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Sex Differences in COPD and Lung Cancer Mortality Trends—United States, 1968–1999

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ABSTRACT

Purpose: **Cigarette smoking by U.S. women in the 1940s and 1950s caused large increases in smoking-related lung disease among women. To determine the magnitude of these increases, we compared the mortality trends for males and females in the United States for chronic obstructive pulmonary disease (COPD) and lung cancer for 1968–1999.**

Methods: **We used the national mortality data files compiled by the National Center for Health Statistics of the CDC and U.S. census data to calculate age-adjusted (2000) death rates for COPD, lung cancer, and all causes.**

Results: **COPD death rate for females increased by 382% from 1968 through 1999, whereas for males it increased by 27% during the same period. As a result, the COPD death rate for U.S. females is approaching that for males. The lung cancer death rate for females increased by 266% from 1968 to 1999, whereas for males, it increased by 15%.**

Conclusions: **Physicians, women, and groups interested in women's health issues need to be aware of these trends and target prevention strategies toward females.**

INTRODUCTION

Respiratory disease is a major cause of mortality among women. In 2000, chronic obstructive pulmonary disease (COPD) was the fourth most common cause of death, and lung cancer was the leading cause of cancer-related mortality among both men and women in the United States. Although other factors are considered risk factors for the development and progression of both lung cancer and COPD, smoking is the dominant risk factor for both diseases.[1–7] Approximately 80%–90% of the risk of developing and dying from COPD is attributable to smoking.[1,8] Other work supports the role of smoking in accelerated lung function decline.[9,10] Additionally, 85%–90% of all lung cancer incidence is attributed to smoking, and effective smoking cessation interventions, along with regulatory efforts, can play significant roles in reducing or preventing lung cancer.[7,11,12]

Changes in smoking behaviors should parallel changes in females' COPD and lung cancer mortality trends. Current medical knowledge suggests that such changes in trends lag behind actual changes in smoking by approximately 20–30

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years. In this paper, we report recent trends among males and females for mortality from COPD and lung cancer.

MATERIALS AND METHODS

We used the national mortality data files compiled by the National Center for Health Statistics (NCHS), Centers for Disease Control and Prevention (CDC), to determine the yearly number of deaths of U.S. residents from COPD, lung cancer, and all causes for 1968 through 1999.[13] Deaths for which COPD and lung cancer were the underlying causes and all deaths were included in the calculation of death rates. The International Classification of Diseases (ICD) codes, eighth (ICD-8), ninth (ICD-9), and tenth (ICD-10) revisions, were searched for 1968–1978, 1979–1998, and 1999, respectively.[14–16] We used the following ICD codes for COPD and lung cancer in our analyses: ICD-8 codes 490–492, 519 (COPD) and 162.0–162.1 (lung cancer); ICD-9 codes 490–492, 496 (COPD) and 162 (lung cancer); ICD-10 codes J40–44 (COPD) and C33–34 (lung cancer). For 1972, the data were available only from a 50% sample of death certificates. To compensate for this, we weighted the number of deaths by a factor of 2.[17] To calculate the yearly death rates, we used as denominators U.S. Census Bureau national resident midpoint population estimates for each year during 1968 through 1999. The death rates were age adjusted to the 2000 U.S. resident population. All data management, statistical analyses, and graphics were developed using the SAS system.[18]

RESULTS

Although all-cause U.S. mortality declined during 1968–1999 (males: 1280/100,000 to 867/100,000; females: 1005/100,000 to 865/100,000), females because of a less dramatic decline, achieved parity in all-cause death rates with males (Fig. 1). All-cause death rates decreased by 32% from 1280/100,000 to 867/100,000 for males and by 14% from 1005/100,000 to 865/100,000 for females. However, for COPD and lung cancer, death rates increased during this period (Figs. 2 and 3). Moreover, females achieved relative parity with males with respect to COPD mortality. During 1968–1999, the COPD death rate for U.S. females increased by 382% from 9/100,000 to 41/100,000 and for males by 27% from 35/100,000 to 44/100,000 (Fig. 2). During the same period, the lung cancer death rate for females increased by 266% from 12/100,000 to 45/100,000 and for males by 15% from 57/100,000 to 66/100,000 (Fig. 3). In addition, because of a

