

DISCUSSION OF PRECEDING PAPER

HILLARY J. FISHER:

The data on mortality of Metropolitan Life Industrial policyholders which are published in their *Statistical Bulletin* and in the *Transactions* from time to time provide some of the most valuable and widely used information available to life insurance companies. I should like to express to Messrs. Lew and Spiegelman and to the Metropolitan Life my own appreciation for this timely and valuable paper.

Believing that some supplementary information on regional mortality might be interesting and perhaps useful, I have prepared Tables 1*a* and 1*b* from the experience of my own company. Liberty Life's weekly premium business, except for emigrations, is concentrated wholly in the states of North Carolina, South Carolina and Georgia. While our total aggregate exposure over a 10-year period is only 6% of the volume analyzed in the paper, it is enough apparently to indicate rather definitely that Industrial mortality in the southeastern states still is appreciably higher than the Industrial mortality for the United States as a whole.

Table 1*a* relates our 1946-1956 mortality on white weekly-premium policyholders to the 1949-1951 population mortality of white males. Since the years 1949-1951 are not far from the center of the 10-year period 1946-1956, the population table serves as a rough standard of comparison. Making some allowance for the improvement in population mortality, as well as for the fact that I have related a composite male-female mortality to a strictly male mortality<sup>1</sup> (which is substantially higher than female mortality), it is evident from the table that our experience mortality on white lives, in general, is definitely higher than the U.S. average for white lives.

The nonwhite aggregate mortality rate, in our experience, is double the white aggregate mortality rate. Relative to the 1949-1951 population table for nonwhite males, our ratios at ages 30 and over, as shown in Table 1*b*, are greater than unity, even for the most recent experience years.

Our nonwhite mortality, particularly at the older ages, is well above even the population rates for the states in our territory according to the

<sup>1</sup> Liberty Life does not keep any in-force records by sex. The Metropolitan female exposure on premium paying policies is about 58% of the total. It is estimated that the proportion of females insured by Liberty Life under weekly premium policies is somewhat less than 50%.

**TABLE 1a**  
**RATIOS OF ACTUAL MORTALITY TO TABULAR MORTALITY\***  
**WEEKLY PREMIUM-PAYING POLICIES—WHITE LIVES**  
**LIBERTY LIFE INSURANCE COMPANY, 1946-1956**

ATTAINED AGES	EXPERIENCE YEARS				PERCENT CHANGE 1955-56 SINCE 1946-49
	1955-56	1952-55	1949-52	1946-49	
By Number of Policies					
1-9.....	.68	.72	1.04	1.22	-44%
10-19.....	1.02	.81	.84	1.07	- 5
20-29.....	.92	.85	.88	1.01	- 9
30-39.....	.83	.96	1.15	1.28	-35
40-49.....	.94	.98	1.06	1.21	-22
50-59.....	.90	.98	1.03	1.03	-13
60-69.....	1.02	.99	1.00	1.01	+ 1
70 and over.....	1.05	1.04	1.01	1.03	+ 2
By Amount of Insurance					
1-9.....	.62	.68	.94	1.14	-46%
10-19.....	.89	.64	.82	1.03	-14
20-29.....	.80	.78	.80	.96	-17
30-39.....	.74	.93	1.10	1.25	-41
40-49.....	.92	.99	1.08	1.21	-24
50-59.....	.90	.95	.99	1.04	-13
60-69.....	1.06	.99	1.00	1.01	+ 5
70 and over.....	1.07	1.05	.98	.99	+ 8
Number of Actual Claims					
1-9.....	116	315	473	632	.....
10-19.....	63	138	160	230	.....
20-29.....	127	320	341	463	.....
30-39.....	133	396	441	492	.....
40-49.....	263	707	672	714	.....
50-59.....	395	1,139	1,136	1,160	.....
60-69.....	635	1,742	1,676	1,620	.....
70 and over.....	742	1,869	1,292	860	.....

\* Tabular mortality based on U.S. population mortality rates, white males, 1949-1951; except that tabular rates at attained ages 1 and 2 are Liberty Life experience rates.

