

# TRANSACTIONS

MAY, 1960

---

## OCCUPATION, SOCIAL CLASS AND MORTALITY

ARTHUR PEDOE

**D**EATH is the end-result of all that is represented by "living." The mortality rates of a country are thus far more than actuarial ratios and their trend may be said to represent the social progress of a country. That wise American, Bernard M. Baruch, in his recent autobiography, wrote: "Instead of trying to judge a nation by some ideological label like 'capitalism,' 'socialism' or some other 'ism,' I would suggest a different measure—namely, the progress a nation is making in bettering the living conditions of its own people." Better living conditions result in better, that is, lower mortality rates and it is from this wider conception of mortality that the trends of mortality in this paper are considered.

The publication in 1958 of the Decennial Supplement on Occupational Mortality<sup>1</sup> by the British Registrar General (the tenth of the series) drew our attention to the lack of similar research into the occupational and social mortality trends of the peoples of the United States and Canada. It also coincided with consideration of the need for a new Joint Occupational Study. Social class and occupation are closely related. As the Registrar General's Report states: "Often the socio-environmental circumstances of an occupation, its locality, the standard of living of those engaged in the occupation, their housing, clothing, education, dietary habits, opportunities for recreation and attitudes towards healthy living determine much more than the occupation itself, the mortality rates of the men in that occupation and *ipso facto*, of their wives and children."

### SOCIAL CLASS MORTALITY IN THE UNITED STATES

Attempts have been made in the past to relate the mortality of the population in the United States to occupation and social class, but with one exception they were abandoned although currently the matter has

<sup>1</sup> The Registrar General's Decennial Supplement, England and Wales, 1951, *Occupational Mortality, Part II*, Volume I, Commentary, London H.M.S.O., 1958; Volume II, Tables, London H.M.S.O., 1958.

been reopened. The difficulties are those of correlating the statements made by relatives of a deceased as regards the latter's occupation and those given in the census record prior to death by the deceased. These defects appear to be inseparable from these investigations and will be referred to later.

For the one U.S. exception mentioned we are indebted to Miss Jessamine Whitney, Actuary to the National Tuberculosis Association, N.Y. In connection with the 1920 Census, the Census Bureau published figures showing the lack of correspondence between occupations as notified at the census and those given on death certificates at a later date. Miss Whitney with the cooperation of the Census Bureau took up the matter with state and city registrars. A new death certificate was prepared and adopted by various states and, after investigation of the figures based on the 1930 Census of the U.S., she decided that the figures provided by ten states were satisfactory. Her report<sup>2</sup> gives death rates for males for 53 occupational classes and, in addition, for the first time a tabulation of mortality by social class in the United States.

Miss Whitney's accomplishment is all the more noteworthy when one considers that twenty-five years later so little additional material is available regarding the United States. Details of current studies are given in two papers by members of the U.S. National Office of Vital Statistics, I. M. Moriyama and L. Guralnick.<sup>3, 4</sup> According to these papers, the studies made of the relation between occupation recorded at the census and on death certificates showed such a lack of correspondence that plans for a mortality study by occupation based on the 1940 U.S. Census were abandoned. Studies made of the 1950 U.S. Census indicated that most of the earlier defects noted still existed, but it was felt that by utilizing broad groups valuable information could be obtained. Figures for a division into social classes are given in Table 5. From correspondence in June 1959 I understand that "tabulations by physical activity" are not to be carried out. A study of the relationship between occupations as reported at the 1950 U.S. Census and on death certificates is nearing completion and the results of this study will influence plans for publication of the data. Considering the slow progress to date, it may be some time before any results are available and it is questionable if they will be of practical value to the life insurance companies.

<sup>2</sup> Jessamine S. Whitney, *Death Rates by Occupation*, National Tuberculosis Association, New York, June 1934.

<sup>3</sup> Moriyama and Guralnick, *Occupational and Social Class Differences in Mortality*, Annual Conference, Milbank Memorial Fund, N.Y., 1955.

<sup>4</sup> L. Guralnick, "The 1950 Occupational Mortality Study," *H.O.L.U.* Vol. 37 (1956).

*Immigrant Labor—Effect in the Past*

U.S. occupational studies in the past have been made difficult by social changes of a special character and one may question whether studies prior to Miss Whitney's would have been of much value, even if available, to compare with the present. In 1909, statistics of the Immigration Commission revealed that in most of the nation's leading industries immigrant workers outnumbered native Americans. European immigration into the U.S. was over eight million in the decade 1901–1910. It was halved in the following decade 1911–1920 and halved again in the decade 1921–1930. Until World War I the Negro was essentially a rural worker mainly confined to the South. With the radical reduction in European immigration in the 1920's he moved into the industrial centers of the North in response to the demand for unskilled labor formerly served by the immigrants. "Many immigrants were attracted to such dangerous occupations as coal mining and steel making, in which their inability to read the warning signs prevented them from achieving even a minimum of physical security on the job."<sup>5</sup>

*Nonwhite Laborers*

There is a wide difference between the mortality of white and non-white lives in the United States. Any figures quoted should, however, note the great improvement in the mortality of nonwhite lives in the United States in recent years, a factor itself of considerable social significance. Table 1 gives the ratios of the death rates of nonwhite lives to white lives in the United States in the years 1956 (the latest available) and 1940 by age and sex. The range of ages given is that of the main period of occupational activity with which we are concerned. The great reductions in the mortality of white lives from 1940 to 1956 have been exceeded by nonwhites in almost every age group shown. This might be considered as indicating that differences between white and nonwhite mortality are not entirely racial and hence that they are within the scope of our study of social class mortality. A valuable paper published in 1954 quotes much statistical evidence supporting this view.<sup>6</sup>

## OCCUPATIONAL AND SOCIAL CLASS MORTALITY IN ENGLAND

In the British A1924–29 mortality investigation (ordinary business), the combined experience of the five contributing companies giving the

<sup>5</sup> Carman and Syrett, *A History of the American People*: Vol. II, Chapter 5, 1952 Edition, A. A. Knopf, New York.

<sup>6</sup> Marcus S. Goldstein, "Longevity and Health Status of Whites and Non-Whites in the United States," *Journal of the National Medical Association*, Vol. 46, March 1954.

highest mortality and of the seven companies giving the lowest mortality was extracted. Two sets<sup>7</sup> of mortality rates were thus developed: "Heavy" and "Light." The actual figures are given in Table 2 and indicate that over the range of ages 30 to 65 the "Heavy" ultimate mortality is approximately 140% of the "Light." All the lives under the experience had been taken at standard rates. This illustrates the concentration of different British companies on different social classes and is itself an illustration of

TABLE 1  
UNITED STATES WHITE AND NONWHITE LIVES  
DEATH RATES PER 1,000 BY AGE

Age Group:		15-24	25-34	35-44	45-54	55-64
<i>Males</i>						
1956	White.....	1.6	1.7	3.3	9.0	22.2
	Nonwhite...	2.3	4.1	7.5	15.3	33.0
	Ratio.....	144%	241%	227%	170%	149%
1940	White.....	2.0	2.8	5.1	11.4	25.2
	Nonwhite...	5.0	8.5	13.2	24.5	39.5
	Ratio.....	250%	304%	259%	215%	157%
<i>Females</i>						
1956	White.....	0.6	0.9	1.9	4.5	11.1
	Nonwhite...	1.2	2.7	5.9	12.2	25.4
	Ratio.....	200%	300%	311%	271%	229%
1940	White.....	1.4	2.2	3.7	7.5	16.8
	Nonwhite...	5.0	7.4	11.7	21.1	35.7
	Ratio.....	357%	336%	316%	281%	213%

TABLE 2  
"LIGHT" AND "HEAVY" MORTALITY  
BRITISH OFFICES A24-29 EXPERIENCE (ULTIMATE)  
1,000  $q_x$

Age	Light	Heavy	Ratio	Age	Light	Heavy	Ratio
20.....	1.72	2.79	162%	60.....	15.74	22.76	145%
25.....	1.90	2.80	147	65.....	26.62	38.01	143
30.....	2.07	2.81	136	70.....	46.66	60.66	130
35.....	2.31	3.23	140	75.....	78.56	92.76	118
40.....	3.10	4.36	141	80.....	120.19	139.86	116
45.....	4.26	6.18	145	85.....	172.54	201.41	117
50.....	6.35	9.13	144	90.....	241.64	275.11	114
55.....	9.83	14.04	143	95.....	334.75	359.60	107

<sup>7</sup>Elderton, Oakley and Smither: "Mortality of Assured Lives 1924-1929" *JIA* 68, p. 54.

the effect of social class on mortality. I doubt if such a difference exists between companies in the United States and Canada under their standard ordinary business.

