Smoking after Age 65 Years and Mortality in Barcelona, Spain

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The objective of this study was to assess the risk of dying associated with smoking after the age of 65 years and the benefits of quitting smoking, taking into account baseline health status. The study was carried out in Barcelona, Spain, a southern European city with an increase in smoking prevalence and lifestyle different from those of other areas where hazards of smoking have been studied. A follow-up study begun in 1986 was carried out in 477 males (94.3% of the original cohort) who were randomly selected by census from members of the Barcelona general population aged ≥65 years. Vital status as of October 1994 and, where applicable, cause of death (cardiovascular disease, cancer, or respiratory disease) were assessed. The relative risk of dying was 2.11 (95% confidence interval (CI) 1.37–3.26) times higher in current smokers and 1.53 (95% CI 1.03–2.27) times higher in former smokers than in never smokers. Quitting smoking after the age of 65 years reduced the relative risk of dying to 0.77 (95% CI 0.51–1.16) in comparison with continuing to smoke, although persons who stopped smoking had poorer self-perceived health and were more frequently reported to suffer from cardiovascular disease (p < 0.05). This study confirms that the effects of smoking extend to later life in this elderly general population, with a magnitude as great as that seen in previous studies with different populations. In addition, it indicates that stopping smoking after age 65 reduces the risk of dying. Am J Epidemiol 1998; 148:575–80.

Recent prospective studies have shown that the effect of smoking on survival extends to later life (1, 2). Previously it had been suspected that smokers who survived to old age had a risk of death similar to that of never smokers (3). Furthermore, a recent report showed that the impact of smoking in absolute terms (the difference between smokers and nonsmokers in risk of dying) increases with age (4). A related observation of studies carried out in the elderly has been that stopping smoking after the age of 65 years probably reduces the risk of death (1, 2). Since persons who stop smoking in later life are likely to do so because of ill health (5), and because health status affects fatality from chronic diseases (6) as well as the hazard due to smoking (7), the benefit of quitting smoking in this age group has probably been underestimated.

Most of the currently available prospective information on mortality and smoking was based on a UK cohort of physicians (1) and on general population cohorts followed in the United States (2, 8, 9). However, temporal variations in smoking patterns vary widely according to geographic area. In Spain, smoking was mainly limited to males until recently; and increased smoking of manufactured cigarettes among Spanish males started in the late 1940s and reached a peak during the mid-1980s, some 25 years later than in the United Kingdom and the United States (10). This could account in part for the lower incidence of lung cancer in Spain during the late 1970s and 1980s (approximately two times lower) (10, 11). Geographic differences in other lifestyle factors, such as alcohol consumption (12), could also imply geographic differences in the effects of smoking on risks of cancer and cardiovascular disease (13, 14).

We had the opportunity to follow a general population-based cohort of elderly people in Barcelona, Spain, with reported information on perceived health and chronic diseases. Our objective was to study the hazard of dying associated with long term smoking among persons who survive to the age of 65 years and the benefits of quitting smoking after that age, taking into account baseline health status. This information may contribute to a better assessment of the worldwide epidemic of smoking-related deaths.
MATERIALS AND METHODS

A cohort of 1,315 individuals (506 males and 809 females) aged 65 years or older was interviewed in 1986, as part of the Health Interview Survey of Barcelona (15). Briefly, a nonproportional random sample of all households in the city of Barcelona, stratified by district and family size, was drawn from the local 1985 census (16). The sample comprised 1,632 (638 males and 994 females) noninstitutionalized elderly people. The analyses described in this paper were based only on the 506 males aged ≥65 years (79 percent of those selected) who responded. Females were excluded, because almost all of them (94 percent) had never smoked (15).

The variables studied have been described elsewhere (15, 17). Briefly, information on self-perceived health ("How would you rate your overall health: very good, good, fair, poor, or very poor?")}, basic activities of daily living (measured by the self-reported ability to perform nine basic activities of daily living), chronic conditions (using a checklist with 14 conditions common among the elderly, including asthma or chronic bronchitis and heart diseases), total physical activity (in four graded categories), alcohol consumption during the previous 12 months (based on a quantity/frequency scale), and cigarette smoking (never, former, or current smoking and age at quitting, but not type of tobacco) was collected through a face-to-face home interview. Among surviving individuals, the same variables were assessed in 1993–1994.

Vital status in October 1994 was obtained for 500 (98.8 percent) of the original 506 men, 209 (41.8 percent) of whom had died, using confidential record linkage with the regional mortality register. A telephone survey was carried out for those not listed in the mortality register, which allowed validation of vital status. All subjects but six were contacted. For 23 subjects, information on smoking was missing. Hence, we studied 477 individuals (94.3 percent of the original cohort). Table 1 shows the ages at entry of these individuals and the mean follow-up time for each age group.

Smoking status was defined by the category in which subjects placed themselves in 1986. In addition, former smokers were categorized according to the age at which they had stopped smoking, the median age being approximately 64 years. No individual classified as a current smoker in 1986 reported being a never smoker in 1994. Similarly, none of the never smokers in 1986 reported being current smokers in 1994.