TABLE 16  
 RATIOS OF ACTUAL MORTALITY TO TABULAR MORTALITY\*  
 WEEKLY PREMIUM-PAYING INSURANCE—NONWHITE LIVES  
 LIBERTY LIFE INSURANCE COMPANY, 1946-1956

ATTAINED AGES	EXPERIENCE YEARS				PERCENT CHANGE 1955-56 SINCE 1946-49
	1955-56	1952-55	1949-52	1946-49	
By Number of Policies					
1-9.....	.85	.99	.89	1.01	-16%
10-19.....	.91	1.04	1.07	1.20	-24
20-29.....	.75	.85	1.01	1.10	-32
30-39.....	1.05	1.08	1.23	1.24	-15
40-49.....	1.14	1.21	1.25	1.36	-16
50-59.....	1.05	1.16	1.23	1.29	-19
60-69.....	1.28	1.42	1.44	1.47	-13
70 and over.....	1.52	1.65	1.62	1.70	-11
By Amount of Insurance					
1-9.....	.85	1.01	.88	1.00	-15%
10-19.....	.95	1.03	1.10	1.23	-23
20-29.....	.86	.92	1.04	1.14	-25
30-39.....	1.11	1.17	1.32	1.31	-15
40-49.....	1.14	1.30	1.28	1.40	-19
50-59.....	1.08	1.19	1.27	1.32	-18
60-69.....	1.31	1.42	1.44	1.47	-11
70 and over.....	1.57	1.65	1.65	1.73	-9
Number of Actual Claims					
1-9.....	91	298	320	554	.....
10-19.....	56	205	270	394	.....
20-29.....	130	468	648	934	.....
30-39.....	269	841	1,053	1,209	.....
40-49.....	441	1,319	1,384	1,778	.....
50-59.....	642	2,114	2,415	2,840	.....
60-69.....	804	2,600	2,468	2,388	.....
70 and over.....	354	992	710	523	.....

\* Tabular mortality based on U.S. population mortality rates, nonwhite males, 1949-1951; except that tabular rates at attained ages 1 and 2 are Liberty Life experience rates.

state life tables. In speculating on the reasons for this disparity, it has been suggested: (1) that, since debit business is concentrated in the cities and larger towns, it produces poor mortality because of an unhealthy environment; (2) that nonwhite applicants are prone to grossly understate their age to the insurance agent but to overstate their age to the census enumerator.

Except for white lives aged 60 and over, the improvement in our mortality over the 10-year period is very encouraging. The percentage changes for white lives, through age 59, seem to be, on the average, as great as those in the Metropolitan experience. For nonwhite lives, the percentage improvement is not as great; still it is substantial in every age group.

In comparing death rates by cause, the relative mortality for each cause in the Metropolitan experience as between whites and nonwhites is substantially confirmed by the Liberty Life experience.

ROBERT C. BAILEY:

The authors of this report have compiled another excellent reference work for actuaries, underwriters and medical research personnel and our thanks are due to these men and their Company for giving us this information which is not available elsewhere. Those of us who are associated with moderate sized combination companies are very appreciative of the opportunity to compare our results with what must be regarded as a standard.

In the Equitable Life Insurance Company we write weekly premium business in the industrial areas of Ohio, Pennsylvania, West Virginia, Maryland and a few similar states and we have felt that we were reaching the point where we could obtain results of some value to us. It happened that we had just completed an initial phase of an investigation when the new Metropolitan experience became available. We wanted a comparison of the mortality of white and nonwhite lives with the 1941 Standard Industrial Mortality Table. We were able to separate white and nonwhite lives but in this phase of the study we did not have a separation by sex. However, we do know that our proportion of female lives is quite high as is characteristic of weekly premium business. In this we follow the Metropolitan experience which in turn is the basis of the 1941 Industrial Tables.

A glance at Chart 1 of the authors' paper shows that in 1957 or 1958 we should expect the adjusted death rates to be about one-half of those prevailing in 1933. Keeping in mind that the 1941 Standard Industrial Table was based on Metropolitan experience from 1930 to 1939 with an added contingency margin, we assumed that our recent mortality should

be about 50% of that table. On white lives we had some 160 million dollars of premium paying business exposed on 400,000 lives, which resulted in 1,300 deaths for about half a million dollars in 1956. The actual to expected mortality by the 1941 Table turned out to be 35.8%. There was no particular secular improvement shown, as the more recently written business exhibited much the same mortality percentage as the older business.

On nonwhite lives we had some 12 million dollars of premium paying business exposed on 43,000 lives, which resulted in 365 deaths for \$80,000 of insurance in 1956. The actual to expected mortality on the 1941 Standard Industrial Table was 56.2%. In spite of the smallness of the exposure there was a distinct secular trend evident in that the more recently written nonwhite business showed consistently better mortality than the older business. This seems to confirm the remarks by the authors of the paper that nonwhite mortality is improving at a relatively faster rate than white mortality.

It follows that the nonwhite mortality on our premium paying industrial business was 157.0% of white mortality. Our study is by no means finished, the results given being preliminary in nature, but in view of the presentation of the Metropolitan figures it seemed an appropriate time to mention them.