The Registrar General's Decennial Supplement on Occupational Mortality is the only continuous series of its kind. It began with the year 1851. Because of the war no census was made and hence no Occupational Supplement appeared for the 1940 period. The previous Occupational Supplement covered the years 1930-32; the present covers the years 1949-53. The importance of the Supplement is that it not only deals with the relative mortality in various occupations but also covers mortality by social class. Credit for this unique study of mortality by social class is due to the British Registrar General who in his 1921 Report gave the mortality of the population of England and Wales as divided into five social classes. Corresponding figures were given following the 1931 Census and this latest report gives the figures following the 1951 Census. Throughout this paper we will refer to "England" when the technical area "England and Wales" is meant.

### *Basis*

The 1951 Occupational Supplement is based on the deaths registered in the five calendar years 1949 to 1953. In prior investigations only three years' deaths were used. The age, occupation and cause of death are as given at the date of registration of death. With married women the occupation recorded at death is that of the husband at that time. The corresponding exposed to risk was five times the census population on April 8, 1951 without adjustment, with age and occupation according to the census records. Those "out of work or retired" were grouped as for the last occupation engaged in. The "unoccupied," *i.e.*, those who have never been gainfully occupied, were considered as a separate class.

### *Social Classes*

As in 1921 and 1931, occupational units as a whole are assigned to one of five broad categories, traditionally called Social Classes. Their general nature is to indicate three distinct classes as professional I, skilled occupations III and unskilled occupations V, with intermediate groups II and IV. However, to appreciate the allocation of occupational units the following details are given:

- Class I —Professional: law, medicine, the Church, stockbrokers, bankers, the highest ranks of the Civil Service and business, including company directors, commissioned officers of the armed forces.
- Class II —Managerial: owners of businesses, farmers, teachers, technicians and accountants.

Class III—Skilled Occupations: clerks, salesmen and sales clerks, foremen, fitters, armed forces (other ranks).

Class IV—Partly Skilled Occupations: machine minders, agricultural workers.

Class V—Unskilled Occupations: laborers (building and dockyard).

The investigators have not hesitated to make changes in the present analysis by transferring occupations from one social class to another and state they have satisfied themselves that comparisons with previous years have not thereby been vitiated. However, in spite of this statement the result of the transfers has been to improve the mortality of Social Class IV as now recorded.

Considering the differences between social classes in 1911 when this idea of mortality by social class first developed, it now appears strange that mortality differences should have created so much interest. All that contributes to life and health was allocated in those days in decreasing measure to the social classes indicated by the range from I to V. It was only after the turn of the century in Britain and in the 1920's in the U.S. that the workers began to exert effective economic pressure for a higher standard of living. It was its acceptance by the general public and employers and legislatures generally that made these efforts effective.

#### *Standard Mortality Ratio (S.M.R.)*

The mortality of each occupational group is summarized in the Report by means of a Standard Mortality Ratio for the age range 20–64 years. The S.M.R. may be defined—*e.g.*, for males—as the number of deaths registered at ages 20–64, expressed as a percentage of the number that would have occurred if the death rates in each separate age group within the occupation had been the same as in a standard population consisting of all the males in England. The same ratios have been calculated for married women based on the deaths of all married women. In dealing with deaths from any particular cause the similar ratio of actual to expected deaths gives the S.M.R. for that particular cause of death.

Table 3 gives the S.M.R.'s for the five social classes and of the corresponding wives for 1949–53, together with the comparison with previous investigations. The definite upward trend in mortality with the lowering of the social class for both men and married women which was so obvious in the earlier investigations is no longer so. It is important to bear in mind that the relative S.M.R.'s of 1949–53 relate to a much lower overall mortality. The highest mortality is still Social Class V, the unskilled workers, but the lowest is Class II, "managerial": the owners of businesses, farmers, teachers, technicians and accountants. In Table 3, the S.M.R.'s for 1949–53 are also given for the same classification as for 1930–

32, for as already stated the transfer did modify the mortality comparisons.

It is not by chance that the differential between Classes I and V as might be given for an intermediate period 1924-29 in Table 3 is approximately 40% of Class I mortality corresponding to the differential in Table 2 between the A1924-29 "heavy" and "light" mortality.

Note in Table 3 that the mortality differential between Classes I and V, which was 52% in 1921-23, is only 18% in 1949-53. Among the wives the differential was 40% in the first period mentioned and only 15% in the last period. Social Class I also appears to be losing its superiority in mortality relative to the other social classes.

TABLE 3  
STANDARD MORTALITY RATIO (AGES 20-64) BY SOCIAL CLASS  
ENGLAND 1949-53

	MALES			MARRIED WOMEN	
	1921-23	1930-32	1949-53*	1930-32	1949-53
All Occupied and Retired . . . . .	100	100	100	100	100
Social Class I . . . . .	82	90	98 (100)	81	96
“ “ II . . . . .	94	94	86 (90)	89	88
“ “ III . . . . .	95	97	101 (101)	99	101
“ “ IV . . . . .	101	102	94 (104)	103	104
“ “ V . . . . .	125	111	118 (118)	113	110

\* Figures in parentheses are those when classification is adjusted to correspond with that in 1930-32.

On account of these changes, major changes in classification appear to be in the making. The recent Report now subdivides the traditional five social classes into subclasses and also into socio-economic groups. Firstly, Social Classes III, IV and V have been subdivided as shown in Table 4 as "Social Subclasses," thus giving eleven social classes.

#### *Socio-economic Groups*

For social and economic characteristics of private households a new socio-economic allocation was developed by a special arrangement of the occupational unit groups. Table 4 gives the S.M.R. of each class in the new subdivisions. Although the socio-economic groups are not exactly comparable with the social classes, approximately Social Class I corresponds with Socio-economic Group 3, Social Class II with 1, 4 and 5, Social Class III with 6, 7, 8, 9, 10 and 13, Social Class IV with 2 and 11 and Social Class V with 12. "Armed forces (other ranks)" is tabulated

separately as Social Subclass III*d*, and is thus a thirteenth socio-economic group.

