The Silent Epidemic Among Wisconsin Women: Chronic Obstructive Pulmonary Disease Trends, 1980-2000

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ABSTRACT
Purpose: To investigate trends in mortality from chronic obstructive pulmonary disease (COPD) in Wisconsin.

Methods: COPD mortality data for those 45 years of age and older were extracted from the Centers for Disease Control and Prevention WONDER database and analyzed. Rates were adjusted to the 2000 US Census.

Results: In Wisconsin, the mortality rate from COPD increased by 88% between 1980 and 2000. A similar increase in COPD mortality occurred in the United States during this same period. Among Wisconsin males, the 33% increase from 1980-2000 was higher than the increase for US males. Likewise, the rate among Wisconsin females increased 3.9 times compared to an increase of 2.8 among US females. Unlike men, mortality increased in all age groups of women from 1980 to 2000.

Conclusions: COPD mortality rates are increasing dramatically in Wisconsin, especially among women. Long-term trends in smoking do not explain the increases in COPD death rates among women. Other possible reasons include changes in the pattern of smoking or in the type of cigarette smoked, or women may be more susceptible to lung disease. Wisconsin physicians should target women for diagnosis and treatment of COPD and for smoking cessation and prevention.

INTRODUCTION
Chronic Obstructive Pulmonary Disease (COPD) is a major public health problem. The most common form of COPD is emphysema, but it also can take the form of chronic bronchitis and other lung ailments. In 1999, COPD was the 4th leading cause of death in the United States. In a recent study published by the Centers for Disease Control and Prevention (CDC), COPD was found to comprise most of the morbidity due to smoking in the United States—more than all other diseases combined. This study found that in 2000, over 7 million people in the United States had COPD attributable to smoking, more than those with cancer, heart disease, and stroke combined.

COPD is a progressive, incurable, debilitating disease, causing significant disability for an average of 7.5 years after diagnosis. Because its primary symptom is severe shortness of breath, it also decreases the patient’s quality of life. Early in the disease, minimal physical activities become difficult to perform due to shortness of breath. In later stages of this disease, pneumonia, weight loss, and depression are common secondary symptoms. COPD is associated with longer hospitalizations compared to other lung diseases. In the 1997 National Hospital Discharge Survey, patients with a discharge diagnosis of COPD had an average hospital stay of 5.4 days, compared to the discharge diagnosis of asthma, which was associated with an average stay of 3.4 days. The 10-year mortality from COPD is 60%.

Cigarette smoking is the primary cause of COPD, and the risk increases with the amount and duration of smoking. Approximately 85% of mortality from COPD in the United States can be attributed to cigarette smoking. The remainder is primarily due to occupational exposure to dust and non-organic filaments. Less than 5% of emphysema in the United States is caused by alpha-1 antitrypsin deficiency, which is a genetic disorder and is not caused by smoking. Mounting evidence indicates that women have a more severe and long-term reaction to smoking than men. Adolescent girls who smoke have reduced rates of lung growth, and adult women who smoke experience a premature decline of lung function.
In this paper we examine trends in mortality from COPD from 1980 to 2000 in Wisconsin compared to the nation, and specifically mortality rates among men and women.

**METHODS**

The data collected for this study were gathered from the public-use mortality database on CDC WONDER. These data are assembled by the National Center for Health Statistics from death certificates across the nation. For purpose of analysis and reporting, a 3-year average was calculated for 1980 using 1979-1981 and 2000 using 1999-2001. The 3-year averages provide more stable estimates, especially for younger age groups.

For the years 1979-1998, International Classification of Diagnoses, 9th revision (ICD-9) was used. The 10th revision (ICD-10) was released in 1999 and encompasses the years 1999-2001. The ICD-9 and ICD-10 codes used are shown in Table 1. The comparability ratio for the codes is 1.0478, which means that COPD is 4.8% more likely to be coded as the underlying cause of death using ICD-10 codes compared to using ICD-9 codes. The data collected were classified by year, gender, and age group. Age groups below 45 years are not included in analysis because the number of COPD deaths in these age groups is insufficient to analyze effectively. Data were age-adjusted using the US 2000 population standard. The data were analyzed using Microsoft Excel. Indirect standardization was used to estimate the number of expected deaths in 2000 (multiplying the age-specific rates in 1980 times the population in 2000). Subtracting this expected number of deaths from the number of deaths observed in 2000 provided the number of excess deaths in 2000.

All differences in rates reported in the results section are statistically significant at the .05 level unless otherwise noted. Testing for significance was accomplished by calculating the standard errors. The standard error was calculated by dividing the rate by the square root of the number of deaths.

**RESULTS**

Over the past 20 years the COPD mortality rate, age-adjusted to the 2000 US population, increased from 59 deaths per 100,000 to 111 deaths per 100,000—an increase of 88%. Because of the aging population, the actual number of deaths from COPD increased over 2-fold in Wisconsin, from 887 deaths in 1980 to 2199 deaths in 2000.

