

JOINT OCCUPATION STUDY

1 9 2 8

COMPILED AND PUBLISHED BY
THE ACTUARIAL SOCIETY OF AMERICA
AND
THE ASSOCIATION OF LIFE INSURANCE MEDICAL DIRECTORS
NEW YORK

JULY, NINETEEN HUNDRED AND TWENTY-NINE

JOINT COMMITTEE

From the Association of Life Insurance Medical Directors

FRANK L. GROSVENOR

WILLIAM MUHLBERG

OSCAR H. ROGERS

H. CRAWFORD SCADDING

T. H. WILLARD

J. A. PATTON (*ex-officio*)

From the Actuarial Society of America

JOHN K. GORE

ROBERT HENDERSON

WILLIAM A. HUTCHESON

HENRY MOIR

E. E. RHODES

ARTHUR B. WOOD

J. D. CRAIG (*ex-officio*)

ARTHUR HUNTER, *Chairman*

CONTENTS

	Page
Introduction.....	7
Change of Occupation.....	8
Incidence of Extra Occupational Mortality.....	9
Contributing Companies.....	9
Standard and Substandard Risks Included.....	10
Probable Deviation Due to Insufficient Numbers.....	11
Mortality Summary Sheet.....	12
Basic Tables of Mortality.....	12
Causes of Death.....	15
Double Accidental Death Benefits.....	19
Comparisons With Other Material.....	24
Description of Results in Each Class.....	29
Summary of Results.....	71
Detail Tables.....	83
Appendix.....	143
Index of the Volume.....	189

INTRODUCTION

IN OCTOBER, 1927, a paper on "Occupational Mortality" was presented to the Actuarial Society of America in which the author pointed out that the material of the Medico-Actuarial Mortality Investigation was from 19 to 42 years old, that there had been a great change in many industries since the World War, that the largest companies had enough data upon which to base their ratings for the principal occupations only, and that the disability and double accidental death benefits had come into being in recent years. After the reading of the paper the Actuarial Society of America requested the Joint Committee on Mortality to proceed with an investigation of occupational mortality and a few days later the Association of Life Insurance Medical Directors concurred in this request. Soon thereafter the Committee came to an agreement upon the principal outlines of the work and a general invitation was extended on the first of March, 1928, to all companies represented in either of the two societies to contribute their material.

The preliminary inquiry indicated that comparatively few companies could furnish their data within a reasonably short period, and as the great majority of the material was expected to be contributed by half a dozen of the largest institutions, it was possible to make plans for obtaining and analysing the material with a minimum of labor and time. As these large companies were well equipped for making mortality studies, and as they could present their results on mortality summary sheets instead of on perforated cards, the method of procedure was adapted to the former. Apart from the saving through the distribution of labor over a few companies instead of all perforated cards being sent to a central bureau, there were the additional advantages of greater speed in obtaining the results and of enabling each contributing company to compare its own material with that of the joint investigation.

Prior to 1926 there was no uniform occupation code used by the companies. In that year the

Canada. A more awakened social conscience on the subject of better care of employees has undoubtedly had an effect on the mortality. Accordingly, it was decided not to go back further than the year 1915. Tests in several of the larger companies indicated that this would give a good volume of material. For those industries in which it was anticipated that accident would be the only occupational hazard, there was thought to be less need for a study of mortality by duration of insurance, and in those occupations the issues were taken since 1920. This matter is mentioned in more detail in connection with the incidence of extra occupational mortality. There are accordingly two groups of classes by years of issue, 1915 to 1926 and 1920 to 1926, carried to the anniversaries of the policies in 1927. The investigation is based upon observations by policies. Both men and women are included.

A sample of the uniform mortality summary sheets on which the contributing companies were requested to furnish their data appears in the appendix. There was no restriction placed upon the perforated card used for this purpose, and many of the companies were therefore able to use their own cards without repunching. It was only necessary that their code number for a given occupation should agree with all or part of a class under investigation. These economies of effort were possible because the uniform methods of perforating cards described in the Committee's pamphlet of 1924 had been generally adopted by the companies.