Note the thirteen socio-economic groups are comprised of

*Agricultural: 1 and 2*

*Nonagricultural: Nonmanual 3 to 8 inclusive*

*Manual 9 to 13 inclusive*

TABLE 4  
STANDARD MORTALITY RATIOS OF SOCIAL CLASSES  
AND SOCIO-ECONOMIC GROUPS  
MALES AND MARRIED WOMEN BY HUSBAND'S CLASS  
ENGLAND, 1949-53

SOCIAL CLASS	MALES (AGES 20-64)			MARRIED WOMEN (AGES 20-64)
	1951 Census Population	Deaths 5 Yr. Period 1949-53	S.M.R.	S.M.R.
All Classes.....	12,759,796	432,843	100	100
I. Professional.....	430,056	14,212	98	96
II. Managerial.....	1,884,072	63,029	86	88
III. Skilled.....	6,629,352	204,031	101	101
IV. Partly Skilled.....	1,986,905	65,634	94	104
V. Unskilled.....	1,618,764	77,241	118	110
Unoccupied.....	210,647	8,696	124	95
III <i>a</i> . Mine Workers.....	253,587	11,148	135	135
III <i>b</i> . Transport.....	733,291	22,293	100	102
III <i>c</i> . Clerical.....	552,486	21,150	111	91
III <i>d</i> . Armed Forces (other ranks).....	273,364	4,411	163	132
III <i>e</i> . Others—Skilled.....	4,816,624	145,029	96	99
IV <i>a</i> . Agricultural Workers.....	436,330	11,960	78	98
IV <i>b</i> . Others—Partly Skilled.....	1,550,575	53,674	99	106
Va. Building & Dock Laborers.....	473,435	14,999	87	95
Vb. Others—Unskilled.....	1,145,329	62,242	129	115
Socio-economic Groups				
1. Farmers.....	245,512	7,678	70	93
2. Agricultural Workers.....	556,098	13,973	75	95
3. Higher—Professional.....	430,056	14,212	98	96
4. Other—and Managerial.....	1,219,085	36,993	84	81
5. Shopkeepers & Wholesalers.....	462,202	19,664	100	99
6. Clerical Workers.....	623,472	23,374	109	91
7. Shop Assistants.....	414,865	9,794	84	79
8. Personal Service.....	273,786	13,283	113	101
9. Foremen.....	459,649	15,529	84	91
10. Skilled Workers.....	4,577,698	142,755	102	105
11. Semiskilled Workers.....	1,423,628	46,822	97	108
12. Unskilled Workers.....	1,589,734	75,659	118	111



From Table 5 it will be noted that the U.S. National Office of Vital Statistics appears to be moving towards the traditional social classes subdivision just when the Registrar General is discarding it. Note the resemblance of Miss Whitney's investigation based on the U.S. 1930 Census (Ten States) to the new classification used by the Registrar General. In 1933 Mr. Alba M. Edwards<sup>8</sup> of the Bureau of the Census recommended twelve classes which he called "social-economic groups" and this group-

TABLE 5  
RELATIVE STANDARDIZED MORTALITY RATIOS  
BY SOCIAL CLASS  
UNITED STATES MALES

1930 (Ten States)* Ages 15-64		1950 (United States)† Ages 20-64			
		All Races	White Lives	Non-white Lives	
Professional Men.....	80				
Proprietors, Managers and Officials	85				
Wholesale and Retail Dealers.....	94				
Others.....	76				
Clerks and Kindred Workers.....	85	I. Professional Workers.....	83	82	103
Agricultural Workers.....	71	II. Technical, Administrative and Managerial Workers.....	85	84	146
Skilled Workers & Foremen.....	93	III. Proprietors, Clerical, Sales and Skilled Workers.....	97	96	124
Semiskilled Workers.....	113	IV. Semiskilled Workers.....	100	97	124
In Manufacturing.....	115	V. Laborers, except Farm & Mine.....	152	120	244
Others.....	111	Agricultural Workers.....	96	83	190
Unskilled Workers.....	151				
Factory & Building Construction Laborers.....	198				
Other Laborers.....	94				
Servant Classes.....	135				
All Gainfully Occupied Males.....	100				

\* Alabama, Connecticut, Illinois, Kansas, Massachusetts, Minnesota, New Jersey, New York, Ohio and Wisconsin.

† Unpublished data from the National Office of Vital Statistics.

ing was used by Miss Whitney, farm owners and farm hired men being put into the same group because of the overstatements in the deaths of farm "owners."

Table 5 also emphasizes the necessity when dealing with social class mortality in the United States to separate white from nonwhite lives. The S.M.R. of 244 in "V. Laborers except farm and mine" in this table for nonwhite lives is not unexpected from the figures in Table 1. Any comparison of social class mortality in the United States using the "all races" figures with those of England is meaningless.

<sup>8</sup> Alba M. Edwards, "A Social Economic Grouping of the Gainful Workers of the United States," *Journal of the American Statistical Association*, Vol. 28, Dec. 1933.

It will be noted that the upward progression of mortality by social class in the United States (considering white lives alone) is, according to Table 5 based on the U.S. 1950 Census, still definitely inverse to the status of the social class. Between the Professional Class I and the Laborers V, the excess mortality is 46% in the United States as compared with only 18% in England. Can this be said to be one of the results of the Welfare State?

This raises the point of recent mortality in the United States and England. The mortality of male lives in England according to English Life Table No. 11 (1950-52) is lower than that of white male lives in the U.S. 1951 in the age range 4 to 59, and, at some ages, substantially lower. For

TABLE 6  
COMPARISON OF MORTALITY RATES  
ENGLAND (1950-52) WITH U.S. WHITE LIVES (1951)  
1,000 *q<sub>x</sub>*

Ages:	20	30	40	50	60	65
<i>Males</i>						
England.....	1.3	1.6	2.9	8.5	23.7	36.9
United States.....	1.7	1.8	3.9	10.0	23.4	34.4
<i>Females</i>						
England.....	.8	1.3	2.3	5.2	12.7	20.7
United States.....	.7	1.1	2.3	5.5	12.9	20.2

female lives the two sets of mortality rates are considerably closer; the United States has the advantage up to age 40 and beyond age 63. Figures covering the age range 20 to 65 are given in Table 6.

#### DIFFICULTIES AND ERRORS

It must be acknowledged that this statistical investigation by the Registrar General is full of pitfalls. When Dr. William Farr, Honorary Fellow of the Institute of Actuaries, inaugurated these occupational mortality investigations in 1851 as part of the work of the Registrar General's Office, he was well aware of the difficulties and his statement at that time which heads the latest Registrar General's Report is still applicable:

... the professions and occupations of men open a new field of inquiry, on which we are now prepared to enter, not unconscious, however, of the peculiar difficulties that beset all inquiries into the mortality of limited, fluctuating, and sometimes ill-defined sections of the population.

These problems are outlined below:

1. *Retired Given as Unoccupied.*—Errors occur in listing the occupation at death as “unoccupied” when the occupation previous to retirement should have been given. As against a probable .7% of men aged 20 and over “unoccupied,” in the age group 55 to 64 it is 1.78%, in the age group 65 to 69 it is 6.73%, and for ages 70 and over it is 12.96%. From these figures any deductions as to occupation on death would be of dubious value after age 64 and hence the main investigations (and all that will be referred to in this paper) are based on age groups 20 to 64. This was also the case in previous reports.

TABLE 7  
OCCUPATIONS RECORDED AT CENSUS AND AT DEATH  
IN SAMPLE OF 10,000 DEATHS  
REGISTRAR GENERAL

	MALES AGED 20-64						Total
	Social Class					Not Allocated	
	I	II	III	IV	V		
(a) At Census.....	32	175	618	224	262	79	1390
(b) At Death.....	46	211	632	218	264	19	1390
Excess of (b) over (a) as a ratio of (a).....	+44%	+21%	+2%	-3%	+1%	-76%	

NOTE.—Of the 10,000 deaths, 2,643 related to males aged 65 and over, 595 to married women aged 16-64, 713 to married women aged 65 and over, and the rest to other groups.

2. *Occupations at Census and on Death Certificates.*—A sample of 10,000 deaths registered some three weeks after the date of the British Census in 1951 were compared individually as regards the occupation registered on death with that given in the census statement. Table 7 gives an idea of the discrepancies found. For “married women” deaths the discrepancies were almost as bad. In the distribution by socio-economic groups similar discrepancies existed in degree. In these circumstances one might despair of proceeding further. The abandonment of efforts by U.S. investigators following similar comparisons as outlined earlier in this paper will now be appreciated.

