Trends in Tobacco Smoking and Mortality From Cigarette Use in Cancer Prevention Studies I (1959 Through 1965) and II (1982 Through 1988)

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INTRODUCTION Despite the vast literature on the adverse effects of tobacco smoking and on trends in the diseases caused by smoking in the general population, there are almost no descriptive data on how death rates in smokers and never-smokers have changed over time. The 1989 U.S. Surgeon General's report (U.S. Department of Health and Human Services, 1989) noted that in the 20-year period from the mid-1960's through the early 1980's, the relative risk of fatal lung cancer approximately doubled in male cigarette smokers and increased nearly fivefold in female cigarette smokers; smaller increases were observed for coronary heart disease (CHD) and stroke. The Surgeon General based these observations on preliminary comparisons of Cancer Prevention Studies I and II (CPS-I and CPS-II) of the American Cancer Society (ACS) that cover the years 1959 through 1965 and 1982 through 1986, respectively.

Because CPS-I and CPS-II provide smoking information and mortality data on populations studied with comparable techniques in the 1960's and 1980's, these data can be used to gain a longitudinal perspective on changes in smoking-specific mortality over time (Shopland et al., 1991). This chapter extends the analyses in the 1989 Surgeon General's report (U.S. Department of Health and Human Services, 1989) by (1) comparing patterns of cigarette smoking (i.e., prevalence, amount, age of initiation, and duration) in CPS-I, CPS-II, and two nationally representative surveys from the same periods; (2) extending followup of CPS-II for 2 additional years through 1988; (3) presenting death rates, rate ratios (RR's) (death rate in smokers divided by that in never-smokers), and rate differences (RD's) (death rate in smokers minus the rate in never-smokers) for lung cancer, CHD, chronic obstructive pulmonary disease (COPD), stroke, other smoking-related cancers, and all causes combined among current cigarette smokers and lifelong never-smokers in CPS-I and CPS-II; and (4) examining the extent to which the rise in lung cancer death rates from CPS-I to CPS-II can be explained by cigarette consumption.

SUBJECTS AND METHODS

Study Population

Subjects in the analyses were drawn from CPS-I (Garfinkel, 1985; Hammond, 1964 and 1966) and CPS-II (Garfinkel, 1985; Garfinkel and Stellman, 1988; Peto et al., 1992; Stellman and Garfinkel, 1986); selected characteristics are shown in Table 1. Subjects were recruited in fall 1959 for CPS-I and in fall 1982 for CPS-II from among the friends, neighbors, and acquaintances of ACS volunteers. Enrollment was based on those who were part of a household, excluding persons in institutions or military service and itinerants who would be difficult to trace (Garfinkel, 1985). Volunteers sought to enroll all household members 30 years of age or older if at least one family member was 45 years or older. CPS-I included subjects from 25 States; CPS-II included subjects from 50 States, the District of Columbia, Puerto Rico, and Guam. Participants in both studies were older, more educated, and more frequently married and part of the middle class than the general U.S. population (Garfinkel, 1985; Stellman and Garfinkel, 1986). Whites made up 97 percent of CPS-I and 93 percent of CPS-II.

Because the age distributions of subjects in CPS-I and CPS-II were similar at the time of enrollment, the two studies represent birth cohorts separated by approximately 20 years (Figure 1). CPS-I includes predominantly cohorts born between 1880 and 1919, whereas CPS-II participants were mostly from cohorts born from 1900 to 1939 and who became adults during the peak years of cigarette smoking in America (U.S. Department of Health and Human

Table 1
Selected characteristics of CPS-I and CPS-II

Full Cohorts	CPS-I		CPS-II	
Followup Period[a]	1959-1965		1982-1988	
Study Participants	1,051,038		1,185,106	
Vital Status, Number (percent)[b]				
Alive:	959,121	(91.3)	1,083,600	(91.4)
Dead:	76,888	(7.3)	79,802	(6.7)
Lost:	15,029	(1.4)	21,704	(1.8)
Exclusions				
Former smokers	70,108		262,790	
Ever pipe/cigar	149,828		101,600	
Smoking data incomplete or unclassifiable[c]	44,715		109,353	
Total exclusions	264,651		473,743	
Analytic Cohorts				
Current cigarette smoker	298,687		228,682	
Lifelong never-smoker	487,700		482,681	
Total analytic cohort	786,387		711,363	

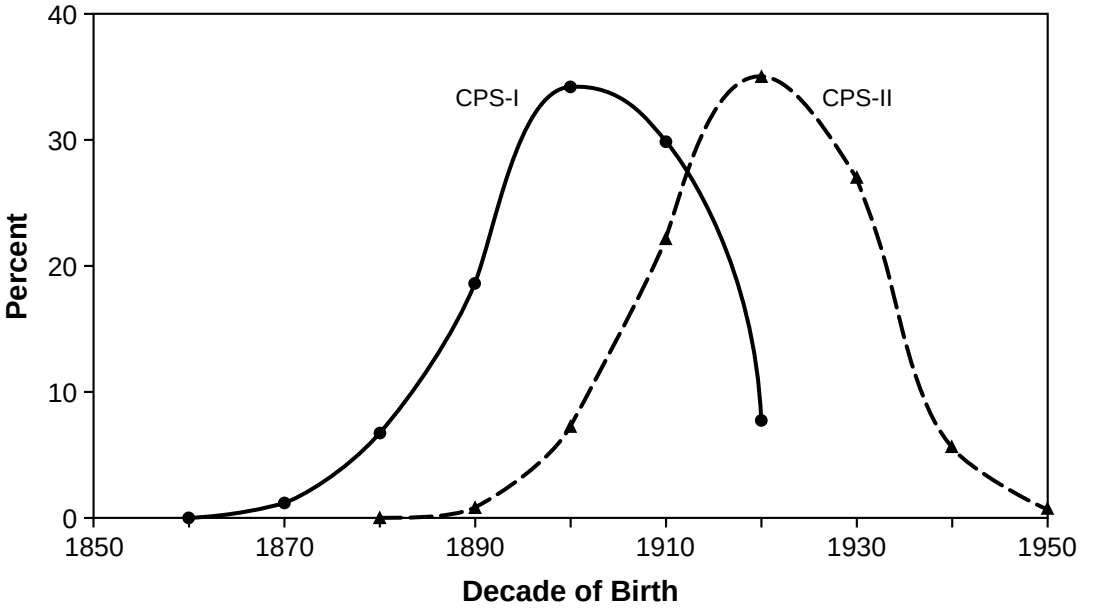
[a] *Analyses restricted to first 6 years of followup to enhance comparability.*

[b] *Vital status as of September 30, 1965, for CPS-I and August 31, 1988, for CPS-II. Followup terminated before September 30, 1965, for 1,005 CPS-I participants because of administrative reasons (see text).*

[c] *Excludes subjects with incomplete or unclassifiable data on status, pipe or cigar smoking, cigarettes per day, or duration of smoking.*

Key: CPS = Cancer Prevention Study.

Figure 1
Distribution of CPS-I and CPS-II participants by 10-year birth cohort



Services, 1989). The number of subjects in each birth cohort and the relationship between year of birth and age at enrollment are shown in Appendix 1.

Table 1 shows the composition of the included and excluded subjects analyzed in this chapter. Death rate analyses were based on more than 220,000 current smokers (defined below) and more than 480,000 lifelong never-smokers in each study, excluding former smokers, persons who ever smoked pipes or cigars, and those whose information on smoking was incomplete or unclassifiable. Analyses of smoking prevalence were based on the full cohorts. Certain analyses of lung cancer were restricted to current cigarette smokers, ages ≥50 years, who reported smoking 20 or 40 cigarettes per day for at least 30 years at baseline.

Followup The participants' vital status was determined through personal inquiry by the volunteers for 12 years in CPS-I and 6 years in CPS-II. For comparability, the analyses were restricted to the first 6 years in each study: for CPS-I from enrollment through September 30, 1965, and for CPS-II from enrollment through August 31, 1988. Persons lost to followup were considered alive until the date last observed, which in CPS-II was considered to be the end of followup. Included in the group "lost to followup" in CPS-I were 1,005 participants for whom followup was terminated early because of the inability of some local field units to continue the study (Table 1) (Hammond, 1966). Death certificates were obtained for deceased subjects. The underlying cause of death was coded according to abbreviated versions

of the *Manual of the International Statistical Classification of Diseases, Injuries, and Causes of Death* (*ICD-7*) (World Health Organization, 1957) for CPS-I and the *Manual of the International Statistical Classification of Diseases, Injuries, and Causes of Death* (*ICD-9*) (World Health Organization, 1977) for CPS-II.

Smoking Information At enrollment in the two studies, participants completed a four-page questionnaire that had similar questions on smoking. Participants in CPS-I were asked, "Do you now smoke?," and if the answer was yes, "How many cigarettes do you usually smoke a day?"; parallel questions were asked about pipe and cigar smoking (men only) and former smoking. Participants in CPS-II were asked, "Do you now or have you ever smoked cigarettes at least one a day for 1 year's time?" For men this question also mentioned cigars and pipes. Current and former smokers were asked to complete separate sections on the age of starting, average number of cigarettes smoked per day, duration of smoking, and depth of inhalation. In the prevalence analyses, current smokers were defined as any current cigarette smokers regardless of their use of pipes or cigars. In the rate analyses, current smoker status was restricted to persons who smoked cigarettes only and to those with complete data on amount and duration. Never-smokers were defined as persons who never smoked any tobacco product.

Smoking Prevalence We compared baseline data on the prevalence of cigarette smoking (with or without pipes or cigars) among subjects in CPS-I and CPS-II. Also assessed was how data from these cohorts represent national smoking patterns by comparing age-, race-, and sex-specific data as well as age-adjusted prevalence in CPS-I and CPS-II to corresponding data for persons ages ≥30 in the National Health Interview Surveys (NHIS) conducted in 1965 (NHIS-65), 1983 (NHIS-83), and 1987 (NHIS-87) (National Center for Health Statistics, 1975; Kovar and Poe, 1985; Massey et al., 1989). These probability samples of the civilian, noninstitutionalized population of the United States provided weighted, nationally representative estimates of smoking in the Nation near the baseline interviews of CPS-I (1959) and CPS-II (1982). NHIS-83 did not include questions on pipe or cigar smoking. The percentage of men in NHIS-83 who smoked only pipes or cigars was therefore estimated from NHIS-87. The age-specific percentage of men in NHIS-83 who smoked only cigarettes was estimated from the age-specific percentage in NHIS-83 who never smoked cigarettes minus the percentage in NHIS-87 who smoked only pipes or cigars. The definition of current smoking differed slightly between NHIS and CPS-I and CPS-II. In NHIS, current smoking was defined as smoking at least 100 cigarettes (in addition to at least some smoking cigars and/or pipes) in a lifetime plus smoking during the past 30 days. Smoking prevalence was adjusted for age using direct standardization with weighting by the combined baseline age distribution for CPS-I and CPS-II (Appendix 2).

Cigarettes Smoked Per Day The data on daily cigarette consumption reflected current (at time of enrollment), but not past, usage in both studies. The CPS-I data were precategorized (1-9, 10-19, 20, 21-39, 40, ≥41 cigarettes per day). Using these categories, we compared the percentage distribution of smokers in CPS-I, CPS-II, NHIS-65, and NHIS-83 within 5-year age groups. We also

estimated the mean daily consumption of cigarettes within age groups, based on published midpoints for the CPS-I categories (4.8, 12, 20, 29.2, 40, 58.6 cigarettes) (Hammond et al., 1977) and the continuous data in CPS-II. The mean`number of cigarettes currently smoked per day in CPS-I and CPS-II were compared with the corresponding values in NHIS-65 and NHIS-83.

Age of Smoking Initiation In CPS-I, the age when subjects began smoking also was precategorized (<10, 10-14, 15-19, 20-24, . . . ≥50 years). Using these categories, we compared the cumulative percentage of cigarette smokers in each of the four studies who had begun smoking by various ages (<15, <20, <25, <30) within 10-year birth cohorts. We also converted the age of initiation categories to their estimated midpoints (9, 12, 17, . . . 50) and compared the mean age of smoking initiation within 10-year birth cohorts in the four studies.

Duration of Smoking The number of years that current smokers had smoked cigarettes prior to enrollment was calculated in CPS-I by subtracting the estimated age of initiation from age at enrollment. In CPS-II, the duration value reported by the respondents was used, or if that value was missing, it was calculated as in CPS-I. Because there was no information on changes in smoking status in CPS-II, the duration was considered to be fixed throughout the followup in both studies.

Endpoints Analyses were restricted to the major causes of smoking-related mortality: lung cancer, CHD, COPD, stroke, other smoking-related cancers (oropharynx, larynx, esophagus, pancreas, bladder, and kidney), and all causes of death combined. *ICD-7* (World Health Organization, 1957) and *ICD-9* (World Health Organization, 1977) codes corresponding to each disease category are listed in footnotes in the relevant tables. As in many other prospective studies of smoking (Doll and Hill, 1966; Doll and Peto, 1976; Hammond, 1964 and 1966; Kahn, 1966; U.S. Department of Health and Human Services, 1989), our analyses included persons with prevalent cancers reported at the time of enrollment, unless otherwise indicated.

Rate Analyses Age-specific and age-adjusted death rates (per 100,000 person-years) were computed based on the number of person-years at risk by attained age through September 30, 1965, for CPS-I and through August 31, 1988, for CPS-II. Age-adjusted death rates were directly standardized to the combined person-year distribution of CPS-I and CPS-II (Appendix 2). These rates were used to compute RR's and RD's. Ninety-five-percent confidence intervals for the RR and RD were calculated using approximate variance formulas (Flanders, 1984; Rothman, 1986).

Death rates were compared among all current cigarette smokers and lifelong never-smokers for each endpoint. For lung cancer, death rates also were compared in CPS-I and CPS-II according to specified numbers of cigarettes smoked daily at enrollment and duration of smoking. Because of sample size considerations, these comparisons were possible only among persons ages ≥50 years who had smoked for at least 30 years. The most precise and potentially least confounded comparison was based on persons

who reported smoking 20 or 40 cigarettes daily at baseline, the two categories for which daily cigarette consumption in CPS-I had not been grouped into broad intervals. First, lung cancer death rates were compared at equivalent levels of current consumption and duration for all races and baseline cancer status (Appendixes 3 and 4). Further analyses were restricted to whites to eliminate potential confounding by race and also excluded persons with prevalent cancer other than nonmelanoma skin cancer (Appendixes 5 and 6). The exclusion of prevalent cancers minimized the possibility that cigarette smokers with cancer might differentially participate in CPS-II. These comparisons are presented only as stratified analyses because of the constraints on standardization discussed elsewhere (Chapter 5).

Attributable Risk in Smokers

In CPS-I and CPS-II, the percentage of deaths attributable to smoking among current cigarette smokers was estimated by using standard formulas for attributable proportion for an exposed population (Rothman, 1986). Also estimated were the proportionate contributions of lung cancer, CHD, and other conditions to the overall increase in death rates by dividing the cause-specific RD by the all-cause RD, expressed as a percentage.

RESULTS

Order of Presentation

The following is the order of presentation: Baseline smoking practices are compared in CPS-I (1959), CPS-II (1982), NHIS-65 (1965), and NHIS-83 (1983); specific causes of death are discussed in order of their contribution to smoking-related mortality in CPS-II (lung cancer, CHD, COPD, stroke, and other smoking-related cancers); and all causes of death combined are presented by smoking status and study.

For each cause, death rates in current cigarette smokers are compared with those in lifelong never-smokers. Lung cancer rates are measured in relation to daily cigarette use and duration of smoking in CPS-I and CPS-II. The percentage of deaths attributable to smoking among current cigarette smokers is examined for each endpoint in the two studies.

Baseline Smoking Practices

Prevalence

Table 2 shows the percentage of black and white men and women who currently smoke, formerly smoked, and never smoked cigarettes at the time of enrollment in CPS-I and CPS-II. Age-adjusted prevalence decreased from 44.8 to 24.3 percent in white men. Smaller decreases occurred in black men and white women, whereas the prevalence in black women increased slightly. The percentage who were former smokers more than doubled among white men, more than quadrupled among white women, more than tripled among black men, and almost quadrupled among black women. The percentage of never-smokers remained essentially unchanged in black men, rose slightly in white men, and decreased in women of both races.

Trends in smoking prevalence from CPS-I to CPS-II resembled those in the general U.S. population, as reflected by NHIS-65 and NHIS-83 (Table 2). The prevalence in CPS-I was somewhat lower than in NHIS-65 and was lower in CPS-II than in NHIS-83, consistent with the higher educational background of CPS participants. However, temporal trends in prevalence

Table 2
Age-adjusted prevalence[a] of current, former, and never cigarette[b] smoking at baseline by race, sex, and study

Race/Sex	Smoking Status	Percent			
		CPS-I	CPS-II	NHIS-65	NHIS-83
White Men					
	Current	44.8	24.3	47.4	33.3
	Former	16.7	39.3	25.5	40.8
	Never	21.5	25.6	15.2	18.8
Black Men					
	Current	47.7	34.3	55.0	43.5
	Former	8.1	26.9	16.1	29.5
	Never	23.2	24.4	13.8	21.1
White Women					
	Current	24.2	20.4		28.3
	Former	5.1	21.3	8.1	19.2
	Never	68.8	52.1	62.1	52.4
Black Women					
	Current	20.0	24.8	23.9	31.5
	Former	3.5	13.8	6.3	13.4
	Never	71.6	48.2	69.4	55.0

[a] *Prevalence in the full cohorts (Table 1), age-adjusted to the baseline age distribution of CPS-I and CPS-II (Appendix 2).*
[b] *Cigarette smoking with or without pipes or cigars.*
Key: CPS = Cancer Prevention Study; NHIS = National Health Interview Survey.

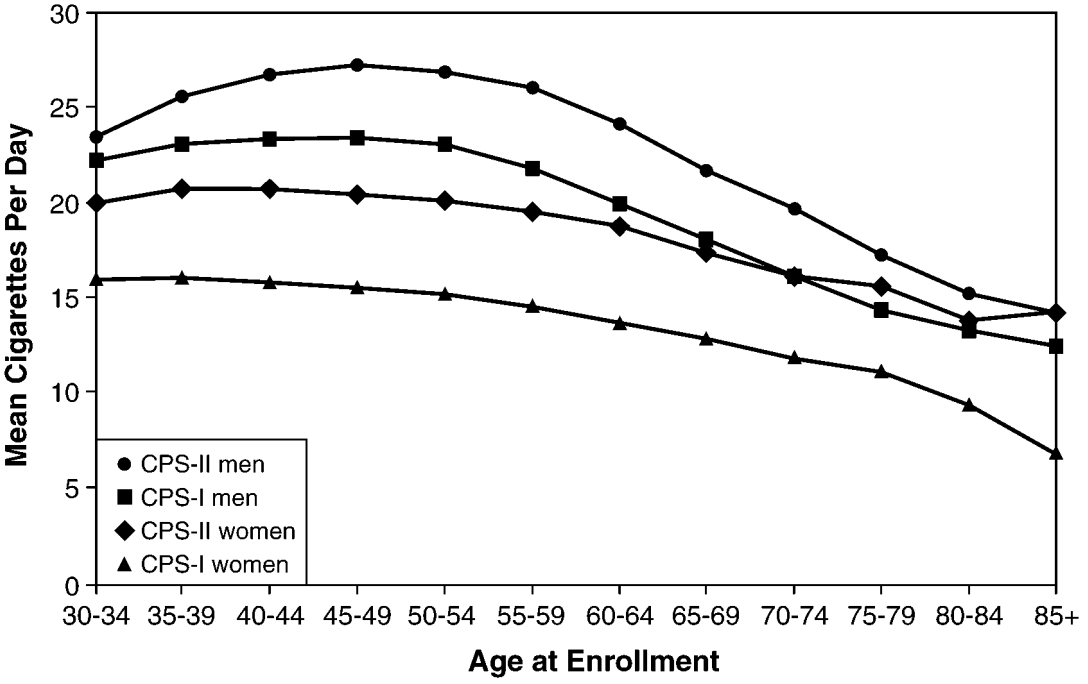
from the 1960's to the 1980's were similar, comparing CPS-I with CPS-II and NHIS-65 with NHIS-83 within race and sex subgroups.

