

DIFFERENCES IN MORTALITY AND LONGEVITY BY SEX,
SMOKING HABITS AND HEALTH STATUS

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ABSTRACT

This paper presents considerably detailed death rates according to smoking habits and health status, based on the American Cancer Society *Cancer Prevention Study I*, which constitutes the largest body of data currently available for the study of smoking habits. This study involved over one million men and women, selected largely from the middle class, traced from July 1, 1960 through June 30, 1972. The overall mortality of the subjects in this study was found to resemble that of persons covered by group life insurance during 1970-74. At ages 65 and older the experience was similar to that of contemporaneous ultimate mortality among persons insured under ordinary policies.

The data on death rates according to smoking habits and health status provide valuable guidance for pricing smoker/nonsmoker policies. They also provide better measures of intrinsic sex differentials than have hitherto been available.

INTRODUCTION

Interest in the effects of smoking on death rates and life expectancies is long-standing. Hammond [1], based on data assembled by the American Cancer Society, reported in 1969 that men aged 35 who had never smoked regularly had a remaining life expectancy of 42.4 years, whereas 35-year-old men who smoked one or more packs of cigarettes a day had a remaining life expectancy of about 36 years, or a differential of 6.4 years. The corresponding differences for men aged 45, 55, and 65 were estimated at 6 years, 5 years, and 3.5 years, respectively. Another large prospective study which developed differences in life expectancies between nonsmokers and heavy smokers was "Smoking and Life Expectancy among U.S. Veterans," begun by Dorn and continued by Rogot [2]. The differences in male life expectancies according to smoking habits found in that study were quite similar to those reported by Hammond in 1969.

In an earlier paper, Hammond [3] reported on the experience of the first 5 years of the American Cancer Society prospective study. Subsequently a

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more detailed analysis of data obtained in that study presented the mortality experience of those aged 65 and older, Lew and Garfinkel [4].

This paper focuses on the effects of smoking and health status on the mortality of men and women observed in the American Cancer Society study follow-up for the 12-year period July 1, 1960 – June 30, 1972. The experience was tabulated separately for men and women smoking 20 or more cigarettes a day, those who never smoked regularly, and for all others. Each of these categories was further subdivided between those in impaired health and those in ostensible good health.

Smoking Habits

The category of “smoking 20 or more cigarettes a day” included some subjects who at the time of enrollment smoked cigars or pipes in addition to 20 or more cigarettes a day. The category of “never smoked regularly” included those who, at the start of the study, never smoked at all as well as those who smoked occasionally. Some smokers quit smoking during the 12 years covered by the study, but they were classified according to their smoking habits at the time of enrollment. Reports by Hammond and Garfinkel [5] have shown that 98 percent of those who reported that they never smoked regularly at the time of enrollment reported on a questionnaire two years later that they were still nonsmokers.

The category “all others” included those smoking fewer than 20 cigarettes a day who also may have smoked cigars or pipes but excluded those in the “never smoked regularly” classification.

Of the men in this study 22 percent were nonsmokers at the time of enrollment, 29 percent smoked one or more packs of cigarettes a day, and 49 percent were other smokers. At ages under 55, 19 percent were nonsmokers, 36 percent smoked one or more packs of cigarettes a day, and 45 percent were other smokers.

Of the women in this study 66 percent were nonsmokers at the time of enrollment, 12 percent smoked one or more packs of cigarettes a day, and 22 percent were other smokers. At ages under 55, 58 percent were nonsmokers, 16 percent smoked one or more packs of cigarettes a day, and 26 percent were other smokers. The Appendix shows the actual numbers of subjects by sex and age who were included in the above mentioned categories.

Health Status

Hammond and Garfinkel [6] and Kahn [7] called attention to the fact that excigar and expipe smokers as well as some excigarette smokers who had discontinued smoking recently experienced higher death rates than current

smokers. This finding was attributed to some exsmokers giving up smoking on account of illness. It became clear that the hazards of smoking could be seen more clearly by comparing the mortality of smokers and nonsmokers, separately for those who were in ostensible good health and those who were in impaired health at the start of a study.

In this study subjects were classified as in ostensible good health or impaired health on the basis of answers given in questionnaires completed at the time of enrollment. If an individual reported that he or she was sick or had a history of heart disease, stroke, high blood pressure, diabetes, cancer, or had a marked departure from average weight (20 percent or more underweight or 40 percent or more overweight), the subject was classified as having impaired health. Good health was defined by the absence of the findings that classified an individual as having impaired health.

Of the men in this study 63 percent were in good health at the time of enrollment and 37 percent were in impaired health. At ages 65 and over, the corresponding figures were 51 percent and 49 percent, respectively. Of the women in this study 52 percent were in good health at the time of enrollment and 48 percent were in impaired health. At ages 65 and over, 39 percent were in good health and 61 percent were in impaired health.

Among both men and women who smoked one or more packs of cigarettes a day the proportions in good health were smaller. This was particularly so for women smokers.

Among male nonsmokers the proportion of those in impaired health increased from 26 percent at ages 35–39 to 32 percent at ages 55–59 and to 48 percent at ages 75–79. The corresponding figures for men smoking one or more packs of cigarettes a day were 34 percent, 43 percent, and 55 percent, respectively.

Among women nonsmokers the proportion of those in impaired health rose from 35 percent at ages 35–39, to 49 percent at ages 55–59, and to 66 percent at ages 75–79. The corresponding figures for women smoking one or more packs of cigarettes a day were 45 percent, 58 percent, and 69 percent, respectively.

Among male smokers the proportions of those in impaired health was about a third higher than among nonsmokers at ages under 60; the differentials decreased to about 15 percent at ages 75–79. Women smokers registered only somewhat higher proportions of those in impaired health than women nonsmokers at ages 55 and older.

The Appendix also shows the actual numbers of subjects by sex and age who were classified as in good health and in impaired health.

Historically, an understanding of how impaired health affects death rates developed from life insurance experience. In the middle of the nineteenth century, insurance companies in England began to issue policies to distinctly

above average risks at increased premium rates. Selection of risks for standard insurance required setting criteria of good health, based on medical reports, statements of personal medical history and personal habits, and some consideration of occupation and place of residence, Brackenridge [8]. In 1859 William Farr developed separate mortality tables for healthy males and healthy females based on the experience of the healthiest districts in England, Elston [9]. Selection for standard insurance was initially based on medical appraisals, but mortality studies were later made to test such judgments, Lew [10]. By the early 1900s, comprehensive mortality studies by the Actuarial Society of America [11] and the Association of Life Insurance Medical Directors were carried out to determine the effects of common medical impairments, personal medical history, family history, habits, and occupation. Mortality among insured persons in impaired health relative to those in good health was found to generally decrease with advancing age. Differences in relative mortality between those in good health and those in impaired health also tended to decrease with time elapsed, Webster and Shepherd [12].