The mortality rate among Wisconsin men increased from about 112 deaths per 100,000 in 1980, to a rate of 150 in 2000—an increase of 34% from 1980. The rise in mortality rate in men has slowed, but it is not decreasing. Among Wisconsin women, the death rate from COPD has increased constantly since 1980, from 23 deaths per 100,000 in 1980 to 89 deaths per 100,000 in 2000—the highest rate ever recorded at that time (Figure 1). The age-adjusted mortality rates by gender can be seen as points in Figure 1 plotted with a 3-year moving average of the mortality rates.

The rates in the United States over this time period are slightly higher than in Wisconsin, but with a lower rate of increase compared to those in Wisconsin. The age-adjusted mortality rate for the United States increased 62% overall, with a 16% increase among men and a 2.8-fold increase among women (Table 2).

In 1980, the age-adjusted mortality rate from COPD for Wisconsin men was 6 times that of women (Table 2). By 2000 the age-adjusted mortality rate for men was 1.8 times the rate in women. In 1980, the age-specific mortality rates in the younger groups (45-54 and 55-64) of men were over 2 times higher than the age-specific rate in women. By 2000, the age-specific rates in the younger groups were equal or higher in women than in men, but were not significantly different.

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**Table 1. ICD-9 and ICD-10 Codes for COPD and Their Descriptors**

<table>
<thead>
<tr>
<th>ICD-9</th>
<th>ICD-10</th>
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<tbody>
<tr>
<td>490 Bronchitis not specified as acute or chronic</td>
<td>J40 Bronchitis not specified as acute or chronic</td>
</tr>
<tr>
<td>491 Chronic bronchitis</td>
<td>J41-J42 Chronic bronchitis</td>
</tr>
<tr>
<td>492 Emphysema</td>
<td>J43 Emphysema</td>
</tr>
<tr>
<td>496 Chronic airways obstruction</td>
<td>J44 Chronic airways obstruction</td>
</tr>
</tbody>
</table>

**Figure 1. Trends in age-adjusted COPD mortality rates by gender, plotted with the 3-year rolling average, Wisconsin 1980-2000.**
Trends in the COPD death rate among Wisconsin males from 1981 to 2000—relative to the rate in 1980—differ among age groups (Figure 2). In the oldest group of males (ages over 85 years), the death rate rose 97% between 1980 and 2000 (Table 2). Among the groups below 65 years of age, the death rate decreased slightly, but not significantly, between 1980 and 2000.

Among Wisconsin females the death rate from COPD relative to the rate in 1980 increased dramatically in all age groups between 1980 and 2000 (Table 2). Among women aged 45-54 years, the death rate in 2000 increased by 25% from 1980, though this change was not statistically significant. The rate in women aged over 85 years raised more than 5 times the 1980 rate.

Indirect standardization was used to estimate the number of excess deaths that occurred in 2000, compared to 1980. Among women, there were 798 more deaths than expected in 2000, with most (73%) of the excess occurring among women older than 75 years of age. There were 254 excess deaths among men, with 27 fewer deaths than expected occurring among men under the age of 65.

**DISCUSSION**

In Wisconsin, the death rate from COPD—including bronchitis, emphysema, and other chronic lung diseases—doubled during the 20 years from 1980 to 2000. This trend of increasing mortality has also been observed in other tobacco-related diseases, such as lung cancer. This increase in COPD is likely due to the substantial increase in cigarette consumption following World War II, peaking in the 1970s, and declining since that time. The 2003 smoking rate for the United States is 22%. Likewise, the 2003 overall rate for Wisconsin is 22%, but for males it is 24% versus 20% for Wisconsin females. Because of the long latency for diseases such as COPD and lung cancer, mortality rates and trends today reflect patterns of tobacco use 20-30 years ago.

While the general rise in COPD deaths is of concern, there are significant differences between men and women. Among men under 75 year old, COPD mortality rates are no longer increasing and may be decreasing among those under 65. In contrast death rates among women over 55 have increased significantly, with the oldest age group of women experiencing more than a 5-fold increase in the death rate from COPD.

We feel that this increase in mortality in women is a “silent epidemic.” The criterion for declaring an epidemic has come to include the language “in excess of normal expectancy.” In the case of COPD in women, if the 1980 rate is used as “normal expectancy,” then epidemic is an appropriate term. The descriptor “silent” is used because chronic obstructive pulmonary disease has received such little attention compared to other leading...
causes of death. For example, in the Surgeon General’s 2001 Report on Smoking and Women, the focus of the disease burden is entirely on lung cancer deaths with little mention of deaths related to COPD despite the fact that COPD deaths exceeded those from lung cancer.9 The cause of the increasing death rates from COPD in Wisconsin women is in part due to the sharp increase in smoking rates in women from 1945 to 1960. Smoking increased from 28% in 1945 to 62% in 1960—more than doubling smoking prevalence. Tobacco companies targeted women during this time with more “feminine brands” that appealed to women by offering longer, slimmer, and lower tar cigarettes.9 In the same time period, smoking prevalence among men remained fairly consistent at 65%. Because of the long exposure prior to the onset of the disease, women who began and continued smoking in the post-war period (1945-1960) became symptomatic from COPD in the 1970-1980s and died from the disease 8-10 years later.