One interesting item appeared in a corresponding study we made of paid-up Industrial business. Here the white lives exhibited a mortality of 39.7% of expected, which seemed reasonable. But on nonwhite lives the ratio turned out to be 17%, a result which we can only attribute to wholesale nonreporting of deaths on these small paid-up policies.

#### ALTON P. MORTON:

The authors' latest paper in a series analyzes mortality trends among Metropolitan Industrial policyholders ending with the year 1955. The paper draws attention to several problems in making such an analysis brought about by the marked changes in the pattern of causes of death. Infectious diseases are now of almost negligible interest in the list of important causes, while heart disease and cancer have become predominantly important. They account for nearly 60% of all deaths among Metropolitan Industrial policyholders.

The authors suggest that because of this fact it is necessary to turn to an analysis of the specific morbid conditions included within these categories in order to understand recent mortality trends. They suggest also that more attention be given to associated or multiple causes but do not make any specific suggestions as to how this might be done practically.

From the point of view of the actuary trying to determine practical underwriting guides, improvement in analyses along these lines is highly desirable. Studies of causes of death should pinpoint the objectives for underwriting rules and requirements. They help in determining the physical histories, symptoms and borderline physical findings on medical examination which, in varying degrees, are suggestive of early serious impairment conditions and aid judgment too in deciding upon appropriate extra mortality ratings.

Thus, direct application of the findings of Table 6 suggests broadly that the problem most deserving of careful underwriting attention among children and young adults is any suggestion of a greater than average accident proneness. Among adults in the broad span to 45 which covers the main insuring ages, accidents are still important, but before age 45 is attained they yield first place to heart disease as the most important cause of death. The underwriting problem of first importance in selecting risks after age 45 is the detection of any symptoms or suggestions of early heart disease. Underwriting rules and requirements, varying both by age and amount, can be planned more intelligently with the help of such information as to causes of death.

The figures for occupational accidents among the causes of death give strong general confirmation of the propriety of many practical underwriters' recent decisions to adopt lower occupational ratings for Ordinary insurance. Whether, in the over-all picture, ratings were reduced on the right occupations or to the proper extent, however, cannot be determined from this type of evidence alone.

The Sixth Revision of the International List of Causes of Death changed the basic method of classification to a reliance on judgment of the attending physician in recording the underlying cause. Previously, in classifying deaths from multiple causes arbitrary rules governed classification. The effect has been, as Table 5 demonstrates repeatedly, for the doctor frequently to omit recording a chronic condition, such as diabetes, and to record instead the terminal cause of death as the underlying cause. The effect is undoubtedly some transfer of diabetic deaths to cardiovascular-renal disease classifications, the most common terminal causes among diabetics. Because diabetes as a cause of death, compared with cardiovascular-renal causes, is less than one twenty-fifth as important numerically, the transfer does not seriously obscure trends in any of the main subdivisions of the latter. However, it does make it difficult to judge the long range trend in mortality due to diabetes as a cause. The same observation might be made for several other causes of death, none of them, however, of great numerical weight in the total mortality picture.

The role of improved diagnostic methods in obscuring trends is probably not a large one today, but undoubtedly has some effect, especially in tabulations of death due to cancer in all its main subdivisions, including cancer of the lungs.

The authors draw attention to the slowing of the rate of improvement in white male mortality, with white female mortality continuing to improve at a more substantial rate—a fact of great practical interest. The data studied do not bear directly on risks covered by Ordinary insurance; in considering the selection of such risks, it will be desirable to await confirmation in future substantial studies of Ordinary data before great reliance is placed on evidence from population and Industrial sources.

The profession is indebted to the authors for yet another important contribution to our knowledge of mortality trends.

J. EUGENE TAYLOR:

Our Society, along with all others who have an interest in studies of mortality and morbidity of insured lives and the general population, are deeply indebted to the authors of this paper for this fourth in a series of publications covering mortality over a period that now embraces nearly a half-century, and also for the detailed analyses made available to interested individuals in the monthly *Statistical Bulletin* published under their direction and in papers presented before other forums. There is little in the way of critical analysis of the material presented in the current paper which has not been anticipated by the authors in such publications.

In their introductory comments the authors have noted the need for further classification of the large number of deaths due to cardiovascular-renal diseases; later they suggest restudy of present procedures for reporting and tabulating deaths in order that mortality analyses may be made by multiple causes of death, thus indicating the effect of significant morbid conditions associated with the primary cause but not always noted on the death certificate. It is quite obvious that additional information is needed in order to explain significant facts developed from an analysis of current mortality. The extent of the classification which would result from more detailed information on the death certificate is problematical. Certainly one of the major questions posed by an analysis of mortality by age and sex is the very much higher death rate of males at practically all ages and, particularly, the lack of improvement in white male mortality above age 45 in comparison with the recent reductions in female mortality in all age classifications. The higher mortality of males is undoubtedly due in part to sociological conditions which can never be brought to light from information reportable in the certificate of death by the attending physician.

