The article by Menvielle et al. (1) in this issue of the Journal fits into the epidemiological tradition of testing how well one scourge explains another. Its goal is to quantify the extent to which educational and socioeconomic differences in smoking in Western Europe account for social class differences in lung cancer occurrence. Complicating this effort, however, is that the relationships between social class, smoking, and lung cancer have not been static but have evolved over the last 50 years, following historical trends in the dissemination of manufactured cigarettes (2). In Europe, dependence on manufactured cigarettes spread from men to women, from North to South, and from higher to lower social classes (2–4).

Vestiges of this demographic progression can be seen in studies conducted early in the 20th century that showed no association between low socioeconomic status and higher risk of lung cancer (5). No disparity in lung cancer was seen among men in England and Wales in 1910–1912 and 1930–1932, among women in Sweden in the 1960s, or in older birth cohorts in Finland from 1971 to 1985. Not until the 1970s were lung cancer incidence and death rates consistently higher among men with lower social status (2,5), especially in Northern Europe (2,5).

Very different socioeconomic patterns in cigarette smoking and lung cancer are still seen in Southern Europe, where the social class gradient is reversed among women and much weaker among men than in the North. Menvielle et al. observe this among participants in the European Prospective
Investigation into Cancer and Nutrition. Men and women from the five countries representing Northern Europe (United Kingdom, Norway, Sweden, Denmark, and the Netherlands) were more likely to smoke if they had completed college than if their education had stopped at primary school. In contrast, women from Southern Europe (Spain, Italy, and Greece) were more likely to smoke if they had progressed further in their education. For men, the educational gradient was in the same direction, but weaker in Southern Europe than in Northern Europe.

In this context, it is extremely difficult for Menvielle et al. to disentangle the historical and birth cohort effects of lifetime smoking on lung cancer risk from any other factors that may have contributed to risk. The authors’ conclusion that “self-reported differences in smoking consistently explain approximately 50%” of the educational inequalities in lung cancer is contingent on the quality of the individual measurement of lifetime smoking and the ability of the study to distinguish fixed relationships from those that are dynamic and evolving.

The design of the study is straightforward. The analyses are based on approximately 391,000 men and women recruited in nine countries (excluding France) in Western Europe between 1992 and 1994. At enrollment, respondents 40–65 years of age were asked to report their highest level of education, smoking status (current, former, never), number of cigarettes currently smoked per day, age at starting, years of smoking, and various dietary factors including fruit and vegetable consumption. A total of 1631 incident cases of lung cancer were identified in follow-up through 2004 or 2006.

Although the study design is simple, its results are difficult to compare with those of cohort studies in North America because educational levels are defined differently in Europe and because the educational gradient in lung cancer risk is expressed in terms of relative index of inequality (RII). In Europe, a primary school education corresponds to the first 5–9 years of education. This varies slightly among countries, ranging from grades 1–5 in Germany and Italy to grades 1–9 in the United Kingdom. The RII approach is useful in comparing these countries because it allows for the different distributions of educational attainment that exist among these countries. However, the results cannot be compared with related findings in the United States because the RII compares risk at the very bottom of the educational hierarchy (zero percentile) with that for the very top (100th percentile). These values are approximately 30% larger than the educational gradients typically reported in the United States, which compare the average risk in the lowest educational category to the average risk in the highest educational category (6).

The strengths of the study are its size, the availability of prospectively collected information on smoking and diet for each participant, and the quality of the follow-up information, which includes data on histological subtypes of lung cancer. The analyses provide strong evidence that variations in the consumption of fruits and vegetables, at least as measured by food frequency questionnaires, account for almost none of the educational gradient in lung cancer risk.

The main limitations of the study are two: 1) the information on smoking behavior is based on a single, relatively short questionnaire that covers only some of the parameters of lifetime smoking, and 2) the study population is drawn from countries that represent different phases of the changing relationship between cigarette smoking and social class. Together, these limitations leave considerable room for misclassification of lifetime smoking behavior. For example, the analyses cannot consider the number of cigarettes smoked per day at various points in the past, the use of pipes or cigars instead of cigarettes, or other product variations such as filtered vs nonfiltered. The intensity with which each cigarette was smoked cannot be measured adequately by questionnaires. One could hypothesize that less affluent smokers may smoke each cigarette more intensively than those with more economic resources. Misclassification of smoking behavior may also be somewhat greater when questionnaires are administered to less educated subjects vs more educated subjects (7).

In some analyses, the authors combine data in a manner that reduces the contrast in risk between never- and ever-smokers or that aggregates geographic areas with very different relationships between smoking and social class. For example, figure 1 combines never-smokers with occasional smokers, light smokers, and “ex-smokers who stopped a long time ago” to improve the precision of the rate estimates among those considered to have minimal smoking. This does add precision, but it inflates the apparent risk among never-smokers. Furthermore, Tables 3, 5, and 6 and Figure 1 combine the data from Northern and Southern Europe. Although these analyses control for the center at which participants were enrolled, the consequence of combining regions with very different socioeconomic relationships is to underestimate the contribution of smoking to the educational gradient in lung cancer.

In conclusion, it is extraordinarily difficult to quantify the degree to which social class differences in tobacco smoking account for the socioeconomic differences in lung cancer in a setting in which all of these factors have changed dramatically over time. Menvielle et al. are almost certainly correct that some fraction of the socioeconomic differences in lung cancer are due to factors other than smoking. Their efforts to quantify this fraction are laudable, even if the collective impact of factors other than smoking ultimately proves to increase lung cancer risk by a lower factor (perhaps 1.4) rather than by 2.0 or more. They are also correct that in the near term and for the foreseeable future, the most effective approach to reducing both the socioeconomic disparities and the overall burden of lung cancer is to implement measures that we already know are effective in reducing tobacco use.

References


