Contemporary Lung Cancer Trends among U.S. Women

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Abstract

The age-standardized lung cancer incidence rate among women in the United States has decreased for each of the last 3 years for which data are available (1999-2001). We conducted this study to assess the stability and near-term sustainability of this decrease. We examined temporal trends in age-specific lung cancer incidence by calendar year and birth cohort and measured trends in the age-standardized rate in each geographic area within the Surveillance, Epidemiology, and End Results (SEER) Program using joinpoint regression analyses. Age-standardized lung cancer incidence rates have peaked or are decreasing in all geographic areas within SEER, although the decline is statistically significant only in San Francisco-Oakland. Age-specific incidence rates are decreasing in six of the seven 5-year age groups between ages 50 and 84 years in all areas of SEER combined. Rates in these age groups contribute nearly 98% of the total age-standardized incidence rate; consequently, trends in incidence at these ages will determine future trends in the overall age-standardized incidence rate for the next 20 to 25 years. Birth cohort patterns suggest that the decrease in the age-standardized rate will continue for at least 20 years, but will be slowed by aging of women born in the late 1950s and early 1960s. Given calendar year and birth cohort age-specific incidence patterns, the early decline in lung cancer incidence among women is likely to persist through at least 2025. Sustaining the downward trend beyond 2025 will require continued reductions in smoking initiation among children and increases in cessation among addicted smokers. (Cancer Epidemiol Biomarkers Prev 2005;14(3):582–5)

Introduction

Lung cancer incidence decreased among women for each of the last 3 years (1999-2001) for which data are available from Surveillance, Epidemiology, and End Results (SEER) tumor registries (Fig. 1; ref. 1). This decrease was the first downturn in lung cancer among women since the epidemic of cancers caused by tobacco smoking accelerated among women in the mid-1960s (2).

Future trends in age-standardized lung cancer rates are strongly influenced by current age-specific incidence rates at ages $\geq 30$ years, because virtually no one begins smoking after age 30 and cessation rates are not likely to decline. Herein, we assess the stability of the decrease in female lung cancer among U.S. women in relation to age, birth cohort, and geographic area. We also consider whether the decrease in the age-standardized incidence rate is likely to continue based on calendar year and birth cohort trends in age-specific rates.

Materials and Methods

We obtained incidence data on lung and bronchus cancer for 1973 to 2001 from the nine cancer registries that have participated in the National Cancer Institute’s SEER Program since 1973 to 1975. These cover $\sim 10\%$ of the U.S. population (3). Trends in overall female lung cancer incidence in the SEER areas were described by a joinpoint regression model that involves fitting a series of joined straight lines on a log scale to the trends in age-adjusted rates, directly standardized to the 2000 U.S. standardized population (4). The resultant trend during each time period was described as the annual percent change, which represents the slope of each line segment.

Results

We also measured age-specific incidence rates by calendar year of diagnosis and calendar year of birth. For the analysis by calendar year of diagnosis, we calculated incidence rates by 5-year age groups from ages 35 to 84 for each year from 1973 through 2001. For the analysis by year of birth cohort, we first computed incidence rates by 5-year age groups from 30 to 84 and by 5-year time periods from 1973 to 2001. For each birth cohort, we computed the age-specific rate(s) by subtracting the age at diagnosis (middle of the 5-year age group) from the calendar year of diagnosis (middle of the 5-year calendar period). The last time interval covers the time period 1998 to 2002 and assumes that the rates for 2002 will not differ significantly from the average rate from 1998 to 2001. We present the age-specific rates by calendar year of diagnosis using an arithmetic scale and by calendar year of birth using a semilogarithmic scale (5). All rates are expressed per 100,000 population.

Figure 1 presents trends in the age-standardized lung cancer incidence rate among women in all SEER areas combined for all lung cancers and for two of the four major histologic types. As previously reported (1), trends in the age-standardized lung cancer incidence rate among women in all SEER areas combined decreased by 2.3% per year from 1998 through 2001. This downturn followed an increase of 4.6% per year from 1975 through 1988 and of 1.3% per year from 1988 through 1998. The recent decrease in incidence involved both adenocarcinoma and squamous cell carcinomas. When age-standardized incidence rates were examined separately within each of the nine SEER areas, the age-standardized incidence rate had peaked or was decreasing in each of the registries (Fig. 2). However, the downturn was statistically significant by joinpoint analyses only in San Francisco-Oakland.

Figure 3 shows the age-specific incidence patterns in relation to calendar year of diagnosis (left) or cohort year of birth (right). The age-specific incidence rate of lung cancer in the most recent time is decreasing among women in all SEER...
areas combined in every age group 50 to 54 years and above (left). The downturn in rates began earlier in younger age groups (35-39, 40-44, and 45-49) than at older ages (50-84). However, the lung cancer rates in the most recent period have increased among women ages 40 to 49. Trends in ages below 35 years could not be assessed.