Appendixes 7 through 10 show that the age-specific prevalence of current cigarette smoking decreased markedly with age in all studies, although patterns of smoking differed among older participants in the two studies. In the 1960's (CPS-I and NHIS-65), older subjects included a larger proportion of never-smokers, reflecting the lower prevalence of beginning to smoke among persons born prior to 1900. In the 1980's (CPS-II and NHIS-83), older subjects included a larger proportion of former smokers as well as never-smokers, showing the increased contribution of smoking cessation. The combined influences of smoking cessation, lower uptake in earlier birth cohorts, and higher mortality in older smokers caused smokers to constitute a smaller fraction of the population with increasing age.

Cigarettes Smoked Per Day

Figure 2 illustrates that the mean number of cigarettes **smoked per** day was higher at every age in CPS-II than in CPS-I and was greater in men than in women (except in CPS-II men age 85 and older). The mean difference in daily consumption between CPS-I and CPS-II at baseline did not exceed six cigarettes per day at any age except for women age 85 and older (mean values shown in Appendix 11). Men in CPS-I and CPS-II averaged 22.4 and 25.4 cigarettes per day, respectively, with age-specific differences

Figure 2
Mean number of cigarettes smoked daily at baseline by current smokers according to age at enrollment



in mean number of cigarettes smoked per day from 5 to 23 percent higher in CPS-II. The mean number of cigarettes smoked per day among women increased from 15.3 to 19.6, with the age-specific mean number of cigarettes per day from 27 to 107 percent higher in CPS-II. The average number of cigarettes smoked per day by all current smokers decreased in all groups after approximately 50 years of age. This age-related decline possibly reflected a combination of reduced consumption by individuals, higher mortality among heavier smokers, and lower cigarette consumption among earlier birth cohorts (Burns, 1994). More detailed categorical data on age-specific consumption patterns are shown in Appendixes 12 through 15 and reveal a consistent increase in the fraction of smokers in CPS-II who smoked 40 and 40+ cigarettes per day in every age group, although the NHIS data are imprecise because of the small number of subjects older than age 75. This trend also is observed in the NHIS data.

Age of Initiating Smoking Persons in more recent birth cohorts began smoking at progressively younger ages, particularly women born after 1910 and men born after 1890 (Table 3). Temporal trends were similar in CPS-I and CPS-II. The mean age of initiation was nearly identical in the two studies where the birth cohorts overlapped. Age of initiation in CPS-I and CPS-II closely paralleled published data from NHIS-87 and NHIS-88 (Centers for Disease Control,

Table 3
Average age of initiation among cigarette smokers[a] by sex and birth cohort, CPS-I and CPS-II

Sex 1950	Study	Birth Cohort								
			1870	1880	1890	1900	1910	1920	1930	1940
Men										
	CPS-I	23.8	21.8	19.8	18.9	18.4	17.7	–	–	–
	CPS-II	–	–	19.2	18.8	18.2	17.8	17.6	17.2	17.2
	NHIS 87-88	–	–	–	–	17.5	17.2	17.1	17.0	17.0
Women										
	CPS-I	42.4	39.3	34.2	27.1	21.8	19.8	–	–	–
	CPS-II	–	–	33.7	27.1	22.4	20.9	19.6	18.4	18.1
	NHIS 87-88	–	–	–	–	22.9	21.0	19.4	18.7	17.5

[a] *Based on age of initiation among current cigarette smokers in the analytic cohorts of CPS-I and CPS-II (Table 1) and published data from the National Health Interview Surveys of 1987 and 1988, whites (Burns, 1994).*

Key: CPS = Cancer Prevention Study; NHIS = National Health Interview Survey.

1991). Birth cohort data in Appendix 16 show the cumulative percentage of persons who began smoking before various ages. This percentage increased with later birth cohorts except among men who began smoking before 15 years of age. In this group the pattern was reversed, and the cumulative percentage decreased with later birth cohorts for unclear reasons. The fraction of smokers who initiated smoking before 15 years of age was substantially higher for CPS-II than for CPS-I among males for those cohorts where the two studies overlap.

Duration of Smoking Figure 3 shows the mean duration of smoking at baseline according to age at enrollment. Male current smokers of comparable age had smoked for a similar number of years in CPS-I and CPS-II at ages younger than 60, but the mean number of years of smoking was higher in CPS-II among older age groups of males (although for those men age 85 and older the difference was slight). Women had smoked longer in CPS-II than in CPS-I. The largest divergence between CPS-I and CPS-II occurred among women ages 65 to 69 and 70 to 74 at enrollment. For these groups, the duration was approximately 11 years longer in CPS-II than in CPS-I (Appendix 17). This difference in smoking duration reflected primarily the younger age at which women began smoking in CPS-II. For males older than age 60, the mean difference in duration for 5-year age groups varied from 0.4 to 2.2 years.

Depth of Inhalation A larger percentage of women reported inhaling cigarette smoke moderately or deeply in CPS-II than in CPS-I (Table 4). The distribution among male smokers did not change significantly according to self-report.

Tar Content of Cigarettes The measured tar content of cigarettes, as determined by machine smoking, decreased markedly from CPS-I (Garfinkel, 1979) to CPS-II (Federal Trade Commission, 1983). Figure 4 shows that most cigarette brands smoked by men at enrollment in CPS-I exceeded 17.0 mg, whereas most brands currently smoked in CPS-II had lower tar ratings. A similar shift in distribution was seen

Figure 3
Mean number of years of smoking cigarettes at baseline by current smokers according to age at enrollment

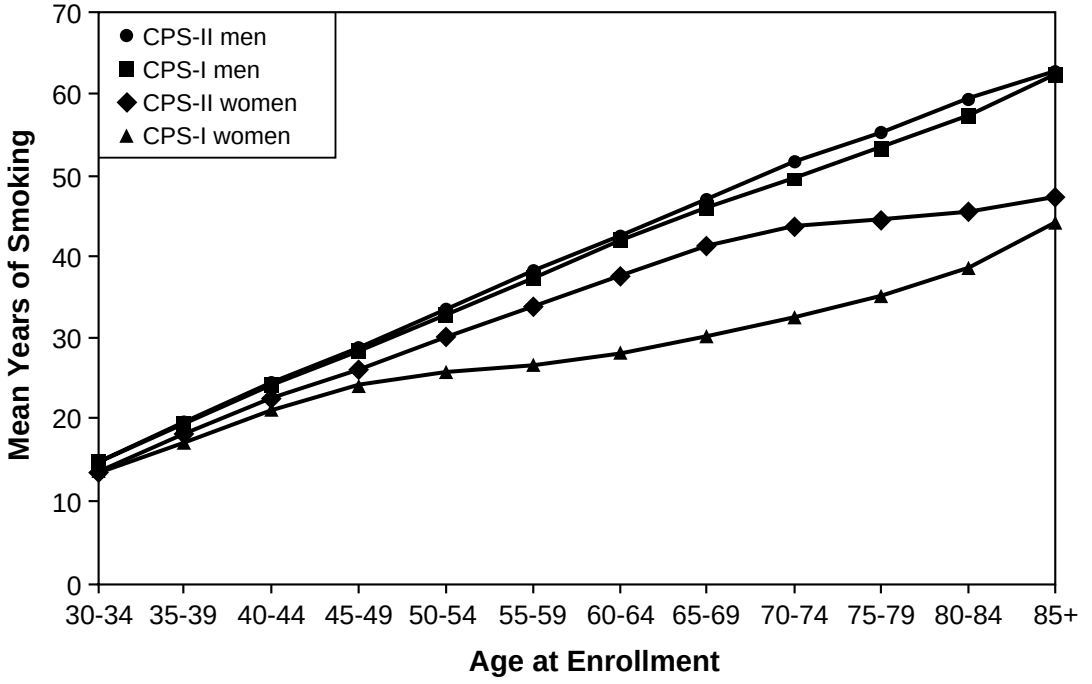


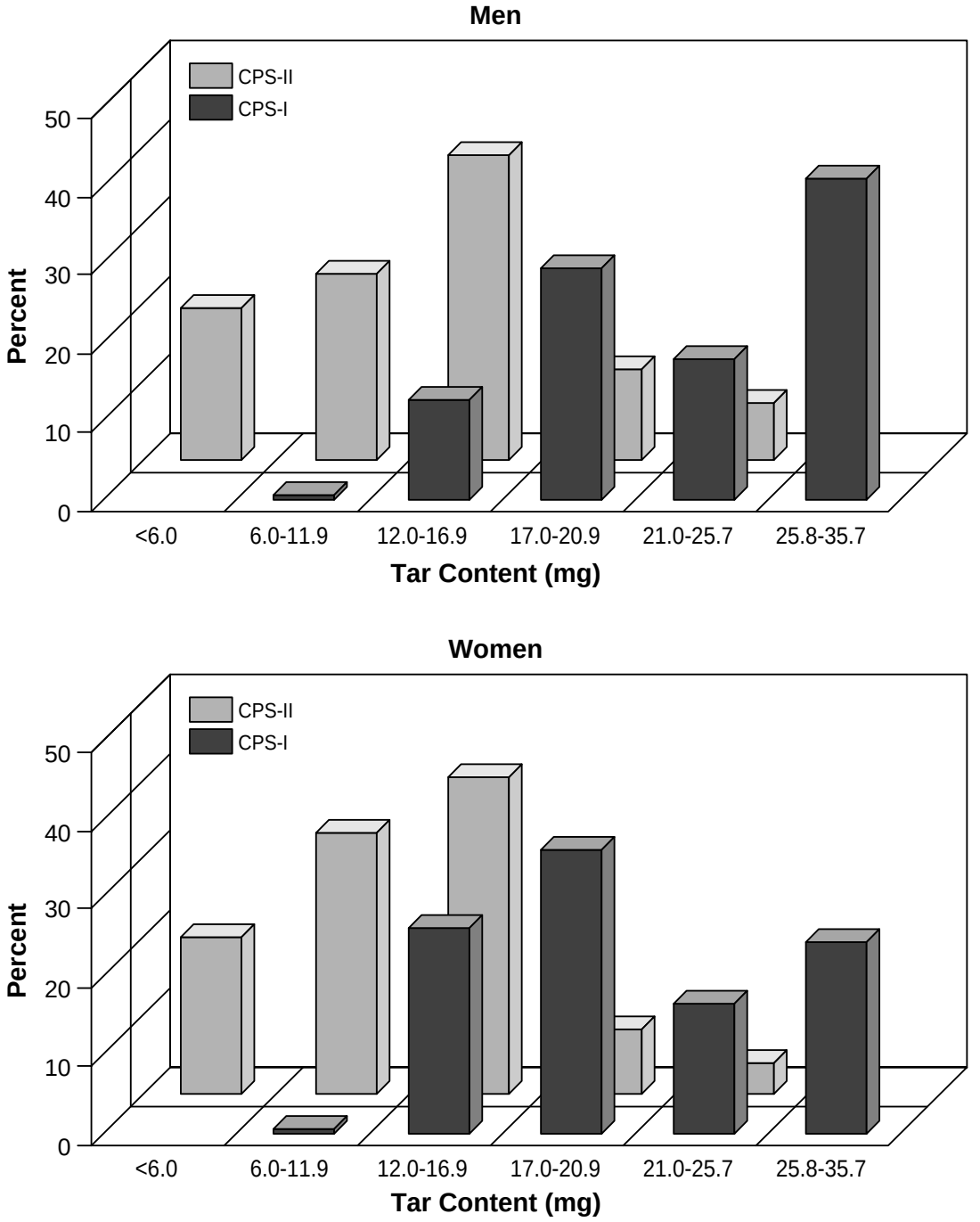
Table 4
Self-reported depth of inhalation among current cigarette smokers by sex and stu$y

	Men (%)		Women (%)	
Depth of Inhalation	CPS-I (N = 146,459)	CPS-II (N = 101,888)	CPS-I (N = 152,228)	CPS-II (N = 126,794)
Do Not Inhale	5.8	5.5	13.0	6.8
Inhale Slightly	13.3	12.6	23.1	16.5
Inhale Moderately	55.6	53.2	51.4	60.4
Inhale Deeply	24.9	26.8	12.1	14.1
Unknown	0.5	1.8	0.4	2.3

Key: CPS = Cancer Prevention Study.

among women, although the tar content was lower in women's than in men's cigarettes (Appendix 18). These data reflect the brand smoked at the time of enrollment, and they may underestimate the tar content of cigarettes smoked earlier in life because the official ratings have decreased since the early 1950's (U.S. Department of Health and Human Services, 1993).

Figure 4
Percentage distribution of tar content, as measured by machine smoking, of the cigarette brand smoked at enrollment



Summary of Changes in Smoking From CPS-I to CPS-II

Substantive changes in smoking practices occurred between CPS-I and CPS-II, but the direction of these changes was mixed and varied by sex: Prevalence decreased markedly in men but not in women; average daily cigarette consumption and duration of smoking increased in women more than in men but increased in CPS-II in both sexes; and machine-measured tar content decreased for both sexes. The increase in measured tobacco consumption from CPS-I to CPS-II was much larger in women than in men. The potential for unmeasured differences in cigarette smoking behavior between the two studies is discussed below.

Specific Causes of Death

Lung Cancer in Current Smokers vs. Never-Smokers

Age-specific death rates from lung cancer among current cigarette smokers and lifelong never-smokers are shown in Figure 5 and Appendixes 19 and 20. Lung cancer death rates were much higher in smokers than in never-smokers, except among women in CPS-I. Rates among both male and female smokers were substantially higher in CPS-II than in CPS-I for all ages older than 50. The absolute increase in death rates from CPS-I to CPS-II was similar among male and female smokers.

Among lifelong never-smokers, the lung cancer death rates changed relatively little from CPS-I to CPS-II (Appendixes 19 and 20). The age-specific death rates were slightly higher in CPS-II than CPS-I among nonsmoking men older than 70 and nonsmoking women 50 and older although differences among CPS-II and CPS-I women did not become substantial until age 70 and older.

Age-adjusted death rates from lung cancer per 100,000 person-years (Table 5) increased from CPS-I to CPS-II among current cigarette smokers from 187.1 to 341.3 in men and from 26.1 to 154.6 in women. Among never-smokers the age-adjusted death rate did not change substantially between studies in either sex.

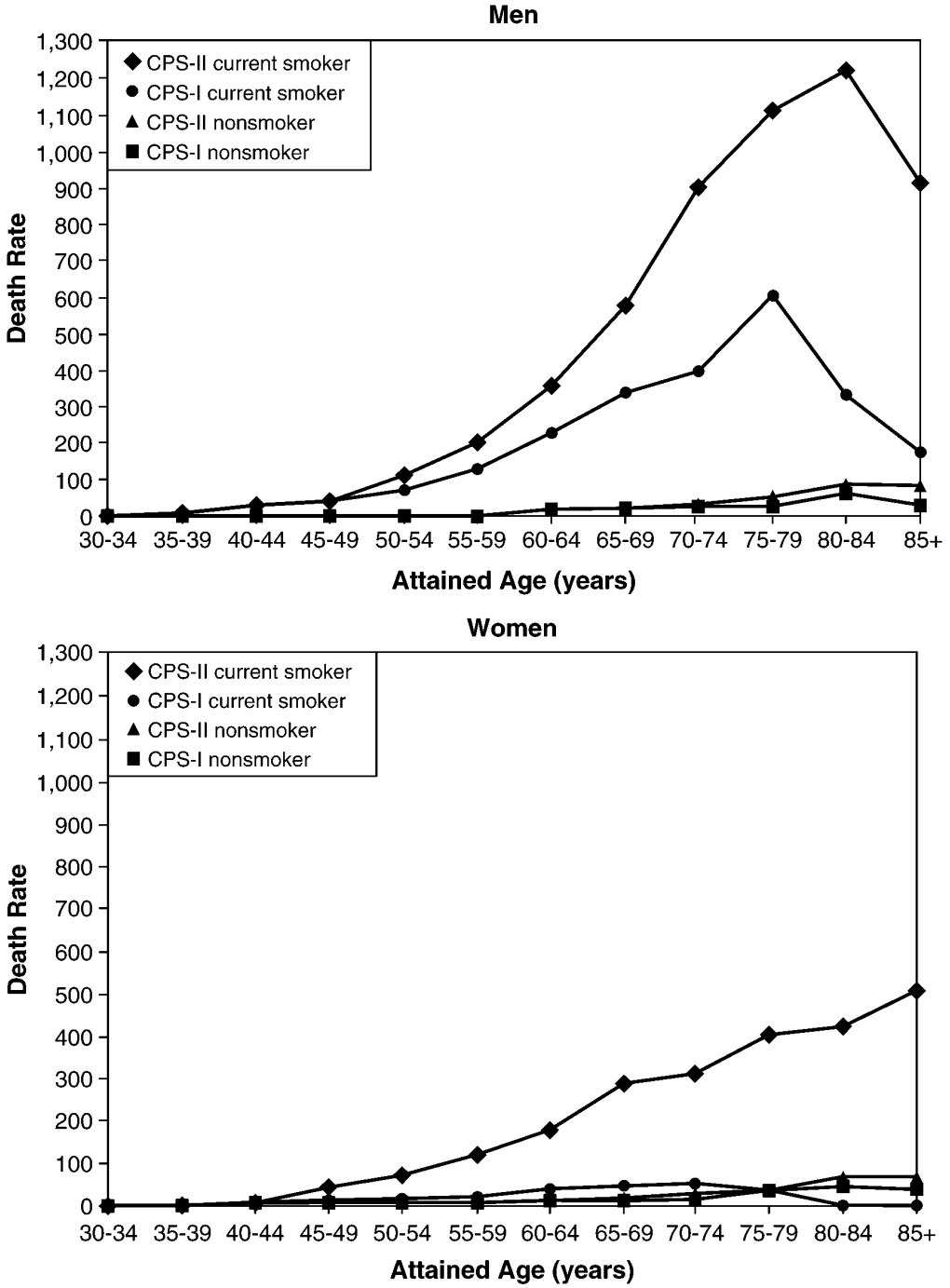
Taken together, the trends in lung cancer death rates among all current smokers (Figure 5 and Table 5) show that the epidemic in women smokers followed that in men by approximately 20 years. In CPS-I, the lung cancer death rate among male smokers was nearly twelvefold that for never-smokers, whereas the rate in women smokers had just begun to increase above that in never-smokers. Two decades later, the death rate among women smokers in CPS-II closely approached that of male smokers in CPS-I, whereas the rate in male smokers had again nearly doubled from CPS-I to CPS-II.