A discussion of mortality by cause of death is facilitated by considering three broad classifications: (a) accidental injury and other forms of external violence, (b) a group of acute causes which include infectious diseases, cancer and other diseases not falling in the class of degenerative diseases, which class may conveniently be called "accidental morbidity," and (c) degenerative diseases which are the result of the wearing out of some one or more of the vital organs of the human body. There are, of course, many instances of interrelationship between these broad classifications of causes, as, for example, the paraplegic from accidental injury or poliomyelitis who survives the injury or acute disease but succumbs years later to a disease (accidental morbidity or degenerative) which would not have resulted but for the earlier injury or disease. Much of the improvement in recent years is from reductions in mortality in the first two categories, with cancer the one major cause which has thwarted modern medical research. There have been significant developments in medical practice which have extended the life span of those who have been afflicted with certain forms of degenerative diseases. However, the reductions in "accidental morbidity" deaths have increased the number who must ultimately die of degenerative diseases.

We know from our studies of life insurance underwriting that longevity is affected by environment, occupation and habits as well as medical history. There are undoubtedly other sociological factors which have an effect on susceptibility to degenerative diseases, which must be classified and analyzed if we are to probe further the underlying cause of death in this broad classification. Arteriosclerotic heart disease accounts for nearly one-fifth of all deaths and almost one-half of deaths in the cardiovascular-renal classification. Therefore, as a start toward the further analysis of underlying causes leading to such deaths, it is suggested that a study in depth be initiated to provide for detailed analysis of a statistical sampling of deaths from this cause in order to develop sociological factors as well as medical history. Because of the broad interest in such a study, it is a proper subject for investigation by some one of the private foundations interested in the health of our nation. Appropriate guidance by and liaison with the Mortality and Morbidity Experience Committees of our Society is desirable in order that such a study may be of maximum value to our membership.

In view of the very substantial improvements in mortality of white females already achieved, it would be of interest to have the authors amplify their conclusion stated at the end of the first paragraph of the section titled "Conclusion" that "the prospect for white female policyholders appears much better" than that for males.

T. N. E. GREVILLE:

This paper is a valuable contribution in bringing up to date the series of papers by Dr. Dublin and Mr. Spiegelman on the mortality of Industrial policyholders. It is striking to observe how over the years the mortality of Industrial policyholders has moved steadily closer to that of the general population, so that this once substandard class can now be regarded as a representative cross-section of the population. This is in itself an eloquent testimonial to the health progress of the nation.

This paper seems to differ in its emphasis from the earlier ones, less attention being given to the mortality of Industrial policyholders per se, and more to the similarity of their mortality experience to that of the general population of the United States. This may be a natural result of the trend referred to in the preceding paragraph. In my opinion, however, the paper would have been even more valuable if a greater effort had been made to point out differences between the mortality of Industrial policyholders and that of the general population, particularly if reasons for such differences could be ascertained. Although the title of the paper refers only to the period 1950-55, much space is devoted to comparisons with the mortality of the preceding period, and especially to the problem of comparability of mortality rates for particular causes of death, occasioned by the differences between the Fifth and Sixth Revisions of the International List of Causes of Death, a problem which would not arise if the limitation implied by the title were strictly adhered to.

Data presented for the general population extend through 1953 only. Therefore, the accompanying table showing age-specific death rates by race and sex for each year from 1950 to 1956 may be of interest. It shows a general leveling off of mortality rates in 1954-56, especially for males, with little improvement at the younger ages and actual increases at some older ages.

The authors' statement that diabetes "is more important than is indicated by recent mortality statistics because probably less than half of the deaths among diabetics are ascribed to the disease" may be misunderstood by some readers. If they merely mean that the mortality statistics do not fully reflect the prevalence of the disease, this is unquestionably true. If, on the other hand, they are suggesting that mortality from diabetes is being seriously understated, it would be appropriate to give some evidence in support of their contention. The old coding rules were often criticized on the ground that the recorded death rate from diabetes tended to reflect the total mortality among diabetics rather than the mortality due to diabetes. The new rules are designed to correct this bias.