It was decided to include only those policies under which life insurance would have been issued at the standard rate of premium if it had not been for the occupation. Thus all policies were omitted which would have been classed substandard because of build, race, residence, or medical impairment. Only Ordinary business was included, and therefore this investigation does not cover the mortality under Industrial, Group and Intermediate (\$500 policies) plans nor policies issued without medical examination. The advisability of investigating separately

made on samples of the material in two large companies showed the effect of this assumption upon mortality ratios to be negligible for practical purposes. This was to be expected, as the great bulk of changes were to an occupation of approximately equal hazard. Numerical illustrations of this are given in the Transactions of the Actuarial Society (1928), vol. 29, page 85.

In many classes the new occupational code specifies details which the companies have not been in the practice of obtaining in their applications for insurance. One of the results of the present investigation is to show the importance of making certain discriminations which have not been observed by all the companies. Special questionnaires have been generally used in a few selected industries such as mining, electrical and marine service. For the benefit of future investigations it is desirable that similar forms be employed in a number of other industries. The present rule in using the code is that when the required detail is not given the case be classified under the "all others" group; thus "(629) other switchmen and flagmen" now includes those who are not in towers and also those who were not specified as to whether or not in towers. There is considerable opportunity for improvement in this particular, and each company is recommended to undertake the task of revising its occupational blanks so that the material under the "not specified" titles may be reduced to a minimum.

INCIDENCE OF EXTRA OCCUPATIONAL MORTALITY

Previous investigations in this subject have led actuaries to expect at least two distinct types of extra mortality—one with a fairly constant extra during the working years of life, and the other with increasing additional cost to middle life or beyond. Locomotive firemen exemplify the first and saloon-keepers the second type. In each of these classes the mortality ratio is affected by the duration of the experience. A less usual type is that where the extra mortality decreases with duration. In the present investigation the average duration

New York Life Insurance Company.....	New York City
Equitable Life Assurance Society.....	New York City
Mutual Life Insurance Company.....	New York City
Northwestern Mutual Life Insurance Company.....	Milwaukee, Wis.
Travelers Insurance Company.....	Hartford, Conn.
Union Central Life Insurance Company.....	Cincinnati, Ohio
Missouri State Life Insurance Company.....	St. Louis, Mo.
Life Insurance Company of Virginia.....	Richmond, Va.
Berkshire Life Insurance Company.....	Pittsfield, Mass.
American Central Life Insurance Company.....	Indianapolis, Ind.

These companies have three-fifths of the total insurance in force in the United States and Canada, and as regards substandard business the proportion is probably greater.

"STANDARD" AND "SUBSTANDARD" RISKS INCLUDED

It was planned to obtain as far as possible the complete experience of the companies for the investigation, including both standard cases and those substandard by reason of occupation only. This did not prove practical in every case. Of the twelve companies contributing, all gave their substandard data, but two companies did not furnish any standard data and two gave one-fifth of their standard material coming within the required occupational classes.

TABLE 1

ADJUSTED FIGURES TO ALLOW FOR "STANDARD" DATA ASSUMED OMITTED

		Addition to Exposed	Adjusted Exposed	Adjusted Actual Deaths	Prelimi- nary Mortality Ratio	Revised Mortali- ty Ratio	De- crease	Company Ratings
A40-A42	Operators, etc., in mines, etc.....	7,000	40,423	322	167% $\pm$ 5	156%	11	100%-150%
B00-B08, B13, B14	Ore dressing and concentrating mill operatives (not handling mercury or cya- nides).....	850	4,843	45	314 $\pm$ 8	274	40	100-210
006, 152, 521	Cranemen, der- rickmen and hoistmen.....	4,550	31,111	164				

MORTALITY SUMMARY SHEET

Since the experience for twelve years of duration only was requested, it was possible to place all the data for an occupational class on a single sheet. In the M. A. M. I. at entry ages 50 and above the material had been combined in groups of three ages each, but in the present studies groups of five ages have been taken up to age 65 and the data for ages 65 and over placed in one group. This change in procedure was largely dictated by the results in the former investigation, and by the fact that in substandard occupational classes there are very few entrants above age 50; furthermore, as relative mortality is sought, the principal consideration is that the age-group shall be the same as those in the basic tables. Several companies had their material for the basic tables prepared only in five-age groups, and it did not seem necessary to ask them to prepare tables on a different basis.