Lung Cancer Mortality by Amount and Duration of Smoking

The differences between smokers in CPS-I and CPS-II with regard to number of cigarettes smoked per day and duration of smoking are potential explanations for the differences in age-specific lung cancer death rates between the two studies. Because of the difficulties in standardizing duration-specific rates described in Chapter 5, the most direct comparison of the lung cancer risks attributable to smoking between CPS-I and CPS-II is to compare stratum-specific lung cancer death rates in the two studies for 5-year age- and duration-specific strata among smokers of 20 and 40 cigarettes per day. Appendixes 3 and 4 present 5-year

Figure 5

Age-specific death rates from lung cancer among current cigarette smokers and lifelong never-smokers, based on smoking status at enrollment in CPS-I or CPS-II, according to attained age



[a] *Rate per 100,000 person-years.*

Table 5

Age-adjusted death rates, rate ratios, and rate differences for lung cancer[a]—current cigarette smokers vs. never-smokers in CPS-I and CPS-II[b]

	CPS-I		CPS-II	
Sex	Never-Smokers	Current Cigarette Smokers	Never-Smokers	Current Cigarette Smokers
Men				
Number of deaths	85	1,035	124	1,781
Rate[c]	15.7	187.1	14.7	341.3
Rate ratio	1.0	11.9	1.0	23.2
(95% CI)		(9.5-14.9)		(19.3-27.9)
Rate difference[c]		171.4		326.6
(95% CI)		(157-186)		(309-344)
Women				
Number of deaths	212	157	310	1,014
Rate[c]	9.6	26.1	12.0	154.6
Rate ratio	1.0	2.7	1.0	12.8
(95% CI)		(2.1-3.5)		(11.3-14.7)
Rate difference[c]		16.6		142.6
(95% CI)		(11-22)		(132-153)

[a] *Disease codes refer to the* Manual of the International Statistical Classification of Diseases, Injuries, and Causes of Death *(*ICD-7*) and* Manual of the International Statistical Classification of Diseases, Injuries, and Causes of Death *(*ICD-9*) (World Health Organization, 1957 and 1977, respectively) for CPS-I and CPS-II, respectively. Codes from* ICD-7 *and* ICD-9 *for lung cancer are 162-63 and 162, respectively.*

[b] *Based on followup from 1959-65 (CPS-I) and 1982-88 (CPS-II) and tobacco smoking status at enrollment.*

[c] *Age-adjusted death rates are directly standardized to the combined CPS-I and CPS-II person-years. Death rates and rate differences are expressed per 100,000 person-years.*

Key: CPS = Cancer Prevention Study; CI = confidence interval.

age- and duration-specific strata among smokers of 20 and 40 cigarettes per day for males and females of all races with duration of smoking fixed at entry into the study and without excluding individuals who had cancer at entry into the study. Table 6 presents the lung cancer death rates for both studies for those strata in Appendix 3 with five or more lung cancer deaths and the results of subtracting the rates in CPS-II from those in CPS-I in strata where five or more deaths occurred in each study. There were too few deaths among women in CPS-I for meaningful comparison. The 50-plus duration category is excluded because of the potential for residual confounding by age and duration in this category, given the longer durations of smoking found among current smokers in CPS-II.

Consistent and substantial increases in lung cancer death rates were found among males in the two longer duration (and correspondingly older age) categories for smokers of 20 cigarettes per day. There was no trend toward higher rates in the difference between CPS-I and CPS-II for the two shorter duration categories for 20 cigarettes per day. When smokers of 40 cigarettes per day are examined, CPS-II has modestly higher rates (5 to 10 percent) in all age and duration categories.

Table 6

Comparison of lung cancer death rates between CPS-I and CPS-II for males of all races with prevalent cancers included

Lung Cancer Death Rates for Males of All Races, 20 Cigarettes Per Day, Duration Fixed at Entry Into the Study, 5+ Deaths in Cell

	CPS-I Rates					CPS-II Rates					CPS-II – CPS-I Difference in Rates			
	Duration					Duration					Duration			
Age	30-34	35-39	40-44	45-49	Age	30-34	35-39	40-44	45-49	Age	30-34	35-39	40-44	45-49
50-54	64.5	154.7			50-54	100	107.4			50-54	35.5	-47.3		
55-59	122.8	127.4	149.9		55-59	101.3	225.9	289.5		55-59	-21.5	98.5	139.6	
60-64		220.7	269.5	312.6	60-64		139.9	323.9	440.5	60-64		-80.8	54.4	127.9
65-69			330.2	449.5	65-69		550.5	583.7	563.2	65-69			253.5	113.7
70-74				304.1	70-74			722.9	551.9	70-74				247.8
75-79					75-79			2,225.5		75-79				

Lung Cancer Death Rates for Males of All Races, 40 Cigarettes Per Day, Duration Fixed at Entry Into the Study, 5+ Deaths in Cell

	CPS-I Rates					CPS-II Rates					CPS-II – CPS-I Difference in Rates			
	Duration					Duration					Duration			
Age	30-34	35-39	40-44	45-49	Age	30-34	35-39	40-44	45-49	Age	30-34	35-39	40-44	45-49
50-54	67.8				50-54	188	174.4			50-54	120.2			
55-59	136.1	189.8	327.1		55-59	161.5	235.2	354.8		55-59	25.4	45.4	27.7	
60-64		319.7	478.6	374.6	60-64		540.7	526.0	404.4	60-64		221	47.4	29.8
65-69			803.5	785.7	65-69		811.1	851.7	836.6	65-69			48.0	50.9
70-74					70-74			1,380.3	1356.2	70-74				

Note: Rates are those presented in Appendix 3. Rates are presented for all cells with five or more lung cancer deaths. Subtractions for the rates in CPS-II minus CPS-I are done only for cells with five or more deaths in the cell for both studies. Person-years of observation and deaths accrue in the age group the individual was in at the year of followup (age advanced) but accrue to the duration category at the time of entry to the study (duration fixed).

Key: CPS = Cancer Prevention Study.

We tested the possibility that including prevalent cases of lung cancer or smokers of various races could bias these results. Appendixes 5 and 6 present 5-year age- and duration-specific strata among smokers of 20 and 40 cigarettes per day for white males and females and with persons reporting prevalent cancers excluded. Table 7 presents the lung cancer death rates for both studies for those st2ata in Appendix 5 with five or more lung cancer deaths and the results of subtracting the rates in CPS-II from those in CPS-I in strata where five or more deaths occurred in each study. No clear trend in the differences between the two studies is evident for smokers of 40 cigarettes per day or for smokers of 20 cigarettes per day who had smoked for less than 40 years. White males who smoked 20 cigarettes for longer than 40 years had lung cancer death rates that were higher in CPS-II than in CPS-I.

Coronary Heart Disease Age-specific death rates from CHD are shown in Figure 6 and Appendixes 21 and 22. In both sexes, CHD death rates were higher in smokers than in never-smokers in both CPS-I and CPS-II. However, CHD death rates decreased markedly from CPS-I to CPS-II regardless of smoking status. The temporal trend was so large that smokers in CPS-II generally had lower death rates from CHD than did lifelong never-smokers in CPS-I (men beginning at age 65 and women beginning at age 60). Because the fall in death rates occurs among lifelong never-smokers as well as active cigarette smokers, reasons for the fall in age-specific death rates must include factors other than smoking cessation.

Age-adjusted death rates from CHD (Table 8) decreased from CPS-I to CPS-II by more than 50 percent. The fall in background CHD rates was slightly larger in proportionate terms among never-smokers than among smokers. Thus, on a relative scale the RR associating current cigarette smoking and CHD death increased from 1.7 to 1.9 in men and from 1.4 to 1.8 in women from CPS-I to CPS-II, respectively. On an absolute scale, the fall in background death rates caused the RD (per 100,000 person-years) to decrease from 486.8 to 253.4 in men and from 113.9 to 96.8 in women. CHD also contributed a smaller proportion of the total excess mortality among smokers in CPS-II than in CPS-I (see below).

Chronic Obstructive Pulmonary Disease Table 9 shows that age-adjusted death rates from COPD (per 100,000 person-years) increased among current male cigarettee smokers from 73.6 in CPS-I to 103.9 in CPS-II and from 17.6 to 61.6 among female cigarette smokers. Age-specific death rates from COPD (Appendixes 23 and 24) in smokers rose from CPS-I to CPS-II at nearly all ages in women and in those older than age 65 in men. The increase over time in death rates from COPD among smokers resembles the pattern seen with lung cancer, although COPD causes fewer excess deaths due to cigarette smoking.

Stroke Age-adjusted death rates from stroke (Table 10) decreased by more than 55 percent from CPS-I to CPS-II among both smokers and never-smokers. As with CHD, the fall in background death rates was proportionately larger in never-smokers than smokers. Thus, the RR between current cigarette smoking and death from stroke increased from 1.3 to 1.9 in men and from

Table 7
Comparison of lung cancer death rates between CPS-I and CPS-II for white males with prevalent cancers excluded

Lung Cancer Death Rates for White Males, 20 Cigarettes Per Day, Duration Fixed at Entry Into the Study, 5+ Deaths in Cell

	CPS-I Rates					CPS-II Rates					CPS-II – CPS-I Difference in Rates				
	Duration					Duration					Duration				
Age	30-34	35-39	40-44	45-49	Age	30-34	35-39	40-44	45-49	Age	30-34	35-39	40-44	45-49
50-54	64	138.2			50-54	80.1	85.6			50-54	16.1	-52.6		
55-59	120.9	124.8	135.1		55-59	101.7	197.8	235.5		55-59	-19.2	73	100.4	
60-64		209.8	254.4	289.8	60-64		156.6	296.4	395.6	60-64		-53.2	42	105.8
65-69			342.7	442.6	65-69		542.7	509	587.7	65-69			166.3	145.1
70-74				320.1	70-74			687	533.2	70-74				213.1

Lung Cancer Death Rates for White Males, 40 Cigarettes Per Day, Duration Fixed at Entry Into the Study, 5+ Deaths in Cell

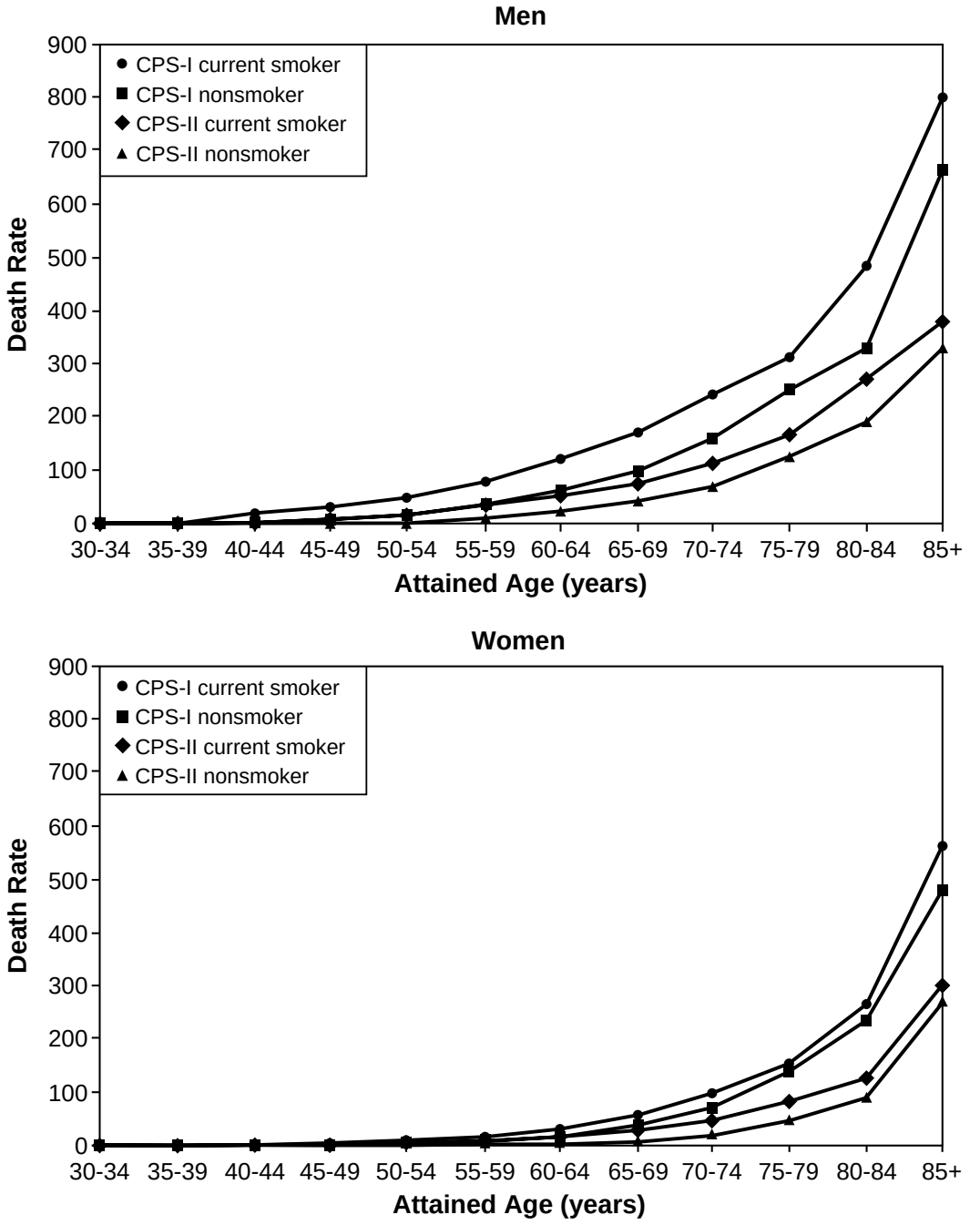
	CPS-I Rates					CPS-II Rates					CPS-II – CPS-I Difference in Rates				
	Duration					Duration					Duration				
Age	30-34	35-39	40-44	45-49	Age	30-34	35-39	40-44	45-49	Age	30-34	35-39	40-44	45-49
50-54	69.1				50-54	187.6	185.5			50-54	118.5			
55-59	139.6	194.3	333.9		55-59	107.3	228.2	341.6		55-59	-32.3	33.9	7.7	
60-64		247.3	466.1		60-64		568.4	475.9	434.2	60-64		321.1	9.8	
65-69			850.1	814.2	65-69		855.3	930.1	747.7	65-69			80	-66.5
70-74					70-74				1,062.5	70-74				

Note: Rates are those presented in Appendix 5. Rates are presented for all cells with five or more lung cancer deaths. Subtractions for the rates in CPS-II minus CPS-I are done only for cells with five or more deaths in the cell for both studies. Person-years of observation and deaths accrue in the age group the individual was in at the year of followup (age advanced) but accrue to the duration category at the time of entry to the study (duration fixed).

Key: CPS = Cancer Prevention Study.

Figure 6

Age-specific death rates from coronary heart disease among current cigarette smokers and lifelong never-smokers, based on status at enrollment in CPS-I or CPS-II, according to attained age



[a] *Rate per 100,000 person-years.*

Table 8
Age-adjusted death rates, rate ratios, and rate differences for coronary heart disease[a]—current cigarette smokers vs. never-smokers in CPS-I and CPS-II[b]

Sex	CPS-I		CPS-II	
	Never-Smokers	Current Cigarette Smokers	Never-Smokers	Current Cigarette Smokers
Men				
Number of deaths	3,769	6,068	2,536	2,722
Rate[c]	681.2	1,168.0	294.6	548.0
Rate ratio	1.0	1.7	1.0	1.9
(95% CI)		(1.6-1.8)		(1.8-2.0)
Rate difference[c]		486.8		253.4
(95% CI)		(440-533)		(227-280)
Women				
Number of deaths	7,065	1,248	3,717	1,161
Rate[c]	305.6	419.5	118.3	215.1
Rate ratio	1.0	1.4	1.0	1.8
(95% CI)		(1.3-1.5)		(1.7-2.0)
Rate difference[c]		113.9		96.8
(95% CI)		(79-149)		(82-111)

[a] *Disease codes refer to the* Manual of the International Statistical Classification of Diseases, Injuries, and Causes of Death *(*ICD-7*) and* Manual of the International Statistical Classification of Diseases, Injuries, and Causes of Death *(*ICD-9*) (World Health Organization, 1957 and 1977, respectively), for CPS-I and CPS-II, respectively. Codes for coronary heart disease are 420 and 410-414, respectively.*

[b] *Based on followup from 1959-65 (CPS-I) and 1982-88 (CPS-II) and tobacco smoking status at enrollment.*

[c] *Age-adjusted death rates are directly standardized to the combined CPS-I and CPS-II person-years. Death rates and rate differences are expressed per 100,000 person-years.*

Key: CPS = Cancer Prevention Study; CI = confidence interval.

1.2 to 1.8 in women from CPS-I to CPS-II. The RD (per 100,000 person-years) between smokers and never-smokers changed minimally, decreasing from 55.5 to 50.4 in men and increasing from 25.1 to 34.0 in women. Appendixes 25 and 26 present age-, sex-, and smoking-specific death rates for stroke.

Other Smoking-Related Cancers As shown in Table 11, age-adjusted death rates from smoking-related cancers other than lung cancer increased among smokers from 102.5 to 120.1 in men and from 45.8 to 53.4 in women from CPS-I to CPS-II. Both the RR and the RD increased as well, paralleling the pattern seen with lung cancer. Age-specific death rates from other cancers were higher in CPS-I compared with CPS-II among smokers of both sexes at nearly every age, although the trend was less consistent among women (Appendixes 27 and 28).

All-Cause Mortality Age-adjusted death rates from all causes (Table 12) decreased substantially from CPS-I to CPS-II among lifelong never-smokers, reflecting

smokers the decrease in death rates from vascular diseases was partially offset by increased smoking-related deaths from lung cancer, other cancers,

Table 9
Age-adjusted death rates, rate ratios, and rate differences for COPD[a]—current cigarette smokers vs. never-smokers in CPS-I and CPS-II[b]

	CPS-I		CPS-II	
Sex	Never-Smokers	Current Cigarette Smokers	Never-Smokers	Current Cigarette Smokers
Men				
Number of deaths	44	284	78	422
Rate[c]	8.0	73.6	8.9	103.9
Rate ratio	1.0	9.3	1.0	11.7
(95% CI)		(6.6-12.9)		(9.1-15.0)
Rate difference[c]		65.7		95.0
(95% CI)		(54-77)		(83-107)
Women				
Number of deaths	61	56	143	303
Rate[c]	2.6	17.6	4.8	61.6
Rate ratio	1.0	6.7	1.0	12.8
(95% CI)		(4.4-10.2)		(10.4-15.9)
Rate difference[c]		15.0		56.8
(95% CI)		(9-21)		(49-65)

[a] *Disease codes refer to the* Manual of the International Statistical Classification of Diseases, Injuries, and Causes of Death *(*ICD-7*) and* Manual of the International Statistical Classification of Diseases, Injuries, and Causes of Death *(*ICD-9*) (World Health Organization, 1957 and 1977, respectively), for CPS-I and CPS-II, respectively. Codes from* ICD-7 *and* ICD-9 *for chronic obstructive pulmonary disease are 500-502, 527.1, and 490-492, 496, respectively.*
[b] *Based on followup from 1959-65 (CPS-I) and 1982-88 (CPS-II) and tobacco smoking status at enrollment.*
[c] *Age-adjusted death rates are directly standardized to the combined CPS-I and CPS-II person-years. Death rates and rate differences are expressed per 100,000 person-years.*

Key: CPS = Cancer Prevention Study; CI = confidence interval.

and COPD. Thus, the all-cause RR increased from 1.7 to 2.3 in men and from 1.2 to 1.9 in women in CPS-I and CPS-II, respectively. The all-cause RD (per 100,000 person-years) was essentially unchanged in men but increased in women from 244.6 to 508.7.

