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<u>SMOKING AND SEX MORTALITY DIFFERENTIALS</u>

Moderator: CHARLES CHITTENDEN
Panelists: MICHAEL J. COWELL
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              ROBERT J. MYERS
Recorder: ROBERTA SHAEFFER

o   How much of the sex mortality differential is due to smoking habits?
o   How convincing are existing studies on:
     --Smoker versus nonsmoker mortality
     --Male versus female nonsmoker mortality
o   What do worldwide trends in mortality suggest about the effects of smoking and sex on mortality?
o   How well do insurers classify the smoking risk?
o   Presentation of paper "United States Life Tables for 1979-81" by Messrs. Robert J. Myers and Francisco R. Bayo (September Preprint, 1985, <u>TSA</u> Volume 37)

MR. CHARLES CHITTENDEN: Mr. Robert J. Myers will present his paper "U.S. Life Tables 1979-81" coauthored with Francisco R. Bayo.

Mr. Michael J. Cowell will discuss his research on the 1979 State Mutual Study, which he coauthored with Brian L. Hirst, and subsequent research on smoking and mortality.

Dr. G. H. Miller, Professor of Mathematics and Computer Science at Edinboro University of Pennsylvania, has been the director of a non-profit organization not affiliated with the university called Studies on Smoking which involves studies on the mortality effects of smoking.

Dr. Miller attracted the interest of actuaries with an article in <u>Public Health Reports</u>, July-August 1983, "Life Expectancy of Nonsmoking Men and Women." He coauthored this article with Dr. Dean Gerstein. The Miller-Gerstein study was a retrospective study of the population of Erie County in 1972-74. It showed nearly identical life expectancies for nonsmoking adult men and women once traumatic deaths were removed. Dr. Miller will discuss this study and some of his recent work including

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a report, soon to be published, based on the same data as the 1983 paper, which compares the mortality of smoking and nonsmoking males in Erie county.

MR. ROBERT J. MYERS: My role at this time is to present the paper "United States Life Tables for 1979-81," which I coauthored with Francisco R. Bayo. Mr. Bayo performed all of the technical work on the construction of these life tables, and we jointly made the analysis of the data and wrote the paper.

Official decennial life tables for the United States have been prepared since the beginning of this century. That data used, in general, have been the deaths in the 3-year period centering on the census date and the population census itself. Mr. Bayo has prepared the latest 3 sets of life tables. Before then, this was done by Monroe Sirken, T.N.E. Greville, and Professor James Glover of the University of Michigan.

Annual abridged life tables are also issued, but these do not have the accuracy and completeness of the decennial tables. One reason is that the population base must be estimated by projection from the preceding census.

Our paper presents annual mortality rates and expectations of life for all quinquennial ages (and for age 1 as well) for the total population on a unisex basis and separately by sex, as well as tables by sex for whites, nonwhites, and blacks. Besides this extensive amount of basic data, we also make analyses over time, since 1900, by age, sex and race (giving both the actual values for each decennial table and analytical ratios). We give a brief analysis of mortality by cause of death, showing changes from 1969-71 to 1979-81. Finally, infant mortality rates and the expectation of life at ages 0 and 65 in industrialized countries are presented for 1970 and 1980.

In the 1970s, improvements in mortality rates in the United States were significant and averaged about 2 percent relatively per year at all ages. The sex differential in the expectation of life at birth reversed a long-time trend of becoming ever larger and, instead, narrowed slightly. However, this was not the case for the expectation of life at age 1, where the differential increased slightly. The differential in mortality between whites and nonwhites narrowed slightly in the 1970s.

In the 1979-81 tables, female mortality rates were lower than male mortality rates by 20 percent at ages 0-10, with the difference increasing to 65 percent at ages 20-30, then falling off to 50 percent at ages 40-70, and finally to only about 10 percent at the centenarian ages. The expectation of life for females was about 10 percent higher than that for males at ages 0-10, with the differential increasing to 30 percent at ages 70-80, and then declining to 10 percent for centenarians.

Comparing United States mortality with that in other countries for periods around 1980, we find that infant mortality in the United States was about the same as in many other industrialized countries, but Japan, Norway, and Sweden had about 40 percent lower rates. As to the expectation of life at birth, Canada, Japan, Netherlands, Norway, and

Sweden had about a 3 percent higher value for males and about 2 percent higher for females, although many of the other industrialized countries were at about the same level as the United States. Considering the expectation of life at age 65, the United States ranked somewhat better--only Canada had higher values (by about 3 percent for males and 2 percent for females).

Between 1970 and 1980, infant mortality in the United States decreased at about the same rate as in most other countries, whereas the expectations of life at ages 0 and 65 increased slightly more in the United States than in most other countries. One of the most striking occurrences in international mortality has been the significant decline in mortality in Japan following World War II, so that now it is in the forefront of those countries with the lowest mortality, whereas some decades ago this had not been the case.

MR. MICHAEL J. COWELL: In 1964, within three months of the publication by the Surgeon General of Smoking and Health, State Mutual introduced smoking habits in classifying risk and pricing life insurance. In 1979, on the heels of the Surgeon General's second major report, State Mutual released the first insurance company experience study of mortality differences between smokers and nonsmokers.

Our paper described the techniques we used to impute from population statistics the mortality differences by smoking status among insured lives, and subsequent refinements based on our actual experience. At that time, we addressed the issue of a three-way classification of smokers, ex-smokers, and those who had never smoked along the lines suggested by Dr. G. H. Miller.

How convincing are our studies? We received the experience of other companies which had been issuing discounts to nonsmokers. This additional experience substantially corroborated our data. The combined experience of those companies in the late 1970s and early 1980s produced a credible body of statistics that was used to create the Society of Actuaries report that broke the 1980 CSO Table down into separate tables for smokers, nonsmokers, males, and females.

Table 1 shows the comparison of smoker to nonsmoker mortality that we presented in our 1979 study. The ratios by policy years are by amount of insurance. Also shown are the ratios by number of policies for the entire 15-year select period of the 1965-70 Basic Tables and the 95 percent confidence intervals for these ratios.

Table 2 updates the mortality ratios by number of policies shown in Table 1 to cover experience between 1979 and 1984 anniversaries. Because this experience contains a small but statistically significant number of female deaths, results are shown separately by sex. The resulting ratios, and their 95 percent confidence intervals, lead us to conclude that there are substantial differences between males and females, smokers and nonsmokers. Male smoker mortality for the most part is about 100 percent of the table and nonsmoker mortality about 55 percent. Female smokers are about 40 percent and female nonsmokers about 30 percent.

PANEL DISCUSSION

TABLE 1

STATE MUTUAL MORTALITY EXPERIENCE BY POLICY YEAR
Standard Medically Examined Issues of 1964-77
Experience between 1973 and 1978 Anniversaries
Male and Female Lives--Issues Ages 20 and Over
Permanent Plans--Face Amounts of $10,000 and Higher

POLICY YEARS	SMOKERS	NONSMOKERS	SMOKER/ NONSMOKER RATIO
1- 5	150%	85%	1.76
6-10	137	36	3.81
11-15	99	52	1.90
1-15	132%	53%	2.49
(By Number of Policies)	127% ± 13%	54% ± 7%	2.35

TABLE 2

STATE MUTUAL MORTALITY EXPERIENCE BY POLICY YEAR
Standard Issues of 1964-83
Experience between 1979 and 1984 Anniversaries
Issues Ages 20 and Over
Permanent Plans--Face Amounts of $10,000 and Higher

POLICY YEARS	MALE SMOKERS	MALE NONSMOKERS	MALE SMOKER/ NONSMOKER RATIO
1- 5	106%	66%	1.61
6-10	107	58	1.84
11-15	83	49	1.69
1-15	93% ± 10%	56% ± 5%	1.67

POLICY YEARS	FEMALE SMOKERS	FEMALE NONSMOKERS	FEMALE SMOKER/ NONSMOKER RATIO
1- 5	25%	32%	.78
6-10	42	32	1.31
11-15	54	27	2.00
1-15	40% ± 14%	30% ± 9%	1.33
MALE/FEMALE RATIO		2.33	1.87

Mortality ratios for Tables 1 and 2 based on Society of Actuaries
1965-70 Select Basic Tables for male and female lives combined.