The pronounced effects of illness and disability on mortality were brought out in a 1982 English study by Fox and Goldblatt [13], which covered males aged 15–64 in the general population over the period 1971–75. The mortality patterns of those employed, those not employed because of illness, and those permanently sick were found to be as shown below (relative to the mortality of all males aged 15–64 in the general population taken as 100 percent):

Employed	82%
Not working because of illness	309%
Permanently sick	382%

In an earlier study, the estimate for smokers was about 160 percent relative to all males aged 15–64 in the general population, Doll and Peto [14].

The detailed data on death rates, jointly and separately by smoking habits and health status, presented in this paper provide valuable guidance for pricing smoker/nonsmoker policies, especially since the mortality of the underlying study population was very similar to that of actively employed insureds under group contracts.

In the next sections, some additional pertinent features of the American Cancer Society study population and calculations of the measures presented will be briefly described. This will be followed by a detailed discussion of the results and then a summary.

It should be noted that in the fall of 1982 the American Cancer Society began another study of 1.2 million men and women similar in purpose, content and format to the investigation drawn on in this paper. The study has been called *Cancer Prevention Study II* or *CPS II*. When follow-ups of

the mortality of *CPS II* subjects become available in the years ahead, it will be possible to observe the changes in absolute death rates among nonsmokers and various classifications of smokers since 1960–72. In the meantime, the relative mortality patterns reported in this paper provide valuable guidance in projecting death rates for smoker/nonsmoker policies.

BACKGROUND

The American Cancer Society study was begun in the fall of 1959. Details of the selection and follow-up procedures have been described by Garfinkel [15]. Briefly, a total of 68,000 volunteer workers for the American Cancer Society enrolled more than 440,000 men and more than 560,000 women. The subjects completed detailed four-page questionnaires dealing with their medical histories, present physical symptoms, personal habits (including smoking, drinking, and diet), family histories, occupational exposures, and other factors. The subjects were enrolled in 25 states, in large and small cities, and from all segments of the population. However, only a few states were in the Southwest or the Rocky Mountain area. Nonwhites and persons in the lowest socioeconomic segments were underrepresented and itinerant workers and institutionalized persons were not enrolled. Seriously ill people and those unable to complete questionnaires also were not enrolled. The subjects were enrolled in family groups with at least one member over age 45; all members of a household over the age of 30 were asked to complete questionnaires.

In the 1121 counties in which the subjects were enrolled about 3 percent of the aged 45-or-older population was included. In large cities the recruitment was less successful (less than 0.5 percent) because fewer volunteers were available in inner cities than in other areas.

The educational level of the subjects in this study was much higher than for the country as a whole. About 36.7 percent of the males and 36.1 percent of the females had some college education or were college graduates. Because the enrollment was by family groups, 78 percent of those enrolled were married, 6 percent single, 14 percent widowed and 2 percent divorced or separated. More than 97 percent were white, 2.2 percent were black, and less than 1 percent were Oriental. Enrollment began in October 1959 and was completed in March 1960. About 70 percent completed questionnaires in November 1959.

The American Cancer Society volunteers reported each year whether the enrolled subjects were alive or dead. Copies of the death certificates were obtained from state health departments. During the first 6 years of the study, the certifying physician or hospital in which a subject died was contacted. If the death was due to cancer, confirmation of the primary site and the basis

of diagnosis (autopsy, biopsy, roentgenogram, and others) was requested. Through the end of the thirteenth year of follow-up (September 1972), 92.8 percent of the subjects were successfully traced alive or dead.

The analysis of the experience in this study was limited to the experience from July 1, 1960 through June 30, 1972, or 12 full years. The first 9 months of the study were omitted because death rates were low. There probably was some underreporting of deaths in the last 9 months of the study, October, 1971–June 30, 1972.

METHODS OF CALCULATION

The death rates per 1000 person years by sex, five-year attained age groups, smoking habits and health status classifications are shown in Tables 2, 3 and 4. The corresponding mortality ratios are given (for the most part) in Table 5.

The death rates were calculated by dividing

- the numbers of deaths classified by five-year attained age groups, by
- the corresponding numbers of person years attaining the same five-year attained age groups.

The life expectancies based on the American Cancer Society study shown in Tables 1, 6 and 7 were calculated as follows:

1. Death rates for individual attained ages were computed from the death rates for five-year age groups by interpolation.
2. Survival rates for individual attained ages were computed as the complements of 1.
3. Number of years lived at individual ages were computed by applying the values obtained in step 2 to a cohort radix of 100,000.
4. Life expectancies were computed by summing the values obtained in step 3.

The computations indicated were performed by a computer program. The life expectancy values so produced were reviewed by comparing them with life expectancies in life tables covering approximately the same period of years.

RESULTS

Overall Life Expectancies

The life expectancies obtained in the American Cancer Society investigation over the period July 1, 1960 – June 30, 1972 compare as shown in Table 1 with corresponding life expectancies for whites in the general population of the United States; the latter figures can be approximately represented by the average of the U.S. Life Tables for 1959–61 [16] and for 1969–71 [17] and also by corresponding life expectancies among actively

employed men and women insured under group life insurance policies during 1970-74 as developed by the Society of Actuaries [18].

TABLE 1
LIFE EXPECTANCIES IN YEARS BY SEX AND ATTAINED AGE

Age	American Cancer Society Study 1960-72			U.S. Life Tables 1959/61 — 1969/71			Actively Employed Persons 1970-74		
	Men	Women	Difference	Men	Women	Difference	Men	Women	Difference
35	39.1	45.6	6.5	36.4	42.3	5.9	39.5	45.5	6.0
45	30.1	36.2	6.1	27.4	33.0	5.6	30.2	36.0	5.8
55	21.7	27.2	5.5	19.5	24.3	4.8	21.6	26.8	5.2
65	14.6	18.8	4.2	13.0	16.4	3.4	14.2	18.1	3.9
75	9.0	11.5	2.5	8.3	9.8	1.8	—	—	—

The life expectancies for men and women in the American Cancer Society study at ages 35, 45, 55, 65 and 75 were quite close to those among actively employed persons insured under group life insurance policies. Compared to the approximately contemporaneous life expectancies in the U.S. Life Tables, the life expectancies calculated in the American Cancer Society study for men aged 35 and 45 were both about 2.7 years greater; at ages 55 and 65 they were 2.2 and 1.6 years greater, respectively. The corresponding figures for women were about 3.3 years, 2.9 years, and 2.4 years greater, respectively.