Figure 3 (right) depicts the trends in age-specific lung cancer incidence in relation to year of birth. In this figure, older age corresponds to earlier birth cohorts. The trend in incidence reflects the increase or decrease in lung cancer incidence in successive birth cohorts. For example, lung cancer incidence increased among 80-84-year-old women across the birth cohorts from 1890 to 1915. The incidence rates generally peak in women born during the late 1930s and then decrease in those born afterward. However, this pattern is interrupted among women born in the late 1950s and early 1960s, as can be seen in the age groups below 45. Birth cohort trends cannot yet be evaluated among women born after the 1970s.

We also assessed the percentage contribution of each age group to the age-standardized lung cancer rates in 2000 (Fig. 4) to understand the potential impact of aging on the future age-standardized incidence rate in women. Lung cancer diagnosed at age ≥50 years contributes almost 95% of the age-standardized rate, although all age groups are considered in calculating the age-standardized rate. Consequently, trends in incidence that currently exist among women ages 50 years and older will continue to dominate the age-standardized rate for at least the next 20 to 25 years.

Discussion

These findings suggest that the recent downturn in female lung cancer incidence in SEER areas is broadly based with respect to both age and geographic distribution. It represents an important turning point in the epidemic of lung cancer among women (2). The initial decline in incidence among women follows a similar decline among men 10 to 15 years ago (6). These patterns reflect progress over the past 40 years in reducing tobacco use. Adult smoking prevalence in U.S. women has decreased from 33.9% in 1965 (7) to 19.2% in 2003 (8). The lag in the temporal trend of lung cancer incidence rates in women compared with men reflects historical differences in cigarette smoking between men and women (9, 10).
Whereas future lung cancer trends cannot be predicted exactly, the qualitative patterns can be anticipated to a greater extent than for many other cancers because lung cancer incidence rates largely reflect calendar year and birth cohort patterns of smoking initiation and cessation. Future trends in age-standardized lung cancer rates over the next 20 to 25 years are largely determined by the lung cancer experience of persons ages ≥50 years as rates in these groups contribute nearly 95% of the overall age-standardized lung cancer incidence rate. Thus, the age-standardized incidence rate among women in SEER areas will continue to decline for at least the next 20 years.

However, the increase in smoking prevalence that occurred among adolescent girls born in late 1950s and early 1960s (11, 12) will slow and possibly reverse the decline in age-standardized lung cancer as these birth cohorts age. We cannot predict how future changes in smoking cessation will affect these patterns. Thus, the long-term continued decline in age-standardized lung cancer rates will require increased cessation among addicted smokers and continuing prevention of initiation among adolescents.

Our analysis considered data from the nine SEER areas, where female lung cancer rates are generally lower compared with those in the non-SEER areas (13). Nevertheless, the downturn in female lung cancer incidence rates in the SEER areas is an indication of the national trend because reduction in adult smoking prevalence have occurred in almost all parts of the country over the last three decades.

**Figure 3.** Age-specific lung cancer incidence trends among U.S. women by year of diagnosis and year of birth.

<table>
<thead>
<tr>
<th>Age in years</th>
<th>Percent contribution</th>
</tr>
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<tbody>
<tr>
<td>35-39</td>
<td>0.2</td>
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<tr>
<td>30-34</td>
<td>0.7</td>
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<tr>
<td>25-29</td>
<td>2.1</td>
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<tr>
<td>20-24</td>
<td>3.1</td>
</tr>
<tr>
<td>15-19</td>
<td>5.9</td>
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<td>4-8</td>
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<tr>
<td>3-7</td>
<td>18.0</td>
</tr>
<tr>
<td>2-6</td>
<td>18.2</td>
</tr>
</tbody>
</table>

**Figure 4.** Percent contribution by age group to the age-standardized lung cancer incidence rates among U.S. women (2000). The contribution of each age group to the 2000 age-standardized lung cancer incidence rate among women was derived by multiplying the age-specific incidence rate in 2000 by the corresponding age-specific weight of the 2000 U.S. standard million population and then by dividing this product by the age-standardized incidence rate and multiplying it by 100.
owing to various tobacco control measures, including publicity about the adverse health effects of smoking, increased excise taxes on cigarettes, restrictions on smoking in public places, and limits on the advertising and promotion of tobacco products (14).

In summary, the encouraging downturn in female lung cancer incidence can be expected to continue for at least two decades. Sustaining this decline and reducing the burden of other smoking-related diseases will require a long-term commitment to tobacco control to prevent the initiation of tobacco use among adolescents and to facilitate cessation among addicted smokers. Legislative initiatives to increase tobacco taxes, enact clean air laws, and mandate coverage of tobacco cessation treatments are critical to maintaining progress against lung cancer.

References

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