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Table 3 presents, for the first time, experience beyond the 15-year select period. In our original paper, we assumed, for lack of actual experience, that the mortality of smokers and nonsmokers would converge at some suitably high age; we tentatively selected age 85 as the point of convergence. The experience emerging during the ultimate period strongly suggests that the approximately 2 to 1 ratio for smoker to nonsmoker mortality persists long after the influence of selection has worn off and that it carries over to the upper range of attained ages.

TABLE 3

STATE MUTUAL MORTALITY EXPERIENCE BY ATTAINED AGE
Standard Medically Examined Issues of 1964-68
Experience between 1974 and 1984 Anniversaries
Male and Female Lives--Issues Ages 20 and Over
Permanent Plans--Face Amounts of $10,000 and Higher

ATTAINED AGE	SMOKERS	NONSMOKERS	SMOKER/ NONSMOKER RATIO
40-49	73%	43%	1.70
50-59	84	42	2.00
60-69	88	41	2.15
70-79	90	46	1.96
40-79	84% ± 13%	42% ± 8%	2.00

Mortality ratios based on Society of Actuaries 1965-70 Ultimate Basic Tables for male and female lives combined.

There was some concern that our smoker mortality rates were distorted because our smoker classification included everybody from a light casual smoker to a 4 to 5 pack a day chain smoker. We don't have any of our company experience on this basis because we ask applicants only whether they smoke--not how much. However, this information is available in the Surgeon General's 1979 report, and there is some limited experience from other companies. At least one major company classifies its smokers as heavy or light. Their breakpoint is one pack a day or less, which ties in with the Surgeon General's classification.

Table 4 presents mortality ratios in the general population of ex-smokers to those who never smoked. They show a strong downward trend in ratios the longer a person has quit smoking; for those who formerly smoked less than a pack a day and who have quit for at least ten years, the ratio is well within most companies' underwriting limits for standard issues. We believe this supports our decision to classify healthy ex-smokers as nonsmokers for pricing purposes.

Using approximately the same method used to split the 1980 CSO Basic Table into smoker and nonsmoker components, we developed the mortality ratios shown in Table 5. We believe these ratios will pertain to an insured group if you use those who have never smoked as the base instead of using nonsmokers as the base. As the table shows, the mortality ratio rises dramatically with the number of cigarettes smoked.

TABLE 4

Age-Adjusted Mortality Ratios of Ex-Smokers
to Those Who Never Smoked

Years Since Cessation	Number of Cigarettes Smoked Per Day	
	1-19	20 or More
< 1	204%	269%
1-10	130	182
>10	108	150

Source: Smoking and Health 1979 Report of the Surgeon General

TABLE 5

Mortality Ratios of Ex-Smokers and Current Smokers
to Those Who Never Smoked
and Related Life Expectancies

Current Nonsmokers		Current Smokers			
Never Smoked	Ex-Smokers	Number of Cigarettes Smoked Per Day			
		15	15-24	25-34	35+
100%	130%	200%	255%	315%	400%
78.7	76.1	72.2	69.9	68.1	65.9

Life Expectancy for 30 year old male based on ratios of Standard
Mortality from Society of Actuaries 1980 CSO Basic Tables

I translated these ratios into life expectancy values for a 30 year old
male, assuming mortality follows the Society of Actuaries 1980 CSO Basic
Tables and that these mortality ratios persist throughout life. These
figures support the generally perceived notion of an eight- to nine-year
life expectancy advantage for nonsmokers as compared to smokers, but
show that at the extremes--comparing current smokers of two or more
packs a day to those who never smoked--the differentials may be at
least 13 years.

Such differences support Dr. Miller's call for greater distinctions by
smoking status. These distinctions are needed not so much between
ex-smokers and those who never smoked, as they are needed among
current smokers at different levels of cigarette consumption. While
valid for population mortality studies, there may be limits to the
applicability of Dr. Miller's proposal for insurance. Insurers would
have to cost justify further subclassifications of a group that now
represents barely one-third of their total market.

Between ex-smokers and lifetime nonsmokers the differences in mortality
are on the borderline for separate classification. Most insurers classify

as "standard," those risks up to 25 percent extra mortality; increasingly, the trend is to extend the "standard" class even higher. To meet our criterion for classification as nonsmokers, ex-smokers must have quit for at least a year and must meet the same underwriting standards applied to lifetime nonsmokers. This reduces the mortality of insured groups of former smokers below that for such groups in the general population.

Few people give up smoking just to obtain better insurance rates. Nevertheless, the fact that ex-smokers who can pass standard underwriting requirements will experience mortality on the borderline of the industry's standard class, if not actually within it, may be viewed as added justification for classifying them as "nonsmokers."

DR. G. H. MILLER: The Erie County Study on Smoking and Health (ECSSH) was begun to determine the full impact of smoking on longevity. This study has been funded by local Erie County industry, the National Academy of Sciences, and the ITT Insurance Company. We hope that the reporting of the life table analysis at this conference will encourage other insurance companies to provide financial assistance so that the data base can be expanded to provider greater contributions for the actuaries of the insurance industries. While it has been known for many years that smoking is bad for one's health, the actual impact on longevity was not investigated thoroughly since most research reported only mortality ratios. In all of the earlier research, only one study by Hammond reported on longevity curtailment, and it concluded that there was an 8.3-year difference in life expectancy of smokers and nonsmokers at age 35. While mortality ratios are fine for making comparisons of diseases between smokers and nonsmokers, they do little to determine the exact longevity curtailment brought about by smoking. ECSSH was initiated to determine the full impact of smoking on longevity. Thus, traumatic deaths were not included nor was anyone age 29 or under. These restrictions were made so that the study would report the total impact of smoking on longevity.

It should be noted that the ECSSH, of course, will not give results identical to those of insurance studies since insurance populations are slightly different. However, such a population study should provide data that give good approximations to insurance studies if insurance companies were to use the same precise categorization of lifetime smoker and lifetime nonsmoker, and the population study included traumatic deaths.

Let me give you a brief resume of the basic points of the ECSSH. This study was done in Erie County, Pennsylvania. Close relatives of the deceased were interviewed to determine their smoking habits. Research on the reporting of smoking habits has shown fairly consistently that reports from close relatives are very accurate. Data on the relatives of the deceased were obtained from death notices and obituaries which list close relatives of the deceased and comprise a nearly complete list of those who died in Erie County. Telephone numbers of relatives were obtained from telephone books, and interviewers were trained to obtain the most accurate information. The interview method was used in place of questionnaires due to its superiority in reliability and accuracy of

data despite the added expense and time requirements of interviewing. Research texts on survey methods note that the interview is superior to the questionnaire since the interview permits ambiguities to be resolved. Also, there is usually a much higher response rate to interviews than to questionnaires.

The interviewers elicited important information on smoking habits such as the detailed smoking history of the deceased, including the smoking history of the spouse and parents, occupation, pollution exposure, cause of death, and prior diseases.

The first point concerns the life table analysis comparing nonsmoking women with nonsmoking men (Figure 1). This was reported in the article "Life Expectancy of Nonsmoking Men and Women" by Dr. Dean Gerstein and myself as published in Public Health Reports in July-August of 1983 and received quite a bit of publicity. Some of you may remember the Herblock cartoon showing that women have come a long way with the implication that if women continue to smoke, they will dies as early as men. This cartoon was based on the results of the ECSSH, which showed that if men and women did not smoke, men would live to be approximately the same age as women. The article attributed the present seven- to eight-year longevity difference between men and women to smoking. Thus, the conclusion was reached that if women continue to smoke as much as men, they will die as early as men.

The present study differs from practically all other studies in that the determination of smoking classifications--lifetime smokers, lifetime nonsmokers, and former smokers--was much more precise because of the interviewers' constant concern for the accuracy of the data. The question that was asked first in the interview was whether or not the decease ever smoked during his life. This question was followed by asking if the deceased used tobacco in any other form. The second question was used to double-check the accuracy of the first statement and to obtain additional information on those who may have used snuff or chewing tobacco. This technique was employed when it was discovered that too many relatives considered a former smoker to be the same as a nonsmoker. Such incorrect classification reduces the accuracy of the data since smokers and former smokers die earlier than lifetime nonsmokers.

Part of the problem with most of the previous studies is that they do not have precise classifications for the lifetime smoker and lifetime nonsmoker. Several studies use the criterion of one year without smoking for the classification of a nonsmoker. This is a particularly weak classification since it can include many former smokers who smoked for thirty or forty years. This category has been shown to have much higher mortality rates than lifetime nonsmokers.