These differentials reflect the superior longevity of middle class persons in the case of the American Cancer Society study and the healthy worker effect in the case of the actively employed persons.

Mortality According to Health Status

Table 2 presents death rates experienced in the American Cancer Society study, separately for those in good health and those in impaired health.

Men in good health, as classified in this study, experienced death rates at attained ages under 75 that were only about 75 percent of those for all male subjects in the study; at ages 75 and older the mortality ratios increased with advancing age up to about 90 percent in the nineties. Women in good health experienced relative death rates of about 70 percent up to age 80, rising thereafter with advancing age up to about 85 percent in the nineties. Men classified as in impaired health recorded a relative mortality of about 150 percent at the youngest ages, decreasing with advancing age up to about 130 percent at age 70 and to 105 percent in the nineties. The corresponding figures for women were 135 percent, 120 percent, and 105 percent, respectively.

TABLE 2
DEATHS AND DEATH RATES PER 1000 PERSON YEARS
BY HEALTH STATUS, BY ATTAINED AGE AND SEX
AMERICAN CANCER SOCIETY STUDY (1960-72)

	Good Health		Impaired Health		Total	
	Death Rate	Deaths	Death Rate	Deaths	Death Rate	Deaths
Males						
Ages 35-39.....	1.51	81	3.06	89	2.06	170
40-44.....	2.68	313	4.51	287	3.36	600
45-49.....	3.82	1,027	7.22	1,062	5.03	2,089
50-54.....	5.94	2,965	11.31	3,247	7.90	6,212
55-59.....	9.47	5,731	17.41	6,461	12.49	12,192
60-64.....	14.70	7,183	27.10	9,085	19.75	16,268
65-69.....	21.97	7,210	39.29	10,163	29.61	17,373
70-74.....	33.99	6,832	57.81	10,382	45.22	17,214
75-79.....	52.34	5,567	81.91	8,575	67.02	14,142
80-84.....	81.90	3,699	119.57	5,706	101.26	9,405
85-89.....	137.72	1,980	174.86	2,981	157.70	4,961
90-94.....	196.69	546	237.75	1,101	222.36	1,647
95-99.....	291.04	78	317.87	274	311.50	352
Females						
Ages 35-39.....	.86	70	1.34	98	1.09	168
40-44.....	1.31	271	2.36	392	1.78	663
45-49.....	1.77	721	3.66	1,241	2.63	1,962
50-54.....	2.89	1,684	5.10	2,648	3.93	4,332
55-59.....	3.88	2,261	6.96	4,088	5.42	6,349
60-64.....	5.86	2,588	10.48	5,460	8.35	8,048
65-69.....	8.96	2,676	16.27	6,812	13.26	9,488
70-74.....	14.80	2,807	26.08	8,060	21.79	10,867
75-79.....	27.08	2,859	45.29	9,008	38.97	11,867
80-84.....	51.03	2,422	76.23	7,960	68.36	10,382
85-89.....	90.35	1,554	128.43	5,566	117.69	7,120
90-94.....	155.81	696	199.73	2,553	188.36	3,249
95-99.....	213.68	125	265.78	657	255.81	782

It is of interest to compare the death rates from the American Cancer Society study for those in good health and in impaired health with corresponding death rates in the general population approximated by the average of the U.S. Life Tables for 1959-61 [16] and for 1969-71 [17]. On this basis, the men in good health experienced relative mortalities of about 63 percent at ages 35-44, about 56 percent in the age range 45-74, about 64 percent in the age range 75-84, and about 76 percent in the age range 84-94. The corresponding figures for the men in impaired health were 116 percent, 100 percent, 97 percent, and 95 percent, respectively. For men, irrespective of health status, the relative mortalities were about 82 percent at ages 35-44, about 75 percent at ages 45-74, about 81 percent at ages 75-84, and about 87 percent at ages 85-94. It should be kept in mind that the death rates among actively employed men and women at ages under 65 ran at about 70 percent of the corresponding death rates in the general population, Lew [19].

On the same basis, the women in good health, as classified in this study, experienced relative mortalities of about 58 percent at ages 35-54, about 47

percent at ages 45–74, about 50 percent at ages 75–84, and about 62 percent in the age range 85–94. The women in impaired health experienced relative mortalities of about 96 percent at ages 35–54, about 83 percent at ages 55–74, about 70 percent at ages 75–84, and about 84 percent at ages 84–94. For all women, irrespective of health status, the relative mortality was about 74 percent at ages 35–54, 66 percent at ages 55–74, 70 percent at ages 75–84, and 78 percent at ages 85–94. It is clear that the women in the American Cancer Society study were a more select group than the men, especially at ages 65 and older, Lew and Garfinkel [4].

Within the American Cancer Society study population, the mortality of men in impaired health was about 180 percent or more of that among men in good health at ages under 65, declining to approximately 150 percent at age 80. The relative mortality of women in impaired health was slightly lower.

Mortality According to Smoking Habits

Table 3 presents the death rates from the American Cancer Society study for those who at the time of enrollment never smoked regularly, those who smoked one or more packs of cigarettes a day, and other smokers. Men who never smoked regularly experienced death rates at ages under 60 that were only 55 percent of those for all male subjects in the study; at ages 60 and older the mortality ratios increased with advancing age to about 75 percent in the early seventies and to about 95 percent in the late eighties. Women who never smoked regularly recorded mortality ratios of about 85 percent at ages under 60, increasing with advancing age to 95 percent in the early seventies. Men smoking one or more packs of cigarettes a day showed mortality ratios of about 140 percent of those for all male subjects in the study up to the early seventies; thereafter the mortality ratios decreased with advancing age to virtually no extra mortality in the nineties. The corresponding figures for women under 75 were about 155 percent.