This aspect of the Report will come in for much criticism. The broad conclusions of these discrepancies, according to the Report, is that they tend—in males, at least—to *exaggerate* the apparent mortality of Social Class I and to *diminish* that of Social Class V, intermediate classes being affected in lesser degree.

Here we touch on one of the great difficulties in this type of investigation. Can there be a lack of cooperation between the executive side of government vital statistics departments and those charged with the analysis of those statistics? It is inconceivable that after a century and a quarter of effort Table 7 should represent the relative accuracy of the material supplied to the Registrar General's Department in England. The fact that in the U.S. a similar situation exists to an even greater degree is no satisfaction, for in the U.S. the division of the work between a Federal Government and civil servants of "sovereign states" introduces problems which do not exist in England.

3. *Changes between Occupations.*—In the interpretation of high or low mortality by occupation the point should be noted that the physical demands or lack of them in certain occupations will determine the mortality of those engaged in them—as selection, where police officers are concerned; conversely, in occupations such as piano tuning and watch repairing. Similarly the tendency to change from an exacting occupation to one less so, should health become impaired, affects the recorded mortality of both types of occupations; janitors and watchmen are "residue" occupations of this kind.

With all these deterrents the determination of the British investigators in going ahead strikes one forcibly. It is noted that Table 7 is based on a sample of 1,390 deaths and this would seem an inadequate sample on which to judge the extensive and detailed statistical investigation of this Supplement on Occupational Mortality (over 400 foolscap pages of tables, apart from numerous tables in the Commentary volume). Further, in the opinion of the writer, the value of the results given in the Report raises questions as to the validity of the so-called "sample." With the 1960 U.S. Census in prospect, another opportunity arises to collate census reports and death certificates for a period following the date of the census and to plan for an investigation into U.S. occupational mortality on a national basis.

#### *Married Women's Mortality by Husband's Occupation*

The mortality figures in the Registrar General's Report of married women classified by the husband's occupation are unique of their kind. The analysis was designed to disclose special mortality features that are of direct occupational origin and thus would affect the husband alone. This would be distinct from mortality results due to the general mode of living which would affect both husband and wife. Thus a distinction could be made between "social class" and "occupational" mortality.

At the 1931 Census in England only about 10% of married women were recorded as gainfully occupied; in 1951 the figure was 22.5%. The

query thus arises as to how their own occupation affects the mortality of married women apart from their husbands?

### *Single Women*

At the 1951 Census in England 17.6% of the single women were classed as "unoccupied" in the age group 20-64 and the proportion similarly classified in the death registers 1949-1953 was 37%. The report adds that the rates of occupational mortality of single women must be treated with "special reserve."

### *Changes in the Social Classes*

Between 1931 and 1951 not only did the numbers of the "Occupied and Retired" males in England increase from 14 million to 15.4 million, but the percentage of those in the higher Social Classes I, II and III increased, while those in the lower Social Classes IV and V decreased, as shown in Table 8. What is most significant is a decrease from 17.5% to

TABLE 8  
PERCENTAGE DISTRIBUTION OF MALES (ALL AGES) OCCUPIED AND  
RETIRED BY SOCIAL CLASS—ENGLAND

	I	II	III	IV	V
1951 Census...	3.3%	14.5%	52.9%	16.1%	13.1%
1931 Census...	2.4%	13.2%	48.7%	18.2%	17.5%

13.1% in the lowest class of occupation, the unskilled. Undoubtedly similar changes have been going on in the United States and Canada and this is one reason for the improvement in mortality in recent years on this side of the Atlantic.

### SOCIAL CLASS MORTALITY FROM ALL CAUSES

There have been considerable reductions in mortality in England (as in the United States and Canada) in the two decades from 1930 to 1950, particularly at the younger adult ages. Table 9 gives the mortality by social class for males aged 20 to 64 in the period 1949-53 expressed as a percentage of that in 1930-32 and also that of 1930-32 as a percentage of the 1921-23 investigation, the latter figures being taken from the author's paper in *JIA* (1946).<sup>9</sup> Corresponding figures for the United States for all U.S. white male lives are given in Table 10 taken from the U.S. Government's Reports on Vital Statistics.

<sup>9</sup> Arthur Pedoe, "The Trend of Adult Mortality in England and the United States," *JIA* 73, p. 213.

In Table 9 dealing with males, note the striking reductions in mortality in each social class in the twenty year period 1931 to 1951, generally so much greater than in the period 1922 to 1931 even allowing for two decades as compared with one. In Social Class I there was practically no over-all change in the decade 1922 to 1931, yet a substantial reduction from 1931 to 1951 except for the age group 55-64 in which the worsening should be noted with the presumed exaggeration in Social Class I mortality referred to earlier. In the earlier period 1922 to 1931 it might be said that the over-all reduction in mortality in England was due to improvements in the standard of living and hence in the mortality of the

TABLE 9  
MALE MORTALITY—ENGLAND  
(x) 1949-53 EXPRESSED AS A PERCENTAGE OF 1930-32  
(y) 1930-32 EXPRESSED AS A PERCENTAGE OF 1921-23

Age Group:	20-24	25-34	35-44	45-54	55-64
All Males (x) 1951/1931.....	42%	46%	51%	74%	97%
(y) 1931/1922.....	89	83	85	95	92
Social Class I (x).....	62%	56%	52%	77%	105%
(y).....	114	99	91	100	100
Social Class II (x).....	39	40	48	69	87
(y).....	92	75	79	94	95
Social Class III (x).....	40	44	52	76	103
(y).....	89	88	90	100	92
Social Class IV (x).....	41	43	48	67	90
(y).....	90	86	91	99	94
Social Class V (x).....	46	57	58	79	101
(y).....	82	75	76	86	83

TABLE 10  
UNITED STATES PERCENTAGE REDUCTION IN MORTALITY RATIOS  
RATIOS OF 1950 TO 1930 AND 1930 TO 1920  
(Average of three years centering on year indicated)

Age Group:	15-24	25-34	35-44	45-54	55-64
White Males					
1950/1930*.....	51%	46%	58%	79%	91%
1930/1920†.....	72	68	88	107	109
White Females					
1950/1930*.....	27	31	45	59	65
1930/1920†.....	62	60	77	90	96

\* Death Registration Area.

† Death Registration States of 1910.

lower social classes only, whereas in the period 1931 to 1951 the improvement has been general throughout the population with possible reservations regarding the age group 55 to 64.

In the U.S. White Males (Table 10), note the worsening of the mortality in the age groups 45 to 64 from 1920 to 1930, yet the definite improvement in the period 1930 to 1950. In the latter period the improvement at all ages parallels that of England.

TABLE 11  
MORTALITY OF MARRIED WOMEN EXPRESSED AS PERCENTAGE  
OF MALE MORTALITY OF SAME SOCIAL CLASS  
ENGLAND 1949-53

Age Group:	20-24	25-34	35-44	45-54	55-64
Social Class					
I.....	25%	55%	80%	62%	50%
II.....	55	74	74	60	53
III.....	61	77	73	59	50
IV.....	64	82	74	64	58
V.....	59	75	63	52	48
All Classes Combined.....	57%	74%	71%	59%	51%

MORTALITY OF WHITE FEMALES (ALL CLASSES) EXPRESSED AS A  
PERCENTAGE OF WHITE MALE MORTALITY (ALL CLASSES)  
UNITED STATES 1949 TO 1951

Ages:	15-24	25-34	35-44	45-54	55-64
Percentage.....	46%	60%	62%	56%	56%

In Table 11, the mortality of married women is compared with that of men of the same social class. The advantage of wives over husbands mortalitywise is strikingly illustrated here. The unusually low figure of 25% in Class I age group 20-24 is due to the high mortality rate of men in that class which includes commissioned officers in the armed forces. However, throughout the classes the advantage of wives over husbands is striking and increasing. In the important age group 55-64, where in the 1930-32 investigation the percentage varied from Class I to Class V progressively from 61% to 72% (given in the paper referred to in footnote 9), in the 1949-53 investigation the ratios varied from 48% to 58% with the lowest ratio in Class V (see Table 11). For all social classes the ratio was 51%. In comparison with the latter ratio the only comparative figure which can be given for the United States is for "All White Fe-

males," married and otherwise, where the ratio for the period 1949-51 is 56% of that of males in the same age group, 55-64 (see Table 11).