Age-specific and smoking-specific death rates from all causes are shown in Appendixes 29 and 30. The all-cause death rate in men ages 40 to 69 was about three times higher in smokers than never-smokers in CPS-II and was about twice as high in CPS-I (Peto et al., 1992). The increased RR in middle-aged men reflected both the increasing risk of lung cancer in smokers and the decreasing cardiovascular mortality, regardless of smoking status.

Attributable Risk in Smokers Table 13 shows that the proportion of all deaths among current cigarette smokers attributable to cigarette smoking (etiologic fraction in the exposed group) increased from CPS-I to CPS-II from 42.2 to 57.1 percent in men and from 18.7 to 47.9 percent in women. Table 14 shows the percentage of the all-cause RD contributed by various diseases. Lung cancer contributed a larger proportion of the all-cause RD in CPS-II. This proportion increased from 14.7 to 28.1 percent in men and from

Table 10

Age-adjusted death rates, rate ratios, and rate differences for stroke[a]—current cigarette smokers vs. never-smokers in CPS-I and CPS-II[b]

Sex	CPS-I		CPS-II	
	Never-Smokers	Current Cigarette Smokers	Never-Smokers	Current Cigarette Smokers
Men				
Number of deaths	1,126	960	501	476
Rate[c]	198.1	253.6	57.3	107.6
Rate ratio	1.0	1.3	1.0	1.9
(95% CI)		(1.2-1.4)		(1.6-2.2)
Rate difference[c]		55.5		50.4
(95% CI)		(30-81)		(38-63)
Women				
Number of deaths	3,319	537	1,331	423
Rate[c]	141.1	166.2	40.6	74.5
Rate ratio	1.0	1.2	1.0	1.8
(95% CI)		(1.0-1.4)		(1.6-2.1)
Rate difference[c]		25.1		34.0
(95% CI)		(3-47)		(26-42)

[a] *Disease codes refer to the* Manual of the International Statistical Classification of Diseases, Injuries, and Causes of Death *(*ICD-7*) and* Manual of the International Statistical Classification of Diseases, Injuries, and Causes of Death *(*ICD-9*) (World Health Organization, 1957 and 1977, respectively), for CPS-I and CPS-II, respectively. Codes from* ICD-7 *and* ICD-9 *for stroke are 33033-4 and 430-438, respectively.*

[b] *Based on followup from 1959-65 (CPS-I) and 1982-88 (CPS-II) and tobacco smoking status at enrollment.*

[c] *Age-adjusted death rates are directly standardized to the combined CPS-I and CPS-II person-years. Death rates and rate differences are expressed per 100,000 person-years.*

Key: CPS = Cancer Prevention Study; CI = confidence interval.

6.8 to 28.0 percent in women in CPS-I and CPS-II, respectively (Table 14). The corresponding proportions contributed by CHD decreased from 41.7 to 21.8 percent in men and from 46.6 to 19.0 percent in women.

DISCUSSION We found that the risk of premature death among active cigarette smokers continued unabated from the 1960's to the 1980's. Despite major changes in cigarettes, patterns of smoking, and background death rates from cardiovascular diseases, the absolute difference in all-cause death rates between smokers and lifelong never-smokers more than doubled in women and remained nearly constant in men over this interval. In relative terms, the overall death rate for men ages 40 to 69 in CPS-II was about three times higher in smokers than in never-smokers compared with the doubling observed in CPS-I (Peto et al., 1992).

Of the various diseases caused by smoking, the largest increase in death rates was because of lung cancer. Although remaining essentially constant in lifelong never-smokers, lung cancer death rates increased almost sixfold among female smokers and nearly doubled among male cigarette smokers from CPS-I to CPS-II (Table 5). This increase in the 6-year CPS-II followup

Table 11

Age-adjusted death rates, rate ratios, and rate differences for other smoking-related cancers[a]—current cigarette smokers vs. never-smokers in CPS-I and CPS-II[b]

Sex	CPS-I		CPS-II	
	Never-Smokers	Current Cigarette Smokers	Never-Smokers	Current Cigarette Smokers
Men				
Number of deaths	205	536	290	610
Rate[c]	37.5	102.5	34.6	120.1
Rate ratio	1.0	2.7	1.0	3.5
(95% CI)		(2.3-3.3)		(3.0-4.0)
Rate difference[c]		64.9		85.6
(95% CI)		(53-77)		(74-97)
Women				
Number of deaths	567	190	553	332
Rate[c]	25.2	45.8	21.0	53.4
Rate ratio	1.0	1.8	1.0	2.6
(95% CI)		(1.5-2.3)		(2.2-2.9)
Rate difference[c]		20.6		32.4
(95% CI)		(11-30)		(26-39)

[a] *Disease codes refer to the* Manual of the International Statistical Classification of Diseases, Injuries, and Causes of Death *(*ICD-7*) and* Manual of the International Statistical Classification of Diseases, Injuries, and Causes of Death *(*ICD-9*) (World Health Organization, 1957 and 1977, respectively), for CPS-I and CPS-II, respectively. Codes from* ICD-7 *and* ICD-9 *for other smoking-related cancers include lip/oral cavity/pharynx, 140-148 and 140-149, respectively; esophagus, 150 in both versions; pancreas, 157 in both versions; larynx, 161 in both versions; kidney/bladder/other urinary, 180-181 and 188-189, respectively.*

[b] *Based on followup from 1959-65 (CPS-I) and 1982-88 (CPS-II) and tobacco smoking status at enrollment.*

[c] *Age-adjusted death rates are directly standardized to the combined CPS-I and CPS-II person-years (Appendix 2). Death rates and rate differences are expressed per 100,000 person-years.*

Key: CPS = Cancer Prevention Study; CI = confidence interval.

is slightly larger than that seen in the 4-year CPS-II followup reported in the 1989 U.S. Surgeon General's report (U.S. Department of Health and Human Services, 1989). Both analyses suggest that the epidemic of lung cancer in the United States has been confined largely to smokers, at least among the white, predominantly middle-class populations that CPS-I and CPS-II participants represent. The rising lung cancer risk among smokers is presumably an important factor in sustaining lung cancer death rates in the general U.S. population. Although the percentage of men who currently smoke cigarettes has decreased from 52 percent in 1965 to 28 percent in 1992 (Centers for Disease Control and Prevention, 1994; U.S. Department of Health and Human Services, 1993), the lung cancer death rate in U.S. men has leveled rather than declined since 1980 (Boring et al., 1994). The substantial decrease in lung cancer risk that occurs 5 to 15 years after cessation (U.S. Department of Health and Human Services, 1990) may be partially offset by increasing risk among persons who continue to smoke.

Table 12

Age-adjusted death rates, rate ratios, and rate differences for deaths from all causes—current cigarette smokers vs. never-smokers in CPS-I and CPS-II[a]

	CPS-I		CPS-II	
Sex	Never-Smokers	Current Cigarette Smokers	Never-Smokers	Current Cigarette Smokers
Men				
Number of deaths	8,919	13,551	7,448	9,899
Rate[b]	1,605	2,773	874.0	2,037
Rate ratio	1.0	1.7	1.0	2.3
(95% CI)		(1.7-1.8)		(2.3-2.4)
Rate difference[b]		1,168.1		1,162.7
(95% CI)		(1,095-1,241)		(1,113-1,213)
Women				
Number of deaths	24,007	4,921	15,450	6,232
Rate[b]	1,047	1,291	550.0	1,059
Rate ratio	1.0	1.2	1.0	1.9
(95% CI)		(1.2-1.3)		(1.9-2.0)
Rate difference[b]		244.6		508.7
(95% CI)		(186-303)		(478-540)

[a] Based on followup from 1959-65 (CPS-I) and 1982-88 (CPS-II) and tobacco smoking status at enrollment.

[b] Age-adjusted death rates are directly standardized to the combined CPS-I and CPS-II person-years (Appendix 2). Death rates and rate differences are expressed per 100,000 person-years.

Key: CPS = Cancer Prevention Study; CI = confidence interval.

Table 13

Percentage of deaths attributable to active smoking among current cigarette smokers in CPS-I and CPS-II[a]

	Percent in Men		Percent in Women	
Disease	CPS-I	CPS-II	CPS-I	CPS-II
Lung Cancer	91.6	95.7	63.4	92.2
Coronary Heart Disease	41.5	46.2	27.0	45.1
Chronic Obstructive Pulmonary Disease	89.2	91.4	85.0	92.2
Stroke	21.9	46.8	15.2	45.7
Other Smoking-Related Cancers	63.4	71.2	45.0	60.8
All Causes	42.2	57.1	18.7	47.9

[a] Attributable risk among exposed persons (Rothman, 1986) based on Tables 5 and 8 through 12.

Key: CPS = Cancer Prevention Study.

Table 14
Percentage of the total rate difference for all causes between smokers and never-smokers contributed by various diseases[a]

Disease	Percent in Men		Percent in Women	
	CPS-I	CPS-II	CPS-I	CPS-II
Lung Cancer	14.7	28.1	6.8	28.0
Coronary Heart Disease	41.7	21.8	46.6	19.0
Chronic Obstructive Pulmonary Disease	5.6	8.2	6.1	11.2
Stroke	4.7	4.3	10.3	6.7
Other Smoking-Related Cancers	5.6	7.4	8.4	6.4
Other Conditions	27.7	30.2	21.8	28.7

[a] *Based on the cause-specific rate difference divided by the all-cause rate difference in Tables 5 and 8 through 12.*

Key: CPS = Cancer Prevention Study.

Caution is urged in interpreting the comparison of lung cancer death rates at "equivalent" levels of self-reported smoking. Information on the number of cigarettes smoked at enrollment may not mirror the lifelong patterns of smoking that cause lung cancer. Cigarette consumption during adolescence and early adulthood was probably heavier among smokers in CPS-II than in CPS-I for several reasons. First, manufactured cigarettes were more available in the 1940's and 1950's than in the 1920's and 1930's (U.S. Department of Health and Human Services, 1989). CPS-II smokers born in the late 1920's typically began smoking after World War II when cigarettes were plentiful and there were few prohibitions against smoking. Second, birth cohort analyses of the U.S. general population show that the peak prevalence of smoking among white men increased with each successive birth cohort from 1900 to 1929 and decreased thereafter (Burns, 1994). Similarly, age-specific death rates from lung cancer death rates have decreased among U.S. men born after 1930 (Devesa et al., 1989; Gilliland and Samet, 1994). Thus, the large increase in death rates from CPS-I to CPS-II probably reflects unmeasured heavier smoking in CPS-II during the 1940's and 1950's as well as the measured increase in daily consumption and duration of smoking.

Other factors that could influence the intensity of cigarette smoking are that CPS-II smokers may include more addicted "hard core" smokers who cannot quit despite health and social concerns. Partly to compensate for the lower tar and nicotine content of modern cigarettes (U.S. Department of Health and Human Services, 1989), CPS-II smokers may inhale more deeply, take more puffs per cigarette, or retain the smoke longer in their lungs than did smokers in the past (Benowitz et al., 1983 and 1986; Herning et al., 1981; Russell et al., 1980; U.S. Department of Health and Human Services, 1988). Strong social prohibitions against smoking may have caused CPS-II smokers to underreport usage or to reduce their consumption in an effort to quit.

Smokers in the 1980's also may have been more vulnerable to the carcinogens in tobacco smoke because of lower dietary intake of fresh fruits and vegetables (Subar et al., 1990; Willett, 1990). Finally, the large decrease in cardiovascular mortality from CPS-I to CPS-II could contribute somewhat to the increasing lung cancer death rates, although most potential confounding resulting from competing causes was eliminated by stratifying person-years at risk into 5-year age intervals.

Despite the many uncertainties that constrain the ability to compare the intrinsic carcinogenicity of cigarettes from these two eras, the net effect of all changes in the cigarette and the smoking of cigarettes has been a large increase rather than decrease in lung cancer mortality in smokers. Although low-tar, filter-tip cigarettes have been shown to slightly reduce lung cancer risk compared with nonfiltered cigarettes in several epidemiologic studies (Hammond, 1980; Hammond et al., 1976; Lubin et al., 1984a and 1984b; Vutuc and Kunze, 1982; Wynder et al., 1970), the potential benefits of these products are clearly overwhelmed by the more potent adverse changes in smoking behavior and perhaps by other unidentified factors. The evaluation of cigarettes has not protected smokers from fatal lung cancer.

The falling death rates from CHD and stroke seen in this study reflect major nationwide declines that began for CHD in the mid-1960's and for stroke in the 1940's or earlier (Cooper et al., 1978; Higgins and Thom, 1989; Moriyama et al., 1971; Ragland et al., 1988; Russell et al., 1980). Data suggest that much of the decline results from factors other than smoking cessation because mortality decreased among both current smokers and lifelong never-smokers, groups largely unaffected by smoking cessation. Much of the nationwide decline in CHD mortality probably reflects reduced mortality resulting from therapeutic advances. We measured mortality rather than incidence and could not distinguish between changes in incidence because of diet, exercise, antihypertensive or antithrombotic therapy, control of lipids, or improvement in survival because of medical care. Most of these factors, as well as smoking cessation, are thought to play some role in the nationwide CHD decline (Cooper et al., 1978; Higgins and Thom, 1989; Moriyama et al., 1971; Ragland et al., 1988; Russell et al., 1980), although their relative importance is unknown.

Because CPS-I and CPS-II include mostly white middle-class Americans (Garfinkel, 1985; Stellman and Garfinkel, 1986), it cannot be concluded that the trend of falling CHD mortality will affect all segments of the U.S. population equally. For the poor and minorities in particular, more limited access to medical treatment and prevention may result in a slower decline in CHD mortality (Cooper et al., 1978) and proportionately greater CHD mortality as a cause of excess death in smokers. Because the poor are increasingly overrepresented among the 46 million Americans who smoke, the authors' data may underestimate the excess in CHD mortality among smokers in the general population.

In summary, CPS-I and CPS-II suggest that the epidemic of tobacco-caused deaths in the United States has not been static but has varied dynamically over time as smoking patterns have evolved and background risks have changed. Nonetheless, cigarette smoking remains the single largest preventable cause of premature mortality in the United States.

CONCLUSIONS Measured changes in smoking practices from CPS-I to CPS-II were mixed. A smaller percentage of men smoked cigarettes in 1982 than in 1959, and cigarette brands had lower tar content as measured by machine smoking. However, both men and women smokers consumed more cigarettes per day, on average; women in 1982 began smoking earlier, smoked longer, and reported inhaling cigarette smoke more deeply.

Temporal trends in cigarette smoking from CPS-I to CPS-II generally resembled trends seen in representative U.S. surveys. A greater decrease in smoking prevalence among men occurred comparing CPS-I and CPS-II participants than in NHIS-65 to NHIS-83 participants, probably because of the higher educational background of the CPS study participants.

Among cigarette smokers, lung cancer death rates from CPS-I to CPS-II nearly doubled in men and increased almost sixfold in women. Lung cancer rates remained essentially constant in lifelong never-smokers.

Comparisons of cigarettes-per-day-, age-, and duration-specific strata reveal modest increases in the lung cancer death rates in CPS-II compared with CPS-I for males of all races who smoked 40 cigarettes per day and when prevalent cancers are included. No consistent difference between the rates for the two studies is noted for the comparison of strata-specific rates of white males who smoked 20 cigarettes per day until they have smoked more than 40 years. The rates for smokers of 20 cigarettes per day who have smoked for 40 to 49 years are substantially higher in CPS-II than in CPS-I for males of all races with prevalent cancers included and for white males with prevalent cancers excluded.

The evolution of cigarettes has not protected smokers from fatal lung cancer. Rather, the potential benefits of reduced tar, as measured by machine smoking, appear to be overwhelmed by adverse changes in smoking practices and perhaps by other unidentified factors.

Although smoking cessation clearly reduces the risk of CHD and stroke, much of the temporal decline in CHD and stroke mortality from CPS-I to CPS-II appeared to reflect factors other than smoking cessation because similar reductions were seen among current cigarette smokers and lifelong never-smokers.

The percentage of all deaths attributable to active cigarette smoking was higher in CPS-II than in CPS-I, increasing from 42.2 to 57.1 percent in men and from 18.7 to 47.9 percent in women.

The two major diseases contributing to accelerated mortality among smokers reversed from CPS-I to CPS-II: Lung cancer became the largest single contributor in 1982, with CHD in second place.

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Appendixes 1 Through 30

APPENDIX 1
Distribution of the Cancer Prevention Study (CPS)-I and CPS-II Full Cohorts, by Birth Cohort and Age at Enrollment

	Decade of Birth										
	1850	1860	1870	1880	1890	1900	1910	1920	1930	1940	1950
CPS-I											
Persons	15	1,134	14,675	73,219	197,006	359,051	321,625	84,313	—	—	—
Percent	0.0	0.1	1.4	7.0	18.7	34.2	30.6	8.0	—	—	—
Age at enrollment	100-109	90-99	80-89	70-79	60-69	50-59	40-49	30-39	—	—	—
CPS-II											
Persons	—	—	13	912	13,225	88,464	261,902	415,840	322,399	71,095	11,256
Percent	—	—	0.0	0.1	1.1	7.5	22.1	35.1	27.2	6.0	0.9
Age at enrollment	—	—	103-112	93-102	83-92	73-82	63-72	53-62	43-52	33-42	30-32

APPENDIX 2
Standard Populations Used To Compute Age-Standardized Death Rates and Smoking Prevalence

Age	Person-Years CPS-I and CPS-II[a]	Age at Baseline CPS-I and CPS-II[b]
30-34	120,780	51,203
35-39	382,619	84,593
40-44	684,255	171,619
45-49	1,591,398	382,258
50-54	2,343,338	401,847
55-59	2,296,964	361,256
60-64	1,968,333	291,430
65-69	1,506,638	213,021
70-74	1,013,392	131,189
75-79	564,855	66,945
80-84	250,957	27,283
85+	120,886	13,321

[a] *Represents the age distribution of all person-years during the first 6 years of followup in both studies combined, used to standardize death rates.*

[b] *Represents the distribution of baseline age of 2,195,965 subjects in CPS-I and CPS-II, used to standardize smoking prevalence. Excludes persons of race other than black or white.*

Key: CPS = Cancer Prevention Study.