It is also of interest to compare the death rates in the American Cancer Society study for those who smoked one or more packs of cigarettes a day and those who never smoked regularly with corresponding death rates in the general population as approximated by the average of the U.S. Life Tables for 1959–61 [16] and for 1969–71 [17]. On this basis, the men who never smoked regularly experienced relative mortalities of about 50 percent at ages 35–44, about 38 percent at ages 45–54, about 46 percent at ages 55–64, about 57 percent at ages 65–74, and about 72 percent at ages 75–84. The corresponding figures for men who smoked one or more packs of cigarettes a day were 107 percent, 102 percent, 100 percent, 108 percent, and 108 percent, respectively. It appears that at ages under 65 men nonsmokers enjoy

TABLE 3
DEATHS AND DEATH RATES PER 1000 PERSON YEARS
BY SMOKING HABITS, BY ATTAINED AGE AND SEX
AMERICAN CANCER SOCIETY STUDY (1960-72)

	Never Smoked Regularly		One or More Packs Cigarettes		Other	
	Death Rate	Deaths	Death Rate	Deaths	Death Rate	Deaths
Males						
Ages 35-39.....	1.34	23	2.55	91	1.88	56
40-44.....	1.93	70	4.59	355	2.61	175
45-49.....	2.60	211	7.04	1,215	4.10	663
50-54.....	4.33	607	11.06	3,443	6.53	2,102
55-59.....	7.39	1,442	16.97	6,067	11.09	4,719
60-64.....	12.81	2,220	27.29	7,065	17.83	6,983
65-69.....	21.43	2,924	41.15	5,906	27.84	8,543
70-74.....	34.38	3,475	63.07	4,207	44.77	9,532
75-79.....	58.35	3,814	89.23	2,211	67.20	8,117
80-84.....	92.30	3,045	135.21	922	102.46	5,438
85-89.....	148.84	1,917	198.82	270	161.04	2,774
90-94.....	225.72	725	216.93	41	219.87	881
95-99.....	299.64	166	291.67	7	324.86	179
Females						
Ages 35-39.....	1.05	79	1.15	34	1.20	55
40-44.....	1.55	298	2.70	193	1.54	172
45-49.....	2.16	860	3.91	520	2.68	582
50-54.....	3.31	2,060	5.90	1,034	4.09	1,238
55-59.....	4.46	3,237	8.48	1,310	6.22	1,802
60-64.....	7.73	4,946	13.17	1,230	9.58	1,872
65-69.....	12.32	6,890	20.74	938	14.68	1,660
70-74.....	20.68	8,635	33.99	659	25.50	1,573
75-79.....	37.97	10,145	51.41	361	44.95	1,361
80-84.....	67.15	9,253	86.48	167	79.22	962
85-89.....	116.92	6,569	132.03	61	125.83	490
90-94.....	188.09	3,068	229.17	11	190.80	170
95-99.....	255.17	740	333.33	1	266.23	41

lower mortality than the men characterized as in good health, but at ages 75 and older being in good health is associated with distinctly lower mortality than being a nonsmoker. Furthermore, being in impaired health carries a somewhat higher mortality than smoking one or more packs of cigarettes a day at ages under 55, but at ages 65-84 smoking one or more packs of cigarettes a day is associated with distinctly higher mortality than being in impaired health.

On the same basis, the women who never smoked regularly experienced relative mortalities of about 70 percent at ages 35-44, about 59 percent at ages 45-64, about 65 percent at ages 65-84, and about 78 percent at ages 85-94. The corresponding figures for women smoking one or more packs of cigarettes a day were about 99 percent at ages 35-44, about 115 percent at ages 45-64, about 105 percent at ages 65-74, and about 90 percent at ages 75-94. It appears that at ages 45 and older smoking one or more packs

of cigarettes a day poses a distinctly higher hazard than being in impaired health.

In relation to the mortality of nonsmokers, males smoking one or more packs of cigarettes a day recorded a mortality ratio of about 190 percent in the late thirties, rising to approximately 260 percent at age 50 and then decreasing to 220 percent at age 60, 190 percent at age 70, and about 150 percent at age 80. Similarly, women smoking one or more packs of cigarettes a day registered a mortality ratio of approximately 180 percent in the forties and fifties, declining to about 165 percent at age 70 and about 130 percent at age 80.

Mortality by Health Status and Smoking Habits

Table 4 presents the death rates experienced in the American Cancer Society study in still greater detail. It shows the death rates for those who never smoked regularly, those who smoked one or more packs of cigarettes a day, and other smokers, with each smoking classification subdivided between persons in good health and those in impaired health.

Men who never smoked regularly and were in good health experienced death rates at ages under 60 that were generally below 45 percent of those for all male subjects in the study, rising with advancing age to 68 percent in the late seventies and to 85 percent in the early nineties.

In sharp contrast, men who never smoked regularly but were in impaired health experienced death rates that were somewhat below those of all male subjects in the study only in the age range 45–59; at ages 35–44 and at ages 60 and older they experienced death rates up to 110 percent of those among all male subjects. The figures for women ranged from 120 percent at ages under 50 to 113 percent at ages 45–79 and to 110 percent in the eighties.

Men who smoked one or more packs of cigarettes a day and were in good health showed mortality ratios of about 115 percent of those for all male subjects in the study through the early seventies; the corresponding figures for women were also about 115 percent.

Men who smoked one or more packs of cigarettes a day and were in impaired health experienced death rates that ranged from 190 percent of those of all male subjects in the study at the youngest ages, decreasing gradually to about 170 percent at ages 64–69 and to 150 percent in the early eighties. The corresponding figures for women also ranged from 190 percent at the youngest ages to 170 percent at ages 65–69 and to 135 percent in the early eighties.

It is clear that in the case of men in the American Cancer Society study, the increase in death rates resulting from a change in status from nonsmoking to smoking one or more packs of cigarettes a day was of about the same

TABLE 4
 DEATHS AND DEATH RATES PER 1000 PERSON YEARS
 BY SMOKING HABITS AND HEALTH STATUS,
 BY ATTAINED AGE AND SEX
 AMERICAN CANCER SOCIETY STUDY (1960-72)