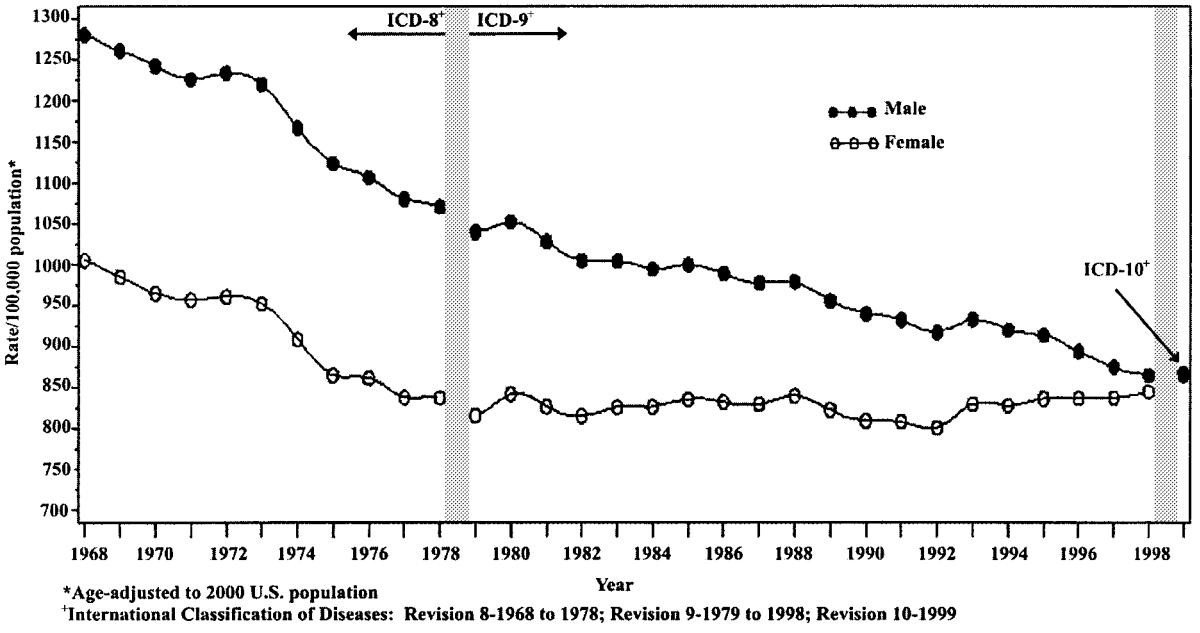

FIG. 1. Age-adjusted all-cause death rates, by year and sex—United States, 1968–1999.