The wealth of detail in which the Registrar General's Report covers the various causes of death according to occupation of the deceased is almost overwhelming. A list of 38 causes have been adopted representing a far larger number of causes of death according to the International List. Apart from the detailed analysis of cause of death by social classes, subclasses and socio-economic groups (both men and married women), similar details by age at death are given for 110 occupational groups and in summary form for another 300 individual occupations. Among other tabulations are deaths from cancer of a large number of individual sites grouped by social class and occupation.

This Supplement on Occupational Mortality by the British Registrar General is a mine of material for future investigation. Two aspects which the author has investigated for separate publication are worthy of mention here: the correlation between the brain-workers, the leaders and professional men and their disposition to cardiovascular-renal disease, but not in the case of their wives; and the relationship between social class and accidental death if occupational hazards be excluded.

#### CONCLUSION

This paper raises the question of the possibility of a joint occupational study by the Society. The *Joint Occupation Study, 1928*, and its sequel, *Occupational Study, 1937*, are over twenty years old. Occupational mortality has received very little attention from actuaries in recent years. Even with the wide scope of the Informal Discussions at the Society meetings the subject has been touched upon only twice in the past ten years: in 1956 and 1957. It is to be hoped that this question will be referred to in the discussion of the paper.

Since this paper was written, two reviews of the Registrar General's Supplement on Occupational Mortality of interest to members of the Society have appeared. The first is by Mr. R. H. Daw in *JIA* 85, p. 104. The other is by Mr. Jules V. Quint of the Metropolitan, given to the Home Office Life Underwriters Association in May 1959. Mr. Quint's review is of particular interest on the subject of occupational mortality as a preliminary to the study of the Supplement itself.



## DISCUSSION OF PRECEDING PAPER

ANDREW C. WEBSTER:

This is an interesting paper for both the demographer and the underwriter. The changes in occupational mortality have been brought about by better living conditions, better industrial medicine and better safety precautions. The improvement in the standard of living with better medical care has possibly had the greatest effect in equalizing the levels of social class mortality. Mr. Pedoe suggests that this may be attributable in some degree to the welfare state in England and Wales, and I am inclined to agree with that statement. In the United States perhaps some credit might be given to the insurance companies, which have furnished better medical care to many of our workers through group insurance.

Mr. Pedoe laments the lack of comparable statistics in the U.S. and makes a plea not only for better census material but also for a reintroduction of the Joint Occupation Study. One objection to making another Joint Occupation Study is the cost. The assembling of the data and the publication of the results is very expensive, and since the mortality variations between occupations are apparently getting smaller it is questionable whether we should spend a large amount of money in getting occupational mortality statistics. Further, these statistics, as was pointed out in the last Occupational Study, might well be out of date by the time of publication because of the introduction of new industrial methods and new safety devices. Automation in industry has undoubtedly lessened the accident rate, but automation applies only to the more complicated industrial processes. There are many occupations where the hazards cannot be automatically eliminated and where the only reason for an improvement, present or future, in the death rate is the effect of better social class mortality.

The Committee on Mortality has considered various ways of getting occupational mortality data. The underwriter has to be content with broad groups and the real test is whether the extra premiums are sufficient to meet the extra death claims. Fine distinctions in occupational ratings are not practical and not justified on the basis of the occupational mortality figures available. As far as the industry is concerned, the Committee has been inclined to suggest that the occupational investigations be limited to certain basic industries and that perhaps individual companies could fill in the gaps by separate studies. They have also been checking outside sources of information without much success to date.

Most of the available statistics are not sufficiently subdivided and in many instances we have the deaths but not the exposures. The searches have led us to group insurance records which give only very general industry figures and no real subdivision by occupation, to Workmen's Compensation records where accurate exposures are not obtainable and, finally, to the Census Bureau. Some work is being done by the National Office of Vital Statistics. At the Home Office Life Underwriters Association meeting next week there is a paper on "Mortality by Occupation in the U.S." submitted by Dr. Moriyama and Miss Guralnick of the National Office. Dr. Philip M. Hauser and Miss E. M. Kitagawa of the Population Research and Training Center of the University of Chicago have undertaken a research project on "Socio-Economic Differentials in Mortality, 1960." This is based on the 1960 Census and part of it will be directed to occupational differences in mortality. The project may provide material on individual occupations, and we have already been in touch with Dr. Hauser.

The figures given by Mr. Pedoe show that there are still variations in the mortality of various occupations. Table 4, which is interesting for its agreements as well as for its differences, gives us some guide to the possible mortality variations. The high S.M.R. of the Armed Forces is a little puzzling.

I would like to disagree with Mr. Pedoe's assumptions that there is not a difference between the standard mortality of various companies. If it were needed, the mortality of the contributing companies to the Committee reports could be divided into *Heavy* and *Light*. The mortality differences are accounted for, I think, by social class mortality as well as by underwriting practices. Further, in Mr. Sternhell's paper on "The New Standard Ordinary Mortality Table" (*TSA IX, 1*), the results of the 33 companies which were not contributors to the Committee reports indicate a very wide variation in mortality, and again part of this might be due to the type of business underwritten rather than to their underwriting practices.

HARRY F. GUNDY:

During the past ten years the occupational rating schedules of most life insurance companies have undergone periodic and substantial revisions. In some companies these schedules are now reduced to relatively small proportions, with extra premiums being required for only a small number of occupational groups. It has been recognized that general living conditions have had a great influence upon occupational mortality rates. Mr. Pedoe's paper is therefore a timely one in bringing forward for dis-

cussion and review the effect which social class, as an indication of living conditions, has had upon mortality rates.

It is perhaps only natural that in our efforts to bring our occupational ratings into line with current experience the competitive situation has, in the case of some occupational groups, led to the removal or reduction of ratings which will prove to be unjustified by experience. As a check upon the hazards of occupation one may refer to industrial accident reports and to various governmental statistical reports, but these have their deficiencies for our purpose because of the groupings of many occupations or because they deal primarily with the accident hazard.

As an example of an occupation which may currently be regarded too generously for life insurance purposes, reference might be made to fire department employees. Many companies have concluded that firemen now fall within standard limits of acceptance, possibly because accident statistics indicate that the rate of accidental death is not excessive. Nevertheless, the 1955 report of the Committee on Group Insurance Mortality shows firemen to have the highest excess claim rate of any group in the study. Accidental deaths accounted for only a small proportion of the excess deaths. In a paper to be presented to a meeting of the Home Office Life Underwriters Association this month, Mr. G. W. Wilson will present the results of an occupational mortality study conducted by the Sun Life of Canada and covering the period 1948 to 1957. In this study firemen were subject to 4.7 extra deaths per 1,000, based upon 32 deaths of which only 2 were occupational accidents. It would seem that there are influences other than accident hazards which affect the mortality of this occupational group.

There are undoubtedly many occupations which are subject to health, environmental and moral hazards where the best source of information for underwriting purposes will continue to be the records of life insurance companies. Modern electronic machines have simplified the preparation of mortality studies similar to the type required for occupational mortality studies, and it is hoped that the defects of a joint study will not be allowed to deter us from engaging in such a study in the next few years as a check upon the accuracy of the many changes in ratings which have recently been made.