There are also a number of prospective studies reporting on the effects of smoking. However, the exact impact of smoking cannot be derived from these studies since the nonsmokers live longer than the smokers. One must wait until all the participants in the study die in order to obtain an accurate picture of the total impact on longevity. Also some

Sex and 5-year cohort	Deaths 1972–74	Population	Age-specific mortality rate	Chiang constants	Adjusted probability function	Number alive at beginning of age interval	Number dying during age interval	Stationary population in age interval	Stationary population in designated age interval + all subsequent age intervals	Life expectancy at entrance to each age category
Males										
30–34	2	8.241	.00024	.52	.00120	100,000	120	499,700	5,085,945	50.9
35–39	3	8.215	.00048	.54	.00240	99,880	240	498,800	4,589,245	46.0
40–44	3	5.790	.00051	.54	.00255	99,640	254	497,565	4,087,445	40.9
45–49	11	5.545	.00198	.54	.00986	99,386	980	494,480	3,589,880	36.2
50–54	13	6.983	.00186	.53	.00926	98,406	911	489,752	3,095,400	31.5
55–59	30	5.431	.00552	.52	.02724	97,495	2,656	480,835	2,605,648	26.7
50–64	40	3.576	.01118	.52	.05444	94,839	5,163	461,287	2,124,813	22.4
65–69	41	3,121	.01313	.52	.06364	89,676	5,707	434,112	1,663,526	18.6
70–74	39	2,648	.01472	.51	.07104	83,969	5,965	404,932	1,229,414	14.6
75–79	69	2.030	.03399	.51	.15688	78,004	12,237	359,427	824,482	10.6
80–84	103	1.051	.09800	.48	.39050	65,767	25,682	264,630	465,055	7.1
85 and older	78	1,048	.07442	...	1.00000	40,085	40,085	200,425	200,425	' 5.0
Females										
30–34	5	13.975	.00035	.52	.00175	100,000	175	499,562	5,060,248	50.6
35–39	8	11.969	.00050	.54	.06250	99,825	250	498,500	4,560,686	45.7
40–44	14	13.641	.00102	.54	.00509	99,575	507	498,667	4,062,186	40.8
45–49	22	15.275	.00144	.54	.00718	99,068	711	493,562	3,565,579	36.0
50–54	40	14.859	.00269	.53	.01337	98,357	1,315	488,497	3,072,017	31.2
55–59	50	14.257	.00350	.52	.01735	97,042	1,684	481,000	2,583,520	26.6
60–64	92	11.586	.00794	.52	.03896	95,358	3,715	467,502	2,102,520	22.0
65–69	141	9.295	.01518	.52	.07323	91,643	6,711	441,437	1,635,018	17.8
70–74	188	8.558	.02196	.51	.10419	84,932	8,849	402,537	1,193,581	14.1
75–79	328	7.342	.04467	.51	.20132	76,083	15,317	342,122	791,044	10.4
80–84	411	4.831	.08507	.48	.34831	60,766	21,165	250,917	448,922	7.4
85 and older	466	4,482	.10397	...	1.00000	39,601	39,601	198,005	198,005	' 5.0

' Estimated, based on U.S. population from U.S. Bureau of Vital Statistics. NOTE: Leaders (...) indicate Chiang constant not applied.

PANEL DISCUSSION

smokers become *former smokers*, reducing their risks and thereby lowering the longevity differences between smokers and nonsmokers. Therefore all prospective reports on smoking presently provide under-estimates of what will be reported finally in the next half century.

A second pertinent topic is the comparison of the lifetime nonsmoking men with lifetime smoking men. A lifetime smoking man is defined as having a lifetime of smoking with the possible exception of his last year of life. Since many smokers quit smoking after their physicians notify them of a serious health problem, most researchers feel that those who smoke until their last year of life should be classified as "smokers." My definition of a lifetime nonsmoker is one who has smoked a maximum of 20 packs of cigarettes in his or her lifetime. Pipe and cigar smokers were not included in the ECSSH. In other studies, they have been included with either the smokers or the nonsmokers. This categori-zation is not very accurate.

The results of comparing the lifetime nonsmoking men with the smoking men showed a 12-year difference in life expectancy (Figure 2). It should be noted that this is the same value which Mr. Cowell obtained in his analysis of nonsmoking men compared with heavy smokers. Thus, the ECSSH results are very similar to his with respect to lon-gevity curtailment of lifetime smoking men compared to lifetime non-smoking men. There appears to be no difference of opinion on this issue. The results of both studies show that smoking curtails one-fifth of the lifetime of smokers.

FIGURE 2

LIFE EXPECTANCIES OF ADULT MALES BY AGE AND SMOKING HABITS

Age	Deaths		Exposure		Life Expectancy	
	Smokers	Nonsmokers	Smokers	Nonsmokers	Smokers	Nonsmokers
30-34	7	2	9,816	8,241	38.4	50.9
35-39	7	3	8,977	6,215	33.5	46.0
40-44	40	3	8,970	5,790	28.6	41.0
45-49	73	11	9,299	5,545	24.2	36.1
50-54	129	13	8,632	6,983	20.0	31.5
55-59	205	30	7,508	5,341	16.4	26.7
60-64	252	40	6,664	3,576	13.5	22.4
65-69	234	41	3,664	3,121	10.7	18.6
70-74	181	39	2,004	2,648	8.9	14.6
75-79	133	69	1,330	2,030	7.7	10.6
80-84	74	103	526	1,051	6.1	7.1
85+	40	78	150	1,048	5.0	5.0
Total	1,375	432	67,540	51,589		

From a two-sample cross-sectional population study in Erie County, Pennsylvania, from 1972-74 by Dr. G. H. Miller.

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As the third topic, I will attempt to show that the present male-female longevity difference, which many experts thought would increase, has now peaked and appears to be receding (Figure 3). The male-female longevity difference started to increase in the 1920s. It peaked at a 7.8 year difference during the 1970s for the total group, and now it appears to be on the decline. This peaking and subsequent slight decline can be attributed to the fact that so many men in the older age groups have quit smoking. The impact of smoking cessation is beginning to appear in the life expectancies of men and women. Now that female teenagers are smoking as much or more than male teenagers, in another forty to fifty years they will be dying at the same rate as men if we cannot get them to quit smoking. Since men now have many more total smoking years than women, it will not be until women's total smoking years catch up with men's that the devastating impact of smoking on both men and women will be observed and fully documented.

Thus, despite the fact that now women are smoking as much as men, it will not be until forty to fifty years when the total smoking years of women will be equal to the total smoking years of men that the equality in life expectancy will be observed. The continuation of the downward trend which appears on Figure 3 will finally result in a life expectancy difference of zero.

MR. MYERS: I certainly agree with Dr. Miller that smoking causes a significant part of the differential in mortality between males and females. But from studying mortality at all ages, I am convinced that it is only part of the differential. There is something genetically built-in which can be observed when mortality rates by age or prenatal mortality are examined. For some reason, males have higher mortality rates than females. For example, in the 1979-81 Life Tables the female mortality rate is 15 percent lower than the male at age 1, 25 percent lower at age 5, and 14 percent lower at age 10. That difference will not be eliminated by excluding accidents or excluding smoking. The evidence is quite clear that smoking is deleterious to one's health, but I certainly do not believe that the entire difference in mortality by sex can be explained by smoking and accidents.

I was very much interested in Dr. Miller's basic, monumental paper "The Life Expectancy of Nonsmoking Men and Women," and in the explanations which he has given at this session. Upon further consideration, I am constrained to say that I believe that his methodology in deriving life expectancies for female and male nonsmokers involves several fundamental weaknesses and errors which make it impossible to determine the validity of the results.

