Public Health Briefs

Smoking and Mortality among Residents of a California Retirement Community

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ABSTRACT

Smoking cessation decreases mortality among the elderly. Participants in the Leisure World Cohort Study initiated in 1981 were followed until death or January 1, 1991. The 8869 women and 4999 men (median age = 73 years at initial survey) contributed 105 952 person-years of follow-up; 4002 had died. All-cause mortality rates were highest among current smokers; compared with never smokers the age-adjusted relative risks (and 95% confidence intervals) were 1.67 (1.46, 1.92) for women and 1.95 (1.66, 2.30) for men. Current smokers had increased risks of coronary heart disease, other cardiovascular disease, and cancer. Risk of death from smoking-related cancers continued to be high among former smokers, although lower than the risk among current smokers. Relative risks of mortality from cancer and cardiovascular disease increased with the number of cigarettes smoked per day and with a decreasing number of years since cessation of smoking. (*Am J Public Health.* 1994;84:992–995)

Introduction

Although cigarette smoking causes coronary heart disease and cancer in middle age, few studies have examined the effect of continued smoking among those who survive to old age.[1–3] LaCroix et al. found that smokers' mortality rates were twice those of never smokers in a prospective study of 7178 persons aged 65 years or older.[1] Current smokers had higher rates of both cardiovascular and cancer mortality. Similarly, the Honolulu Heart Study found that smokers continued to have an increased risk of heart disease in older age.[2] However, the Framingham Heart Study reported no relation between smoking and mortality after 30 years of follow-up.[3] We evaluated the effect of smoking in a population-based cohort comprising a large number of people older than 75 years (including many women) and followed prospectively for 9½ years.

Methods

In June 1981, a health survey was mailed to all residents of Leisure World, Laguna Hills, a retirement community near Los Angeles, Calif. Residents moving into the community after this date were mailed this questionnaire in June 1982, June 1983, and October 1985. Residents are primarily White, affluent, well educated, and female (two thirds). The residents' median age at initial survey was 73 years. Of the 22 781 residents, 13 981 (61%), including 8879 women, returned questionnaires. Details of the study have been reported previously.[4,5]

The health survey requested information on life-style practices including use of cigarettes. Smoking status was classified as *current, past,* or *never* based on response to the question, "Have you *ever* smoked cigarettes during any period of your life (aside from possibly trying them once or twice)?" Current and past smokers were asked, "What is the greatest number of cigarettes that you have regularly smoked?" with the choices of *¼, ½, 1, 1½,* and *2 or more packs per day.* Current and past smokers were also asked, "At what age did you start smoking regularly?" Past smokers were asked, "At what age did you last stop?"

Cohort members were followed until death or January 1, 1991. Twenty cohort members were lost to follow-up; a search of the National Death Index did not reveal that these individuals were deceased. Cause of death as recorded on the death certificates was coded by using the *International Classification of Diseases,* Ninth Revision (ICD-9).

We evaluated the relation of smoking to mortality from all causes and from selected specific causes: coronary heart disease (ICD-9 codes 410–414); other cardiovascular disease (codes 390–405, 415–459, and 798); total cardiovascular disease (codes 390–459 and 798); smoking-related cancers (codes 141–145, 150, 157, 161, 162, 188, and 189), that is, cancers of the lung, trachea, bronchus, oral cavity, larynx, esophagus, pancreas, bladder, and kidney; and all cancers (codes 140–208).

Age-adjusted relative risks, with five age groups ($\leq$74, 75–79, 80–84, 85–89, and 90+ years), and two-sided *P* values

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were obtained by using a regression method that assumed that the occurrence of death could be regarded as a Poisson process with a constant hazard rate for a given person.[6,7] The GLIM statistical software package program was used to make these calculations.[8]

Results

The 8869 women and 4999 men providing information on smoking contributed 105 952 person-years of follow-up (70 309 for women and 35 643 for men). Deaths occurred in 1987 women and 2015 men. More women than men were current smokers at baseline (12% vs 9%), and the prevalence of smoking decreased with age in both sexes (Table 1). Age-adjusted relative risks of specific causes of death by various smoking categories are shown in Tables 2 and 3 for women and men, respectively.

Mortality rates from all causes were nearly double among current smokers compared with never smokers. The age-adjusted relative risk of total mortality was 1.67 (95% confidence interval [CI] = 1.46, 1.92) in women and 1.95 (CI = 1.66, 2.30) in men. The relative risks for current smokers were increased in each age group (≤74, 75–79, 80–84, 85–89, and 90+ years) except for men aged 90 years or older (2.08, 1.83, 1.55, 1.26, and 1.59 for women and 2.09, 1.45, 2.09, 1.63, and 0.50 for men). Both female and male former smokers had rates of total mortality between those of current smokers and never smokers; the age-adjusted relative risk was 1.20 (CI = 1.09, 1.33) for women and 1.24 (CI = 1.13, 1.37) for men.