ALTON P. MORTON:

Mr. Pedoe has written an interesting review of the problems related to the study of mortality by occupation. His paper draws attention especially to the existence of a relationship or correlation between occupational mortality and socio-economic class. I, in fact, go somewhat further than the author and suggest that under today's conditions in industry in

the United States and Canada, direct occupational hazards in many, if not most, occupations are secondary in importance in the mortality picture to the indirect or socio-economic grade implied in the pursuit of a particular occupation.

Mr. Pedoe has indicated that an intercompany study of occupations would be interesting and valuable to the life insurance industry at this time. Reviewing this problem as a member of the Committee on Mortality under Ordinary Insurances and Annuities, I am not sure that I agree with him. This does not imply disinterest in the subject of occupations and their associated mortality problems. But rapid improvements and changes in technological processes in many industries almost certainly affect the mortality outlook for applicants in most occupations. Automation has eliminated many occupations wholly or changed their content with resulting reduction or elimination of direct occupational hazards. New occupations have been created with new industry and the newer technological processes. Also, improvements in housing and living conditions, and an improved standard of living in the United States and Canada, have more favorable socio-economic mortality implications for many occupations today. Any results from a current intercompany occupational study reflecting primarily past conditions in industry and socio-economic implications of past years would seem to be of little value in predicting future mortality associated with many occupations.

A better approach in studying this problem would seem to be to explore sources of mortality data from outside the life insurance industry. Outside sources have been used for many years in developing aviation statistics by the Society's Committee on Aviation, and equally promising sources of data may be available for occupations.

The advantages of outside sources of information over insurance data appear to be several. Among them I would enumerate that (1) a sufficiently large volume of data may often be available to yield reliable mortality figures even though attention is confined to a short period of years in order to reflect up-to-date occupational conditions, (2) figures for a number of industries may be available more cheaply from outside sources than through the relatively expensive route of intercompany mortality studies and (3) outside sources appear to offer promise as a valuable supplement and may be a substitute for, or permit some curtailment of, intercompany studies.

EDWARD A. LEW:

We should be grateful to Mr. Pedoe for calling our attention to the need for more information about the relationship between occupation, social class, and mortality.

The general impression, supported by several individual company studies, is that the number of occupations where there are distinct accident or health hazards has dwindled to relatively few, such as military pilots, caisson workers, bridge and structural iron workers, divers, dock laborers, power line workers, bartenders, rivermen and woodsmen, underground miners, shooters and drillers in the oil and natural gas industry, sandblasters, and building wreckers. In most other occupations which are still rated, we are confronted in large part with mortality gradations by social class. A comparison of the Whitney (1930) study and the Moriyama-Guralnick (1950) study suggests that the mortality differentials between professional and managerial occupations and semiskilled workers have narrowed appreciably and that agricultural workers no longer enjoy the advantage in mortality they did thirty years ago. This is brought out in the accompanying table.

OCCUPATIONAL CLASS	WHITNEY STUDY U.S. 1930	MORIYAMA-GURALNICK STUDY U.S. 1950	
		White	Total
Average for males ages 20-64 . . . . .	100%*	100%	100%
Professional occupations . . . . .	81	82	83
Managerial occupations . . . . .	85	84	85
Skilled workers . . . . .	93	96	97
Semiskilled workers . . . . .	113	97	100
Unskilled workers . . . . .	151	120	152
Agricultural workers . . . . .	71	83	96

\* Average for males 15-64; refers largely to a white population group.

A number of recent studies by individual companies of the mortality by occupation among persons insured under Ordinary policies also indicate that the mortality of skilled, and particularly of semiskilled workers has improved to a striking degree during the postwar years.

The marked decline in death rates of the lower socio-economic groups, whose mortality in the past was materially higher than that of the more favored segments of the population, has apparently been a major factor in recent decreases in mortality. Rising living standards, with their associated benefits, including improved environment at home, at work, and in public places, have been more of a force working for lower mortality than has been generally recognized.

The differences in social class mortality among nonwhite persons are particularly striking, as may be seen from the following experience on

nonwhites insured by the Metropolitan Life under Ordinary policies during the years 1922-31, traced to December 31, 1949.

NONWHITE LIVES INSURED UNDER ORDINARY POLICIES 1922-31  
TRACED TO DECEMBER 31, 1949

Mortality Ratios Based on  
Corresponding Standard Ordinary Experience

OCCUPATIONAL CLASS	ISSUE AGES				
	10-29	30-39	40-49	50 and over	All
Professional occupations.....	155%	116%	99%	91%	109%
Managerial occupations, clerks, salesmen, etc.....	187	121	115	90	117
Other standard Ordinary occupations— mainly skilled workers.....	213	177	101	104	137
Dependent women.....	189	163	104	*	157
Occupations in first substandard class.....	281	218	162	147	200
Occupations in second substandard class..	346	251	198	178	239

\* Less than 10 deaths.

The differentials in mortality between whites and nonwhites in the general population are considerably greater than those between white and nonwhite insured lives. In the Metropolitan's 1959 experience among Industrial policyholders these differentials were as follows:

RATIO OF NONWHITE TO WHITE MORTALITY  
BY AGE GROUP

Sex	15-24	25-34	35-44	45-54	55-64
Males.....	1.35	1.74	1.58	1.19	1.01
Females.....	1.63	2.46	2.20	1.86	1.50

J. B. MACDONALD:

I very much enjoyed reading Mr. Pedoe's very interesting and valuable paper. I hope that I may be able to contribute a few footnotes to it.

It was especially interesting to me as a group actuary as we quite often have an opportunity to insure groups where the members belong pretty much to one social class. It might be interesting to attempt to investigate social class mortality using either the statistics published in the detailed reports of group mortality given by the Society or the experience of certain individual companies. The people covered under a group policy are

not necessarily a homogeneous group, as people in the managerial and professional classes will be included in a group which consists largely of laborers, but possibly the error caused by this would be no greater than that inherent in all census data, to which Mr. Pedoe refers. Further, an individual company studying its experience under group policies may be able to eliminate those people not belonging to the social class in which it is interested. I, myself, have done this in a study I made of mortality on employees in the lumber industry under group policies issued by the Crown Life.

The growth of union welfare plans may give us a better opportunity to study mortality by social class, as I would expect that people insured under such group policies would be a more homogeneous group than those insured under the traditional employee-employer group.

There are always exceptions to all general rules and I hope that I may be allowed to mention one. One large Canadian company has for many years covered its employees under two group policies. My company underwrote one on their managerial, office and sales personnel, while another Canadian company underwrote one on their plant employees. We always congratulated ourselves with having the cream of the business, except on those occasions where we compared our mortality experience with that of the other company. The mortality of the factory workers was always considerably below that of the supposedly more select group.

I am also prompted to comment on Mr. Pedoe's reference to policemen as a select group. It has always been difficult to understand why policemen showed a considerably higher than average mortality in the group life reports, an excess mortality not accounted for by any increase in accidental deaths. The position of the group underwriter has always been complicated by the ordinary department being willing to take policemen at standard mortality rates when the group department wishes an occupational loading. I have come to the conclusion that the excess mortality on the policemen is occasioned primarily by diseases peculiar to big men—that is, cardiovascular-renal diseases—and not by any occupational hazard as such.

One must be careful in drawing conclusions from a study of social class mortality and attempting to apply them to accident and health insurance. It is probably quite true that morbidity is higher in the lower social classes, but the claims experience under group policies insuring such people is quite often very satisfactory. Of course, people in the upper economic brackets likely use more expensive medical facilities and this explains higher claims under major medical policies, but it does not account for higher claims under scheduled basic casualty benefits.

It appears that members of the lower economic classes just do not go to doctors and hospitals unless it is absolutely necessary. Accordingly, there are lower claim rates and claim costs. This may be caused by a lack of education, with the result that they either fear doctors and hospitals or that they use quack remedies. In any event, claims ratios are considerably lower and the experience on a reasonable number of group casualty policies issued by my company confirms this.