Mortality hazards were estimated for lifelong non-smokers and for former and current smokers. Causes of death were classified according to the Ninth Revision of the International Classification of Diseases (ICD-9) (18) on the basis of the underlying cause recorded in the death register. Mortality rates for each smoking category were calculated by dividing the numbers of deaths from all causes and from cardiovascular disease (ICD-9 codes 390–459), lung cancer (ICD-9 code 162), all cancers (ICD-9 codes 140–239), and respiratory disease (ICD-9 codes 460–519) by the accumulated person-years of follow-up (19). Rates were standardized by age in years. Rate differences for specific causes of death by smoking status were assessed using Poisson regression (19), since cause-specific mortality rates followed a Poisson distribution. Poisson regression allowed adjustment for other risk factors for death at baseline in addition to age, such as perceived health, reported chronic conditions, current alcohol intake, basic activities of daily living, and current physical activity.

Mortality from all causes was assessed using survival methods, which are based on a much finer division of time than Poisson regression methods. The survival function for all causes of death by smoking status, using age as the time scale and entries at different ages, was estimated by means of the Kaplan-Meyer method and the Cox proportional hazards model (20). The latter allowed us to calculate the relative risk of dying among current smokers in relation to that among never or former smokers, adjusting for the other risk factors. Using age as the time scale allows comparisons between the hazards of death in different ages, was estimated by means of the Kaplan-Meyer method and the Cox proportional hazards model (20). The latter allowed us to calculate the relative risk of dying among current smokers in relation to that among never or former smokers, adjusting for the other risk factors. Using age as the time scale allows comparisons between the hazards of death in groups of comparable ages but in different calendar periods. Since individuals entered into observation at different ages, the survival methods used here were those for cohort studies with staggered entry times. An individual subject contributed to the risk sets only at ages where he could have been observed. Comparisons carried out did not violate the assumption of constant proportionality of the hazards. The inclusion of interaction terms in the model allowed assessment of whether the relative risk associated with smoking varied according to baseline health status.

| TABLE 1. Distribution of 477 men aged ≥65 years by age at study entry in 1986 and vital status in 1994, Health Interview Survey of Barcelona, Barcelona, Spain |
|---|---|---|---|
| Age (years) at study entry (1986) | No. | % of deaths | Mean years of follow-up |
| 65–74 | 310 | 29.4 | 7.1 (2.3)* |
| 75–84 | 150 | 56.7 | 5.9 (2.6) |
| >84 | 17 | 70.6 | 4.4 (3.1) |
| All ages | 477 | 39.4 | 6.6 (2.5) |

* Numbers in parentheses, standard deviation.
respiratory diseases (p < 0.05). Current smokers reported being in better health than never smokers and less frequently in activities of daily living and 23 percent had respiratory conditions (table 2). Health status was worse among men who had stopped smoking after the age of 65 years (38 percent of them reported having difficulty in activities of daily living, cardiac or respiratory diseases, alcohol intake, and physical activity did not confound or modify these risks.

The yearly excess mortality attributed to the persistence of smoking was 38.4 deaths per 1,000 persons aged ≥65 years. The highest proportion of the excess mortality was due to cancer (26.9 - 9.2 = 17.7 (see table 3), which accounts for 46.1 percent of the excess), followed by cardiovascular diseases (14.8 percent) and respiratory diseases (10.9 percent).

Figure 1 depicts the survival function after age 65 years for never, former, and current smokers, by age. Half of the never smokers died before reaching age 84, whereas half of the current smokers died before reaching age 78. The age-adjusted relative risk for current smoking was 2.11 (95 percent CI 1.37–3.26). This higher risk was maintained after adjustment for self-reported health status, basic activities of daily living, and cardiac or respiratory diseases. We did not find any interaction between smoking and alcohol consumption; the preventive effect of alcohol intake among never smokers was also observed among smokers.

Among former smokers, the relative risk for all-cause mortality was significantly higher than that in never smokers (RR = 1.53, 95 percent CI 1.03–2.27) but was lower than that in current smokers (RR = 0.73, 95 percent CI 0.52–1.02), coinciding with the survival function depicted in figure 1. After adjustment for baseline health status, the relative risk of mortality are shown in table 3. Current smokers had higher risks of dying from any type of cancer (age-adjusted relative risk (RR) = 3.11, 95 percent confidence interval (CI) 1.38–7.01), from cardiovascular disease (RR = 1.33, 95 percent CI 0.71–2.50), and from respiratory disease (RR = 3.36, 95 percent CI 0.64–17.4) than never smokers, though the difference was statistically significant only for cancer (p < 0.05). Adjustment for self-perceived health, activities of daily living, cardiac or respiratory diseases, alcohol intake, and physical activity did not confound or modify these risks.