In their concluding paragraph, the authors are critical of "current practices in certifying, classifying and tabulating causes of death." Such criticisms have been frequently made, but there has been a dearth of concrete and specific suggestions as to how the practices in question can be improved. The problem of extracting reliable and useful information from records of causes of death is an extremely difficult one and all the thinking and experience that can be brought to bear on the question is needed if real improvements are to be made. In particular, the tabulation

U.S. POPULATION DEATH RATES PER THOUSAND BY AGE, RACE, SEX, AND  
CALENDAR YEAR, 1950-56

CALENDAR YEAR	AGE											
	Total	Under 1	1-4	5-14	15-24	25-34	35-44	45-54	55-64	65-74	75-84	85 and over
White Males												
1950.....	10.9	34.2	1.34	.67	1.53	1.85	3.80	9.82	23.0	48.4	104.6	217.3
1951.....	11.0	33.6	1.31	.67	1.58	1.89	3.80	9.77	23.0	48.4	105.3	213.7
1952.....	10.9	32.9	1.36	.66	1.64	1.86	3.69	9.72	23.1	47.8	104.3	200.7
1953.....	11.0	32.2	1.27	.62	1.60	1.78	3.61	9.57	23.0	48.2	105.5	204.6
1954.....	10.6	30.6	1.15	.57	1.50	1.70	3.38	9.17	21.8	47.4	100.9	192.9
1955.....	10.7	29.8	1.10	.56	1.54	1.68	3.38	9.09	21.9	48.3	103.6	200.6
1956.....	10.8	29.8	1.01	.54	1.55	1.68	3.44	9.21	22.2	49.2	103.3	199.1
White Females												
1950.....	8.00	25.8	1.11	.45	.72	1.13	2.35	5.44	12.9	32.2	84.1	193.1
1951.....	8.02	25.4	1.11	.44	.69	1.10	2.29	5.38	12.7	31.6	84.8	191.8
1952.....	7.97	25.1	1.15	.46	.69	1.05	2.23	5.21	12.4	31.1	83.4	187.9
1953.....	7.94	24.0	1.05	.41	.63	.97	2.13	5.08	12.1	31.1	83.5	188.8
1954.....	7.64	23.1	.96	.38	.57	.90	2.01	4.84	11.4	29.7	79.0	181.5
1955.....	7.77	22.4	.91	.36	.59	.88	1.98	4.62	11.2	29.9	80.3	191.6
1956.....	7.79	22.5	.88	.35	.55	.85	1.86	4.66	11.1	29.6	79.2	191.9
Nonwhite Males												
1950.....	12.4	59.8	2.67	.97	2.89	4.95	8.59	18.5	34.6	57.6	89.3	157.4
1951.....	12.5	59.2	2.65	1.01	2.82	4.82	8.53	18.3	34.4	58.4	88.9	139.4
1952.....	12.5	63.5	2.65	.91	2.83	4.83	8.60	18.0	34.8	58.1	90.3	125.3
1953.....	12.2	58.3	2.42	.88	2.66	4.58	8.36	17.9	34.5	60.0	88.1	123.3
1954.....	11.4	56.4	2.18	.80	2.37	4.25	7.57	16.4	32.0	57.4	82.0	105.5
1955.....	11.3	57.0	2.09	.75	2.25	4.02	7.58	15.7	32.0	60.8	80.8	103.2
1956.....	11.4	58.1	2.07	.86	2.25	4.30	7.26	15.4	33.1	61.6	80.9	102.6
Nonwhite Females												
1950.....	9.87	47.7	2.27	.75	2.17	3.89	7.51	15.4	27.5	45.7	70.3	129.3
1951.....	9.76	45.6	2.28	.71	1.97	3.60	7.19	15.2	26.9	46.1	73.5	120.0
1952.....	9.60	50.4	2.27	.68	1.82	3.50	6.88	14.8	26.1	46.0	70.7	110.8
1953.....	9.35	48.1	2.00	.61	1.60	3.12	6.52	14.3	25.5	46.3	72.4	106.5
1954.....	8.77	45.1	1.87	.55	1.36	2.88	6.07	13.4	23.9	44.6	64.2	90.7
1955.....	8.75	45.6	1.85	.54	1.27	2.77	5.84	12.6	24.2	46.8	63.9	90.8
1956.....	8.71	46.0	1.74	.52	1.24	2.91	5.92	11.7	24.4	49.3	60.6	81.6

NOTE.—Rates are deaths in year divided by estimated population on July 1. Deaths for 1956 were based on a 10% sample. Armed forces overseas were excluded. A small number of deaths with age not stated were included in totals but not distributed among the age groups. Some rates differ slightly from those published by the National Office of Vital Statistics because of the use of revised population estimates.

of multiple causes of death, as recommended by the authors, is much easier said than done. The difficulties of designing a multiple cause tabulation so as to produce meaningful results are formidable, and concrete proposals are in order. Moreover, physicians differ much among themselves in the amount of detail provided as to the cause of death. Some are inclined to proliferate concerning the morbid conditions from which the decedent suffered, while others give only the minimum amount of information needed to fulfill their statutory obligation to certify the cause of death. Under these conditions it is questionable how much reliance could be placed on the results of any multiple cause tabulation, and further educational work among physicians might have to be the first step.