JAMES L. COWEN:

Mr. Pedoe's excellent and very timely paper focuses attention on an important subject which has not received the consideration it deserves from the actuarial profession. A study of the effect of occupation on mortality is important not only to insurance companies but also to pension plans whether they are private or public.

I might go a little further than Mr. Pedoe and ask the Society to consider the desirability of making this occupational mortality study on two bases, one from data of ordinary insurance and the other from data of group insurance, group annuity, and pension plans. It seems to me that there might be some desirability of having a study based on the occupation at the time the insurance is issued and also a study based on the occupation at the time of death or retirement. Both of these studies would be of use and interest to actuaries.

My interest in this subject derives from a study<sup>1</sup> prepared by the Railroad Retirement Board. This study dealt with occupational differences in active service mortality, disability, retirement, and withdrawal rates. The mortality part of that study is shown in the table on page 251. In our study, the occupations were those at the time of the employee's death.

I would like to call attention to the relatively light active service mortality of railroad employees in the extra-gang, section, and other maintenance of way occupations. This group is one of those with the lowest socio-economic standings in the industry. This finding was rather surprising, but a partial explanation is probably found in the relatively high rates of disability which showed up for this group. Perhaps if the death rates in active service and shortly after disability retirement were combined, the rates for this group would have been relatively worse. However, we were not able to make this combination for this study, but we expect to be able to do so at some future date.

This brings another question to my mind concerning any occupational

<sup>1</sup> J. L. Cowen, *Occupational Differences in Separation Rates for Railroad Workers, 1954-56*, RRB Actuarial Study No. 2, Railroad Retirement Board, August 1959. This was digested on page 1142 of Vol. XI of the *Transactions*.



ACTIVE SERVICE MORTALITY† OF RAILROAD WORKERS WITH 10 OR MORE YEARS OF SERVICE  
BY AGE AND OCCUPATIONAL GROUP, 1954-56  
Ratios to Rates for All Employees

OCCUPATIONAL GROUP	ATTAINED AGE ‡						ALL AGES	
	Under 50	50-54	55-59	60-64	65-69	70 and over	Un-adjusted	Adjusted#
All employees§ . . . . .	100.0% (.00339)	100.0% (.00840)	100.0% (.01142)	100.0% (.01907)	100.0% (.02358)	100.0% (.03299)	100.0% (.01020)	100.0% (.01020)
Operating employees . . . . .	108.0	97.7	99.7	110.7	100.5	106.7	107.5	104.3
Nonoperating employees . . . . .	97.1	100.5	100.1	96.2	99.8	97.7	97.6	98.4
Executives, supervisors and professionals . . . . .	114.2	116.0	118.0	80.4	89.3	*	102.2	98.2
Station agents, telegraphers, clerks and other office employees . . . . .	100.9	108.2	73.6	108.3	109.8	123.7	102.1	101.9
Engineers and conductors . . . . .	71.4	70.2	117.4	92.0	105.0	108.2	130.2	94.6
Firemen, brakemen, switchmen and hostlers . . . . .	118.9	113.2	84.7	134.8	93.1	103.3	93.2	110.4
Way, structure, and shop craftsmen, helpers and apprentices . . . . .	77.9	94.5	98.0	87.4	73.3	75.8	85.4	86.0
Extra-gang, section and other maintenance of way employees . . . . .	104.7	109.2	103.2	80.4	102.3	*	91.9	95.9
Shop and store employees . . . . .	110.3	75.5	75.0	105.9	113.8	113.1	94.9	98.0
Station and platform employees . . . . .	84.7	71.2	138.4	107.3	98.3	*	94.5	101.3
All others . . . . .	116.5	104.8	122.2	132.6	149.4	131.3	129.7	127.5

\* Less than 5 actual deaths in the sample.

† Death in the same year or the year following the year last worked in the railroad industry.

‡ Age attained in the calendar year of exposure.

§ Figures in parentheses are crude death rates.

# Standardized using age distribution of all employees.

NOTE.—Based on a 4-percent sample.

mortality study which the Society might make. Would it be desirable to have the data from group insurance, group annuity, and pension plans separated according to whether the death occurred before or after retirement or would it be preferable to have them combined? The answer, of course, depends somewhat on the availability of data. Whatever the situation, an occupational mortality study is long overdue. I hope that Mr. Pedoe's urgent call for such a study will bring this about.

(AUTHOR'S REVIEW OF DISCUSSION)

ARTHUR PEDOE:

I am indeed gratified that four members of the Society's Committee on Mortality should have taken part in the discussion of my paper.

*The Need for a New Intercompany Occupational Study*

The paper formed part of a larger work. One thought behind its preparation was the need for a new intercompany study on occupational mortality. Of the four members of the Committee on Mortality, Mr. Gundy is definitely in favor of such a study. As he states, his company, the Sun Life of Canada, has already done much work in that direction. Messrs. Webster, Morton and Lew are, least to say, lukewarm to the idea. I realize that a breathing spell is desirable after the enormous labor of the Build and Blood Pressure Study, but I do trust it will receive the attention it deserves.

The occupational rating manuals of companies have a history of at least 45 years. The Actuaries Club of Toronto issued its first Schedule of Occupational Ratings in 1915 and undoubtedly the manuals of a number of United States companies preceded this. Arthur Hunter's paper in *TASA XXI* (1920) gave detailed schedules of occupational ratings also covering the total disability and double indemnity accident benefits. The growth in the size of these occupational rating manuals is illustrated by one U.S. company official who in 1947 commented on the growth of his company's manual:

In 1922 it had an area of 160 square inches

In 1932 it had an area of 667 square inches

In 1947 it had an area of 1,518 square inches

or an increase to nearly ten times its size in 25 years.

Protests against the size of occupational rating manuals became apparent after 1947. The substantial reduction in mortality from prewar to postwar was one reason. A 40% reduction between the periods 1934-39 and 1947-51 was evident in the Society's intercompany experience on new issues. The doubling and more of new ordinary business in the period meant an increasingly critical attitude to occupational extras.

The reaction has been phenomenal. To illustrate this: one prominent U.S. company which had an occupational rating manual of some 50 pages has now reduced it to 5 pages, exclusive of aviation extras. A prominent Canadian company which had a manual of some 60 pages (quite usual in pre-1950 days in Canada) has cut this to 4 small pages. As far as I can ascertain neither of these companies has made detailed studies of its experience under various occupations to justify its action.

I wish to make it clear that whatever can be done to simplify our business is most desirable and I am in favor of a reduction in the size of occupational rating manuals and have often advocated this. However, the justification of our profession is to "substitute facts for appearances and demonstrations for impressions." Is the trend back to the "ancient" practice of confining occupational ratings to mining and the liquor trade only? If this can be justified it will be welcome.

I would suggest, if a full scale intercompany study is not feasible, that a dozen congenial spirits, including the four already mentioned, get together and divide up among them the important occupations on which there is some doubt. If only those companies took part which had the material ready in suitable form, we could have the results in a year or so. These would indicate what our experience has been in the fifties on a number of presumed hazardous occupations. Then any reduction or elimination of occupational extras would be based on knowledge and not presumption or competition.

### *Extra Mortality Premiums*

Another gap in our knowledge which should be rectified is the relationship between extra percentage mortality, extra deaths per thousand and net extra premiums based on recent mortality as Tables X<sub>17</sub> and X<sub>18</sub> (1950-54 intercompany experience of the Society of Actuaries). At age 20 according to Table X<sub>18</sub>, 100% extra mortality means less than one extra death per thousand; at age 60 it means an extra 17.6 deaths per thousand. When a period of 20 years is considered (ignoring interest), 100% extra mortality over the period represents an extra 1.2 deaths per annum per thousand for age 20 at entry and 45.2 extra deaths for age 60 at entry.