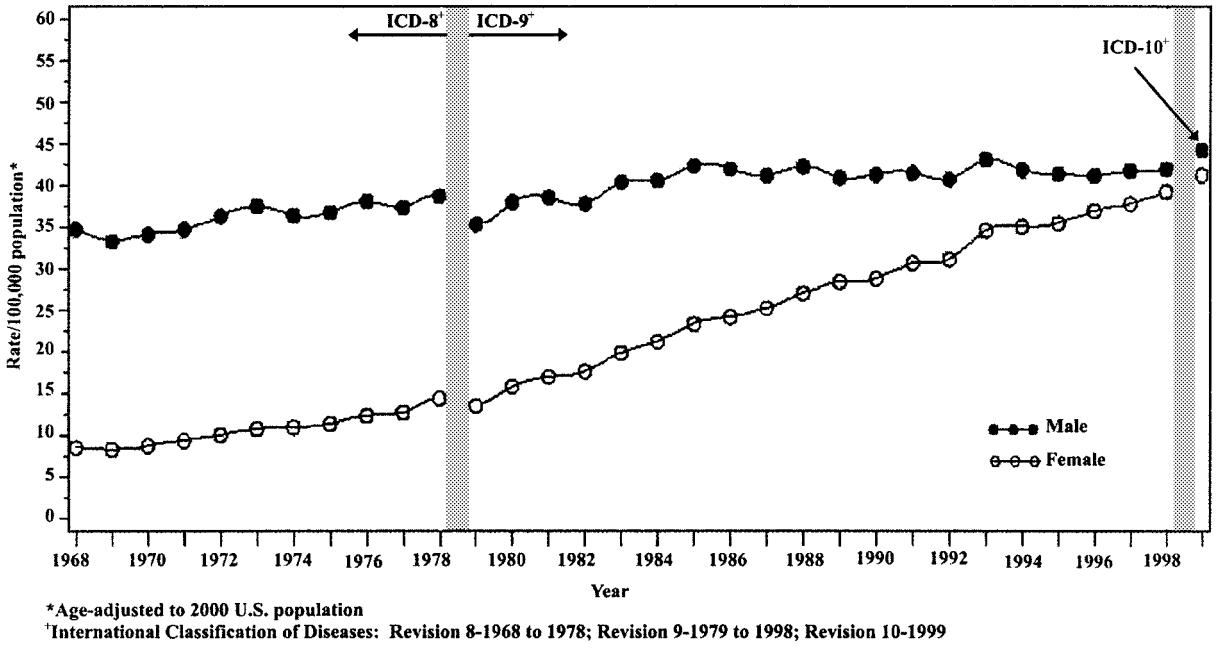

FIG. 2. Age-adjusted death rate from chronic obstructive pulmonary disease, by year and sex—United States, 1968–1999.

relatively greater increase in COPD mortality among females, the death rate reached that for lung cancer.

From 1968 through 1999, the male/female rate ratio of mortality for COPD declined by 74% from 34.8/8.6 to 44.3/41.3 and for lung cancer by 69% from 57.4/12.2 to 66.0/44.7 (Fig. 4). For females, the COPD death rate/lung cancer death rate ratio increased by 29% from 8.6/12.2 to 41.3/44.7 since 1968. The corresponding increase for males was 17% from 34.8/57.4 to 44.3/66.0 (Fig. 5).