The higher risk of death among current smokers was because of deaths from cardiovascular disease and cancer.

TABLE 1—Distribution of Smoking Status at Initial Survey, by Sex and Age: The Leisure World Cohort

	Females (n = 8869), %			Males (n = 5102), %		
Age, y	Current Smoker (n = 1106)	Past Smoker (n = 2880)	Never Smoker (n = 4883)	Current Smoker (n = 438)	Past Smoker (n = 2953)	Never Smoker (n = 1708)
<65	21	36	43	16	50	34
65–69	18	39	43	12	55	33
70–74	14	37	49	10	58	31
75–79	9	30	60	7	60	33
≥80	4	21	74	3	60	37

TABLE 2—Age-Adjusted Relative Risks (RRs) for Cause-Specific Mortality, by Smoking Categories: Females

		Cause of Death and ICD-9 Code											
		All Causes 1–999		CHD 410–414		Other CVD 390–405, 415–459, 798		Total CVD 390–459, 798		Smoking Cancers 141–145, 150, 157 161–162, 188–189		All Cancers 140–208	
Smoking Category	Person-Years[a]	RR	95% CI	RR	95% CI	RR	95% CI	RR	95% CI	RR	95% CI	RR	95% CI
Smoking													
Never[b]	38 761	1.00		1.00		1.00		1.00		1.00		1.00	
Past	22 775	1.20	1.09, 1.33	1.28	1.06, 1.55	1.18	0.97, 1.45	1.24	1.08, 1.42	1.51	1.01, 2.25	1.00	0.81, 1.23
Current	8 725	1.67	1.46, 1.92	1.47	1.10, 1.95	1.93	1.48, 2.53	1.68	1.38, 2.05	3.70	2.41, 5.67	1.65	1.27, 2.14
Test for trend[c]		$P < .001$		$P < .01$		$P < .001$		$P < .001$		$P < .001$			
No. of years smoked													
1–19	6 336	1.06	0.89, 1.26	1.06	0.76, 1.47	1.22	0.88, 1.69	1.14	0.90, 1.43	0.85	0.39, 1.87	0.89	0.62, 1.28
20–39	12 114	1.10	0.96, 1.26	1.31	1.02, 1.67	1.12	0.85, 1.47	1.22	1.10, 1.46	1.38	0.83, 2.30	0.90	0.68, 1.19
≥40	11 693	1.68	1.49, 1.89	1.59	1.27, 2.00	1.51	1.18, 1.92	1.55	1.31, 1.83	3.59	2.45, 5.28	1.62	1.29, 2.03
Test for trend		$P < .001$		$P < .001$		$P < .01$		$P < .001$					
No. of packs/day													
¼–½	15 987	1.17	1.04, 1.31	1.15	0.93, 1.43	1.25	1.00, 1.55	1.20	1.03, 1.40	1.33	0.84, 2.10	1.03	0.81, 1.30
≥1	14 199	1.58	1.40, 1.78	1.65	1.32, 2.07	1.54	1.21, 1.96	1.60	1.35, 1.89	3.04	2.05, 4.51	1.38	1.10, 1.74
Test for trend		$P < .001$		$P < .001$		$P < .001$		$P < .001$		$P < .001$		$P < .05$	
Years since last smoked													
>20	8 575	0.99	0.85, 1.15	1.09	0.83, 1.42	1.03	0.78, 1.36	1.06	0.87, 1.28	0.86	0.44, 1.69	0.87	0.64, 1.19
11–20	6 576	1.32	1.13, 1.55	1.53	1.14, 2.04	1.13	0.80, 1.60	1.34	1.08, 1.67	1.60	0.87, 2.94	1.12	0.81, 1.55
6–10	3 222	1.32	1.05, 1.65	1.42	0.93, 2.15	1.26	0.79, 2.00	1.34	0.98, 1.83	2.05	0.97, 4.31	1.02	0.64, 1.63
≤5	3 391	1.52	1.22, 1.88	1.28	0.81, 2.01	1.45	0.92, 2.28	1.36	0.98, 1.87	3.30	1.79, 6.11	1.12	0.71, 1.75
Test for trend		$P < .001$		$P < .01$		$P < .001$		$P < .001$		$P < .001$		$P < .001$	
Age quit smoking													
<65	17 312	1.08	0.96, 1.22	1.17	0.93, 1.46	1.07	0.84, 1.37	1.12	0.95, 1.32	1.30	0.82, 2.07	0.97	0.76, 1.23
≥65	4 575	1.45	1.25, 1.69	1.55	1.18, 2.04	1.25	0.92, 1.71	1.41	1.14, 1.73	2.36	1.36, 4.12	1.11	0.78, 1.58
Test for trend		$P < .001$		$P < .001$		$P < .001$		$P < .001$		$P < .001$		$P < .001$	

Note. CHD = coronary heart disease; CVD = cardiovascular disease; CI = confidence interval.
[a]Person-years do not always total 70 309 because of missing values for some persons.
[b]Reference category for all relative risks.
[c]*P* values for test for linear trend are given unless test for deviation from linearity was significant ($P < .05$).