First, let me describe Dr. Miller's methodology in deriving age-sex-specific mortality rates exclusive of deaths due to accidents, homicides, and suicides for nonsmokers aged 30 and over in Erie County in 1972-74 (which are later used, in the final analysis, to derive expectations of life). For any particular quinquennial age group by sex, the denominator is the product of (a) the estimated total population in the county in the central year, 1973 (as estimated by the Pennsylvania Department of Health), multiplied by (b) the estimated proportion of nonsmokers for that age-sex cell (as derived by

DIFFERENCE IN LIFE EXPECTATION
AT BIRTH: WOMEN-MEN

YEARS
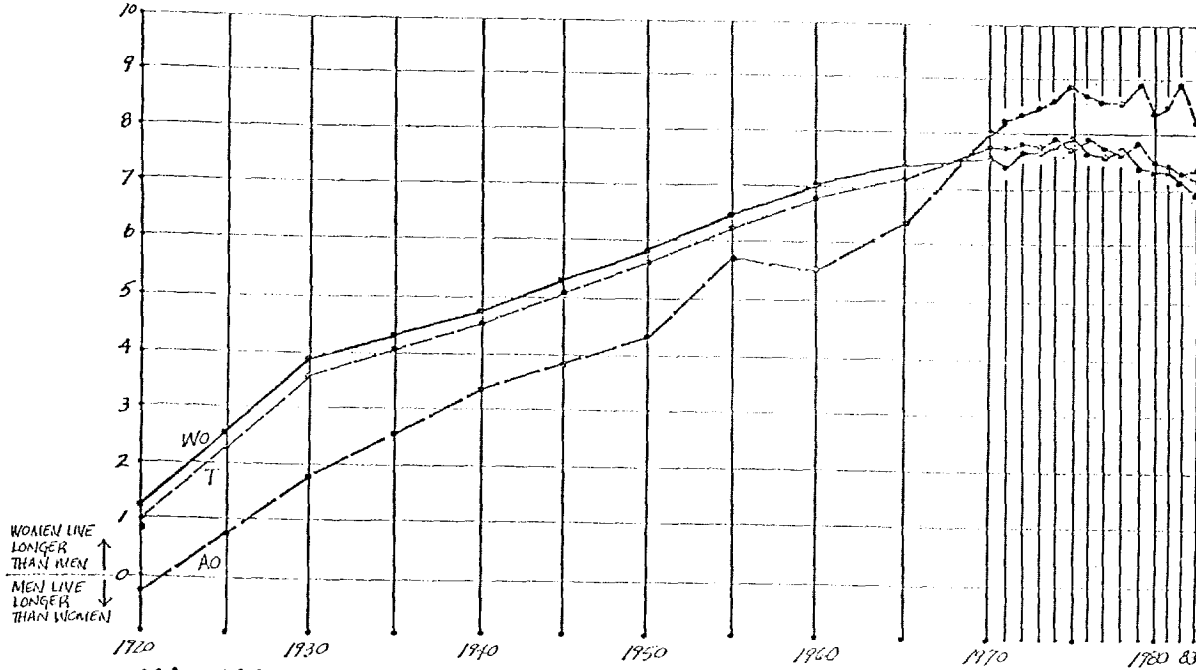
WO-WHITE ONLY GROUP
T -TOTAL GROUP
AO- ALL OTHERS GROUP

NOTE ALSO THAT LUNG CANCER RATES (MORTALITY)
FOR BLACK MEN (MOST OF THE OTHER" GROUP)
HAVE GONE UP MORE RAPIDLY THAN FOR WHITE
MALES.

PANEL DISCUSSION

FIGURE 3

Dr. Miller from a telephone survey of residents of the county made in 1979 for a 2 percent random sample of persons listed in the telephone directories for 1972-74), multiplied by (c) 3 (so as to recognize that deaths for 3 years are considered). Similarly, the numerator for the age-sex cell is the number of nonsmoker deaths which are identified in the processing by Dr. Miller of all newspaper death notices in the period under consideration by telephone inquiry to the listed survivors of the decedent.

One basic problem with data involving telephone reports of smoking activity is the matter of reliability of the information furnished, especially when it relates to a period some years previously, and further, when it is for a deceased person, rather than the informant. Also, a bias toward having a greater proportion of nonsmokers may well arise because of the strong belief held by many persons that smoking is immoral, so that they will not report accurately on smoking habits (especially with respect to a deceased relative).

Another problem is that the data on the smoking characteristics of both the living population and the deaths were based on telephone inquiries, and about 15 percent of the population do not have telephones or listed numbers. Considerable question arises as to whether the smoking characteristics and the mortality experience of the nontelephone group is the same as that of the telephone category. One should never forget the far-famed experience of the now long-defunct magazine Literary Digest and its disastrous attempt to forecast the 1936 presidential elections by a poll of persons with telephones.

A further problem is that it is arbitrarily assumed that the expectation of life at age 85 is the same for men and women--a rounded 5.0 years--an assumption in advance of what was to be proved in the end for younger ages. Incidentally, the crude mortality rates derived for men and women aged 85 and over, which were not used in deriving the expectations of life at the younger ages, seem unduly low, especially for men (namely 0.074 for men and 0.104 for women); under a stationary-population concept, they imply life expectancies at age 85 of about 13.5 years for men and 9.6 years for women--impossibly high! These nonused deaths at ages 85 and over (544) were 25 percent of the total deaths of nonsmokers aged 30 and over (2,195).

A major problem arises in connection with the determination of the numbers of nonsmoker deaths which are used in the numerator of the mortality rates. Presumably, complete coverage of all deaths in the county for the time period was obtained from the death notices. However, several elements resulted in incomplete classification by smoking status. First, for about 15 percent of the deaths, no telephone number of the survivors could be located, in order to inquire about the smoking status of the decedent. Second, for about 10 percent of the remaining cases, no telephone contact could be made. Third, for those contacted, about 5 percent of the cases did not supply the information requested. Thus, in only about 73 percent of the cases was sufficient information obtained. The Miller-Gerstein paper states that "usable interviews were obtained for 63 percent of the decedents aged 30 and older." The difference of 10 percentage points includes

eliminated deaths due to accident, homicide, and suicide--and may possibly include some other cases.

Therefore, at least 27 percent of all deaths in the age and cause-of-death category being considered were not included. The character-istics of such a large portion of the total may well have been quite different from those of persons who were included. Equally important, in developing the age-sex-specific mortality factors, no adjustment factor was introduced to allow for the "no-data" cases; using only a 27 percent proportion of such cases would result in an adjustment factor of 1.37 to be applied to the identified number of nonsmoker deaths. In turn, the use of properly adjusted deaths would result in higher age-specific mortality rates, and then in lower expectations of life. There is, of course, the unanswerable question of whether such an adjustment factor should be uniform across all age-sex cells. If not, the relative expectations of life by sex might be quite different from those shown in the paper.

As a minor matter, several arithmetical errors occur in the abridged life table presented in the Miller-Gerstein paper. The age-specific 1-year mortality rates are adjusted to 5-year mortality rates (used to obtain 5-year survival rates) by multiplying them by the so-called "Chiang constants" (Reference source: Chiang, C.L.: Introduction to Stochastic Processes in Biostatistics. John Wiley & Sons, Inc., New York, 1968), which are stated to be approximately 0.5. However, the results shown for the product indicate that these constants should be of the order of 5.0--as one would expect. For example, the 1-year age-specific death rate for men aged 45-49 is shown as 0.00198, and the Chiang constant is shown as 0.54. The derived 5-year age-specific mortality rate is shown, quite reasonably, as 0.00986, whereas the product of 0.00198 and 0.54 is 0.001069. Obviously, the values for the Chiang constants should be 10 times the values stated, yielding a 5-year mortality rate of 0.01069 in this case. Even so, it is not clear why there would still be a discrepancy between the 5-year rate shown and the adjusted product--namely, 0.00986 versus 0.01069.

The foregoing analysis indicates many weaknesses and flaws in the methodology used by Dr. Miller, largely due to inadequate and hetero-geneous data, with appropriate adjustment not being possible. This is another instance of the impossibility of using "graveyard" data for adequate mortality research, instead of the usual actuarial procedure of tracing lives from the starting date of the investigation until death or the end of the period, if later. So I conclude that the Miller-Gerstein study fails in its attempt to prove that smoking is the sole cause of female/male mortality differentials (after accident, homicide, and suicide deaths are excluded).

MR. COWELL: Let me add my comments to Mr. Myers's because I too tend to be skeptical of Dr. Miller's conclusions. I feel somewhat biased in favor of actuarial methodology. I also have some bias in favor of the quality of the data that we have. We have examined groups of insured lives with the only distinction between the male smokers and the male nonsmokers being their smoking habits. Furthermore, when we look at the differential between male nonsmokers and female nonsmokers, there

is only one difference, and that is their sex. Their smoking characteristics are the same. When you examine these two groups, you find that there is still a mortality differential.