COPD and lung cancer accounted for 0.9% and

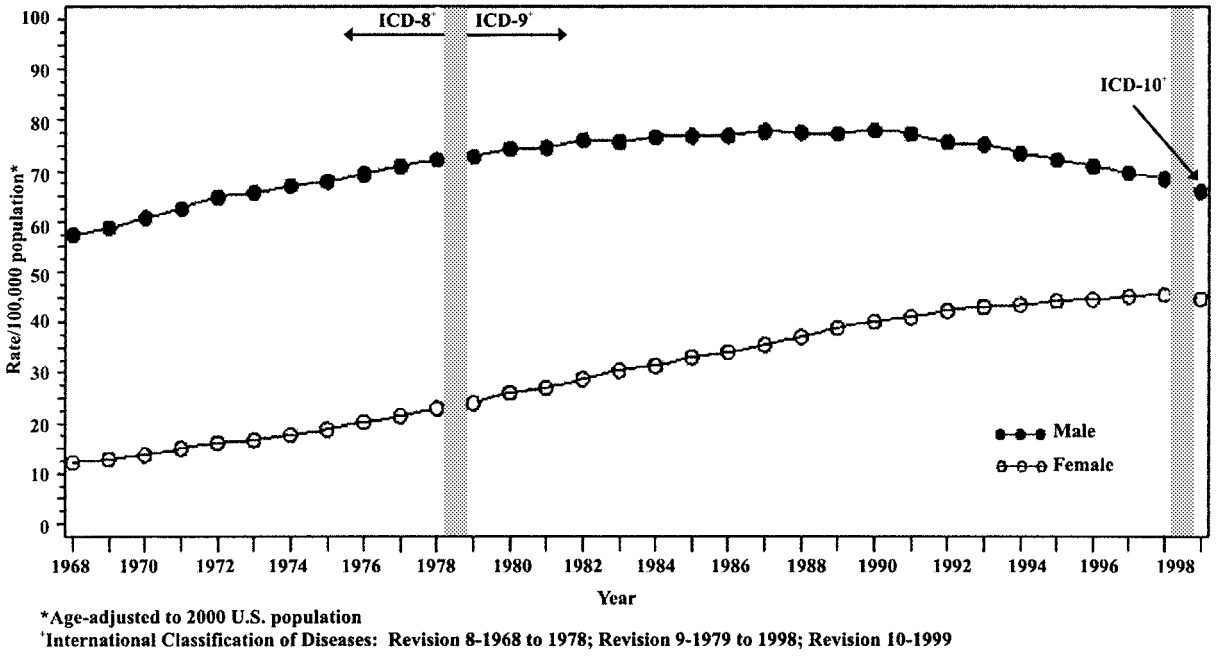

FIG. 3. Age-adjusted rate of death from lung cancer, by year and sex—United States, 1968–1999.

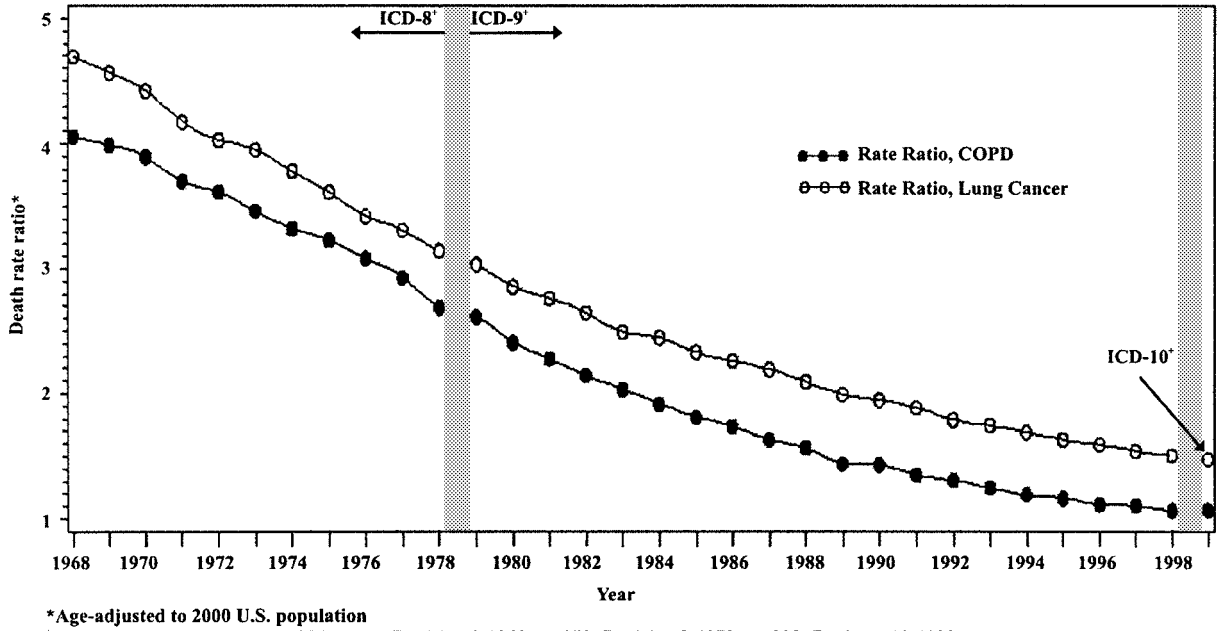

FIG. 4. Death rate ratios from lung cancer and chronic obstructive pulmonary disease comparing males to females, by year—United States, 1968–1999.