APPENDIX 3
Deaths and Death Rates From Lung Cancer, by Amount and Duration of Current Cigarette Smoking: Men (all races—includes prevalent cancers)

Never-Smokers

	CPS-I (N = 66,154)			CPS-II (N = 94,958)		
Age	Number of Deaths	Person-Years	Rate[a]	Number of Deaths	Person-Years	Rate[a]
50-54	6	105,584	5.7	7	127,821	5.5
55-59	13	95,592	13.6	7	132,430	5.3
60-64	16	76,190	21.0	14	121,174	11.6
65-69	14	60,654	23.1	22	102,124	21.5
70-74	13	43,770	29.7	25	71,536	34.9
75-79	8	25,766	31.0	21	40,363	52.0
80-84	8	11,858	67.5	16	17,946	89.2
85+	2	5,658	35.3	7	8,069	86.8
			18.8			17.7

20 Cigarettes Per Day Smoked for 30 to 34 Years

	CPS-I (N = 6,690)			CPS-II (N = 3,150)		
Age	Number of Deaths	Person-Years	Rate[a]	Number of Deaths	Person-Years	Rate[a]
50-54	25	38,751	64.5	14	14,003	100.0
55-59	22	17,921	122.8	9	8,883	101.3
60-64	2	3,246	61.6	4	2,293	174.4
65-69	2	596	335.7	3	700	428.7
70-74	0	184	—	1	222	450.1
75-79	0	90	—	0	63	—
80-84	0	25	—	0	2	—
85+	0	18	—	0	0	—

20 Cigarettes Per Day Smoked for 35 to 39 Years

	CPS-I (N = 9,008)			CPS-II (N = 4,921)		
Age	Number of Deaths	Person-Years	Rate[a]	Number of Deaths	Person-Years	Rate[a]
50-54	21	13,576	154.7	7	6,520	107.4
55-59	36	28,260	127.4	33	14,608	225.9
60-64	23	10,423	220.7	10	7,146	139.9
65-69	4	1,854	215.8	8	1,453	550.5
70-74	1	326	306.5	2	288	693.6
75-79	0	77	—	0	85	—
80-84	0	11	—	0	23	—
85+	0	6	—	0	4	—

APPENDIX 3 (continued)

20 Cigarettes Per Day Smoked for 40 to 44 Years

	CPS-I (N = 6,743)			CPS-II (N = 5,516)		
Age	Number of Deaths	Person-Years	Rate[a]	Number of Deaths	Person-Years	Rate[a]
50-54	2	1,971	101.5	1	1,045	95.7
55-59	15	10,008	149.9	22	7,599	289.5
60-64	46	17,068	269.5	47	14,513	323.9
65-69	21	6,360	330.2	39	6,682	583.7
70-74	3	1,068	281.0	10	1,383	722.9
75-79	0	169	—	5	225	2,225.5
80-84	1	36	2,758.6	0	34	—
85+	0	2	—	1	9	10,909.1

20 Cigarettes Per Day Smoked for 45 to 49 Years

	CPS-I (N = 3,288)			CPS-II (N = 3,154)		
Age	Number of Deaths	Person-Years	Rate[a]	Number of Deaths	Person-Years	Rate[a]
50-54	0	15	—	0	137	—
55-59	3	1,184	253.3	3	947	316.8
60-64	17	5,439	312.6	23	5,222	440.5
65-69	36	8,010	449.5	45	7,989	563.2
70-74	7	2,302	304.1	15	2,718	551.9
75-79	3	316	950.9	3	374	801.8
80-84	0	45	—	1	56	1,777.8
85+	0	8	—	0	11	—

20 Cigarettes Per Day Smoked for 50 or More Years

	CPS-I (N = 2,457)			CPS-II (N = 4,199)		
Age	Number of Deaths	Person-Years	Rate[a]	Number of Deaths	Person-Years	Rate[a]
50-54	0	0	—	0	12	—
55-59	0	15	—	1	195	512.8
60-64	3	848	353.9	8	1,326	603.3
65-69	14	3,546	394.8	52	5,745	905.1
70-74	27	4,878	553.5	86	8,606	999.3
75-79	21	2,157	973.6	64	4,449	1,438.6
80-84	3	557	519.6	20	1,133	1,764.6
85+	0	126	—	2	215	929.5

APPENDIX 3 (continued)

40 Cigarettes Per Day Smoked for 30 to 34 Years

	CPS-I (N = 1,967)			CPS-II (N = 1,750)		
Age	Number of Deaths	Person-Years	Rate[a]	Number of Deaths	Person-Years	Rate[a]
50-54	8	11,807	67.8	20	10,639	188.0
55-59	7	5,144	136.1	8	4,952	161.5
60-64	2	785	254.9	4	1,027	389.5
65-69	2	140	1,431.1	1	179	558.7
70-74	0	31	—	0	56	—
75-79	0	7	—	0	9	—
80-84	0	5	—	0	5	—
85+	0	3	—	0	1	—

40 Cigarettes Per Day Smoked for 35 to 39 Years

	CPS-I (N = 2,485)			CPS-II (N = 3,394)		
Age	Number of Deaths	Person-Years	Rate[a]	Number of Deaths	Person-Years	Rate[a]
50-54	4	4,650	86.0	10	5,735	174.4
55-59	15	7,903	189.8	25	10,631	235.2
60-64	8	2,502	319.7	22	4,069	540.7
65-69	0	366	—	5	616	811.1
70-74	0	60	—	1	87	1,152.7
75-79	0	9	—	0	14	—
80-84	0	0	—	0	0	—
85+	0	0	—	0	0	—

40 Cigarettes Per Day Smoked for 40 to 44 Years

	CPS-I (N = 1,592)			CPS-II (N = 3,229)		
Age	Number of Deaths	Person-Years	Rate[a]	Number of Deaths	Person-Years	Rate[a]
50-54	2	718	278.7	3	981	305.8
55-59	10	3,057	327.1	21	5,919	354.8
60-64	18	3,761	478.6	45	8,555	526.0
65-69	8	996	803.5	22	2,583	851.7
70-74	0	105	—	5	362	1,380.3
75-79	0	4	—	0	49	—
80-84	0	0	—	0	6	—
85+	0	0	—	0	0	—

APPENDIX 3 (continued)

40 Cigarettes Per Day Smoked for 45 to 49 Years

	CPS-I (N = 651)			CPS-II (N = 1,538)		
Age	Number of Deaths	Person-Years	Rate[a]	Number of Deaths	Person-Years	Rate[a]
50-54	0	5	—	0	113	—
55-59	2	371	539.1	1	765	130.7
60-64	5	1,335	374.6	13	3,214	404.4
65-69	11	1,400	785.7	30	3,586	836.6
70-74	0	273	—	11	811	1,356.2
75-79	0	30	—	2	73	2,739.7
80-84	0	1	—	0	5	—
85+	0	0	—	0	0	—

40 Cigarettes Per Day Smoked for 50 or More Years

	CPS-I (N = 375)			CPS-II (N = 1,366)		
Age	Number of Deaths	Person-Years	Rate[a]	Number of Deaths	Person-Years	Rate[a]
50-54	0	0	—	0	9	—
55-59	0	3	—	2	141	1,415.9
60-64	3	209	1,436.0	7	743	942.1
65-69	5	699	715.1	21	2,293	916.0
70-74	6	655	916.7	33	2,660	1,240.8
75-79	5	225	2,220.6	16	1,034	1,547.8
80-84	0	47	—	2	206	970.9
85+	0	3	—	0	51	—

[a] *Rate per 100,000 person-years.*

Key: CPS = Cancer Prevention Study.

APPENDIX 4
Deaths and Death Rates From Lung Cancer, by Amount and Duration of Current Cigarette Smoking: Women (all races—includes prevalent cancers)

Never-Smokers

	CPS-I (N = 260,036)			CPS-II (N = 266,430)		
Age	Number of Deaths	Person-Years	Rate[a]	Number of Deaths	Person-Years	Rate[a]
50-54	20	388,546	5.1	18	309,700	5.8
55-59	23	373,403	6.2	25	345,629	7.2
60-64	38	316,344	12.0	42	340,560	12.3
65-69	34	254,315	13.4	47	280,728	16.7
70-74	28	176,096	15.9	63	206,345	30.5
75-79	25	100,201	24.9	44	135,257	32.5
80-84	21	48,439	43.4	41	71,175	57.6
85+	9	25,046	35.9	25	41,281	60.6
			11.5			15.0

20 Cigarettes Per Day Smoked for 30 to 34 Years

	CPS-I (N = 4,963)			CPS-II (N = 5,963)		
Age	Number of Deaths	Person-Years	Rate[a]	Number of Deaths	Person-Years	Rate[a]
50-54	5	20,798	24.0	16	20,621	77.6
55-59	4	11,910	33.6	16	15,370	104.1
60-64	1	4,869	20.5	11	5,821	189.0
65-69	1	2,197	45.5	3	2,453	122.3
70-74	0	831	—	2	1,061	188.5
75-79	0	302	—	2	375	533.9
80-84	0	58	—	0	105	—
85+	0	24	—	0	31	—

20 Cigarettes Per Day Smoked for 35 to 39 Years

	CPS-I (N = 2,582)			CPS-II (N = 6,793)		
Age	Number of Deaths	Person-Years	Rate[a]	Number of Deaths	Person-Years	Rate[a]
50-54	0	3,093	—	5	5,448	91.8
55-59	0	6,422	—	25	18,119	138.0
60-64	3	3,427	87.6	27	11,707	230.6
65-69	3	1,552	193.2	10	3,458	289.2
70-74	0	629	—	1	1,207	82.9
75-79	0	183	—	3	461	651.1
80-84	0	61	—	0	124	—
85+	0	13	—	0	19	—

APPENDIX 4 (continued)

20 Cigarettes Per Day Smoked for 40 to 44 Years

	CPS-I (N = 771)			CPS-II (N = 5,690)		
Age	Number of Deaths	Person-Years	Rate[a]	Number of Deaths	Person-Years	Rate[a]
50-54	0	97	—	0	318	—
55-59	0	785	—	8	4,976	160.8
60-64	3	1,804	166.3	23	14,857	154.8
65-69	2	1,001	199.9		9,112	384.1
70-74	0	427	—	11	2,622	419.5
75-79	0	157	—	8	857	934.0
80-84	0	32	—	3	247	1,213.3
85+	0	11	—	0	85	—

20 Cigarettes Per Day Smoked for 45 to 49 Years

	CPS-I (N = 202)			CPS-II (N = 2,878)		
Age	Number of Deaths	Person-Years	Rate[a]	Number of Deaths	Person-Years	Rate[a]
50-54	0	0	—	0	6	—
55-59	0	41	—	0	201	—
60-64	0	211	—	7	3,207	218.3
65-69	1	471	212.1	27	8,009	337.1
70-74	0	221	—	17	3,850	441.6
75-79	0	80	—	7	866	808.6
80-84	0	36	—	1	193	518.4
85+	0	3	—	0	54	—

20 Cigarettes Per Day Smoked for 50 or More Years

	CPS-I (N = 98)			CPS-II (N = 2,450)		
Age	Number of Deaths	Person-Years	Rate[a]	Number of Deaths	Person-Years	Rate[a]
50-54	0	0	—	0	0	—
55-59	0	0	—	0	14	—
60-64	0	30	—	2	240	834.2
65-69	1	118	847.5	19	2,699	703.9
70-74	0	195	—	30	5,843	513.5
75-79	0	107	—	15	3,427	437.7
80-84	0	39	—	7	977	716.6
85+	0	6	—	3	202	1,482.7

APPENDIX 4 (continued)

40 Cigarettes Per Day Smoked for 30 to 34 Years

	CPS-I (N = 478)			CPS-II (N = 1,517)		
Age	Number of Deaths	Person-Years	Rate[a]	Number of Deaths	Person-Years	Rate[a]
50-54	4	2,491	160.6	10	7,300	137.0
55-59	2	1,207	165.7	8	4,093	195.5
60-64	0	390	—	3	1,185	253.2
65-69	1	166	601.2	0	353	—
70-74	0	51	—	0	91	—
75-79	0	7	—	0	34	—
80-84	0	0	—	0	8	—
85+	0	0	—	0	0	—

40 Cigarettes Per Day Smoked for 35 to 39 Years

	CPS-I (N = 325)			CPS-II (N = 2,008)		
Age	Number of Deaths	Person-Years	Rate[a]	Number of Deaths	Person-Years	Rate[a]
50-54	1	472	211.8	4	2,361	169.4
55-59	0	878	—	10	5,928	168.7
60-64	0	453	—	9	3,067	293.4
65-69	0	137	—	3	713	420.5
70-74	0	53	—	0	153	—
75-79	0	7	—	1	47	2,142.9
80-84	0	0	—	0	8	—
85+	0	0	—	0	0	—

40 Cigarettes Per Day Smoked for 40 to 44 Years

	CPS-I (N = 87)			CPS-II (N = 1,462)		
Age	Number of Deaths	Person-Years	Rate[a]	Number of Deaths	Person-Years	Rate[a]
50-54	0	30	—	0	124	—
55-59	0	149	—	4	1,936	206.6
60-64	0	204	—	24	4,114	583.4
65-69	0	68	—	6	1,756	341.6
70-74	0	27	—	1	369	270.7
75-79	0	11	—	0	115	—
80-84	0	7	—	0	31	—
85+	0	0	—	0	1	—

APPENDIX 4 (continued)

40 Cigarettes Per Day Smoked for 45 to 49 Years

	CPS-I (N = 20)			CPS-II (N = 649)		
Age	Number of Deaths	Person-Years	Rate[a]	Number of Deaths	Person-Years	Rate[a]
50-54	0	0	—	0	9	—
55-59	0	3	—	0	92	—
60-64	0	25	—	6	970	618.4
65-69	0	63	—	11	1,888	582.5
70-74	0	14	—	3	591	507.3
75-79	0	2	—	1	139	720.7
80-84	0	2	—	0	19	—
85+	0	0	—	0	0	—

40 Cigarettes Per Day Smoked for 50 or More Years

	CPS-I (N = 10)			CPS-II (N = 475)		
Age	Number of Deaths	Person-Years	Rate[a]	Number of Deaths	Person-Years	Rate[a]
50-54	0	0	—	0	0	—
55-59	0	0	—	0	1	—
60-64	0	5	—	0	83	—
65-69	0	21	—	4	689	580.7
70-74	0	18	—	7	1,164	601.5
75-79	0	7	—	5	467	1,071.2
80-84	0	0	—	1	108	922.4
85+	0	0	—	0	65	—

[a] *Rate per 100,000 person-years.*

Key: CPS = Cancer Prevention Study.

APPENDIX 5
Deaths and Death Rates From Lung Cancer in Those With Comparable Histories of Cigarette Smoking: Men (white race—excludes prevalent cancers)

Never-Smokers

	CPS-I (N = 62,916)			CPS-II (N = 84,913)		
Age	Number of Deaths	Person-Years	Rate[a]	Number of Deaths	Person-Years	Rate[a]
50-54	5	101,888	4.9	3	116,506	2.6
55-59	13	91,971	14.1	3	120,910	2.5
60-64	14	73,004	19.2	10	110,092	9.1
65-69	12	57,813	20.8	14	91,920	15.2
70-74	13	41,354	31.4	18	63,295	28.4
75-79	7	24,138	29.0	11	34,706	31.7
80-84	8	10,988	72.8	12	15,176	79.1
85+	2	5,239	38.2	5	6,551	76.3
			18.3			12.8

20 Cigarettes Per Day Smoked for 30 to 34 Years

	CPS-I (N = 6,476)			CPS-II (N = 2,770)		
Age	Number of Deaths	Person-Years	Rate[a]	Number of Deaths	Person-Years	Rate[a]
50-54	24	37,478	64.0	10	12,485	80.1
55-59	21	17,365	120.9	8	7,869	101.7
60-64	2	3,178	62.9	3	1,988	150.9
65-69	2	589	339.6	3	589	509.6
70-74	0	180	—	1	178	563.1
75-79	0	88	—	0	51	—
80-84	0	25	—	0	1	—
85+	0	18	—	0	0	—

20 Cigarettes Per Day Smoked for 35 to 39 Years

	CPS-I (N = 8,651)			CPS-II (N = 4,400)		
Age	Number of Deaths	Person-Years	Rate[a]	Number of Deaths	Person-Years	Rate[a]
50-54	18	13,024	138.2	5	5,838	85.6
55-59	34	27,253	124.8	26	13,143	197.8
60-64	21	10,008	209.8	10	6,385	156.6
65-69	4	1,748	228.8	7	1,290	542.7
70-74	0	305	—	2	248	805.1
75-79	0	75	—	0	68	—
80-84	0	10	—	0	19	—
85+	0	5	—	0	4	—

APPENDIX 5 (continued)

20 Cigarettes Per Day Smoked for 40 to 44 Years

	CPS-I (N = 6,486)			CPS-II (N = 4,850		
Age	Number of Deaths	Person-Years	Rate[a]	Number of Deaths	Person-Years	Rate[a]
50-54	1	1,885	53.0	1	955	104.7
55-59	13	9,624	135.1	16	6,794	235.5
60-64	42	16,509	254.4	38	12,819	296.4
65-69	21	6,127	342.7	30	5,894	509.0
70-74	3	1,022	293.6	8	1,180	678.0
75-79	0	168	—	4	195	2,049.5
80-84	1	36	2,758.6	0	27	—
85+	0	2	—	0	1	—

20 Cigarettes Per Day Smoked for 45 to 49 Years

	CPS-I (N = 3,123)			CPS-II (N = 2,782)		
Age	Number of Deaths	Person-Years	Rate[a]	Number of Deaths	Person-Years	Rate[a]
50-54	0	15	—	0	111	—
55-59	3	1,118	268.4	3	821	365.6
60-64	15	5,176	289.8	18	4,551	395.6
65-69	34	7,682	442.6	42	7,146	587.7
70-74	7	2,187	320.1	13	2,438	533.2
75-79	1	290	344.5	3	320	937.5
80-84	0	39	—	1	47	2,127.7
85+	0	8	—	0	11	—

20 Cigarettes Per Day Smoked for 50 or More Years

	CPS-I (N = 2,287)			CPS-II (N = 3,578)		
Age	Number of Deaths	Person-Years	Rate[a]	Number of Deaths	Person-Years	Rate[a]
50-54	0	0	—	0	12	—
55-59	0	14	—	1	175	572.0
60-64	1	792	126.2	7	1,168	599.4
65-69	14	3,345	418.5	43	4,984	862.8
70-74	26	4,582	567.5	75	7,365	1,018.3
75-79	18	2,024	889.5	49	3,792	1,292.2
80-84	3	525	571.2	18	973	1,849.3
85+	0	115	—	1	183	547.7

APPENDIX 5 (continued)

40 Cigarettes Per Day Smoked for 30 to 34 Years

	CPS-I (N = 1,914)			CPS-II (N = 1,641)		
Age	Number of Deaths	Person-Years	Rate[a]	Number of Deaths	Person-Years	Rate[a]
50-54	8	11,577	69.1	19	10,128	187.6
55-59	7	5,013	139.6	5	4,658	107.3
60-64	2	761	263.0	4	971	412.1
65-69	2	139	1,436.3	1	160	625.7
70-74	0	31	—	0	51	—
75-79	0	7	—	0	9	—
80-84	0	4	—	0	5	—
85+	0	3	—	0	1	—

40 Cigarettes Per Day Smoked for 35 to 39 Years

	CPS-I (N = 2,417)			CPS-II (N = 3,209)		
Age	Number of Deaths	Person-Years	Rate[a]	Number of Deaths	Person-Years	Rate[a]
50-54	4	4,525	88.4	10	5,392	185.5
55-59	15	7,721	194.3	23	10,078	228.2
60-64	6	2,426	247.3	22	3,871	568.4
65-69	0	356	0.0	5	585	855.3
70-74	0	60	0.0	0	71	0.0
75-79	0	9	0.0	0	6	0.0
80-84	0	0	0.0	0	0	0.0
85+	0	0	0.0	0	0	0.0

40 Cigarettes Per Day Smoked for 40 to 44 Years

	CPS-I (N = 1,539)			CPS-II (N = 3,001)		
Age	Number of Deaths	Person-Years	Rate[a]	Number of Deaths	Person-Years	Rate[a]
50-54	1	702	142.6	3	915	328.0
55-59	10	2,995	333.9	19	5,562	341.6
60-64	17	3,647	466.1	38	7,985	475.9
65-69	8	941	850.1	22	2,365	930.1
70-74	0	101	—	4	327	1,222.6
75-79	0	4	—	0	49	—
80-84	0	0	—	0	6	—
85+	0	0	—	0	0	—

APPENDIX 5 (continued)

40 Cigarettes Per Day Smoked for 45 to 49 Years

	CPS-I (N = 626)			CPS-II (N = 1,419)		
Age	Number of Deaths	Person-Years	Rate[a]	Number of Deaths	Person-Years	Rate[a]
50-54	0	5	—	0	102	—
55-59	2	365	547.6	1	704	142.0
60-64	4	1,297	308.3	13	2,994	434.2
65-69	11	1,351	814.2	25	3,344	747.7
70-74	0	261	—	8	753	1,062.5
75-79	0	25	—	2	66	3,045.7
80-84	0	0	—	0	3	—
85+	0	0	—	0	0	—

40 Cigarettes Per Day Smoked for 50 or More Years

	CPS-I (N = 356)			CPS-II (N = 1,213)		
Age	Number of Deaths	Person-Years	Rate[a]	Number of Deaths	Person-Years	Rate[a]
50-54	0	0	—	0	9	—
55-59	0	3	—	2	137	1,456.3
60-64	3	207	1,449.9	5	682	732.7
65-69	5	667	750.2	15	2,083	720.3
70-74	5	625	799.6	26	2,373	1,095.8
75-79	4	220	1,815.4	15	918	1,634.1
80-84	0	44	—	1	170	589.1
85+	0	3	—	0	38	—

[a] *Rate per 100,000 person-years.*

Key: CPS = Cancer Prevention Study.