An examination of our recent experience of smokers and nonsmokers will illustrate this. All comparisons are based on the 1965-70 Basic Table. The mortality ratio for male nonsmokers was about 50 percent of the Basic Table, for the ex-smokers about 55 percent of the Basic Table, and for the smokers about 100 percent of the table. For the females, the ratios were 30 percent for nonsmokers, 35 percent for ex-smokers, and about 40 percent for the smokers. If you take the nonsmokers and the ex-smokers, you see female and male ratios very closely in line with the ones that Mr. Myers has. In other words the female/male percentages here are about 50 percent for nonsmokers and about 40 percent for smokers.

What this suggests to me is that the closer males and females are in terms of their lifestyles and habits, then the sharper and more distinct are the basic genetic differences affecting their mortality. From an insurance pricing standpoint, I am firmly convinced that smoking accounts at most for one-half of the difference. That is, if we're talking about a life expectancy difference of perhaps eight years between males and females, then no more than 3 to 4 years is attributable to smoking.

I have difficulty agreeing with Dr. Miller's prediction that eventually those two mortality curves are going to come together. As you all know, for every 100 baby girls born, there are approximately 105 baby boys born. This has been true across all societies for centuries. I can only conclude that it is nature's way of compensating for a genetic inferiority on the part of the males. That seems to be incontrovertible.

I am not saying that there are not other lifestyle differences that have some impact. Eighty percent of adult female nonsmokers have never smoked, as against only 56 percent of male nonsmokers. Also, female ex-smokers have consumed far fewer cigarettes on the average than their male counterparts. Thus, the longevity difference between females who have never smoked and those who have quit would be less than the 30 percent differential between males in these two categories. Whatever that difference is, it still leaves a longevity gap among lifetime nonsmokers between males and females that is statistically significant at any reasonable level. Like the gap between smokers and nonsmokers, the male/female mortality difference is too large to be ignored for underwriting and pricing purposes.

Thus, while I concur in Dr. Miller's view that we need finer distinctions in classifying people by smoking status, I totally disagree with the conclusions that he and Dr. Gerstein reached. They cited smoking as the "overwhelming" cause for the difference in longevity between males and females. Our data suggest that smoking accounts for at most one-half of that difference.

Further, I am concerned that Dr. Miller's work has been misused by a militant faction of the women's movement to support a position that life

insurers not be permitted to classify by sex. I recognize that Dr. Miller never intended this result, but this is how the findings have been manipulated. If we had not been allowed to distinguish risks by sex, we certainly could not have priced differences by smoking status with enough confidence to pass mortality savings along to our non-smoker policyholders to the extent we have done. One of the items for which the Tobacco Institute attacked us (incorrectly so because their premise was wrong) was not distinguishing between males and females.

Significant differences exist in mortality patterns between smokers and nonsmokers just as between males and females. In the case of the male/female difference, a combination of genetic, environmental, and lifestyle factors--including, importantly, but not exclusively, smoking --appears responsible. To ignore these differences by combining male and female data, when we know that mortality patterns by sex are distinct, will cloud the very issues that Dr. Miller is urging us to clarify.

We acknowledge the strong theoretical argument that Dr. Miller has made to establish more classifications by smoking status. However, mortality differences within the category of smokers far exceed those between ex-smokers and lifetime nonsmokers. Further, this latter difference among males is less than two-thirds the mortality difference between male and female nonsmokers.

In summary, I would like to suggest that the efforts that we have undertaken to study mortality differences by smoking status and by sex continue and that we not cloud this issue by pretending that one set of differences or the other will vanish.

DR. MILLER: Mr. Myers has criticized my study's use of telephone interviews. However, as I have noted previously, studies have shown that telephone interviews yield more accurate results than do written questionnaires. The source of data for the United States Life Tables that Mr. Myers introduced is the U.S. census, which relies mainly on written questionnaires. The U.S. census uses written questionnaires only because the cost of more extensive interviewing is prohibitive.

I share Mr. Myers's concern about getting truthful answers to questions about smoking habits. I have found, for example, that people will often mislabel former smokers as nonsmokers. This is true even if the interviewer asks whether the person is a smoker, nonsmoker, or former smoker. To determine the appropriate classification, the interviewer must ask the question, "Did the person ever smoke at any time during his or her life?" I have trained my interviewers to take great care in determining smoking habits. I believe the smoking classifications used in the Miller-Gerstein study are the most accurate of any mortality study published to date.

In insurance studies, information on smoking habits comes from the applicant and from his agent. The applicant who smokes has a financial incentive to lie. The agent's motivation is to make sales. In the case of brokered business, the insurer must rely on someone else's agents.

SMOKING AND SEX MORTALITY DIFFERENTIALS

Lying about smoking habits must be a bigger problem in insurance studies than it is in my study.

Mr. Myers has referred to the Literary Digest fiasco of 1936. In 1936 the country was in the midst of the Great Depression. Having a telephone was highly correlated with income. Since voting patterns of the rich differ from those of other votes, telephone sampling of political preferences proved misleading. The situation is far different for current telephone surveys about smoking habits. Over 85 percent of the households in Erie County have telephones. There is no evidence that people with telephones are in any way atypical or inclined to lie about smoking habits.

With regard to the Chiang constants, I would point out that one can derive the expectations of life shown in the table directly from the raw death and exposure information by Greville's method. This method is explained on pages 131-33 of Introduction to Demography by Mortimer Spiegelman. Our study used Greville's method adjusted by the Chiang constants, a technique used by the Pennsylvania Department of Health in constructing its life tables to provide slightly more accurate life expectancy estimates.

Another one of Mr. Myers's points is concerned with the expectation of life at age 85 and above. After making some estimates based on his hypothesis, he concludes that there would be life expectancies of 13.5 years for men and 9.5 years for women which he notes is impossibly high. However, there is a footnote for our life table which specifically deals with the 85 and above age category and states that the five-year estimate is based on the data from the National Center for Health Statistics for this age category. We used these estimates which were close to ours to provide the best estimates for this age grouping.

Mr. Myers criticizes my study because of nonrespondents. All studies of this type have nonrespondents. My study assumes that nonrespondents resemble respondents in their smoking habits. No other assumption seems plausible. In a recent analysis, I determined that nonrespondents and respondents have nearly identical age distributions for both men and women. As our study proceeded and we succeeded in getting information on some difficult-to-reach people, the percentage of nonrespondents declined. However, our results did not change because the new respondents resembled our original respondents. Thus, our findings show that Mr. Myers's concerns about the unreliability of data due to nonrespondents is unfounded.

It is important to remember that the Miller-Gerstein study attempts to gather information about all the deaths in the population of Erie County. Usually, studies use a "random" sample of deaths and attempt to show that the sample is representative. One has fewer worries about representativeness when one studies the entire group of deaths. I am in the process of extending the Miller-Gerstein study to include ten years of exposure rather than three. If the results of this extension confirm the original result, it will be difficult to imagine that the nonrespondents are seriously distorting the results.

In a comparison of my data with the data in an insurance study, the following points are in order:

1.   Most insurance companies' "smoker" classifications contain a sub-
     stantial number of nonsmokers. State Mutual began its classifi-
     cations in 1964 but only on certain policies. Most companies did
     not distinguish smoking habits until the late 1970s. Usually, when
     the classification is introduced, nonsmoker discounts are not
     available on all policies. Insureds with full-premium policies are
     identified as "smokers," although they may never have smoked.

2.   The smoker classification depends only on the smoking status at
     issue. "Smokers" are not reclassified if they give up smoking. In
     the 1979 State Mutual study, Mr. Cowell estimated that as many as
     25 percent of his company's "smokers" had quit and therefore
     would be classified as nonsmokers if they purchased another
     policy.

3.   The smoker classification is not subdivided to reflect the number
     of smoking years or the average number of cigarettes smoked per
     day. Those who have smoked for only a few years are lumped
     together with lifetime smokers. The effect of smoking on females
     is greatly understated because so many females are late-starting
     smokers who do not have the same total inhalation of smoke as male
     smokers do.

4.   There is no former smoker classification. Those who have quit for
     one year at issue are classified as nonsmokers, although they may
     have smoked for many years and may take up smoking again after
     issue without penalty. The male "nonsmoker" category is domi-
     nated by former smokers. This puts male "nonsmokers" at a
     disadvantage relative to female "nonsmokers," a disadvantage which
     stems not from the difference in sex but from differences in
     smoking histories.

In view of these points, I believe Mr. Myers's criticism of "hetero-
geneous" data applies more to insurance studies than to the Miller-
Gerstein study.

All four of the deficiencies noted would cause insurance studies to
reduce male-female longevity differences. Insurance actuaries using
such poorly defined classifications should be aware of the severe limi-
tations of their studies.