In addition, part of the difference in the increase in rates might be due to greater susceptibility of women to lung disease as a result of cigarette smoking. Research has suggested that cigarette smoking may be more detrimental in its effects on lung function in women than in men and women may become symptomatic at younger ages.15 Research also suggests that there may be disparities among groups of women as well, including higher odds ratios for women who began smoking at a younger age and for women who were overweight.16

Finally, increasing exposure to other causes of lung disease may explain the increasing COPD mortality rates among women. The proportion of women in the workforce has increased, from only 23% of women in 1940 to 43% by the 1970s.17 As part of their working environment these women may have been exposed to indoor air pollutants, including secondhand smoke.

Currently, the age-adjusted death rate from COPD in Wisconsin men is higher than women. However, death rates for women are rising at a higher rate than in men, and in the age groups under 65, the death rates in women are already equal to or higher than men in the same age groups. This shift in the younger age groups may portend the not-so-distant future, when COPD will be predominantly a female disease. Another indicator of the burden of COPD mortality in Wisconsin women is that by 1998 the number of COPD deaths exceeded those from breast cancer and have continued to be higher every year since 1998. This phenomenon has also occurred at the national level.

Some of the limitations in this study are common to all studies investigating mortality by analyzing death certificate data. Misdiagnosis of the underlying cause of death could introduce error into these statistics. Studies cited later describe the possibility of under-reporting of COPD by as much as 32% of persons who have smoked more than 1 pack per day for 10 years or more. As demonstrated by the comparability ratio for COPD, using both ICD-9 and ICD-10 codes could cause some discrepancy between 1998 and 1999. Also diagnoses used on death certificates change over time and therefore are another possible source of error in these data.

This paper describes a clear disparity between men and women in rate increases of COPD mortality, but is limited by its significant reliance on mortality data as an outcome measure. More studies are needed to determine which groups experience the most morbidity from COPD, so these groups can be further targeted for treatment and prevention.

The data presented in this paper indicate a need for intervention to prevent further increase in COPD mortality among women. According to the Global Initiative on Chronic Obstructive Lung Disease (GOLD) guidelines, which take into account symptoms and spirometric results, 32% of persons with 10 pack-years or more of smoking have undiagnosed COPD. More than half of these individuals have moderately advanced forms of the disease.18 This indicates a large group of people that could be diagnosed with COPD and treated. Though the level of COPD diagnoses would increase, the death rate would hopefully decrease.

Wisconsin primary care physicians should be particularly observant of symptoms of COPD in their female patients, many of whom might not know they have the disease. At the population health level, reducing tobacco use in general will result in reducing the COPD disease burden, since 80%-90% of COPD is attributable to smoking. Smoking cessation is particularly
important in women because they have been shown to benefit more than men in recovering pulmonary function and greater reduction in risk of lung cancer.10 There are 4 main effective strategies for reducing tobacco use in the population:20

- Publicly available cessation services that include nicotine replacement and other pharmaceutical aids that help people quit successfully.
- Increasing excise taxes on cigarettes reduces tobacco consumption rates.
- The enforcement of indoor clean air policies by the local government, such as enforcing smoking bans in the workplace, has been shown to protect non-smokers and reduce the number of cigarettes that employees smoke during the workday.
- Consistent mass media campaigns aimed to decrease tobacco use are essential, as are regulations that severely limit tobacco advertising.

The increase in smoking among women is in part driven by the tobacco industry’s concerted campaign to make cigarettes attractive to women. One of the means of reducing the effectiveness of this campaign is to, as noted by the Surgeon General, “Expose and counter the tobacco industry’s deliberate targeting of women and decry its effort to link smoking, which is so harmful to women’s health, with women’s rights and progress in society.”9 Programmatically this means unlinking the tobacco industry from everything from women’s athletics (independence and power of women) to support for centers to protect women from domestic violence (advocacy especially from a primary by-product of alcohol abuse).

Finally, further study is necessary to understand the potentially special risk of smoking to women in pulmonary disease. This is of importance for non-smokers who live with smokers and are heavily exposed to environmental tobacco smoke. Almost all cases of COPD can be prevented. Policies to reduce COPD must be implemented now to reverse the trend toward an even higher burden of death and disease.

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REFERENCES

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