APPENDIX 6
Deaths and Death Rates From Lung Cancer in Those With Comparable Histories of Cigarette Smoking: Women (white race—excludes prevalent cancers)

Never-Smokers

	CPS-I (N = 238,983)			CPS-II (N = 225,190)		
Age	Number of Deaths	Person-Years	Rate[a]	Number of Deaths	Person-Years	Rate[a]
50-54	14	364,599	3.8	14	271,833	5.2
55-59	21	348,195	6.0	20	300,943	6.6
60-64	29	292,936	9.9	27	292,653	9.2
65-69	25	234,033	10.7	25	237,357	10.5
70-74	22	160,720	13.7	34	171,648	19.8
75-79	21	90,455	23.2	27	111,271	24.3
80-84	16	43,436	36.8	27	57,612	46.9
85+	8	22,403	35.7	18	32,626	55.2
			9.8			11.3

20 Cigarettes Per Day Smoked for 30 to 34 Years

	CPS-I (N = 4,631)			CPS-II (N = 5,213)		
Age	Number of Deaths	Person-Years	Rate[a]	Number of Deaths	Person-Years	Rate[a]
50-54	5	19,759	25.3	14	18,275	76.6
55-59	4	11,195	35.7	11	13,551	81.2
60-64	1	4,547	22.0	9	5,073	177.4
65-69	0	2,016	—	2	2,120	94.3
70-74	0	746	—	2	935	214.0
75-79	0	253	—	1	330	303.0
80-84	0	47	—	0	93	—
85+	0	19	—	0	29	—

20 Cigarettes Per Day Smoked for 35 to 39 Years

	CPS-I (N = 2,401)			CPS-II (N = 5,919)		
Age	Number of Deaths	Person-Years	Rate[a]	Number of Deaths	Person-Years	Rate[a]
50-54	0	2,940	—	3	4,817	62.3
55-59	0	5,995	—	21	15,932	131.8
60-64	2	3,192	62.7	21	10,217	205.5
65-69	2	1,438	139.1	9	3,008	299.2
70-74	0	566	—	1	1,040	96.2
75-79	0	173	—	1	370	270.6
80-84	0	59	—	0	99	—
85+	0	9	—	0	18	—

APPENDIX 6 (continued)

20 Cigarettes Per Day Smoked for 40 to 44 Years

	CPS-I (N = 721)			CPS-II (N = 4,902)		
Age	Number of Deaths	Person-Years	Rate[a]	Number of Deaths	Person-Years	Rate[a]
50-54	0	82	—	0	255	—
55-59	0	733	—	7	4,238	165.2
60-64	3	1,702	176.3	18	13,004	138.4
65-69	2	931	214.8	28	7,881	355.3
70-74	0	402	—	8	2,243	356.7
75-79	0	157	—	7	727	962.6
80-84	0	32	—	1	206	485.6
85+	0	11	—	0	63	—

20 Cigarettes Per Day Smoked for 45 to 49 Years

	CPS-I (N = 177)			CPS-II (N = 2,433)		
Age	Number of Deaths	Person-Years	Rate[a]	Number of Deaths	Person-Years	Rate[a]
50-54	0	0	—	0	2	—
55-59	0	41	—	0	156	—
60-64	0	196	—	7	2,750	254.6
65-69	1	406	246.6	23	6,793	338.6
70-74	0	187	—	14	3,282	426.6
75-79	0	72	—	6	744	806.2
80-84	0	30	—	0	174	—
85+	0	2	—	0	52	—

20 Cigarettes Per Day Smoked for 50 or More Years

	CPS-I (N = 86)			CPS-II (N = 2,033)		
Age	Number of Deaths	Person-Years	Rate[a]	Number of Deaths	Person-Years	Rate[a]
50-54	0	0	—	0	0	—
55-59	0	0	—	0	10	—
60-64	0	24	—	0	203	—
65-69	1	100	999.2	11	2,274	483.6
70-74	0	178	—	24	4,882	491.6
75-79	0	103	—	13	2,887	450.3
80-84	0	37	—	5	811	616.2
85+	0	2	—	3	159	1,890.8

APPENDIX 6 (continued)

40 Cigarettes Per Day Smoked for 30 to 34 Years

	CPS-I (N = 443)			CPS-II (N = 1,361)		
Age	Number of Deaths	Person-Years	Rate[a]	Number of Deaths	Person-Years	Rate[a]
50-54	4	2,355	169.9	8	6,623	120.8
55-59	2	1,135	176.3		83,711	215.6
60-64	0	357	—	2	1,050	190.4
65-69	1	142	705.1	0	292	—
70-74	0	51	—	0	61	—
75-79	0	7	—	0	33	—
80-84	0	0	—	0	8	—
85+	0	0	—	0	0	—

40 Cigarettes Per Day Smoked for 35 to 39 Years

	CPS-I (N = 304)			CPS-II (N = 1,775)		
Age	Number of Deaths	Person-Years	Rate[a]	Number of Deaths	Person-Years	Rate[a]
50-54	1	445	224.8	2	2,113	94.7
55-59	0	824	—	9	5,297	169.9
60-64	0	423	—	7	2,702	259.1
65-69	0	127	—	3	613	489.6
70-74	0	48	—	0	135	—
75-79	0	6	—	1	43	2,312.1
80-84	0	0	—	0	5	—
85+	0	0	—	0	0	—

40 Cigarettes Per Day Smoked for 40 to 44 Years

	CPS-I (N = 80)			CPS-II (N = 1,258)		
Age	Number of Deaths	Person-Years	Rate[a]	Number of Deaths	Person-Years	Rate[a]
50-54	0	29	—	0	112	—
55-59	0	138	—	3	1,690	177.5
60-64	0	179	—	20	3,531	566.4
65-69	0	65	—	6	1,510	397.4
70-74	0	27	—	1	310	323.0
75-79	0	11	—	0	93	—
80-84	0	7	—	0	26	—
85+	0	0	—	0	1	—

APPENDIX 6 (continued)

40 Cigarettes Per Day Smoked for 45 to 49 Years

	CPS-I (N = 16)			CPS-II (N = 554)		
Age	Number of Deaths	Person-Years	Rate[a]	Number of Deaths	Person-Years	Rate[a]
50-54	0	0	—	0	6	—
55-59	0	3	—	0	72	—
60-64	0	23	—	5	830	602.1
65-69	0	48	—	10	1,623	616.2
70-74	0	7	—	3	510	588.4
75-79	0	2	—	1	128	779.7
80-84	0	2	—	0	19	—
85+	0	0	—	0	0	—

40 Cigarettes Per Day Smoked for 50 or More Years

	CPS-I (N = 9)			CPS-II (N = 401)		
Age	Number of Deaths	Person-Years	Rate[a]	Number of Deaths	Person-Years	Rate[a]
50-54	0	0	—	0	0	—
55-59	0	0	—	0	1	—
60-64	0	4	—	0	62	—
65-69	0	16	—	4	584	685.5
70-74	0	18	—	6	1,020	588.1
75-79	0	7	—	4	389	1,029.4
80-84	0	0	—	1	97	1,029.2
85+	0	0	—	0	54	—

[a] *Rate per 100,000 person-years. Age-adjusted rate standardized to CPS-I and CPS-II 6-year person-years distribution (Appendix 2).*

Key: CPS = Cancer Prevention Study.

APPENDIX 7
Number and Percentage of Men Who Currently Smoke or Formerly Smoked Cigarettes[a] When Enrolled in CPS-I (1959) or CPS-II (1982), by Age and Race

	White Men											
			Percentage of Those Enrolled									
			Cigarette Smokers				Pipe/Cigar Smokers Only Ever		Never-Smokers		Unclassifiable	
	Number		Current		Former							
Age	CPS-I	CPS-II	CPS-I	CPS-II	CPS-I	CPS-II	CPS-I	CPS-II	CPS-I	CPS-II	CPS-I	CPS-II
30-34	10,189	7,623	59.5	31.9	10.2	18.5	4.5	3.7	21.2	44.0	4.7	1.9
35-39	17,218	9,298	57.8	33.5	12.2	25.3	5.6	5.4	18.5	33.9	5.9	2.0
40-44	31,947	15,087	56.4	31.5	13.1	31.6	5.5	6.4	19.0	28.5	6.1	2.0
45-49	94,993	68,835	54.5	28.4	15.3	34.7	5.6	7.8	18.5	27.3	6.2	1.8
50-54	92,933	87,127	51.1	26.8	16.8	38.9	6.7	7.7	18.6	24.6	6.9	2.0
55-59	71,328	91,343	45.5	24.7	18.5	43.1	7.9	8.2	20.0	21.8	8.1	2.3
60-64	52,083	79,467	38.4	21.1	19.9	44.3	9.9	8.9	21.8	22.9	9.9	2.8
65-69	35,982	58,269	31.5	18.1	19.6	45.3	11.8	8.6	25.2	24.2	11.9	3.9
70-74	20,490	35,577	25.2	14.6	17.5	46.6	14.3	9.2	29.7	24.4	13.3	5.2
75-79	9,750	17,109	18.0	11.0	14.5	44.4	16.9	10.8	35.0	26.7	15.6	7.1
80-84	3,841	5,944	13.9	8.1	11.3	41.5	20.1	12.5	38.5	28.9	16.3	9.1
85+	1,700	2,440	7.4	5.8	6.8	34.9	23.1	16.7	45.2	32.6	17.5	10.0

APPENDIX 7 (continued)

	Black Men											
			Percentage of Those Enrolled									
			Cigarette Smokers				Pipe/Cigar Smokers Only Ever					
	Number		Current		Former				Never-Smokers		Unclassifiable	
Age	CPS-I	CPS-II	CPS-I	CPS-II	CPS-I	CPS-II	CPS-I	CPS-II	CPS-I	CPS-II	CPS-I	CPS-II
30-34	539	609	67.7	42.2	5.4	14.6	3.2	2.1	21.3	36.0	2.4	5.1
35-39	800	655	68.1	42.4	5.6	18.2	4.9	2.0	17.4	30.8	4.0	6.6
40-44	1,012	938	63.1	41.7	6.0	21.1	6.2	3.9	19.7	27.7	4.9	5.5
45-49	1,790	2,809	61.1	39.8	7.0	25.0	8.2	5.3	18.9	25.5	4.8	4.5
50-54	1,746	3,191	52.8	37.0	8.0	26.8	11.5	5.8	20.3	23.9	7.5	6.6
55-59	1,355	3,149	46.1	35.4	8.9	29.6	14.8	7.2	22.2	20.5	8.0	7.2
60-64	873	2,795	38.3	29.1	8.6	30.8	16.2	8.9	26.6	23.7	10.4	7.6
65-69	736	2,072	32.1	29.1	8.0	30.0	18.6	9.9	28.7	22.1	12.6	8.9
70-74	481	1,437	27.2	24.1	11.2	29.4	19.1	10.3	29.1	23.9	13.3	12.3
75-79	273	711	21.3	18.4	10.6	28.7	19.1	12.0	36.3	25.5	12.8	15.5
80-84	102	303	16.7	12.5	11.8	27.4	16.7	16.2	30.4	26.7	24.5	17.2
85+	46	142	8.7	15.5	8.7	20.4	23.9	16.9	47.8	36.6	10.9	10.6

[a] *Defined as cigarette smoking with or without pipes or cigars.*

Key: CPS = Cancer Prevention Study.

APPENDIX 8
Number and Percentage of Women Who Currently Smoke or Formerly Smoked Cigarettes[a] When Enrolled in CPS-I (1959) or CPS-II (1982), by Age and Race

	White Women									
			Percentage of Those Enrolled							
			Cigarette Smokers							
	Number		Current		Former		Never-Smokers		Unclassifiable	
Age	CPS-I	CPS-II	CPS-I	CPS-II	CPS-I	CPS-II	CPS-I	CPS-II	CPS-I	CPS-II
30-34	17,868	11,803	42.7	25.2	7.1	17.8	48.6	53.4	1.6	3.6
35-39	34,640	18,891	41.0	26.5	7.6	23.0	49.8	46.6	1.6	3.9
40-44	73,263	44,665	39.2	24.7	7.4	23.5	51.9	47.7	1.6	4.2
45-49	114,005	92,077	36.2	24.3	7.0	22.6	55.2	48.5	1.6	4.5
50-54	102,887	106,281	29.1	22.8	6.0	22.5	63.2	49.7	1.7	5.0
55-59	79,027	108,015	21.0	21.3	4.7	22.2	72.5	51.0	1.8	5.6
60-64	58,577	92,195	14.3	18.4	3.7	21.1	80.1	53.8	1.9	6.7
65-69	42,583	68,992	10.1	15.7	3.0	21.0	84.7	54.7	2.2	8.6
70-74	25,717	44,662	6.9	11.8	2.4	18.3	88.5	59.2	2.3	10.7
75-79	13,595	23,968	4.7	8.0	2.0	13.7	90.5	66.1	2.8	12.3
80-84	6,389	9,964	2.7	5.0	1.4	9.5	93.2	71.7	2.8	13.9
85+	3,167	5,392	1.1	2.7	1.0	5.4	94.4	77.2	3.4	14.7

APPENDIX 8 (continued)

	Black Women									
			Percentage of Those Enrolled							
			Cigarette Smokers							
	Number		Current		Former		Never-Smokers		Unclassifiable	
Age	CPS-I	CPS-II	CPS-I	CPS-II	CPS-I	CPS-II	CPS-I	CPS-II	CPS-I	CPS-I
30-34	1,207	1,365	47.1	31.8	4.3	9.2	45.2	51.7	3.5	7.3
35-39	1,548	1,543	43.4	34.1	4.2	13.8	49.4	43.2	3.1	8.9
40-44	2,090	2,617	36.5	30.1	4.6	14.0	54.5	45.7	4.4	10.1
45-49	2,714	5,035	29.6	30.2	4.5	15.0	61.9	44.1	4.1	10.8
50-54	2,299	5,383	21.8	29.6	3.8	15.1	69.5	44.1	4.9	11.1
55-59	1,837	5,202	16.2	25.9	3.7	15.1	75.6	46.1	4.6	12.8
60-64	1,202	4,238	11.2	21.4	2.9	14.2	80.9	49.7	5.0	14.7
65-69	972	3,415	7.1	15.9	2.6	13.3	83.4	53.2	6.9	17.6
70-74	601	2,224	4.8	12.1	1.8	10.3	87.5	58.1	5.8	19.5
75-79	310	1,229	3.2	7.0	1.3	7.9	90.3	63.9	5.2	21.2
80-84	133	607	1.5	7.4	3.0	5.3	87.2	63.9	8.3	23.4
85+	66	368	0.0	5.7	0.0	5.4	97.0	68.2	3.0	20.7

[a] Assumed to be cigarette smoking only.

Key: CPS = Cancer Prevention Study.