1.2%, respectively, of all deaths among U.S. females in 1968, compared with 4.8% and 5.2%, respectively, in 1999. For males, these proportions were 2.7% (COPD) and 4.5% (lung cancer) in 1968 and 5.1% and 7.6%, respectively, in 1999. In addition, since 1968, the ratio of the COPD death rate for males increased by 89% and for females by 465% (Fig. 6). For lung cancer, this rate ratio increased by 69% for males and by 333% for females (Fig. 7).

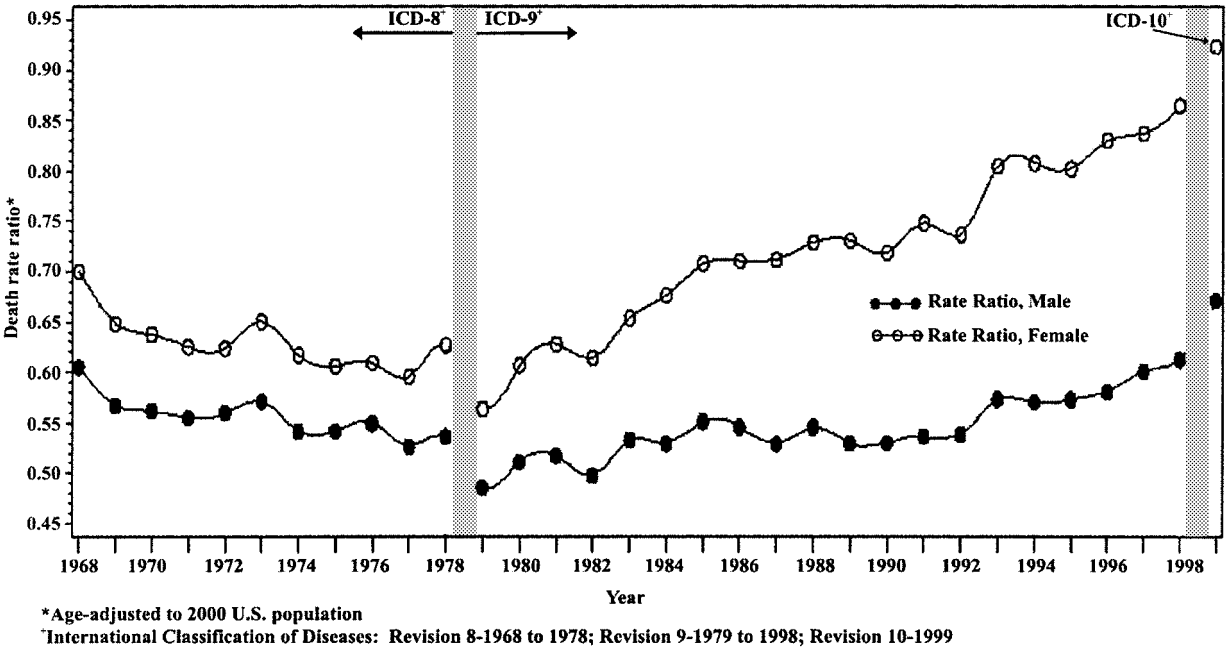

FIG. 5. Death rate ratios comparing chronic obstructive pulmonary disease to lung cancer, by year and sex—United States, 1968–1999.