Insurers use four categories--male, female, smoker, and nonsmoker.
These categories do not, however, divide the business neatly into four
equal parts. The female part accounts for less than a quarter of the
in-force business--female smokers for less than 5 percent. Faced with
such unequal divisions, insurance actuaries have a difficult time gather-
ing sufficient data on females. For example, Mr. Cowell's Table 2
shows fairly consistent male smoker/nonsmoker ratios but highly signif-
icant variability for the women. The 1-5 year category for insured
women shows a higher mortality ratio for women nonsmokers than for
women smokers. Shouldn't results such as this cause one to be

skeptical of the female data? Thus insurance studies' reports of female mortality cannot be considered reliable and certainly should not be used as the basis for "total disagreement" with the results of the Miller-Gerstein Study.

Because of the small amounts of data on females, insurance company actuaries have been forced to rely on intercompany studies. Intercompany studies work rather well for mortality studies by age and sex only, but not for studies subdivided by smoking habits. The problem is that classification practices differ from company to company. For example, five companies contributed to the Society's Report of the Task Force on Smoker/Nonsmoker Mortality of 1983. Three of the companies' smoker classifications included a "substantial number" of insureds who do not smoke. One company classified insureds as "smokers" if they failed to receive the nonsmoker discount because of "age, plan, amount, or build." Actuaries would not tolerate such classifications in mortality studies by age and sex. Nevertheless, the task force used these data in compiling the 1980 CSO Smoker and Nonsmoker Tables.

I have great respect for actuaries' abilities to analyze mortality. However, I believe the data available to actuaries have been so poorly classified by smoking status that the results of insurance studies have generally understated the effect of smoking and overstated the effect of sex on mortality. Progress in analyzing the effect of smoking on mortality will not be possible until insurers begin to use more homogeneous classification, namely, lifetime nonsmokers, lifetime smokers, and former smokers subdivided by 10 year intervals of smoking years. When they do, I believe they will find that smoking has an equally devastating effect on the health of both men and women.

I would also like to comment on the point Mr. Cowell made about the misuse of my study by some women's groups. The fact that women are now smoking as much as men has misled some into thinking that both men and women now live to the same age. Certainly the militant women's groups did not use similar arguments in winning their court case as Mr. Cowell mentioned. However, there remains a 7-8 year difference in life expectancies at present. My study suggests this gap will diminish and perhaps disappear in the next 40-50 years, but there is no doubt that it exists today. Thus, unisex rates for those retiring in the next few years will reduce the basic retirement annuity for men while increasing the annuity for the women for such retirement plans as the Teachers Insurance Annuity Association.

I'll now show you results from a number of studies that provide evidence that if women smoke as much as men, they die as early as men.

First let us consider the well-known British Physicians Study, the first of the major studies on smoking and health (Figure 4). This table was reported in the 1983 Surgeon General's Report dealing with cardiovascular disease (CVD). Comparison of the male and female smokers in both the 15-24 and 25 plus cigarettes smoked categories shows that the women physicians have a slightly higher mortality ratio for CVD than the male physicians.

PANEL DISCUSSION

FIGURE 4

SURGEON GENERAL'S REPORT ON CVD--1983

Study	Cigarettes Per Day	Mortality Ratios	
		Males	Females
British Physicians Study	Nonsmoker	1.00	1.00
	1-14	1.47	0.96
	15-24	1.58	2.20
	25+	1.92	2.12

When one compares the data on the studies of lung cancer in the 1982
Surgeon General's Report (Figure 5), the same trend is noted for the
moderate and heavy smokers. One can observe from the 25 plus ciga-
rette category in the British Physicians Study and the 8-15 cigarette
category in the Swedish Study that the incidence of lung cancer is
slightly higher for women. The Japanese Study shows the very close
mortality ratios for men and women in the 20-39 cigarette smoking
category.

FIGURE 5

SURGEON GENERAL'S REPORT ON LUNG DISEASE--1982

Population	Cigarettes Per Day	Mortality Ratios	
		Males	Females
British Physicians Study			
	Nonsmoker	1.00	1.00
	1-14	7.80	1.28
	15-24	12.70	6.41
	25+	25.10	29.71
Swedish Study			
	Nonsmoker	1.00	1.00
	1- 7	2.30	1.80
	8-15	8.80	11.30
	16+	13.70	
Japanese Study--All Ages			
	Nonsmoker	1.00	1.00
	1-19	3.49	1.90
	20-39	5.69	4.20
	40+	6.45	

We have an example from an early report by Hammond, et al., in the
1969 Surgeon General's Supplement (Figure 6) which shows the same
pattern for women who smoke as much as men and inhale as deeply
when the data on cardiovascular diseases are considered. Hammond's
data show that women are as susceptible as men to the deadly impact of
smoking.

FIGURE 6

SURGEON GENERAL'S REPORT ON CVD--1983

TABLE 10--CORONARY HEART DISEASE MORTALITY RATIOS BY
INHALATION CHARACTERISTIC, PROSPECTIVE STUDIES

Study	Sex	Age	Nonsmoker	Inhalation Characteristic		
				Deep	Light	None
Swedish	Male		1.00	1.8	1.6	1.2
	Female		1.00	1.6	1.2	1.7*
				Yes	No	
British	Male	< 65	1.00	2.2	1.4	
Physicians		> 65	1.00	1.5	1.3	
				None-Slight	Moderate-Deep	
ACS	Male	45-54	1.00	2.67	3.17	
25-State		55-64	1.00	1.83	2.01	
		65-74	1.00	1.31	1.63	
		75-84	1.00	1.29	1.20	
	Female	45-54	1.00	1.82	2.15	
		55-64	1.00	1.61	1.89	
		65-74	1.00	1.30	1.78	
		75-84	1.00	1.13	**	

* Number of deaths too small for statistical reliability
** Number of deaths too small to compute

Consider lung diseases and, in particular, emphysema (Figure 7). We return to the most recent Surgeon General's Report on lung diseases (1984). The British Physicians Study shows again at the higher levels of smoking, women have slightly higher mortality ratios than men.

The Japanese Study gives even more conclusive evidence since one notes that women have higher mortality ratios at all levels of smoking (Figure 7). Since this study is the only study in which accurate accounting of the amount of smoking was taken into consideration, it provides the most solid evidence that women who smoke do not have any longevity advantage. In fact, the data support the hypothesis that when women smoke as much as men, they die as early or earlier than men.

Therefore I conclude by noting that I have shown you evidence from a number of studies that if men and women do not smoke, starting at age 30 and eliminating traumatic deaths, they have the same life expectancy. There is also much data showing that if women do smoke as much as men, they die as early as men. These data reinforce the conclusion that smoking is the major reason for the present male-female longevity difference. Since smoking is detrimental to the health of women and women are beginning to smoke like men in the younger age groups, then my original prediction will be correct: In the next forty to fifty years the present male/female longevity difference will be reduced to zero.

PANEL DISCUSSION

FIGURE 7

SURGEON GENERAL'S REPORT ON LUNG DISEASES--1984

Study	Cigarettes Per Day	Mortality Ratios Males	Females
British Physicians			
Chronic bronchitis emphysema, or both			
	Nonsmoker	1.00	1.00
	1-14	17.00	10.50
	15-24	26.00	28.50
	25+	38.00	32.00
Japanese			
Emphysema			
	Nonsmoker	1.00	1.00
	100,000	0.51	2.28
	200,000	2.57	3.14
	300,000	1.93	10.93

MR. CHITTENDEN: I want to reply to a couple of points that Mr. Myers and Mr. Cowell made about infant mortality and neonatal and prenatal mortality as evidence that not all the male/female longevity differences are attributable to smoking. Dr. Miller's work, of course, has only dealt with adult ages--30 and over. Nonetheless, it may be true that the higher male mortality rates at very young ages show that there is a genetic source of risk to the male that isn't present to the female. But, that doesn't show that the risk persists into adulthood. Even if it does persist into adulthood, we don't know a priori how large it is compared to risks associated with lifestyle difference. To measure whether there is any genetic female advantage in adulthood, one has to do an experiment. Drs. Miller and Gerstein have done such an experiment in Erie County, Pennsylvania, and the male/female difference apparently doesn't exist there among lifetime nonsmokers. We have to discover an explanation. If the genetic female mortality advantage is as potent as we think, why didn't it surface in Erie County?