Undoubtedly our views on flat extras require modification, but the plea that it be based on investigation and demonstration still holds. I suggest that such tables be issued as a supplement to Shepherd and Webster's *Selection of Risks*. Keppie and Stepney gave such tables in a paper to the Faculty of Actuaries in 1949, but they are based on the A 1924-29 experience and so of little value to us.

*Accidental Deaths*

In U.S. life insurance companies, deaths from accident dominate the claims payments in the early policy years, and with every reduction in the over-all rate of mortality this domination increases. The 1958 Reports Volume of *TSA* gives the intercompany experience on Ordinary Insurances for the years of issue 1942 to 1956 between the 1956 and 1957 anniversaries. For medically examined lives 61.8% of the total amount paid in claims in the first 5 policy years, ages 10 to 29 at issue, was due to "accidents and homicide." For nonmedical issues the ratio was 61.1%, for ages 30-39 at issue it was 27.8% and for all ages at issue 46.5%.

A study of the Registrar General's Report emphasizes the need for a study of life insurance mortality by occupation particularly as regards accidental death—the double indemnity study is not the answer. An analysis I made of this English experience indicates that if "miners" and "other unskilled workers" be excluded, the rate of mortality of artisans generally in the age group 20-64, after deducting all accidental deaths, is lower than that of the "clerical," "professional" and "managerial" classes. As the accidental death rate in the United States is more than double that in England, this point may be all the more significant on this side.

*Outside Sources*

Mr. Morton outlines the advantages of outside sources of information regarding occupational hazards. Mr. Webster mentions that the Committee has not had much success to date in this connection. I investigated this as part of the work done on the original paper. In nonlife insurance there is very little published material of use to life insurance companies, and this includes the *Proceedings* of the Casualty Actuarial Society. The fact that ASTIN (Actuarial Studies in Non-Life Insurance) has recently been organized as a section of the International Congress of Actuaries indicates the gap existing in nonlife insurance as regards statistics of value to the actuary.

As for statistics based on Workmen's Compensation Schemes: after inquiry I doubt if these will be of any use for occupational extras. It is difficult and perhaps impossible to remove the political considerations which affect such statistics.

Authorities in these various fields rather look to the Society of Actuaries to make available to them the results of its investigations which have a bearing on their own particular fields. The life insurance companies have the data, the men and the machines and cannot afford to ignore the prestige arising from such researches.

*University of Chicago's Research Plan*

As noted by Mr. Webster, announcement was made last month of a million dollar grant by the Department of Health, Education, and Welfare of the United States to a group of researchers at the University of Chicago headed by Dr. Philip M. Hauser, director of its Population Research and Training Center. Dr. Hauser was acting director of the Bureau of the Census in 1950.

The object of the study is to match certificates of death in the United States from May 1st to August 31st, estimated at 500,000, with census data supplied by the same individuals in April 1960. This matching procedure will be used to analyze causes of death in relation to social, economic, geographic and ethnic backgrounds. The relationship of mortality to income, education, housing, place of birth and occupation will be sought.

According to the announcement, because the census machinery will be preoccupied with its primary functions through 1962 the bulk of the matching work cannot begin until 1963 and the final analysis will not be published until 1965.

*Nonwhite Lives*

The Metropolitan figures given by Mr. Lew are important. No one made the point that the heavy relative mortality of nonwhite lives in the past, with all that it implied, was a justification for segregation; or that the figures indicate that this is diminishing, and hence likewise the reason for segregation. It is to be noted that the differences between white and nonwhite mortality are lower among Metropolitan policyholders than among the general population. This is itself a "social-class distinction" indicating that nonwhites who buy life insurance are a superior class to those who do not.

*Railroad Workers*

Mr. Cowen's *Actuarial Study* is important as indicating a source of material on occupational mortality. He comments on the relatively light active service mortality of railroad employees in the "Extra-gang, section and other maintenance of way" occupational group which is low, relatively, in a socio-economic sense. A point of interest bearing on this is given in the Registrar General's Supplement. Mortality ratios among railway workers give definite evidence of selection by occupation, undoubtedly due to transfers to less demanding duties as health deteriorates. Thus the S.M.R. for locomotive engineers is 93, locomotive firemen 86, round-house employees 95, porters 104, ticket collectors 135.

*Armed Forces*

Mr. Webster questions the high S.M.R. of the Armed Forces (other ranks) in Table 4: Social Class III*d*, namely males 163, wives 132. With the large number of U.S. servicemen presently stationed abroad, the following points of the Registrar General's Report should be of interest. In England the invaliding home of unfit men in the services or those with a high risk of dying disturbs the mortality ratios for that occupational group. Further, those invalided from the services are in number related to the strength of the services at the time of retirement, not that at the census date. Another factor is that retired servicemen, particularly those with any disability, who engage in any occupation will record that occupation at the census date. However, at death informants may, quite naturally, record the occupation as a retired serviceman. These points indicate the difficulties inherent in a population study of mortality by occupation. It is worth noting here that commissioned officers record an abnormally high accidental death rate.

*Workers in Unskilled Occupations*

Both Mr. Webster and Mr. Morton stress the importance of socio-economic grade rather than occupation in underwriting. The R.G.'s Report lists over one million men under "workers in unskilled occupations," ages 20 to 64 and not included in specific industries. Their S.M.R. was 132, wives 123. The Report expresses the opinion that these ratios err on the high side. Yet repeatedly in the Report the relatively high rate of mortality of this class of worker is apparent.

An investigation by the Metropolitan Life reported by Mr. Van Keuren in Vol. 38 of the H.O.L.U. (1957) indicates that they did not find *any* class of laborer showing a standard mortality experience except certain high grades of farm laborers. The importance of socio-economic grade in underwriting is illustrated by this.

*Heavy versus Light Mortality*

Mr. Webster disagrees with my statement that in the United States and Canada there is not such a wide difference between companies under standard ordinary insurance mortality as in England as represented by Table 2 in my paper and he refers to Mr. Sternhell's paper in *TSA IX*. I had in mind U.S. companies which did a countrywide business covering all social classes. On page 21 of Mr. Sternhell's paper the largest difference among the fifteen companies contributing to the intercompany experience which produced Table X<sub>13</sub> is 10 points (from 93.7% to 104.0%). Among the thirty-three other companies the difference was as much as 50 points.

However, Mr. Sternhell on page 208 explains this wide difference as due to geographical concentration, distribution of business by duration, and statistical differences due to small amount of exposure.

A point I wish to make is that where the artisan class does purchase large volumes of ordinary life insurance, some discrimination between high and low mortality in occupational groups is necessary. This was the justification for the extensive occupational rating manuals formerly in use. With the narrowing of mortality differences among social classes and the introduction of step rate plans, the need for such extensive rating manuals is considerably reduced.

#### *Other Items*

The group cases mentioned by Mr. MacDonald where the managerial and clerical staff consistently gave a higher mortality than the plant employees is of interest, but I doubt if it is an exception to the rule. I suggest the conditions and claims of the first case be examined. Some peculiar results arise in group life business. Technically we call it "antiselection"; a stronger term might be justified occasionally.

In the R. G.'s Report, policemen showed an S.M.R. of 112. The Report notes that for ages 20-54 the ratio of actual to expected deaths was 76% and for ages 55-64 it was 159%. It presumes that policemen who retire early will on death be reported in that occupation, although engaging in other work as reported on the census date. The ratio of actual to expected deaths (ages 20-64) for policemen from the major cardiovascular-renal diseases was 136%, thus supporting Mr. MacDonald's statement that policemen are more subject to these diseases than the average.

The S.M.R. of Fire Brigade Officers and Men was reported as 81, which is very favorable as compared with the 4.7 extra deaths per 1,000 which Mr. Gundy gives.