ARTHUR PEDOE:

It is a privilege to discuss this paper by Messrs. Lew and Spiegelman presenting the fourth investigation into the mortality of Industrial policyholders of the Metropolitan. We now have this continuous record of urban mortality for forty-five years. Many of our members seeing the title "Industrial Policyholders" might be inclined to pass the paper by as of limited interest, but I would inform them that here is a picture of mortality trends which is unique of its kind. Its only parallel for U.S. lives is the reports published by the National Office of Vital Statistics in Washington (which only cover the whole U.S.A. since 1933), but when one seeks the specific death rate by cause of death no national tables can match those of the Metropolitan for accuracy and care. This is not to denigrate those published by Washington, but by their very nature with errors of age and reporting they cannot match these investigations for which Dr. Dublin was responsible for many years and which are now being continued by two of our own Fellows.

I would also draw attention to the high standard of reporting in presenting the results: every figure quoted has a meaning and a place in the picture yet there is no effort to force a point of view or to strain a comparison. Another valuable aspect of these investigations is that in early 1957 we are discussing detailed analyses of deaths by cause with regard to age, sex and race for a period including the year 1955, which would be impossible for a series of national tables.

We have mortality tables galore, but the analysis of mortality by cause of death, as given in these Metropolitan investigations, is quite another matter. We here deal with material which presents difficulties at each step and the source of the material and the care in its compilation are of major importance. So much depends on the choice of the cause of death

as reported by the doctor on the death certificate and thus on his opinion and medical "fashions" in such reporting, which we know vary in different countries and possibly in different parts of the same country. They might even vary with the medical school at which the doctor was trained. An interesting aspect of this problem is given in reference No. 11 of the paper, in which Mr. Lew attempts to analyze the increasing rate of deaths from coronary artery disease with the observation: "The reporting of coronary disease has, furthermore, become fashionable with medico-legal officials." My own opinion has been that, except in the broadest possible groupings, trends of the specific death rate by cause must be suspect. Yet man must continue his ceaseless search for truth, and under the guidance of experts such as Lew and Spiegelman the path will be well lit even if not beyond challenge.

The trends of mortality are of paramount interest to all actuaries these days. This investigation shows what we already know: that mortality rates are moving downwards and as between men and women are ever widening. We feel we must probe into this; and the specific death rate by cause is the obvious step, which is this paper's importance. Yet in passing I would note that material above age 74 is ignored. I realize that the cause of death becomes even less satisfactory than ever beyond this age; but the trends in the death rate should be of the greatest interest here, for the major problem before us is the future trend of mortality *above* age 65 and the age range 75 and over is becoming of increasing importance to us as the years go by. If the material is not available for Industrial policyholders could it be developed along similar lines for the Ordinary policyholders of the Metropolitan?

The authors state that according to Table 3 and covering the period 1951-53 the aggregate mortality of white Industrial policyholders at ages 1-74 is now practically identical with that of white persons in the general population of the United States. This unduly simplifies the picture. At ages 45-64 the mortality of male Industrial policyholders is 17% above that of the general population; this indicates a *bulge* which is worth further investigation by cause of death.

The death rate "all causes" for 1955 shows a decrease of 15% for white males and 22% for white females from those for as recent a period as the years 1946-50, but for the age group 45-64 males the reduction is only 1% and in the age group 65-74 males only 4%. However, in my opinion this illustration of reduction in mortality by a percentage change in the mortality is apt to obscure the progress made in reducing the death toll at the older ages.

If we compare the reduction in mortality from the period 1946-50 to

1955 as a percentage with the number of lives saved in a group of 100,000 lives in each age group we get the following figures (white males).

	AGE GROUP			
	15-24	25-44	45-64	65-74
Percentage Reduction.....	11%	15%	1%	4%
Number of Lives Saved.....	16	46	15	201

My main interest in mortality trends is the deferment of death at the older ages as I believe it can be achieved only when there is greater vitality throughout life. From this point of view the 15 lives saved in the age group 45-64 are of as great significance as the 16 saved in the age group 15-24, yet the latter is eleven times the former when expressed as a percentage change. Note the 201 lives saved in the 65-74 age group! I would stress that the real and remarkable progress in postponing death in the older age groups is being minimized by the method generally used in illustrating the trend in rates of mortality.