	Never Smoked Regularly		One or More Packs Cigarettes		Other	
	Good Health*	Impaired Health*	Good Health*	Impaired Health*	Good Health*	Impaired Health*
Males						
Ages 35-39	0.87 (10)	2.32 (13)	1.74 (39)	3.89 (52)	1.63 (32)	2.37 (24)
40-44	1.29 (32)	3.32 (38)	4.14 (197)	5.33 (158)	1.88 (84)	4.03 (91)
45-49	2.00 (113)	3.94 (98)	5.77 (608)	9.02 (607)	2.87 (306)	6.49 (357)
50-54	3.30 (349)	6.60 (318)	8.92 (1,659)	14.25 (1,784)	4.61 (957)	10.05 (1,145)
55-59	5.59 (731)	11.04 (711)	14.05 (2,927)	21.06 (3,104)	7.79 (2,073)	16.61 (2,646)
60-64	9.42 (1,048)	18.87 (1,172)	22.31 (3,213)	33.52 (3,852)	12.52 (2,922)	25.67 (4,061)
65-69	15.42 (1,265)	30.49 (1,659)	33.85 (2,533)	49.09 (3,373)	19.92 (3,412)	37.86 (5,131)
70-74	25.79 (1,468)	45.44 (2,007)	51.02 (1,671)	74.70 (2,536)	33.16 (3,693)	57.52 (5,839)
75-79	45.50 (1,578)	72.87 (2,236)	75.16 (875)	101.70 (1,336)	51.87 (3,114)	82.19 (5,003)
80-84	75.53 (1,256)	109.35 (1,789)	115.30 (352)	151.35 (570)	82.05 (2,091)	121.31 (3,347)
85-89	129.69 (777)	165.48 (1,140)	179.62 (104)	213.09 (166)	140.77 (1,099)	177.83 (1,675)
90-94	195.45 (232)	243.58 (493)	150.68 (11)	258.62 (30)	199.87 (303)	232.04 (578)
95-99	308.33 (37)	297.24 (129)	**	266.67 (4)	275.36 (38)	341.40 (141)
Females						
Ages 35-39	0.67 (29)	1.38 (50)	1.02 (15)	1.27 (19)	1.10 (26)	1.31 (29)
40-44	1.13 (128)	2.13 (170)	2.06 (73)	3.32 (120)	1.20 (70)	1.91 (102)
45-49	1.46 (337)	3.15 (523)	2.75 (176)	4.99 (344)	1.85 (208)	3.58 (374)
50-54	2.40 (839)	4.47 (1,221)	4.68 (378)	6.94 (656)	3.08 (467)	5.09 (771)
55-59	3.08 (1,171)	5.97 (2,066)	6.90 (465)	9.70 (845)	4.60 (625)	7.65 (1,177)
60-64	5.11 (1,641)	9.35 (3,305)	9.73 (365)	15.48 (865)	6.96 (582)	11.54 (1,290)
65-69	8.21 (1,959)	15.38 (4,931)	15.83 (263)	23.60 (675)	10.44 (454)	17.34 (1,206)
70-74	14.04 (2,261)	24.84 (6,374)	25.07 (162)	38.44 (497)	17.36 (384)	30.05 (1,189)
75-79	26.62 (2,480)	44.04 (7,665)	38.46 (87)	57.56 (274)	28.73 (292)	53.14 (1,069)
80-84	50.33 (2,172)	74.81 (7,081)	72.27 (43)	92.81 (124)	55.75 (207)	89.56 (755)
85-89	90.53 (1,445)	127.39 (5,124)	106.38 (15)	143.30 (46)	85.77 (94)	141.58 (396)
90-94	155.08 (656)	199.65 (2,412)	**	**	159.29 (36)	201.50 (134)
95-99	219.64 (123)	263.68 (617)	**	**	**	302.33 (39)

* Figures in parentheses show number of deaths involved.

** Death rates based on fewer than 10 deaths omitted.

order of magnitude as in going from good health status to impaired health status. In the case of women, however, the increase in going from good health status to impaired health status was distinctly greater than that of going from a nonsmoker status to the status of smoking one or more packs of cigarettes a day. This reflects the fact that the classification of smoking one or more packs of cigarettes a day included a much higher proportion of heavy smokers among men than among women.

Table 5 summarizes these differences in death rates by smoking characteristics and health status, in terms of mortality ratios.

TABLE 5
RELATIVE MORTALITY* BY SMOKING HABITS
AND HEALTH STATUS, AGE AND SEX
AMERICAN CANCER SOCIETY STUDY (1960-72)

Ages	Never Smoked Regularly			One or More Packs of Cigarettes			Total, All Subjects	
	Good Health	Impaired Health	Total	Good Health	Impaired Health	Total	Good Health	Impaired Health
Males								
35-39	42%	113%	65%	84%	189%	124%	73%	149%
40-44	38	99	57	123	159	137	80	134
45-49	40	78	52	115	179	140	76	144
50-54	42	84	55	113	180	140	75	143
55-59	45	88	59	112	169	136	76	139
60-64	48	96	65	113	170	138	74	137
65-69	52	103	72	114	166	139	74	133
70-74	57	100	76	113	165	139	75	128
75-79	68	109	87	112	152	133	78	122
80-84	75	108	91	114	149	134	81	118
85-89	82	105	94	114	135	126	87	111
90-94	88	110	99	**	116	**	88	107
Females								
35-39	61%	127%	96%	94%	117%	105%	79%	123%
40-44	63	120	87	116	187	152	74	133
45-49	56	120	82	105	190	149	67	139
50-54	61	114	84	119	177	150	74	130
55-59	57	110	82	127	179	156	74	128
60-64	61	112	93	117	185	158	70	126
65-69	60	112	93	115	172	156	68	123
70-74	64	114	95	115	176	156	68	120
75-79	68	113	97	99	150	132	69	116
80-84	74	109	98	106	136	127	75	112
85-89	77	108	99	90	122	112	77	109
90-94	84	108	100	**	**	122	83	106

*Mortality for all males and for all females each equals 100%.

**Relative mortality ratios based on fewer than 10 deaths omitted.

Life Expectancies by Health Status and Smoking Habits

Table 6 shows the effects of smoking habits and health status in terms of differences in life expectancies for men and women at ages 35, 4, 55, 65,

and 75, as determined in the American Cancer Society study. Table 7 shows the actual life expectancies in some detail.

These tables indicate that the differences in life expectancies by sex according to health status but regardless of smoking habits range from 6.8 years at age 35 down to 3.0 years at age 75, in the case of persons in good health, and from 7.7 years at age 35 down to 2.7 years at age 75, in the case of persons in impaired health. The tables also show that the differences in life expectancies by sex according to smoking habits but regardless of health status range from 6.5 years at age 35 to 2.7 years at age 75, among those smoking one or more packs of cigarettes a day, and from 3.8 years at age 35 down to 2 years at age 75, among those who never smoked regularly. At ages under 70, the differentials in life expectancies between nonsmokers and persons smoking one or more packs of cigarettes a day are at least 50 percent greater in the case of men than in the case of women, but the differentials in life expectancies between those in good health and those in impaired health are only somewhat greater in the case of men than in the case of women.