MR. ANTONIO D. VILA: Dr. Miller's last set of figures seemed to indicate that the mortality ratio for women compared to that for men got worse as women smoked instead of being the same. That could be explained by saying that smoking has equal effects on men and women but that women start from a lower base. It's like adding a constant force of mortality to both. If women start out with lower mortality, they should show a larger percentage increase. I've seen certain studies on cause of death that show that the causes of death sometimes seen in smokers are very interesting. Smokers die more often from things like homicide than do nonsmokers. It's hard to believe that smoking causes you to get murdered. Presumably, there's a cross

correlation with drinking habits and perhaps with socio-economic status. I wonder if anyone has ever done any multivariable studies with smoking and drinking habits.

DR. MILLER: In my stop smoking clinics, I have tried to get alcoholics to quit. They tell me that they can't quit smoking because getting rid of one vice is more than enough, and they do not want to enroll in a stop smoking clinic while they are learning to stop drinking. From my experience it appears almost every alcoholic smokes. A women in my clinic who quit smoking for six months had to attend Alcoholics Anonymous meetings with her husband. She resumed smoking because most of the former alcoholics at the meetings were smoking.

MR. JOHN M. BRAGG: I would like to comment about the male/female differences resulting from smoking and also about a new study that is underway. In 1981, our firm created elaborate mortality tables for smokers and nonsmokers. They are select and ultimate in the four-way divisions male/female, smoking/nonsmoking. They were based on as much data as we could assemble, including data that were largely unpublished at that time. I would like to use some of the ultimate tables in the report to discuss this controversial topic.

First of all, the male smokers are far worse than the female smokers at all ages. In the two nonsmoker groups, the nonsmoker males are always higher than the nonsmoker females. However, in the middle age range among nonsmokers, mortality rates come pretty close together. The following age 50 mortality rates per 1,000 illustrate this:

	Males	Females
Smokers	6.26	4.65
Nonsmokers	3.48	3.11

At the young ages and the higher ages, the nonsmoker mortality rates differ greatly for males and females. At age 65, the nonsmoker mortality rates are 14.40 for males and 6.98 for females. By the time they reach age 65 even though neither smokes, the mortality rates have spread apart. At about age 30, the mortality rate is 0.99 for non-smoking males and 0.37 for nonsmoking females.

How do I interpret all of this? I am a believer in the basic genetic difference. I have to believe that when I see that the smokers are so much different.

We are undertaking a large new study called the 1986 Nonsmoking/ Smoking Basic. We will be producing new death rates and studying the effect of misrepresentation due to smokers claiming to be nonsmokers. We expect a substantial body of new data to be included. I am interested in making sure everybody knows about this project so that anyone who is interested in participating should contact me. We sent out a questionnaire to large ordinary companies to find out whether there was a need for this study, and we received returns representing over one-half of the ordinary business in force in Canada and the

United States. It was just stunning. There is a tremendous demand for new work in this whole area.

MR. CHITTENDEN: I want to comment about Mr. Bragg's and Mr. Cowell's comments concerning the fact that if you compare male smokers to female smokers, the men do worse than the women. That is undeniably true, but you still can ask whether it is due to sex or due to smoking. That may sound paradoxical but in this country, and in fact in all developed countries, there has been until recently a taboo against women smoking. It has been stronger in some other countries than in this one, but even here women didn't generally take up smoking until fairly recently. So when you compare smokers, you will find that, in the same age group, men smokers have far more years of smoking in their backgrounds than women do. The higher mortality rates among male smokers may be due to a genetic defect or due to the fact that they smoke more cigarettes. We have to do more research and compare the mortality of men and women with like smoking habits. Because of the difficulty in obtaining data for a large number of women who have long years of smoking in their histories, it may take some time before there are sufficient data on the females.

DR. MILLER: I went overseas this summer and met many of those who are studying smoking. I told them I would like some information on what percentage of women smoked before World Ware II and even before World War I, or as far back as possible. I received some information from England and Germany. Basically there were no data before World War II. It appears that practically everywhere in developed countries there was a taboo against women smoking. I have computed that total smoking years for women are about 30 percent of those for men. This is one of the reasons I predict that in about 40-50 years after the smoking years become very similar, women who smoke will die at the same rate as men. These vast differences in total smoking years between men and women combined with the evidence that men and women in the younger age groups are presently smoking at the same level is my justification in making that prediction.

MR. ERNEST J. MOORHEAD: I wish to discuss the paper by Mr. Myers and Mr. Bayo. I was brought up under the influence of a paper in the old Transactions by Mr. Bowerman entitled "Centenarians" which was devoted almost entirely to debunking the idea that people who said they were 100 years old were 100 years old. I have noticed in recent years there has been a new menace to the cause of truth. A broadcaster on the morning NBC program departs from the subject we want him to discuss in order to introduce somebody who is 100 years old, thereby encouraging people to distort the truth. I would like to have a comment from either of the authors of the paper on the extent to which the statistics at the upper ages can be relied upon more than during Bowerman's time, if indeed they agree with Mr. Bowerman's remarks.

MR. FRANCISCO R. BAYO: With respect to the official tables, the data at the end of the table were not the actual data obtained through the general vital statistics and census records. The data were obtained from the Social Security Administration (SSA) and follow the Medicare

data, although toward the very end of the table even Social Security data are not to be trusted. We have decided to incorporate what we consider a more appropriate way of ending the table by assuming that mortality increases with age after 102-103. The truth is, as Mr. Moorhead said, we haven't seen much data at the very older ages that are completely reliable. We are still searching for more data. I authored a paper a few years ago analyzing data on age 100, and I'm continuing to collect data. As soon as I have enough data, I will convey to the membership my interpretation of its quality and its reliability.

I have a question for Dr. Miller. In the Japanese study shown in Figure 7, the mortality ratio for men who were in the 300,000 cigarettes category was lower than the ratio for men in the 200,000 category. One must question the reliability of data that show that the mortality ratio decreases with increasing consumption of cigarettes (2.57 versus 1.93).

Does this indicate that the ratio decreases with increasing consumption of cigarettes? Or are the data so scanty that comparisons are not totally reliable? This would also indicate that the comparison in that study between the male smokers and the female smokers is unreliable.

DR. MILLER: It appears as if there is an inconsistency in the data on smoking men in the Hirayama study. The Hirayama report on emphysema is the only report in the six different study comparisons that had this inconsistent data. A likely possibility is that it is a typographical error.

With regard to the comparison between the Japanese men and women, even now only 10 percent of Japanese women smoke, which means that the study probably had very few women smoking over 300,000 cigarettes. About 10-15 years ago, I read the Surgeon General's report and noticed then that if men and women smoke at very high levels, they have about the same mortality ratio. It was Hammond data, so it's been known a long time. When Hammond and Garfinkel looked at my data, they told me that they had data showing similar results.

MR. MYERS: I would like to add something to the answer that Mr. Bayo gave on centenarians. There is one other element that helped the SSA to close off the life tables by having good external data as to the mortality rates at the upper ages. It so happens that people who received Social Security benefits in the first month that monthly benefits were payable, January, 1940, not only had to prove that they were at least 65 years old but, because of a very technical feature in law, they also had to prove that they were not older than 67. The SSA was very strict in seeing that they were in that narrow age range. This group of so-called Charter Beneficiaries was followed until the last one died in 1981. From that study of 31,557 people, reasonably reliable mortality rates were obtained in the upper 90s and early centenary ages.

In the years to come, the SSA will probably have very reliable data because people provide their birth dates when they apply for Social

Security numbers. It should prove a valuable source of information about mortality at these oldest ages, whereas a census, along with death reports, tends to have exaggerated ages for people who have gotten along that far. Interestingly, the last beneficiary who died was a man, and not a woman, at age 108 or 109. Of course, there were more men to start with, but if one were to draw only on that one fact, it could be said, "See, men outlive women. Therefore, unisex tables are absolutely right."

MR. W. RANDALL PALMER: I have a question for Dr. Miller about the data used in the Erie County, Pennsylvania, study. Am I correct in believing that is a predominately Amish area?

DR. MILLER: No. You are confused with another study of mine on the Amish which was done in Lancaster County.

I did a genetic study of the Amish, and I found that the men lived as long as the women. That is a purely nonsmoking population. It's true some of them do smoke cigars, but the women don't let them smoke in the house. There is no passive smoking to contend with.