The life insurance actuary will want to know the trend of deaths from cardiovascular-renal diseases, the leading cause of death for male and female lives above age 45. As a whole it declined in the period under review, with striking reductions in age groups *under* 25 due to "the control of the rheumatic and other infectious conditions which often affect the cardiovascular-renal system." I have a strong belief that this control of infectious conditions under age 25 will have a major effect in the future on deaths from cardiovascular-renal diseases when these youngsters enter their sixties. In 1955 in the age group 45-64 the male (white) mortality from cardiovascular-renal disease is almost two and a half times that of the female (white). For tuberculosis the death rate ages 1-74 for males (white) is over four times that of the females (white); there are still no signs of the slowing down in the remarkable progress of the conquest of the "white plague" in the U.S.A.

As the proportion of deaths at the older ages increases, the method of recording the cause of death takes an increasing significance. It would seem that the change in the death certificate made, I believe, in 1949 has not produced the results anticipated. The authors refer to an analysis of mortality "with respect to multiple causes of death." When I made a study of this subject some fifteen years ago I felt that there was some danger in trying to get from the statistical returns of causes of death more than they could be expected to yield (*JIA* 73). Perhaps the authors

might explain what is meant, for the same intentions regarding multiple causes of death were expressed fifteen years ago. As schemes of national health insurance develop, records will be obtained of each individual indicating his medical history for years prior to death; and one might visualize an analysis by cause of death where the rubrics would indicate a pattern or a sequence of medical events culminating in death. Possibly not enough is known of cardiovascular impairments to make this feasible but it is a line of research which might repay study. Diabetes leads to arteriosclerosis, nephritis to high blood pressure, and both to heart impairments. In this way the vital statistician could erect the signposts for medical men and indicate the areas to be attacked and then record the progress made.

(AUTHORS' REVIEW OF DISCUSSION)

EDWARD A. LEW AND MORTIMER SPIEGELMAN:

We appreciate very much the valuable comments of those who were kind enough to discuss our paper.

Several referred either directly or indirectly to the major problem confronting us today in the analysis by cause of death, namely, the accuracy of the medical certification of causes of death. Thus, Mr. Pedoe commented on the influence of the training of the reporting physician and the role of changing medical concepts. In addition, the credibility of any medical certification of cause of death depends much on the diagnostic tests used, the length of the period the certifying physician was in attendance and the efforts he made to secure information from other physicians. Much depends also on his attitude in those instances where the underlying cause of death cannot be readily ascertained—for example, the coroner or medical examiner certifying for a deceased not seen before death may, in the absence of facts, ascribe a sudden death to coronary disease rather than certify the case as due to causes ill defined or unknown. In the case of cancer, an additional problem is frequently presented in trying to determine the primary site of the cancer when several parts of the body may be affected. These problems of accuracy vary not only from one physician to another, but also geographically within the country, and indicate a lack of uniformity in the quality of certification.

Since the cause of death selected for tabulation depends so much upon the manner in which the physician completes the medical section of the death certificate, his understanding of the requirements of the certification procedure naturally influences the results. Altogether, we are dealing with issues related to certification, classification and tabulation that

require study and re-evaluation. The basic problems in these areas will be pointed up in a forthcoming report by a Committee on Medical Certification of Causes of Death to the Statistics Section of the American Public Health Association.

Important among these problems is that of the tabulation of multiple causes of death, referred to by Messrs. Morton, Pedoe and Taylor. A suggested form for future tabulations by multiple cause is contained in the first volume of the Sixth Revision of the International Lists of Diseases and Causes of Death. Problems in multiple cause tabulation are particularly difficult for the cardiovascular-renal conditions because of their complex and obscure origins. Data are wanted with regard to etiology, anatomical site, pathology and other factors. In this connection, the example for multiple cause tabulation of the cardiovascular-renal diseases proposed by Weiner and his associates is of some interest.<sup>1</sup> It is also pertinent to note that the last tabulation by multiple causes of death on a national scale is that contained in the *Vital Statistics of the United States: 1940, Part I*, which showed the distribution of the associated causes of death reported on the certificates in relation to the primary causes of death.