Table 6 also indicates the differentials in life expectancies by sex and age for nonsmokers in good health and for smokers of one or more packs of cigarettes a day in good health. The differences for nonsmokers in good health provide a better measure of intrinsic sex differentials, in that they do not reflect any effects of smoking or of impaired health. These differentials are about 4.2 years at ages 35 and 45, about 4.1 years at age 55, about 3.5 years at age 65, and about 2.5 years at age 75.

The effects of smoking one or more packs of cigarettes a day raised these differences between the sexes to 7.2 years at age 35, to 6.9 years at age 45, to 6.2 years at age 55, to 5.0 years at age 65 and to 3.4 years at age 75. It needs to be emphasized that this classification includes more heavy smokers among men than among women. It should also be kept in mind that smokers of one or more packs of cigarettes a day include a distinctly higher proportion of persons in impaired health (as determined in this study) than do nonsmokers, notably men under 55.

Mortality in males and females is differently affected by a number of other significant factors. Most notable among these are marital status, obesity, physical activity, use of health services, abuse of alcohol, and extent of social activities, as indicated in such studies as those reported by Berkman and Syme [20], Breslow and Enstrom [21], and Lew and Garfinkel [4].

It might also be noted that between 1973 and 1983 the life expectancies of white males in the general population of the United States increased by about 2.4 years at age 35, about 2.1 years at age 50, and about 1.3 years at age 65, according to the United States Public Health Service [22] [23]. The corresponding figures for women were 2 years, 1.7 years, and 1.4 years.

TABLE 6
EXPECTATIONS OF LIFE BY SEX AND AGE
AMERICAN CANCER SOCIETY STUDY (1960-72)

a) DIFFERENCES REGARDLESS OF SMOKING HABITS OR HEALTH STATUS									
Age	M	F	Difference						
35	39.1 years	45.6 years	6.5 years						
45	30.1	36.2	6.1						
55	21.7	27.2	5.5						
65	14.6	18.8	4.2						
75	9.0	11.5	2.5						

b) SMOKING HABITS IRRESPECTIVE OF HEALTH STATUS									
Age	Smoking 1 plus packs a day			Nonsmokers			Smoking 1 plus Packs a Day Compared to Nonsmokers		
	M	F	Difference	M	F	Difference	M	F	Difference
35	35.8 years	42.3 years	6.5 years	42.4 years	46.2 years	3.8 years	6.6 years	3.9 years	2.7 years
45	26.9	33.0	6.1	33.0	36.7	3.7	6.1	3.7	2.4
55	19.0	24.4	5.4	24.0	27.6	3.6	5.0	3.2	1.8
65	12.4	16.6	4.2	16.0	19.0	3.0	3.6	2.4	1.2
75	7.6	10.3	2.7	9.6	11.6	2.0	2.0	1.3	0.7

c) SMOKING HABITS IN GOOD HEALTH									
35	37.9 years	45.1 years	7.2 years	45.0 years	49.2 years	4.2 years	7.1 years	4.1 years	3.0 years
45	28.8	35.7	6.9	35.4	39.6	4.2	6.6	3.9	2.7
55	20.6	26.8	6.2	26.2	30.3	4.1	5.6	3.5	2.1
65	13.7	18.7	5.0	17.8	21.3	3.5	4.1	2.6	1.5
75	8.4	11.8	3.4	10.8	13.3	2.5	2.4	1.5	0.9

d) SMOKING HABITS IN IMPAIRED HEALTH									
35	33.6 years	40.9 years	7.3 years	39.3 years	44.4 years	5.1 years	5.7 years	3.5 years	2.2 years
45	25.0	31.7	6.7	30.2	35.1	4.9	5.2	3.4	1.8
55	17.4	23.4	6.0	21.6	26.3	4.7	4.2	2.9	1.3
65	11.3	15.8	4.5	14.3	18.0	3.7	3.0	2.2	0.8
75	6.9	9.8	2.9	8.6	10.9	2.3	1.7	1.1	0.6

e) HEALTH STATUS IRRESPECTIVE OF SMOKING									
Age	Good Health			Impaired Health			Good Health Compared to Impaired Health		
	M	F	Difference	M	F	Difference	M	F	Difference
35	41.9 years	48.7 years	6.8 years	36.1 years	43.8 years	7.7 years	5.8 years	4.9 years	0.9 years
45	32.7	39.1	6.4	27.3	34.5	7.3	5.4	4.6	0.8
55	24.1	29.9	5.8	19.4	25.9	6.5	4.7	4.0	0.7
65	16.5	21.1	4.6	13.0	17.8	4.8	3.5	3.3	0.2
75	10.2	13.1	3.0	8.1	10.8	2.7	2.1	2.3	0.2

f) HEALTH STATUS IN SMOKERS (1 plus packs a day)									
35	37.9 years	45.1 years	7.2 years	33.6 years	40.9 years	7.3 years	4.3 years	4.2 years	0.1 years
45	28.8	35.7	6.9	25.0	31.7	6.7	3.8	4.0	0.2
55	20.6	26.8	6.2	17.4	23.4	6.0	3.2	3.4	0.2
65	13.7	18.7	5.0	11.3	15.8	4.5	2.6	2.9	0.3
75	8.4	11.8	3.4	6.9	9.8	2.9	1.5	2.0	0.5

g) HEALTH STATUS IN NONSMOKERS									
35	45.0 years	49.2 years	4.2 years	39.3 years	44.4 years	5.1 years	5.7 years	4.8 years	0.9 years
45	35.4	39.6	4.2	30.2	35.1	4.9	5.2	4.5	0.7
55	26.2	30.3	4.1	21.6	26.3	4.7	4.6	4.0	0.6
65	17.8	21.3	3.5	14.3	18.0	3.7	3.5	3.3	0.2
75	10.8	13.3	2.5	8.6	10.9	2.3	2.2	2.4	0.2

TABLE 7
LIFE EXPECTANCY BASED ON AMERICAN CANCER SOCIETY STUDY (1960-72)