TABLE 3—Age-Adjusted Relative Risks (RRs) for Cause-Specific Mortality, by Smoking Categories: Males

Smoking Category	Person-Years[a]	Cause of Death and ICD-9 Code: All Causes 1–999 RR	95% CI	CHD 410–414 RR	95% CI	Other CVD 390–405, 415–459, 798 RR	95% CI	Total CVD 390–459, 798 RR	95% CI	Smoking Cancers 141–145, 150, 157, 161–162, 188–189 RR	95% CI	All Cancers 140–208 RR	95% CI
Smoking													
Never[b]	12 325	1.00		1.00		1.00		1.00		1.00		1.00	
Past	20 408	1.24	1.13, 1.37	1.16	0.98, 1.37	1.01	0.83, 1.24	1.10	0.97, 1.25	2.45	1.62, 3.71	1.42	1.14, 1.75
Current	2 907	1.95	1.66, 2.30	1.41	1.03, 1.93	1.91	1.36, 2.70	1.60	1.27, 2.02	6.39	3.83, 10.6	2.74	2.01, 3.74
Test for trend[c]				$P < .05$						$P < .001$		$P < .001$	
No. of years smoked													
1–19	4 560	0.93	0.79, 1.09	0.75	0.56, 1.00	0.88	0.63, 1.23	0.80	0.64, 1.00	1.01	0.49, 2.07	1.14	0.82, 1.59
20–39	9 582	1.16	1.03, 1.31	1.13	0.92, 1.38	1.02	0.80, 1.31	1.09	0.93, 1.27	1.86	1.14, 3.04	1.28	0.99, 1.66
≥40	8 400	1.68	1.51, 1.88	1.48	1.22, 1.79	1.33	1.05, 1.68	1.42	1.25, 1.64	4.85	3.18, 7.42	2.08	1.65, 2.63
Test for trend						$P < .05$						$P < .001$	
No. of packs/day													
¼–½	6 633	1.16	1.03, 1.32	1.19	0.96, 1.47	0.99	0.76, 1.29	1.11	0.94, 1.30	1.26	0.71, 2.24	1.21	0.92, 1.60
≥1	15 731	1.41	1.27, 1.56	1.21	1.01, 1.44	1.17	0.94, 1.46	1.19	1.04, 1.37	3.65	2.41, 5.53	1.72	1.38, 2.14
Test for trend		$P < .001$		$P < .05$		$P < .10$		$P < .05$		$P < .001$		$P < .001$	
Years since last smoked													
>20	10 225	1.09	0.98, 1.22	1.03	0.85, 1.25	0.95	0.75, 1.20	1.00	0.86, 1.16	1.77	1.10, 2.84	1.31	1.03, 1.67
11–20	5 732	1.36	1.19, 1.55	1.21	0.96, 1.53	1.21	0.91, 1.60	1.21	1.01, 1.45	2.91	1.76, 4.80	1.44	1.08, 1.92
6–10	2 125	1.48	1.22, 1.80	1.43	1.02, 1.99	0.86	0.52, 1.42	1.20	0.91, 1.58	3.91	2.11, 7.25	1.72	1.16, 2.55
≤5	1 670	2.00	1.64, 2.45	2.02	1.44, 2.84	1.38	0.84, 2.25	1.77	1.34, 2.34	4.10	2.07, 8.12	1.92	1.24, 2.96
Test for trend		$P < .001$		$P < .001$		$P < .001$		$P < .001$		$P < .001$		$P < .001$	
Age quit smoking													
<65	16 425	1.11	1.00, 1.24	1.03	0.86, 1.23	0.98	0.79, 1.22	1.01	0.88, 1.16	1.99	1.28, 3.08	1.30	1.04, 1.63
≥65	3 363	1.74	1.52, 1.98	1.71	1.37, 2.14	1.19	0.89, 1.60	1.49	1.25, 1.78	4.22	2.58, 6.91	1.92	1.44, 2.56
Test for trend						$P < .01$				$P < .001$		$P < .001$	

Note. CHD = coronary heart disease; CVD = cardiovascular disease; CI = confidence interval.
[a]Person-years do not always total 35 643 because of missing values for some persons.
[b]Reference category for all relative risks.
[c]*P* values for test for linear trend are given unless test for deviation from linearity was significant ($P < .05$).