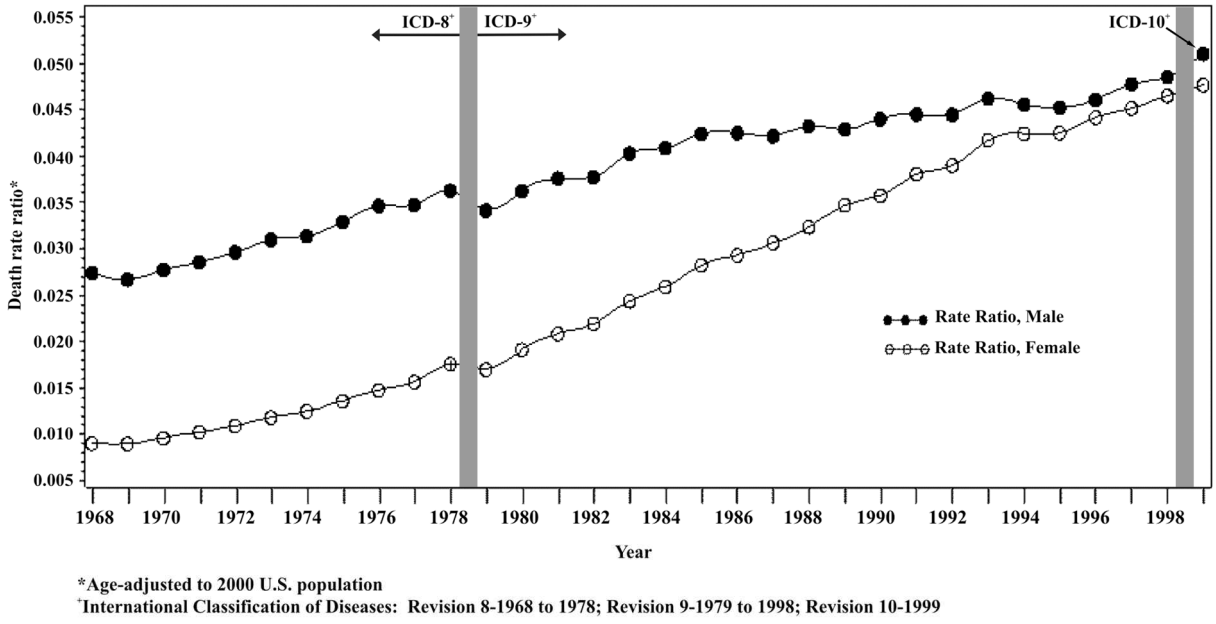

FIG. 6. Death rate ratios comparing chronic obstructive pulmonary disease to all causes, by year and sex—United States, 1968–1999.

DISCUSSION

Rates of death from COPD and lung cancer have increased steadily over 32 years, with rates increasing much more rapidly for females than for males. Although males traditionally have had higher COPD death rates, by 1999, rates of death from COPD and lung cancer among females became similar to that of males. These increases in cause-specific death rates occurred during a period in which male and female all-cause death rates declined steadily.