APPENDIX 9
Number and Percentage of Men Who Currently Smoke or Formerly Smoked Cigarettes[a] When Enrolled in NHIS-I (1965) or NHIS-II (1983), by Age and Race

White Men												
			Percentage of Those Enrolled									
	Unweighted Number		Cigarette Smokers				Pipe/Cigar Smokers Only Ever		Never-Smokers		Unclassifiable	
			Current		Former							
Age	NHIS-65	NHIS-83	NHIS-65	NHIS-83	NHIS-65	NHIS-83	NHIS-65	NHIS-83	NHIS-65	NHIS-83	NHIS-65	NHIS-83
30-34	3,394	906	59.4	37.7	17.7	23.9	7.3	4.4	15.2	33.6	0.5	0.4
35-39	3,645	795	58.2	39.9	21.1	25.9	6.8	4.6	13.5	29.3	0.4	0.2
40-44	3,843	664	56.3	41.8	21.9	30.0	8.3	5.9	13.1	22.3	0.4	—
45-49	3,602	599	55.8	40.7	21.7	35.3	7.9	6.6	14.4	17.5	0.3	—
50-54	3,431	632	54.7	35.4	23.8	37.4	7.8	6.5	13.4	20.4	0.3	0.3
55-59	2,898	655	48.9	34.8	26.9	43.2	9.9	7.2	13.9	14.5	0.5	0.3
60-64	2,275	596	42.4	28.7	29.9	49.0	11.5	7.2	15.3	15.0	1.0	0.2
65-69	1,926	490	33.7	24.5	32.5	51.3	15.4	6.9	17.5	17.3	0.9	—
70-74	1,482	388	29.6	26.6	28.7	45.8	22.3	7.2	18.9	20.2	0.5	0.2
75-79	969	246	23.4	13.8	24.9	58.8	26.6	13.2	23.5	14.3	1.6	—
80-84	497	118	15.8	10.0	25.4	42.8	34.7	13.3	23.3	33.9	0.8	—
85+	231	77	9.3	2.4	18.5	43.9	37.3	11.8	32.1	41.9	2.8	—

APPENDIX 9 (continued)

	Black Men											
			Percentage of Those Enrolled									
	Unweighted Number		Cigarette Smokers				Pipe/Cigar Smokers Only Ever		Never-Smokers		Unclassifiable	
			Current		Former							
Age	NHIS-65	NHIS-83	NHIS-65	NHIS-83	NHIS-65	NHIS-83	NHIS-65	NHIS-83	NHIS-65	NHIS-83	NHIS-65	NHIS-83
30-34	320	82	68.4	42.2	8.8	21.9	6.6	0.9	16.2	35.0	—	—
35-39	315	72	67.9	48.6	12.6	19.3	8.2	2.4	10.4	29.7	0.9	—
40-44	382	69	66.3	41.8	12.0	26.5	6.3	4.6	13.9	25.8	1.6	1.4
45-49	301	51	63.2	51.6	14.2	18.1	10.4	4.3	11.2	26.0	0.9	—
50-54	313	55	61.2	44.3	16.2	31.9	8.4	3.0	13.7	20.8	0.6	—
55-59	263	50	53.8	36.1	13.8	39.1	17.5	3.7	13.8	19.3	1.1	1.9
60-64	173	52	48.8	45.3	18.1	37.7	19.8	5.5	12.6	11.6	0.6	—
65-69	165	35	47.6	47.1	20.0	25.1	16.1	11.8	15.2	16.0	1.1	—
70-74	107	33	41.6	31.6	22.9	29.7	21.9	13.5	12.6	25.2	1.0	—
75-79	59	14	23.3	39.5	20.0	39.9	31.9	7.5	24.8	13.2	—	—
80-84	31	7	12.2	28.4	34.1	28.4	24.5	1.5	24.9	41.7	4.2	—
85+	15	2	14.0	—	5.6	—	34.1	—	46.3	—	—	—

[a] *Defined as cigarette smoking with or without pipes or cigars.*

Key: NHIS = National Health Interview Survey.

APPENDIX 10
Number and Percentage of Women Who Currently or Formerly Smoked Cigarettes[a] When Enrolled in NHIS-I (1965) or NHIS-II (1983), by Age, Race, and Sex

	White Women									
			Percentage of Those Enrolled							
			Cigarette Smokers							
	Unweighted Number		Current		Former		Never-Smokers		Unclassifiable	
Age	NHIS-65	NHIS-83	NHIS-65	NHIS-83	NHIS-65	NHIS-83	NHIS-65	NHIS-83	NHIS-65	NHIS-83
30-34	3,676	1,220	43.2	31.5	10.3	15.9	46.2	52.6	0.3	—
35-39	4,018	1,040	45.2	34.9	10.6	18.0	44.1	47.1	0.2	—
40-44	4,149	880	42.5	34.7	9.3	17.9	48.0	47.4	0.2	—
45-49	3,949	757	40.2	34.5	9.7	19.4	49.9	46.1	0.2	0.1
50-54	3,708	768	35.9	32.2	9.4	17.2	54.5	50.6	0.2	—
55-59	3,099	789	30.1	30.0	8.1	19.9	61.5	50.0	0.4	—
60-64	2,576	765	20.4	26.0	7.3	19.4	72.0	54.5	0.3	0.1
65-69	2,327	671	14.3	21.9	5.3	22.3	79.9	55.7	0.6	0.1
70-74	1,780	544	10.5	12.4	4.5	25.0	84.3	62.4	0.7	0.2
75-79	1,233	399	5.3	10.4	4.4	17.5	89.1	72.1	1.3	—
80-84	717	244	4.1	3.2	3.5	9.9	91.3	87.0	1.1	—
85+	384	155	2.8	1.2	1.4	7.2	95.6	91.6	0.3	—

APPENDIX 10 (continued)

	Black Women									
			Percentage of Those Enrolled							
			Cigarette Smokers							
	Unweighted Number		Current		Former		Never-Smokers		Unclassifiable	
Age	NHIS-65	NHIS-83	NHIS-65	NHIS-83	NHIS-65	NHIS-83	NHIS-65	NHIS-83	NHIS-65	NHIS-83
30-34	433	171	47.4	39.0	7.4	4.0	44.8	57.0	0.4	—
35-39	454	128	44.9	36.5	7.3	10.3	47.6	53.2	0.2	—
40-44	491	92	40.8	27.3	6.7	10.1	52.4	62.6	—	—
45-49	424	85	37.7	48.3	5.9	11.1	55.8	40.6	0.6	—
50-54	358	90	25.9	38.7	8.5	9.8	65.3	51.5	0.3	—
55-59	277	84	18.6	32.0	6.3	20.9	75.1	46.0	—	1.2
60-64	251	60	14.1	22.1	5.4	21.5	79.7	56.4	0.9	—
65-69	214	49	11.6	22.0	5.1	11.6	82.3	66.4	0.9	—
70-74	137	42	4.4	14.4	5.4	9.1	88.8	76.4	1.5	—
75-79	76	36	5.8	5.2	5.9	13.1	88.3	81.7	—	—
80-84	44	14	3.4	13.6	—	—	96.6	86.4	—	—
85+	30	17	—	—	—	5.5	100.0	94.5	—	—

[a] *Assumed to be cigarette smoking only.*

Key: NHIS = National Health Interview Survey.

APPENDIX 11
Mean[a] Number of Cigarettes Smoked Per Day at Baseline (plus 5th and 95th percentiles) Among Current Cigarette Smokers, by Sex, Study, and Age

	Men				Women			
	CPS-I		CPS-II		CPS-I		CPS-II	
Age	Mean	(5th-95th)	Mean	(5th-95th)	Mean	(5th-95th)	Mean	(5th-95th)
30-34	22.3	(4.8-40)	23.4	(3-40)	15.9	(4.8-29.2)	20.2	(3-40)
35-39	23.2	(4.8-40)	25.5	(4-50)	16.1	(4.8-29.2)	21.1	(3-40)
40-44	23.4	(4.8-40)	26.6	(5-50)	15.8	(4.8-29.2)	21.0	(3-40)
45-49	23.5	(4.8-40)	27.1	(5-50)	15.6	(4.8-29.2)	20.8	(4-40)
50-54	23.2	(4.8-40)	26.8	(5-50)	15.2	(4.8-29.2)	20.4	(4-40)
55-59	21.9	(4.8-40)	26.1	(5-50)	14.6	(4.8-29.2)	19.9	(4-40)
60-64	20.1	(4.8-40)	24.3	(5-40)	13.7	(4.8-29.2)	19.1	(4-40)
65-69	18.2	(4.8-40)	22.0	(5-40)	12.9	(4.8-29.2)	17.7	(4-40)
70-74	16.3	(4.8-29.2)	20.0	(4-40)	11.9	(4.8-20)	16.5	(3-40)
75-79	14.5	(4.8-29.2)	17.5	(3-40)	11.2	(4.8-20)	15.8	(3-30)
80-84	13.4	(4.8-29.2)	15.4	(2-40)	9.5	(4.8-20)	13.7	(3-30)
85+	12.7	(4.8-29.2)	14.3	(2-40)	6.9	(4.8-20)	14.3	(2-40)

[a] Based on published mean values of categories in CPS-I (Hammond et al., 1977) and continuous data in CPS-II.

Key: CPS = Cancer Prevention Study.

APPENDIX 12
Number and Percentage of Current Cigarette Smokers at Each Age, by Cigarettes Smoked Per Day: Men, CPS-I and CPS-II

		Cigarettes Per Day (%)						
Age	Study	1-9	10-19	20	21-39	40	41+	Number of Persons
30-34	CPS-I	6.9	18.6	39.6	23.8	8.8	2.2	5,062
	CPS-II	11.7	16.7	29.9	23.7	13.3	4.7	2,579
35-39	CPS-I	6.6	15.7	39.0	25.6	10.6	2.5	8,089
	CPS-II	10.0	14.5	26.4	25.0	17.4	6.8	3,221
40-44	CPS-I	6.5	15.7	39.1	24.2	11.4	3.0	13,864
	CPS-II	8.1	12.1	25.6	26.1	20.1	7.9	18,621
45-49	CPS-I	6.4	15.7	38.5	24.6	11.9	3.0	38,826
	CPS-II	8.1	12.1	25.6	26.1	20.1	7.9	18,621
50-54	CPS-I	7.1	16.6	38.6	23.0	11.9	2.8	34,490
	CPS-II	7.7	11.8	27.9	25.8	19.3	7.5	21,843
55-59	CPS-I	8.5	19.2	39.6	20.4	10.1	2.2	22,443
	CPS-II	7.8	13.4	29.1	24.6	18.4	6.6	20,451
60-64	CPS-I	11.3	23.2	39.7	16.5	7.8	1.4	12,936
	CPS-II	9.3	15.6	32.7	22.4	15.3	4.8	14,896
65-69	CPS-I	14.6	27.3	39.3	12.5	5.6	0.8	6,649
	CPS-II	11.2	19.9	35.5	18.5	11.9	3.1	9,157
70-74	CPS-I	20.2	30.8	35.4	8.9	4.1	0.5	2,835
	CPS-II	14.2	24.0	35.9	14.9	9.0	2.1	4,454
75-79	CPS-I	28.1	30.9	31.8	6.6	2.3	0.3	919
	CPS-II	20.7	27.0	34.0	11.5	5.6	1.3	1,510
80-84	CPS-I	31.5	33.5	28.4	4.7	1.9	—	257
	CPS-II	30.1	28.9	26.6	8.7	4.0	1.7	346
85+	CPS-I	37.9	31.0	25.9	3.4	—	1.7	58
	CPS-II	43.0	18.6	26.7	3.5	5.8	2.3	86

Key: CPS = Cancer Prevention Study.

APPENDIX 13
Number and Percentage of Current Cigarette Smokers at Each Age, by Cigarettes Smoked Per Day: Women, CPS-I and CPS-II

		Cigarettes Per Day (%)						
Age	Study	1-9	10-19	20	21-39	40	41+	Number of Persons
30-34	CPS-I	22.9	29.6	32.8	11.3	3.1	0.3	7,933
	CPS-II	15.7	23.1	31.1	18.0	9.5	2.5	3,452
35-39	CPS-I	22.1	30.0	32.6	11.3	3.7	0.3	14,556
	CPS-II	13.8	21.1	31.7	20.7	10.1	2.7	5,505
40-44	CPS-I	21.9	31.2	33.3	10.3	3.1	0.3	28,764
	CPS-II	14.2	20.5	32.6	19.2	11.0	2.4	11,613
45-49	CPS-I	22.6	32.3	32.3	9.4	3.1	0.3	40,928
	CPS-II	14.3	21.7	32.1	19.0	10.7	2.3	23,440
50-54	CPS-I	24.6	32.1	31.5	8.5	3.1	0.3	29,422
	CPS-II	14.6	22.0	33.8	17.4	10.1	2.0	25,020
55-59	CPS-I	27.4	31.9	30.7	6.9	2.8	0.3	16,148
	CPS-II	14.3	23.8	34.6	16.4	9.2	1.6	23,271
60-64	CPS-I	31.5	31.4	28.8	5.9	2.2	0.2	7,998
	CPS-II	15.1	25.5	35.9	14.5	7.8	1.3	16,756
65-69	CPS-I	35.6	31.5	26.3	4.5	1.8	0.2	4,006
	CPS-II	17.0	28.9	36.3	10.8	6.1	0.9	10,437
70-74	CPS-I	40.6	31.3	24.0	2.8	1.3	0.1	1,627
	CPS-II	20.7	31.2	34.4	7.9	5.0	0.8	4,968
75-79	CPS-I	43.0	32.9	21.0	2.4	0.7	—	575
	CPS-II	22.8	31.2	33.7	7.7	4.1	0.5	1,746
80-84	CPS-I	57.5	24.8	15.7	2.0	—	—	153
	CPS-II	32.2	31.6	27.8	5.1	2.4	0.9	450
85+	CPS-I	81.8	12.1	3.0	3.0	—	—	33
	CPS-II	31.9	30.4	26.7	4.4	5.9	0.7	135

Key: CPS = Cancer Prevention Study.

APPENDIX 14
Number and Percentage of Current Cigarette Smokers at Each Age, by Cigarettes Smoked Per Day: White Men, NHIS-65 and NHIS-83

		Cigarettes Per Day (%)						
Age	Study	1-9	10-19	20	21-39	40	41+	Number of Persons
30-34	NHIS-65	10.2	16.8	43.4	15.9	10.5	3.3	1,972
	NHIS-83	6.4	19.8	33.4	21.5	15.3	3.6	335
35-39	NHIS-65	10.2	16.7	39.1	17.9	12.2	3.9	2,037
	NHIS-83	7.8	12.7	36.8	23.8	14.6	4.4	308
40-44	NHIS-65	9.2	16.1	39.2	17.4	13.8	4.4	2,090
	NHIS-83	11.1	13.1	28.0	25.2	15.3	7.2	270
45-49	NHIS-65	10.1	17.9	38.6	16.3	13.4	3.9	1,934
	NHIS-83	5.4	7.6	31.0	24.2	23.5	8.3	241
50-54	NHIS-65	10.1	17.2	40.3	15.4	12.9	4.1	1,805
	NHIS-83	6.7	9.7	34.0	21.4	21.6	6.7	214
55-59	NHIS-65	14.0	19.4	37.3	13.6	12.1	3.6	1,350
	NHIS-83	7.2	10.8	34.8	24.1	17.6	5.5	221
60-64	NHIS-65	17.3	22.2	36.0	13.2	8.5	2.8	914
	NHIS-83	4.4	15.1	44.6	12.6	19.1	4.1	167
65-69	NHIS-65	19.8	28.5	31.8	10.2	7.4	2.4	623
	NHIS-83	11.4	21.6	33.7	17.1	13.8	2.4	119
70-74	NHIS-65	25.2	27.8	32.5	8.4	5.0	1.2	409
	NHIS-83	26.2	21.5	32.1	10.2	9.0	0.9	99
75-79	NHIS-65	28.5	34.0	28.1	5.2	2.7	1.5	206
	NHIS-83	20.4	45.4	21.8	12.4	0.0	0.0	34
80-84	NHIS-65	34.5	31.7	26.3	4.2	3.3	0.0	69
	NHIS-83	16.1	43.7	24.0	8.0	8.1	0.0	11

Key: NHIS = National Health Interview Survey.

APPENDIX 15
Number and Percentage of Current Cigarette Smokers at Each Age, by Cigarettes Smoked Per Day: White Women, NHIS-65 and NHIS-83

		Cigarettes Per Day (%)						
Age	Study	1-9	10-19	20	21-39	40	41+	Number of Persons
30-34	NHIS-65	18.2	25.7	37.0	12.9	5.2	1.0	1,541
	NHIS-83	14.5	24.3	36.7	14.7	8.3	1.7	378
35-39	NHIS-65	17.2	27.1	36.4	12.1	6.2	1.0	1,748
	NHIS-83	11.3	22.9	41.0	12.1	10.3	2.4	354
40-44	NHIS-65	18.1	24.7	38.2	10.3	6.9	1.8	1,705
	NHIS-83	6.8	19.5	41.3	17.9	12.6	1.9	295
45-49	NHIS-65	18.2	28.6	37.2	9.5	5.7	0.9	1,512
	NHIS-83	10.4	17.5	40.0	16.8	11.5	3.9	249
50-54	NHIS-65	21.1	30.6	33.3	8.4	5.7	1.0	1,270
	NHIS-83	12.5	19.4	40.5	15.5	10.8	1.4	244
55-59	NHIS-65	22.5	27.4	35.6	7.9	5.5	1.3	896
	NHIS-83	12.1	24.6	41.1	11.5	8.2	2.4	228
60-64	NHIS-65	24.4	29.8	33.2	7.2	4.5	1.0	506
	NHIS-83	14.4	29.7	36.6	10.8	6.2	2.3	189
65-69	NHIS-65	35.3	26.7	31.2	3.5	3.0	0.3	313
	NHIS-83	19.5	29.3	38.1	8.5	3.9	0.7	137
70-74	NHIS-65	34.6	33.6	23.8	6.3	1.7	0.0	173
	NHIS-83	23.2	20.2	36.4	12.6	7.6	0.0	68
75-79	NHIS-65	47.5	22.9	24.8	1.6	3.2	0.0	60
	NHIS-83	22.4	35.2	32.9	7.2	2.3	0.0	41
80-84	NHIS-65	57.2	13.4	14.6	7.9	6.9	0.0	28
	NHIS-83	12.5	24.9	62.6	0.0	0.0	0.0	8

Key: NHIS = National Health Interview Survey.

APPENDIX 16
Cumulative Percentage of Cigarette Smokers Who Began Smoking Cigarettes Before Given Ages, by Sex, Study, and Birth Cohort

Sex	Age of Initiation	Study	1860	1870	1880	1890	1900	1910	1920	1930	1940	1950
Women												
	<15	CPS-I	—	—	0.8	0.8	1.2	3.3	3.9	—	—	—
		CPS-II	—	—	—	3.1	2.8	5.1	4.5	6.9	11.3	11.2
	<20	CPS-I	—	—	5.0	7.1	20.8	48.0	59.7	—	—	—
		CPS-II	—	—	—	13.4	26.4	47.1	52.8	63.1	71.6	72.5
	<25	CPS-I	—	—	10.6	17.8	48.0	76.6	87.5	—	—	—
		CPS-II	—	—	—	25.6	50.4	72.6	81.3	87.6	91.7	92.6
	<30	CPS-I	—	—	17.3	32.5	67.0	87.0	95.1	—	—	—
		CPS-II	—	—	—	38.6	65.6	83.4	89.7	93.9	96.2	98.6
Men												
	<15	CPS-I	—	18.7	15.8	13.8	12.2	12.4	12.1	—	—	—
		CPS-II	—	—	—	24.7	18.1	17.6	16.1	17.4	19.1	17.0
	<20	CPS-I	—	53.9	55.8	61.2	66.1	70.4	77.1	—	—	—
		CPS-II	—	—	—	61.2	66.6	69.4	74.1	74.5	78.9	79.0
	<25	CPS-I	—	72.3	75.9	86.3	90.8	93.3	96.9	—	—	—
		CPS-II	—	—	—	85.3	87.4	90.5	94.2	94.8	95.8	96.6
	<30	CPS-I	—	75.8	83.2	92.3	95.8	97.5	99.2	—	—	—
		CPS-II	—	—	—	90.0	93.5	96.4	97.7	97.9	98.6	99.8

Key: CPS = Cancer Prevention Study.