The age-adjusted relative risks for all cardiovascular disease for current smokers were 60% greater than those of never smokers: 1.68 (CI = 1.38, 2.05) for women and 1.60 (CI = 1.27, 2.02) for men. This increased risk was observed for mortality from coronary heart disease and from other cardiovascular disease. No elevation in the rate of all cardiovascular disease was observed among male former smokers, although the rate in female former smokers was increased.

The rates of death from all cancers were higher among the current smokers than among the never smokers. The age-adjusted relative risk was 1.65 (CI = 1.27, 2.14) for women and 2.74 (CI = 2.01, 3.74) for men. Current smokers had especially high rates of mortality from smoking-related cancers compared with never smokers. The age-adjusted relative risk was 3.70 (CI = 2.41, 5.67) for women and 6.39 (CI = 3.83, 10.6) for men. The risk of death from smoking-related cancers continued to be high among former smokers, although it was lower than the risk among current smokers. The age-adjusted relative risks for former smokers were 1.51 (CI = 1.01, 2.25) and 2.45 (CI = 1.62, 3.71) for women and men, respectively.

Risks of death from cancer and cardiovascular disease increased with the number of cigarettes smoked per day in both sexes. Less consistent trends were observed for the number of years of smoking. Former smokers who quit smoking more than 20 years ago had rates of death similar to those among never smokers for each specific cause except cancer in men, the risk for which remained high. In all cases the risk of death increased with decreasing number of years since cessation of smoking. Likewise, for all causes of death and each cause-specific category, the relative risk of death was higher among those who quit smoking at age 65 years or later than it was among those who quit before age 65.

Discussion

Previous reports concerning middle-aged populations have linked current smoking to mortality from coronary disease and cancer. However, few studies have evaluated the association between smoking and mortality in people older than 65 years, and only one has had a substantial number of subjects older than 75 years of age. Our findings suggest that the increased risks associated with smoking extend to groups beyond age 75. This agrees with the recent report by LaCroix et al.,[1] who found a marginally significant increased risk of death among smokers in that age group.

Previously, we found little evidence of response bias in this cohort when comparing early and late respondents on most variables.[9] In terms of illness (hypertension, angina, myocardial infarction, stroke, diabetes, rheumatoid arthritis, glaucoma, and cancer), we found no large differences between early and late respon-

dents. As with other surveys, we found that current smokers were slower to respond and former smokers were faster to respond than never smokers. However, the differences were not large. Nonetheless, systematic differences between early and late responders and the slightly higher incidence of hospitalizations during the first year of study among nonrespondents indicate that the early respondents are the "worried well," i.e., healthy individuals who see their doctor regularly, receive disease detection screening, and follow healthful life-style practices. However, using internal standards for comparing mortality rates, as we did, is unlikely to produce biased results.

The findings of this study support the efforts toward smoking cessation. Cancer and cardiovascular disease are essentially diseases of older persons, and the positive effects of smoking cessation on these diseases extend to old age. In view of the finding that former smokers who quit less than 20 years ago remain at increased risk of death, smoking cessation should begin early to reduce the risks of cardiovascular and cancer mortality and increase the health of older adults. □

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The Utility of HMO Data for the Surveillance of Chronic Diseases

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ABSTRACT

In an area served by a single medical center that operates as both health maintenance organization (HMO) and fee-for-service clinic, we reviewed existing computerized medical records to determine the prevalence of 11 diseases. Standardized medical care utilization prevalence ratios, comparing the annual prevalences in the two groups, varied from 1.38 for rheumatoid arthritis to 0.60 for liver cirrhosis. Unless supplemented by data from hospitals, physicians, and other sources, HMO data may result in invalid estimates of the prevalence of chronic disease. (*Am J Public Health.* 1994;84:995–997)

Introduction

Surveillance of disease is the continuing scrutiny of all aspects of occurrence and spread of a disease that are pertinent to effective control.[1] Because in the United States chronic diseases account for a majority of deaths,[2] the Centers for Disease Control and Prevention are evaluating improved methods of surveillance.[3]

Traditionally, surveillance of chronic diseases has been done by using mortality data.[4] Although some registries track nonfatal cancer, cardiovascular disease, stroke, birth defects, trauma, and other noninfectious conditions,[5] few have employed routinely collected morbidity data from hospital discharge, health maintenance organization (HMO), or ambulatory care records.

Several characteristics of HMOs make them attractive for research, especially the existence of an identified and relatively stable population.[6,7] Yet examples of the use of clinical databases to relate the experience of the HMO population to epidemiologic trends are limited.[8,9] Studies of HMO populations are relatively recent.[10] No studies address the validity of such research, particularly with respect to disease surveillance.

Methods

Study Population

Marshfield Clinic is a 400-physician group practice adjacent to Saint Joseph's Hospital in Marshfield, Wis. The clinic

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