Age	Total			Never Smoked Regularly			One or More Packs Cigarettes		
	Good Health	Impaired Health	Total	Good Health	Impaired Health	Total	Good Health	Impaired Health	Total
Males									
35	41.92 yrs.	36.06 yrs.	39.13 yrs.	44.96 yrs.	39.29 yrs.	42.41 yrs.	37.89 yrs.	33.62 yrs.	35.80 yrs.
40	37.21	31.58	34.50	40.15	34.72	37.69	33.19	29.23	31.22
45	32.68	27.26	30.05	35.40	30.24	33.03	28.81	24.98	26.89
50	28.28	23.19	25.77	30.74	25.82	28.45	24.60	21.03	22.79
55	24.08	19.42	21.73	26.22	21.62	24.03	20.63	17.43	18.96
60	20.14	16.00	18.00	21.88	17.74	19.87	16.99	14.15	15.47
65	16.51	12.99	14.64	17.84	14.29	16.05	13.74	11.32	12.41
70	13.19	10.36	11.64	14.11	11.28	12.63	10.88	8.90	9.76
75	10.24	8.11	9.05	10.78	8.64	9.62	8.42	6.95	7.58
Females									
35	48.66 yrs.	43.83 yrs.	45.60 yrs.	49.21 yrs.	44.41 yrs.	46.19 yrs.	45.05 yrs.	40.94 yrs.	42.32 yrs.
40	43.85	39.11	40.84	44.37	39.71	41.42	40.27	36.18	37.55
45	39.12	34.55	36.18	39.60	35.11	36.72	35.65	31.73	33.02
50	34.46	30.14	31.64	34.89	30.64	32.11	31.14	27.48	28.63
55	29.93	25.86	27.22	30.28	26.28	27.60	26.83	23.37	24.42
60	25.48	21.76	22.92	25.73	22.03	23.19	22.69	19.44	20.40
65	21.18	17.77	18.81	21.35	18.00	19.02	18.73	16.65	15.83
70	17.06	14.10	14.96	17.16	14.27	15.11	15.10	12.56	13.25
75	13.23	10.80	11.46	13.28	10.90	11.55	11.82	9.75	10.29

The increases in life expectancies among gainfully employed persons covered by group life insurance between 1970-74 [18] and 1975-79 [24] are of about the same order of magnitude as the increases in life expectancies in the population covered by the American Cancer Society study.

SUMMARY

The differences in life expectancies by sex among nonsmokers in good health were much smaller than either the differences in life expectancies by sex for all subjects in this study or the differences in life expectancies by sex in the general population of the United States over approximately the same period of time. This finding reflects the more deleterious effects of smoking in men, as may be seen from the fact that the absolute differences in life expectancies between male smokers (one or more packs of cigarettes a day) and male nonsmokers were about 1.5 times as great as the corresponding differences between female smokers and nonsmokers.

Impaired health as defined in this study had somewhat smaller effects on male life expectancy at ages under 60 than did smoking one or more packs of cigarettes a day. In males aged 60 or older impaired health and smoking habits had about the same effects. Impaired health appeared to have greater influence than smoking habits on female life expectancy, especially at ages 60 and older. Male smokers (one or more packs of cigarettes a day) in good

health showed a lower life expectancy than corresponding male nonsmokers in impaired health.

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APPENDIX

DISTRIBUTION OF SUBJECTS BY SEX, AGE, HEALTH STATUS AND SMOKING HABITS
AMERICAN CANCER SOCIETY STUDY (1960-72)

Ages	Never Smoked Regularly			Smoked 20 or More Cigarettes a Day			All Others			Total		
	Good Health	Impaired Health	Total	Good Health	Impaired Health	Total	Good Health	Impaired Health	Total	Good Health	Impaired Health	Total
Males												
35-39	2,598	895	3,493	4,886	2,482	7,368	5,249	2,202	7,451	12,733	5,579	18,312
40-44	4,744	1,570	6,314	8,096	4,364	12,460	9,457	3,958	13,415	22,297	9,892	32,189
45-49	13,581	4,941	18,522	23,131	12,945	36,076	29,252	13,187	42,439	65,964	31,073	97,037
50-54	13,309	5,219	18,528	19,575	12,589	32,164	29,811	15,487	45,298	62,695	33,295	95,990
55-59	10,431	4,913	15,344	11,597	8,726	20,323	23,550	14,556	38,106	45,578	28,195	73,773
60-64	7,744	4,507	12,251	5,801	5,270	11,071	17,441	13,001	30,442	30,986	22,778	53,764
65-69	5,793	4,066	9,859	2,720	2,818	5,538	11,551	10,496	22,047	20,064	17,380	37,444
70-74	3,599	3,041	6,640	909	1,164	2,073	6,267	6,429	12,696	10,775	10,634	21,409
75-79	1,961	1,787	3,748	260	322	582	2,667	3,228	5,895	4,888	5,337	10,225
80-84	732	870	1,602	53	87	140	1,030	1,231	2,261	1,815	2,188	4,003
85-89	313	328	641	11	12	23	324	391	715	648	731	1,379
90-94	102	56	158	1	0	1	99	77	176	202	133	335
95-99	20	9	29	0	0	0	15	8	23	35	17	52
100-104 ..	0	1	1	0	0	0	3	1	4	3	2	5
Females												
35-39	12,100	6,479	18,579	3,899	3,208	7,107	6,307	4,589	10,896	22,306	14,276	36,582
40-44	25,230	14,066	39,296	7,036	6,528	13,564	12,432	9,228	21,660	44,698	29,822	74,520
45-49	40,565	25,507	66,072	9,370	9,602	18,972	17,616	15,219	32,835	67,551	50,328	117,879
50-54	38,600	29,827	68,427	5,882	7,324	13,206	12,429	12,720	25,149	56,911	49,871	106,782
55-59	31,005	29,493	60,498	2,927	3,966	6,893	6,741	8,374	15,115	40,673	41,833	82,506
60-64	23,026	26,353	49,379	1,238	1,926	3,164	3,650	4,971	8,621	27,914	33,250	61,164
65-69	16,196	21,873	38,069	531	909	1,440	2,076	3,049	5,125	18,803	25,831	44,634
70-74	9,343	14,875	24,218	178	313	491	946	1,561	2,507	10,467	16,749	27,216
75-79	4,457	8,617	13,074	49	109	158	369	763	1,132	4,875	9,489	14,364
80-84	1,924	4,361	6,285	11	21	32	127	281	408	2,062	4,663	6,725
85-89	735	1,696	2,431	1	0	1	43	93	136	779	1,789	2,568
90-94	263	348	611	1	0	1	14	17	31	278	365	643
95-99	46	50	96	0	0	0	3	5	8	49	55	104
100-104 ..	5	4	9	0	0	0	0	1	1	5	5	10

DISCUSSION OF PRECEDING PAPER

ROBERT J. JOHANSEN:

While we are and should be grateful to Messrs. Lew and Garfinkel for providing us with this extensive mortality study from noninsurance sources, we cannot help but wonder why it took so long or why it did not continue to a more recent year. Also, we hope the authors will, in the near future, provide us with more recent experience of this group. Although the distinction between smokers and nonsmokers will likely be different from that of any particular insurance company, the experience does provide some needed guideposts. Longer duration experience would be very helpful.