APPENDIX 17
Mean Number of Years Smoked at Baseline[a] (plus 5th and 95th percentiles) Among Current Cigarette Smokers, by Sex, Study, and Age

	Men				Women			
	CPS-I		CPS-II		CPS-I		CPS-II	
Age	Mean	(5th-95th)	Mean	(5th-95th)	Mean	(5th-95th)	Mean	(5th-95th)
30-34	14.9	(9-21)	14.6	(7-21)	13.2	(5-17)	13.4	(5-19)
35-39	19.2	(13-26)	19.5	(11-26)	17.1	(6-22)	18.2	(8-25)
40-44	24.3	(17-31)	24.5	(16-31)	21.4	(8-27)	22.6	(10-29)
45-49	28.5	(20-36)	28.7	(20-36)	24.4	(9-32)	26.3	(12-33)
50-54	33.1	(24-41)	33.6	(23-40)	26.1	(8-36)	30.4	(15-38)
55-59	37.7	(28-45)	38.3	(27-46)	26.9	(9-40)	34.1	(17-43)
60-64	42.3	(29-51)	42.7	(30-50)	28.5	(12-44)	38.0	(20-48)
65-69	46.4	(29-56)	47.5	(35-56)	30.4	(16-48)	41.8	(20-53)
70-74	50.1	(28-61)	52.2	(38-61)	32.8	(20-53)	44.1	(20-57)
75-79	53.8	(29-66)	55.6	(35-65)	35.6	(25-56)	45.0	(16-61)
80-84	57.8	(32-70)	60.0	(30-71)	39.1	(30-64)	45.8	(13-66)
85+	62.7	(36-78)	63.1	(10-79)	44.5	(35-69)	47.8	(20-72)

[a] *Based on published mean values of categories in CPS-I (Hammond et al., 1977) and continuous data in CPS-II.*

Key: CPS = Cancer Prevention Study.

APPENDIX 18
Percentage Distribution of Measured Tar Content[a] of Cigarette Brand Currently Smoked at Enrollment in CPS-I and CPS-II

Sex	Number[b] of Subjects	Percentage by Tar Content (mg)					
		<6.0 mg	6.0-11.9 mg	12.0-16.9 mg	17.0-20.9 mg	21.0-25.7 mg	25.8-35.7 mg
Men							
CPS-I	128,427	—	0.4	12.4	29.2	17.5	40.6
CPS-II	91,209	19.5	23.5	38.8	11.1	7.1	—
Women							
CPS-I	135,604	—	0.7	25.3	34.9	15.7	23.3
CPS-II	123,442	18.9	31.7	38.6	7.5	3.3	—

[a] Tar content based on Garfinkel, 1979, and Federal Trade Commission, 1983.
[b] Excludes cigarette smokers who did not specify the brand of cigarettes currently smoked. Total number of smokers shown in Table 4.

Key: CPS = Cancer Prevention Study.

APPENDIX 19
Age-Specific Deaths and Death Rates From Lung Cancer as Underlying Cause Among Lifelong Never-Smokers and Current Cigarette Smokers: Men, CPS-I and CPS-II

	CPS-I				CPS-II			
	Never-Smokers		Current Cigarette Smokers		Never-Smokers		Current Cigarette Smokers	
Age	Deaths	Rate[a]	Deaths	Rate[a]	Deaths	Rate[a]	Deaths	Rate[a]
35-39	0	—	3	8.1	1	4.6	1	5.9
40-44	1	4.0	16	28.1	0	—	4	18.7
45-49	4	6.0	66	45.6	4	6.0	26	41.4
50-54	6	5.7	162	75.3	7	5.5	136	115.3
55-59	13	13.6	217	131.5	7	5.3	260	206.1
60-64	16	21.0	229	231.2	14	11.6	381	361.1
65-69	14	23.1	183	341.1	22	21.5	400	581.6
70-74	13	29.7	97	403.4	25	34.9	343	909.0
75-79	8	31.0	53	612.7	21	52.0	170	1,118.3
80-84	8	67.5	8	334.9	16	89.2	51	1,227.7
85+	2	35.3	1	178.5	7	86.8	9	919.0
Total	85		1,035		124		1,781	

[a] *Death rate per 100,000 person-years.*

Key: CPS = Cancer Prevention Study.

APPENDIX 20
Age-Specific Deaths and Death Rates From Lung Cancer as Underlying Cause Among Lifelong Never-Smokers and Current Cigarette Smokers: Women, CPS-I and CPS-II

	CPS-I				CPS-II			
	Never-Smokers		Current Cigarette Smokers		Never-Smokers		Current Cigarette Smokers	
Age	Deaths	Rate[a]	Deaths	Rate[a]	Deaths	Rate[a]	Deaths	Rate[a]
35-39	0	—	0	—	1	2.0	1	4.0
40-44	1	0.7	11	9.5	0	—	4	8.9
45-49	13	4.3	28	13.6	4	1.9	43	42.4
50-54	20	5.1	41	19.4	18	5.8	93	64.7
55-59	23	6.2	21	15.6	25	7.2	175	119.9
60-64	38	12.0	29	41.3	42	12.3	215	176.6
65-69	34	13.4	17	48.2	47	16.7	232	286.3
70-74	28	15.9	8	51.6	63	30.5	142	310.0
75-79	25	24.9	2	34.5	44	32.5	77	400.0
80-84	21	43.4	0	—	41	57.6	24	417.6
85+	9	35.9	0	—	25	60.6	8	499.6
Total	212		157		310		1,014	

[a] *Death rate per 100,000 person-years.*

Key: CPS = Cancer Prevention Study.

APPENDIX 21
Age-Specific Deaths and Death Rates From Coronary Heart Disease as Underlying Cause Among Lifelong Never-Smokers and Current Cigarette Smokers: Men, CPS-I and CPS-II

	CPS-I				CPS-II			
	Never-Smokers		Current Cigarette Smokers		Never-Smokers		Current Cigarette Smokers	
Age	Deaths	Rate[a]	Deaths	Rate[a]	Deaths	Rate[a]	Deaths	Rate[a]
35-39	2	12.9	18	48.7	2	9.1	5	29.6
40-44	10	39.7	101	177.4	3	13.4	18	84.1
45-49	54	80.7	443	305.9	18	26.8	92	146.6
50-54	174	164.8	1,065	495.1	72	56.3	251	212.9
55-59	329	344.2	1,289	781.0	157	118.6	407	322.7
60-64	477	626.1	1,215	1,226.8	277	228.6	576	545.9
65-69	596	982.6	914	1,703.7	414	405.4	531	772.1
70-74	707	1,615.3	586	2,437.1	490	685.0	437	1,158.2
75-79	650	2,522.7	272	3,144.4	497	1,231.3	254	1,670.9
80-84	392	3,305.7	116	4,856.3	340	1,894.6	113	2,720.3
85+	377	6,663.3	45	8,030.9	266	3,296.6	37	3,778.1
Total	3,768		6,064		2,536		2,721	

[a] *Death rate per 100,000 person-years.*

Key: CPS = Cancer Prevention Study.

APPENDIX 22
Age-Specific Deaths and Death Rates From Coronary Heart Disease as Underlying Cause Among Lifelong Never-Smokers and Current Cigarette Smokers: Women, CPS-I and CPS-II

	CPS-I				CPS-II			
	Never-Smokers		Current Cigarette Smokers		Never-Smokers		Current Cigarette Smokers	
Age	Deaths	Rate[a]	Deaths	Rate[a]	Deaths	Rate[a]	Deaths	Rate[a]
35-39	1	1.4	5	8.3	1	2.0	0	—
40-44	12	7.9	22	19.1	5	5.9	4	8.9
45-49	44	14.6	82	39.9	8	3.8	28	27.6
50-54	131	33.7	177	83.9	25	8.1	66	45.9
55-59	253	67.8	220	163.4	84	24.3	112	76.7
60-64	585	184.9	219	311.9	211	62.0	198	162.6
65-69	989	388.9	208	589.8	353	125.7	249	307.2
70-74	1,281	727.4	156	1,005.7	523	253.5	219	478.2
75-79	1,415	1,412.2	89	1,537.3	717	530.1	163	846.7
80-84	1,152	2,378.3	44	2,634.7	694	975.1	73	1,270.2
85+	1,201	4,795.2	24	5,657.0	1,096	2,655.0	48	2,997.7
Total	7,064		1,246		3,717		1,160	

[a] *Death rate per 100,000 person-years.*

Key: CPS = Cancer Prevention Study.

APPENDIX 23
Age-Specific Deaths and Death Rates From Chronic Obstructive Pulmonary Disease as Underlying Cause Among Lifelong Never-Smokers and Current Cigarette Smokers: Men, CPS-I and CPS-II

	CPS-I				CPS-II			
	Never-Smokers		Current Cigarette Smokers		Never-Smokers		Current Cigarette Smokers	
Age	Deaths	Rate[a]	Deaths	Rate[a]	Deaths	Rate[a]	Deaths	Rate[a]
35-39	0	—	0	—	0	—	0	—
40-44	0	—	2	3.5	0	—	0	—
45-49	0	—	2	1.4	0	—	2	3.2
50-54	1	0.9	16	7.4	2	1.6	15	12.7
55-59	2	2.1	54	32.7	3	2.3	28	22.2
60-64	7	9.2	65	65.6	4	3.3	46	43.6
65-69	9	14.8	56	104.4	8	7.8	102	148.3
70-74	4	9.1	45	187.1	18	25.2	98	259.7
75-79	11	42.7	31	358.4	15	37.2	85	559.2
80-84	2	16.9	10	418.6	13	72.4	33	794.4
85+	8	141.4	3	535.4	15	185.9	13	1,327.4
Total	44		284		78		422	

[a] *Death rate per 100,000 person-years.*

Key: CPS = Cancer Prevention Study.

APPENDIX 24
Age-Specific Deaths and Death Rates From Chronic Obstructive Pulmonary Disease as Underlying Cause Among Lifelong Never-Smokers and Current Cigarette Smokers: Women, CPS-I and CPS-II

	CPS-I				CPS-II			
	Never-Smokers		Current Cigarette Smokers		Never-Smokers		Current Cigarette Smokers	
Age	Deaths	Rate[a]	Deaths	Rate[a]	Deaths	Rate[a]	Deaths	Rate[a]
35-39	0	—	0	—	0	—	0	—
40-44	1	0.7	2	1.7	0	—	0	—
45-49	1	0.3	4	1.9	0	—	2	2.0
50-54	3	0.8	7	3.3	2	0.6	12	8.3
55-59	1	0.3	9	6.7	6	1.7	24	16.4
60-64	6	1.9	11	15.7	11	3.2	44	36.1
65-69	5	2.0	6	17.0	16	5.7	68	83.9
70-74	9	5.1	9	58.0	24	11.6	65	141.9
75-79	15	15.0	7	120.9	24	17.7	39	202.6
80-84	14	28.9	1	59.9	29	40.7	30	522.0
85+	6	24.0	0	—	31	75.1	19	1,186.6
Total	61		56		143		303	

[a] *Death rate per 100,000 person-years.*

Key: CPS = Cancer Prevention Study.

APPENDIX 25
Age-Specific Deaths and Death Rates From Stroke as Underlying Cause Among Lifelong Never-Smokers and Current Cigarette Smokers: Men, CPS-I and CPS-II

	CPS-I				CPS-II			
	Never-Smokers		Current Cigarette Smokers		Never-Smokers		Current Cigarette Smokers	
Age	Deaths	Rate[a]	Deaths	Rate[a]	Deaths	Rate[a]	Deaths	Rate[a]
35-39	0	—	3	8.1	0	0	2	11.9
40-44	4	15.9	14	24.6	1	4.5	1	4.7
45-49	7	10.5	48	33.1	4	6.0	14	22.3
50-54	33	31.3	111	51.6	6	4.7	28	23.7
55-59	46	48.1	140	84.8	13	9.8	49	38.8
60-64	80	105.0	177	178.7	35	28.9	83	78.7
65-69	114	188.0	170	316.9	52	50.9	91	132.3
70-74	201	459.2	146	607.2	80	111.8	83	220.0
75-79	225	873.3	91	1,052.0	113	280.0	81	532.8
80-84	213	1,796.2	42	1,758.3	108	601.8	36	866.6
85+	203	3,587.9	18	3,212.4	89	1,103.0	8	816.9
Total	1,126		960		501		476	

[a] *Death rate per 100,000 person-years.*

Key: CPS = Cancer Prevention Study.

APPENDIX 26
Age-Specific Deaths and Death Rates From Stroke as Underlying Cause Among Lifelong Never-Smokers and Current Cigarette Smokers: Women, CPS-I and CPS-II

	CPS-I				CPS-II			
	Never-Smokers		Current Cigarette Smokers		Never-Smokers		Current Cigarette Smokers	
Age	Deaths	Rate[a]	Deaths	Rate[a]	Deaths	Rate[a]	Deaths	Rate[a]
35-39	2	2.7	6	10.0	1	2.0	1	4.0
40-44	14	9.2	15	13.0	1	1.2	3	6.7
45-49	31	10.3	50	24.3	6	2.9	22	21.7
50-54	85	21.9	100	47.4	16	5.2	36	25.0
55-59	102	27.3	84	62.4	23	6.7	58	39.7
60-64	203	64.2	88	125.3	55	16.1	50	41.1
65-69	340	133.7	64	181.5	104	37.0	78	96.2
70-74	458	260.1	56	361.0	135	65.4	81	176.9
75-79	654	652.7	39	673.6	215	159.0	61	316.9
80-84	687	1,418.3	24	1,437.1	273	383.6	19	330.6
85+	741	2,958.6	7	1,650.0	501	1,213.6	13	811.9
Total	3,317		533		1,330		422	

[a] *Death rate per 100,000 person-years.*

Key: CPS = Cancer Prevention Study.

APPENDIX 27
Age-Specific Deaths and Death Rates From Other Smoking-Related Cancers as Underlying Cause Among Lifelong Never-Smokers and Current Cigarette Smokers: Men, CPS-I and CPS-II

	CPS-I				CPS-II			
	Never-Smokers		Current Cigarette Smokers		Never-Smokers		Current Cigarette Smokers	
Age	Deaths	Rate[a]	Deaths	Rate[a]	Deaths	Rate[a]	Deaths	Rate[a]
35-39	1	6.5	0	0.0	0	0.0	1	5.9
40-44	0	0.0	6	10.5	2	8.9	3	14.0
45-49	5	7.5	29	20.0	1	1.5	17	27.1
50-54	10	9.5	92	42.8	16	12.5	54	45.8
55-59	18	18.8	112	67.9	31	23.4	93	73.7
60-64	34	44.6	108	109.1	45	37.1	133	126.0
65-69	39	64.3	102	190.1	53	51.9	118	171.6
70-74	37	84.5	48	199.6	56	78.3	103	273.0
75-79	33	128.1	26	300.6	50	123.9	58	381.6
80-84	24	202.4	12	502.4	20	111.4	25	601.8
85+	4	70.7	1	178.5	16	198.3	5	510.6
Total	205		536		290		610	

[a] *Death rate per 100,000 person-years.*

Key: CPS = Cancer Prevention Study.

APPENDIX 28
Age-Specific Deaths and Death Rates From Other Smoking-Related Cancers as Underlying Cause Among Lifelong Never-Smokers and Current Cigarette Smokers: Women, CPS-I and CPS-II

	CPS-I				CPS-II			
	Never-Smokers		Current Cigarette Smokers		Never-Smokers		Current Cigarette Smokers	
Age	Deaths	Rate[a]	Deaths	Rate[a]	Deaths	Rate[a]	Deaths	Rate[a]
35-39	0	0.0	0	0.0	2	4.0	1	4.0
40-44	3	2.0	8	6.9	2	2.4	2	4.4
45-49	10	3.3	22	10.7	4	1.9	10	9.9
50-54	29	7.5	34	16.1	20	6.5	27	18.8
55-59	42	11.2	43	32.0	31	9.0	41	28.1
60-64	64	20.2	31	44.1	68	20.0	73	60.0
65-69	95	37.4	18	51.0	97	34.6	78	96.2
70-74	115	65.3	23	148.3	119	57.7	55	120.1
75-79	103	102.8	7	120.9	95	70.2	28	145.4
80-84	69	142.4	3	179.6	66	92.7	12	208.8
85+	35	139.7	1	235.7	48	116.3	5	312.3
Total	565		190		552		332	

[a] *Death rate per 100,000 person-years.*

Key: CPS = Cancer Prevention Study.

APPENDIX 29
Age-Specific Deaths and Death Rates From All Causes Among Lifelong Never-Smokers and Current Cigarette Smokers: Men, CPS-I and CPS-II

	CPS-I				CPS-II			
	Never-Smokers		Current Cigarette Smokers		Never-Smokers		Current Cigarette Smokers	
Age	Deaths	Rate[a]	Deaths	Rate[a]	Deaths	Rate[a]	Deaths	Rate[a]
35-39	19	122.7	85	229.8	16	72.9	37	219.3
40-44	48	190.6	236	414.6	21	93.7	65	303.6
45-49	168	251.1	958	661.6	102	151.8	268	427.1
50-54	437	413.9	2,181	1,013.8	283	221.4	800	678.5
55-59	741	775.2	2,694	1,632.3	487	367.7	1,367	1,083.8
60-64	1,011	1,326.9	2,603	2,628.3	815	672.6	1,925	1,824.2
65-69	1,298	2,140.0	2,161	4,028.0	1,120	1,096.7	1,984	2,884.9
70-74	1,566	3,577.8	1,433	5,959.6	1,321	1,846.6	1,760	4,664.5
75-79	1,497	5,810.0	764	8,832.2	1,389	3,441.2	1,113	7,321.7
80-84	1,100	9,276.2	308	12,894.2	981	5,466.5	434	10,447.8
85+	1,026	18,134.2	118	21,058.9	899	11,141.6	135	13,784.9
Total	8,911		13,541		7,434		9,888	

[a] *Death rate per 100,000 person-years.*

Key: CPS = Cancer Prevention Study.

APPENDIX 30
Age-Specific Deaths and Death Rates From All Causes Among Lifelong Never-Smokers and Current Cigarette Smokers: Women, CPS-I and CPS-II

	CPS-I				CPS-II			
	Never-Smokers		Current Cigarette Smokers		Never-Smokers		Current Cigarette Smokers	
Age	Deaths	Rate[a]	Deaths	Rate[a]	Deaths	Rate[a]	Deaths	Rate[a]
35-39	73	100.1	67	111.4	40	80.6	22	88.8
40-44	230	150.7	230	199.2	93	109.3	50	110.9
45-49	638	211.4	600	291.6	255	122.4	256	252.6
50-54	1,247	320.9	932	442.0	564	182.1	501	348.5
55-59	1,696	454.2	906	673.1	927	268.2	874	598.8
60-64	2,371	749.5	756	1,076.6	1,401	411.4	1,140	936.3
65-69	3,140	1,234.7	545	1,545.4	1,871	666.5	1,243	1,533.7
70-74	3,700	2,101.1	425	2,739.9	2,216	1,073.9	1,020	2,227.0
75-79	3,933	3,925.1	241	4,162.7	2,487	1,838.7	658	3,417.9
80-84	3,406	7,031.6	147	8,802.4	2,245	3,154.2	285	4,959.2
85+	3,552	14,182.1	55	12,964.1	3,331	8,069.2	171	10,679.2
Total	23,986		4,904		15,430		6,220	

[a] *Death rate per 100,000 person-years.*

Key: CPS = Cancer Prevention Study.