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dying among individuals who had quit smoking in comparison with current smokers decreased to 0.69 (95 percent CI 0.49–0.97). After adjustment for baseline health, quitting smoking after age 65 years was associated with a decreased risk of death in comparison with persisting in smoking (age-adjusted mortality from all causes = 69.0 deaths per 1,000 person-years; RR = 0.77, 95 percent CI 0.51–1.16), although this reduction was not statistically significant.

DISCUSSION

This study found that smokers who survived to old age had a higher risk of dying than did never smokers, while those who stopped smoking, even after age 65 years, had an intermediate risk. These results confirm the findings of previous studies carried out in the United Kingdom and the United States (1, 2, 8, 9). A second finding was that former smokers reported more cardiac and respiratory diseases than never smokers, which is consistent with results from the Framingham cohort (4). This suggests that poorer health was one reason for quitting smoking.

This study contributes to the ongoing assessment of the worldwide epidemic of smoking-related deaths in several ways: 1) it provides data from a specific area with a relatively late onset of cigarette smoking and with dietary factors that differ from those of other studies, including different patterns of alcohol consumption (12); 2) the data analyzed were based on a representative sample of the noninstitutionalized elderly population; and 3) we were able, at least partially, to avoid the confounding effect of a worse health status associated with stopping smoking in evaluating the benefit of quitting smoking after age 65.

It is important to note that the tobacco consumed in Spain during the 1960s and 1970s was mainly the black type, which differed from the mainly blond tobacco consumed in the United Kingdom and the United States. Blended tobacco was introduced in Spain in the 1960s, and its use increased until 1988, when it constituted half of all tobacco sold in Spain (21). However, we could not assess the effect of tobacco type in our study.

The magnitudes of the risk ratio and risk difference for all-cause mortality were somewhat greater in our study (RR = 2.1) than in a US study (2) (RR = 1.9) and in a UK study (1) among persons aged 65 years or older (RR = 1.7). Doll et al. (1) reported a decrease with age in the risk of dying due to smoking, which they explained by a reduction in the proportion of deaths caused by cancer and the reduction in intensity of smoking among the elderly. In our study, most of the excess mortality attributed to tobacco use was due mainly to cancer (46 percent of the excess deaths), not to cardiovascular conditions as in previous studies (1, 2). Similarly, in the mortality statistics of Barcelona (22), the proportion of mortality due to cancer at ages 65–74 years was higher (38 percent) than that in the United Kingdom (24 percent) and the United States (26 percent) (1, 2). Since misclassification of diag-
noses is unlikely to occur when causes of death are combined into a few large groups, as a previous validity study conducted in Barcelona showed (23), a likely explanation is that the cancer epidemic due to smoking in Barcelona was postponed, appearing in persons of older ages because of a delay in the introduction of mass cigarette smoking.

We found a benefit of stopping smoking in this elderly Barcelona cohort that was consistent with findings from other cohorts. An improvement in survival was observed, even though persons who had stopped smoking had poorer self-perceived health and were more frequently reported to suffer from cardiac and respiratory diseases. Those who stopped smoking after age 65 also showed a reduction in the mortality hazard (though it was not statistically significant, probably because of the reduced number of subjects who quit after age 65).

Alcohol could confound some of the association between smoking and premature death, because of its protective effect against cardiovascular disease (13, 14) and because smoking and alcohol use are highly correlated. Alcohol consumption is common in Spain (74 percent of our males drank alcohol), but most of our subjects (81 percent) reported moderate consumption (<40 g/day). However, for both all-cause and cardiovascular mortality, we found similar relative risks associated with smoking in alcohol consumers and abstainers, as well as similar protective effects of alcohol in smokers and nonsmokers.

Misclassification of smoking status could have biased our results. However, use of repeated information on smoking allows assessment of and improvement in the quality of data. When we took as "never" smokers and "current" smokers only those individuals who reported being such in both interviews (i.e., in both 1986 and 1993–1994), the hazard ratio for smoking became even higher (RR = 2.49). The lower relative risk found when we defined smoking only by the information obtained in 1986 can probably be explained by the misclassification, as current smokers, of subjects who stopped smoking between 1986 and the year of death. Unfortunately, the short time interval between the second interview and the end of follow-up precluded the use of this secondary information on smoking to more accurately define exposure. The group with less consistent data was the former smokers, since this group could have included persistent smokers who, because of embarrassment, did not accurately report their actual smoking status. However, when we defined smoking only by the men who reported being former smokers on both questionnaires, we still found a beneficial effect of stopping smoking.

In summary, the present study found that smoking reduced life expectancy by approximately 6 years among persons alive at age 65 in a Mediterranean city. We estimated that almost 38 deaths per 1,000 males aged ≥65 per year could be attributed to smoking—the same number of deaths that could be attributed to all of the other causes (table 3). In addition, the findings suggested that quitting smoking was beneficial even after health had deteriorated (probably in association with previous smoking). The resulting estimates of public health impact are of a similar magnitude as, if not higher than, those reported by prospective studies carried out in countries with an earlier peak in tobacco smoking prevalence and different lifestyle patterns. These results support the prediction made by other investigators (24, 25) that a rise in mortality will follow the recent massive introduction of smoking in developing countries.

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