As a matter of fact, the study is a mine of information, and much can be gleaned from comparing the results in the various groupings. The study also serves to remind us that properly documented noninsurance experiences are useful in providing data which can serve to reassure us in interpreting insured experiences or to indicate what an insured experience might provide in cases in which insured data do not exist.

The study provides us with an example of the effects of selection, broadly defined, by comparing healthy lives, selected by a form of nonmedical underwriting, first with their counterpart impaired lives and then with group life insurance mortality. The authors' finding that the experience prior to age 65 was comparable to contemporary group life experience is not surprising; it reflects the screening process of becoming and remaining employed—the "healthy worker effect" noted by the authors, which is the keystone of group life insurance. It would also be interesting to compare the American Cancer Society (ACS) experience with corresponding nonmedical life insurance experience. Unfortunately, the ACS data are presented in the form of an aggregate experience, rather than by duration since entry.

We recall having observed the duration effects of selection in a very early study of smoker/nonsmoker mortality, in which both groups were ostensibly healthy when selected for the study. The data were presented by year since entry. Over a short period of some five years, the effect of selection wearing off was striking: The mortality of smokers rose at a much faster rate than that of the nonsmokers. In the present study, Messrs. Lew and Garfinkel remarked that the first nine months' experience was excluded from their study "because death rates were low," an indication of the effect of the initial selection. Perhaps the authors can produce a sequel by duration from entry. Either the ACS aggregate mortality rates or the group life insurance

tables could be used to calculate expected deaths. Ratios of actual to expected deaths could be computed for broad age groups by duration. Mortality improvement over the period may mask some of the effect of selection.

The ACS experiences provided by Messrs Lew and Garfinkel serve to remind us, as actuaries, that by applying any kind of screen to a body of lives, the experience of the lives admitted by the screen is different from that of the total body. The existence of this difference must be recognized in any analysis, rate-making, or other uses or comparisons of the data. In this study, it would not have been useful to rely only on a comparison of the healthy smokers' mortality with that of the general population because the latter contains "unselect" lives. Note that the combined smoker mortality was, in fact, not much elevated over population mortality. As the authors were careful to point out, certain classes of individuals were not included in any part of the sample. *A priori* we might expect individuals in the excluded groups to exhibit higher mortality than those in the study. Because the lives in the ACS study were further screened into healthy and impaired, we are able to compare healthy smokers with healthy nonsmokers, unaffected, to the extent possible, by extraneous factors.

In the discussion of Table 6, there is a statement,

It should also be kept in mind that smokers of one or more packs of cigarettes a day include a distinctly higher proportion of persons in impaired health (as determined in this study) than do nonsmokers, notably men under 55.

A similar statement is needed in the discussion of Table 3, which compares total smokers with total nonsmokers. The later discussions of healthy smokers and healthy nonsmokers make clear the relationship between the two statuses without the effect of differing proportions of impaired lives. Apparently there is, as one would expect, a high correlation between smoking and being in impaired health.

The paper, "Blended Mortality Tables—Life Insurance and Annuities," *TSA*, XXXIX (1987), stated that at the higher ages female 1980 CSO smoker mortality was lower than that of male nonsmokers, which made the blending of male and female smoker mortality even more preposterous than blending the composite tables. The same characteristic can be observed in the ACS data. However, the similarity may reflect the use of some preliminary ACS data in adjusting the 1980 CSO smoker and nonsmoker rates at the higher ages.

The relative mortality of smokers and nonsmokers in the ACS study should be interpreted with caution in applying the results to life insurance. Statements by insurance applicants may not be as credible as those from persons in the ACS study who will not experience any financial penalty from disclosure of their smoking habits. This would be especially true of companies

not requiring a screening test. Further, by design a company may include in its nonsmoker class cigar and pipe smokers or even those who smoke only three or four cigarettes a day. On the other hand, a nonsmoker class may require meeting preferred risk standards as well. The practical effects of these considerations may be to increase or decrease the differences between smoker and nonsmoker insured mortality.

Again, our thanks to Messrs. Lew and Garfinkel for their useful and thought-provoking paper.

(AUTHORS' REVIEW OF DISCUSSION)

EDWARD A. LEW AND LAWRENCE GARFINKEL:

The enormous size of the Cancer Prevention Study and the labor involved in obtaining a reasonably complete follow-up of a million subjects who had to be traced individually impeded rapid analysis of the mortality data.

The data for the study were put together over thirteen years (1959-72) by 68,000 volunteers working in twenty-five states. It took four years to transfer the information from more than a million questionnaires to punched cards and then to computer tapes; the fifteen rolls of magnetic tape contain some 450 million bits of information.

Volunteers kept tab on each of the more than one million subjects year by year for six years and again in 1972. While 98% of the subjects were successfully traced within twelve years, the task of determining the status of the last 10 percent was both difficult and time-consuming.

In 1976 it was decided to extend the follow-up on a portion of the study, that of long-lived subjects, to the middle of 1979 or for an additional seven years. It took several years to do this, and the results were published in the paper "Mortality at Ages 65 and Over in a Middle-Class Population," *TSA*, XXXVI (1984).

It should be kept in mind that the American Cancer Society had a number of other priorities. Altogether some 100 papers were written on other aspects of the investigation.

We agree with Mr. Johansen that analysis of select mortality can indeed be very informative for a risk such as smoking, whose influence changes sharply with time elapsed. In our 1985 paper we presented mortality analyses in select form separately for ostensibly healthy persons and for persons in impaired health. Data on mortality by kind of cigarettes smoked were likewise developed separately for the first six years and for the subsequent six years [1].

It is anticipated that in Cancer Prevention Study II, begun in 1982, major analysis of the experience, including mortality by time elapsed, will become available more promptly.

We want to thank Mr. Johansen for his perceptive comments, especially with respect to the application of the American Cancer Society's experience for life insurance purposes.

REFERENCE

1. HAMMOND, E.C., GARFINKEL, L., et al. "Tar and Nicotine Content of Cigarette Smoke in Relation to Death Rates," *Environmental Research*, 12 (1976): 236-274.