa/obesity/faq.htm#adults.