It's the same way in Slieve Lochner, Ireland. A study of that community found out that the Irish who lived there were a nonsmoking, nondrinking population, and the men and women lived to be about the same age. In fact, there was a median age difference of 2.5 years in favor of the men. When they were compared with their Irish relatives in the U.S.; the same eight-year difference in favor of the women was noticed. As we get more research, we will find out that these data are correct.

However, regardless of whether smoking reduces life expectancy by 3-4 years or 7-8 years, the important point to remember is the deadly impact of cigarette smoking. We need to work to reduce the plague of cigarette smoking and try to control it as soon as we can.

MR. RALPH E. EDWARDS: I am a little surprised that we appear to be saying that if you don't smoke the mortality rate is similar, but if women smoke there is a genetic difference. On the one hand, we say there is no genetic difference, and then we say that there is one. It seems to me that the data prove it. I might comment, incidentally, that this morning we had a showing of the new Associates and new Fellows. None of the new Associates was sitting in the smoking section, and only 5 percent of the new Fellows were. I would guess here where there is a more representative and older group, that about 10 percent are in the smoking section which would lead me to conclude that the longer you stay in this profession the more apt you are to smoke.

MR. COWELL: There has been a substantial decline in smoking by cohorts from 1900 to 1970. The cohorts born in 1900 peaked at about 45 percent smoking whereas the cohorts born in 1920, essentially the men who went to war in 1940, peaked at over 70 percent. The military provided soldiers free cigarettes, encouraging smoking. The cohort

born in 1960 has reached only 40 percent. The new Associates would probably be the ones in the cohort born in the early 1960s.

Population data show that smoking has definitely become a socio-economic habit. It is virtually nonexistent in the highest socio-economic occupation levels represented by the group here. It is still very high among those who can least afford the health costs--the poor.

DR. MILLER: Another possible interpretation of Mr. Edward's observation is that the younger generation of actuaries believe the reports on the significant detrimental health effects of smoking and therefore don't smoke. The smoking rate of 10 percent for an occupation is undoubtedly the lowest smoking rate compared with all the professions.

MR. PRICE GAINES*: Some six or seven years ago I talked with Mr. Cowell about the differentiation in the effects on mortality among cigars, pipes, and cigarettes. This afternoon, we have talked almost exclusively on nonsmoking. I believe we really have been talking about noncigarette smoking. When is this industry going to get smart enough to continue to refer to the problem, and I believe it is a problem, as noncigarette smoking?

MR. COWELL: Let me give an industry response to that because you are right. When we talk about nonsmoking, we really mean noncigarette smoking. It's just too much of a mouthful to say noncigarette smoking, and that is really a problem from two standpoints. First, the percentage of the population that smokes only cigars and only pipes is minuscule. Second, the additional mortality from people who smoke pipes and nothing else is about 10 percent above that of nonsmokers, and most of that extra 10 percent mortality is cancer of the lip and larynx. It's not a nice death, but it's very limited in numbers, and again, 10 percent extra mortality is well within most companies' standard underwriting. There is a great homogeneity of the product in terms of pipe tobacco and pipe usage which is almost always non-inhalation.

Cigar smoking is a little different. There is quite a variation in cigar usage and, of course, the greatest variation in cigarette smoking. People who smoke cigars only are a very small percentage of the smokers and a minuscule percentage of the entire population. Their extra mortality is about 25 percent; again, still within the borderline of standard mortality. You are right. We are using an abbreviation when we should say noncigarette smoking.

MR. GAINES: Essentially the same lecture you gave to me six years ago. I'm one of the minuscule percentage. I don't know whether the combination of being both a pipe and a cigar smoker doubles the risk or not. In our statistical publications, we have used a variety of NCS designations for 8-9 years. They're very useful for distinguishing the differences.

* Mr. Gaines, not a member of the Society, is employed by National Underwriter Company, Cincinnati, Ohio

PANEL DISCUSSION

DR. MILLER: I have done some work with cigar and pipe smokers. One of the problems is that you are dealing with an older population, unlike cigarette smokers. If you attempt to develop a life table, you run into problems. However, there are not that many cigar and pipe smokers now. Many are former cigarette smokers who inhale. In my research, I did find that heavy pipe or cigar smoking did curtail mortality. People who did not inhale smoked only about 1-2 cigars a day because most cigar smokers chew them and therefore don't have much damage that way.

MR. RICHARD G. FIELDING: I question the appropriateness of comparing male and female mortality based simply on the number of cigarettes smoked. It seems to me that since females are normally much slighter of build than males, the females who smoke like males would be putting a higher percentage of these poisonous materials into their systems by body size than the males. Did Dr. Miller consider this as a possible explanation?

DR. MILLER: Indeed, I did, in my 1976 report. That is what I teach in my clinics. Body size does make a difference. Originally, I found a difference of 4 years between smoking men and smoking women. Even though that probably will be true eventually, I don't say that because it's even more controversial than trying to say that there is no difference.

MR. HARRY A. WOODMAN: Mr. Cowell, do you have any cause of death data for nonsmokers and males and females, and if so, does it throw any light on the difference in mortality?

MR. COWELL: We have very good data by cause of death on males. This is covered in our 1979 paper. We don't yet have enough deaths among females to make comparisons on other than a total basis. We have cause of death, but the numbers are too small. Table 9 of our 1979 paper (page 200 of TSA Volume 32, 1980) does show our experience by cause of death. I will be updating this in the form of an actuarial note to show the male data by cause of death, but I think we will have to wait a little longer, maybe another 5 years, before we have statistically credible data for females by cause.

MR. ARNOLD A. DICKE: This whole debate, not just today but over the years, is a little frustrating. We have two kinds of problems. On the one hand, we're concerned about the pragmatic problem of pricing, and probably from that point of view, Mr. Cowell's work is fairly definitive. On the other hand, the underlying question, which is, depending on how you look at it, either a scientific or an ideological question, is very important to us as an industry because our right to continue underwriting on a male/female basis will depend on there being a reasonably accepted theory that says that males and females are different in ways other than their smoking patterns. We have to focus on the idea that the issue is whether, apart from smoking and lifestyle differences, males and females are different. This is the issue that we have to settle. is there any way we can design a study that would have sufficient exposure and really come to grips with this issue?

SMOKING AND SEX MORTALITY DIFFERENTIALS

MR. COWELL: As I observed earlier, there is no one who would like more than I to be able to get that data, but there are limitations. There are practical limitations in that there is only so much you can spend on underwriting and selection. Unless you can demonstrate that the additional amount you will be spending will generate mortality differences that you can justify, it's going to be difficult to go to our companies and say we want a study. From the standpoint of the person being underwritten, there is a certain tolerance level of how many questions you can ask applicants when underwriting the risk. We made an enormous step over 20 years ago when we added the smoking criterion.

A few companies have gone further and asked for more detail by number of cigarettes smoked. There are even 1-2 companies now that subclassify their nonsmokers into average nonsmokers and super-healthy nonsmokers, but all of this gets tied up with the type of marketing you're doing and to what extent you can successfully differentiate. From a purely scientific standpoint, you'd like to perform a lab type experiment. You would get as many distinctions as you could, and ultimately you would have one person in every cell. You have to blend that with the practicality of doing business and getting credible bodies of data.

There has been some sort of insinuation that you can do anything that you want with the numbers. We do have a limitation in the life insurance business. We have to be reasonably correct about our mortality assumptions. This is even more true now that we are guaranteeing mortality rates well into the future with thinner and thinner dividend margins or, in the case of many products, no margin at all. We had better be right. One of the disciplines we have is the bottom line profit discipline. We spent millions of dollars over the last several years differentiating risks by smoking status. I would like to see more data, but there are some limitations. I think Dr. Miller and I both have the same motivation. Maybe we approach it from a different angle. I think as we work closer together, we would probably find more similarities in our results than differences. It is just on this one issue of the male/female difference that we still disagree.

DR. MILLER: As I analyze it from the standpoint of smoking and health, since most of my research is on smoking and health, actuaries have a tough problem--the problem of former smokers. If everybody were either a nonsmoker or smoker, it would be simple. But you have smokers, former smokers, and nonsmokers. The former smokers distort the statistics because a former smoker could have stopped one year ago--or fifty years ago. The only way to do an accurate study would be to do one on current smokers (somebody who smoked for most of his adult life) and former smokers by 10 year cohorts. You may then be able to develop a better estimate for setting premiums. Otherwise, it's a difficult task. The other problem is that while many older people are quitting smoking, girls are starting to smoke in elementary school more than boys. The effects will show up in 40-50 years if we don't get them off smoking.