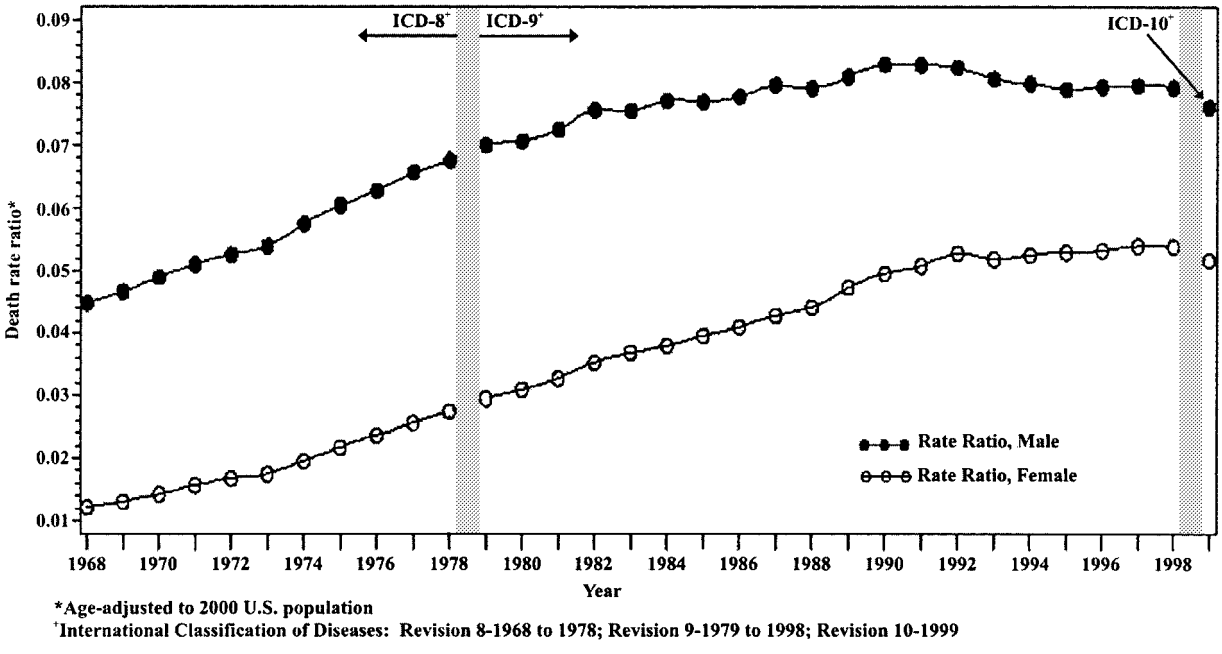

FIG. 7. Death rate ratios comparing lung cancer to all causes, by year and sex—United States, 1968–1999.

The increase in COPD and lung cancer rates in our report is probably explained by historic tobacco consumption trends as well as by the long periods required for COPD and lung cancer to manifest themselves.[19–23] Several reports indicate that after the smoking prevalence peaked among women in the 1960s, the sex gap in smoking prevalence narrowed between 1965 and 1985 and has remained relatively stable since 1985. Considering a latency period of 15–20 and 20–30 years between smoking cigarettes and death from lung cancer and COPD, respectively, the declining disparity between deaths among males and females appears to reflect the convergence of smoking behaviors between the sexes that began two to three decades ago.[22,24] The relative stabilization of the sex gap in lung cancer mortality since 1997, as indicated in our report, provides additional support for this claim.

A recent report on smoking-attributable mortality in 1995–1999 showed a higher proportion of smoking-attributable mortality from lung cancer among males (30.5%) than females (24.8%).[25] In the same report, the proportion of smoking-attributable mortality from COPD was higher among females (21.1%) than males (16.9%). Several explanations are possible for the sharp increase in COPD mortality among females throughout our study period (1968–1999) and a very narrow gap in COPD mortality between males and females in 1995–1999. First, because females, on average, live longer than males, they have more time to have COPD diagnosed. Also, because the prevalence of smoking among women had lagged several decades behind that of men,[24,26] the longer latency period of COPD relative to lung cancer may have begun to manifest itself during 1995–1999. Moreover, the different latency periods for COPD and lung cancer, with consideration of smoking trends,[22,23] could explain the relatively stable lung cancer death rate from 1993 through 1998, then decline in 1999, and the sharp increase in the COPD death rate for females throughout our study period. Second, several studies have suggested greater susceptibility to COPD from tobacco smoke in women.[27–32] These studies have demonstrated an increased effect of smoking on lung function, after controlling for smoking intensity, in females than in males. Third, sex differences in pulmonary function testing may have changed over time,[33,34] bringing about more accurate detection of COPD among women.

From 1965 to 2001, the smoking prevalence decreased by 37% from 34.0% to 21.5% among U.S. women but by 51% from 52.0% to 25.5% among U.S. men.[19,20] A recent report showed no change in the prevalence of current smoking during 1996–2001 among adults in the United States.[20] However, despite a peak of current smoking among high school students during 1997–1999 and 1991–1997, the prevalence of current smoking declined significantly by 2001 among both sexes.[21] If the current trends in mortality and smoking behavior continue, we should expect lower rates of death from lung cancer and COPD among U.S. residents within the next decades, considering the latency periods for COPD and lung cancer mortality.

CONCLUSIONS

The COPD death rate for U.S. females achieved relative parity with that for males, and the sex gap in the lung cancer death rate decreased over time. Women, healthcare providers, and groups interested in women's health issues need to be aware of current mortality trends and target additional interventions to females. Furthermore, efforts are needed to prevent smoking initiation among girls and women.

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