The matter of more far-reaching proposals for multiple cause tabulation, as suggested by Dr. Greville, would require special studies. Nevertheless, we believe that this is an aspect of mortality analysis which should be followed by actuaries, particularly those concerned with underwriting problems. As a case in point, in investigations of mortality among lives with specific physical impairments, analyses with respect to the more common combinations of causes of death might enable us to develop better prognostic criteria. Also, in some instances, multiple cause tabulations may show that some morbid conditions present in terminal cases gave a better indication of the significant impairments than can be obtained from a consideration of the primary causes of death alone; diabetes is a case in point.

A number of specific points have been raised which require answer. Thus, Mr. Pedoe notes that data above age 74 have not been included in our paper. The reason for this was explained in the first report of this series, "Twenty-five Years of Health Progress," where it was pointed out that at ages 75 and over the majority of Industrial policies are on a paid-up basis and there was some question whether claims on such policies were being fully reported. This was also indicated in the discussion

<sup>1</sup> L. Weiner, M. T. Bellows, G. H. McAvoy and E. V. Cohen, "Use of Multiple Causes in the Classification of Deaths from Cardiovascular-renal Disease," *American Journal of Public Health*, vol. 45, p. 492, April 1955.

by Mr. Bailey, in which he reported on the experience of his company.

Although we may have oversimplified the situation in stating that the aggregate mortality of white Industrial policyholders is now very much like that of the general population, we did draw attention to the advantage of the insured at ages 15-24; however, we neglected to mention the excess mortality among white male Industrial policyholders at ages 45-64, as pointed out by Mr. Pedoe. He also calls attention, quite properly, to the important fact that a small percentage change in mortality at the older ages may signify the deferment of a large number of deaths.

It is rather unusual to group cancer with the acute causes of death, as was done by Mr. Taylor. Commonly, cancer is classified with the chronic diseases which also include the degenerative diseases, such as the cardiovascular-renal conditions. The suggestion by Mr. Taylor that mortality be studied in depth by statistical sampling for the purpose of developing the effect of habits and social influences on mortality is of considerable interest. In fact, such a survey is being conducted by the U.S. Public Health Service in Pennsylvania. This survey is in the nature of a trial study, and is largely concerned with the smoking habits of the deceased.<sup>2</sup>

In so far as our statement regarding the better mortality prospect of females as compared with males is concerned, we took note of the fact that in the general population and Industrial insurance experience, female mortality from the cardiovascular-renal diseases has been declining consistently at all ages during the past 15 years; also, female mortality from cancer and allied conditions had decreased over the same period by about 10 percent among white females at ages 25 and over, mainly because of the decline in mortality from cancer of certain female genital organs. In contrast, male mortality from the cardiovascular-renal diseases has increased by about 10 percent in the age range from 45-64 during the past 15 years and has remained substantially level at ages 35-44. Furthermore, mortality from cancer and allied conditions among males increased by more than 10 percent among white males during this period, primarily as a result of the continuing rise in the death rate from lung cancer. So long as there is no material reduction achieved in the mortality from the cardiovascular-renal diseases or cancer among white males; there is little reason to expect the mortality of white males to decrease appreciably in the near future.

The data presented by Messrs. Bailey and Fisher from the experience of their companies are a welcome addition to our knowledge regarding

<sup>2</sup> W. Haenszel, I. M. Moriyama and M. G. Sirken, "A Proposed Study for Extending the Scope and Improving the Quality of Mortality Data," in *Improving the Quality of Statistical Surveys*, p. 57, American Statistical Association, Washington, 1956.

Industrial insurance mortality. Mr. Bailey reports a ratio of 157 percent for nonwhite to white mortality among the premium-paying Industrial policyholders of his company. According to the experience presented by Mr. Fisher, the aggregate nonwhite mortality has been double that of the white. Among Metropolitan premium-paying Industrial policyholders in 1955, at ages 1-74, the ratio of nonwhite to white mortality was 157 percent for females, but only 111 percent for males. The finding that white male Industrial mortality is relatively close to that of nonwhite male mortality may reflect different social-economic stratification of the white and nonwhite lives involved. It is possible that only the white males in the lower income brackets and more hazardous occupations purchase Industrial insurance, whereas among nonwhite males purchasing Industrial insurance, by and large, many belong also to higher social-economic classes. However, wage-earners with higher earnings who may purchase Ordinary insurance for themselves have, to a degree, continued to buy Industrial insurance for their wives. The effect of this may be to lighten the mortality of white females with Industrial insurance. In commenting on the higher mortality among nonwhite lives with Industrial insurance as compared with the general population in the experience of his company, Mr. Fisher suggests that this may be due to the concentration of their business in larger communities where the health environment may be poor and also to the possibility of an understatement of age for insurance. There is also the likelihood that the mortality of nonwhites in the general population may be understated because of underreporting of deaths.