In view of the large number of classes it seemed desirable to confine the tabulation of causes of death to what might reasonably be expected to be the principal causes. In determining these, all causes were considered which had been found important in one or more of the three preceding investigations, the M. A. M. I., the blood pressure investigation (1925) and the disability investigation (1926). When accidents were divided into three sections this gave sixteen specified causes of death. A comparison of these causes with those which had been chosen in 1917 by the Metropolitan Life (Bulletin No. 207 of U. S. Bureau of Labor Statistics) showed that, while a few more causes had been listed by that company, none of them represented as much as one per cent. of the deaths.

such as between the average age in quinquennial groups of two large companies for the years of issue 1901 to 1909 inclusive and the American Men Table (observations of 1900 to 1915 inclusive). From these it appeared that there would be little difference in any investigations of this nature.

Mention may be made of a peculiar feature in the basic data of the 1920-'26 table. The mortality rate for the youngest age-group was at several durations and in the aggregate greater than the corresponding rates of the next two five-age groups. A similar characteristic was found in the ungraded data of the A. M. Select Table (using seven years of duration only) but to a less pronounced extent. For the 1920-'26 Basic Table this peculiarity was eliminated and the adjusted death rate in each age-group is never less than for the same duration in the preceding age-groups, and, on the other hand, the rate for any duration among entrants in any age-group does not exceed the rate for a duration five years greater among those entering the next previous age-group.

In the case of the 1915-'26 Basic Table, however, the effect of the influenza epidemic was of more importance than the effect of selection at the young and middle ages. To follow the same principles as in the other table would have sacrificed too much in the way of accuracy or fidelity to the original. The characteristics of the ungraded data were, therefore, in this table more closely preserved. The formula used for a preliminary graduation of the first five years of duration was obtained by rewriting expressions (12) and (13) on page 32 of the Transactions of the Actuarial Society, vol. 25 (1924), so that they appear as follows:

$$\Delta U'_{x-h} = \frac{1}{$$

TABLE 2
BASIC TABLE 1915-'26
Graded Rates of Mortality per 1000

Policy Year	AGES AT ENTRY										
	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65 & over
1	2.17	2.26	2.32	2.36	2.63	3.26	4.41	6.41	9.64	14.28	20.63
2	2.68	2.86	2.90	3.08	3.64	4.57	6.14	9.19	13.66	19.64	26.8

TABLE 3
BASIC TABLE 1920-'26
Graded Rates of Mortality per 1000

Policy Year	AGES AT ENTRY										
	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65 & over
1	1.59	1.68	1.70	1.90	2.29	3.00	4.34	6.70	10.52	14.29	20.22
2	1.93	1.98	2.02	2.41	3.06	4.23	6.08	9.49	13.50	18.84	

The following tables show the distribution of deaths by cause in each of the basic tables used in this investigation:

TABLE 4
DEATHS BY CAUSE AS PERCENTAGE OF TOTAL DEATHS
Basic Table 1915-'26

M. A. Code	Cause	Ages at Entry		All Ages
		15-39	40 and over	
82-91	Accident due to occupation.....	1.8%	1.1%	1.5%
82-91	Accident not due to occupation nor war.	13.3	6.9	10.6
82-91	Warfare.....	2.6	.3	1.5
01	Typhoid.....	1.8	.6	1.3
05	Influenza.....	10.0	3.5	7.3
17	Tuberculosis of lungs.....	12.9		

TABLE 5
DEATHS BY CAUSE PER 1000 EXPOSED
Basic Table 1915-'26

M. A. Code	Cause	15-39	Ages at Entry 40 and over	All Ages*
82-91	Accident due to occupation.....	.057	.090	.065
82-91	Accident not due to occupation nor war..	.420	.567	.455
82-91	Warfare.....	.082	.025	.065
01	Typhoid.....	.057	.049	.055
05	Influenza.....	.316	.288	.313
17	Tuberculosis of lungs.....	.407	.321	.395
18	Other tuberculosis.....	.050	.041	.050
21	Cancer and other malignant tumors.....	.139	1.052	.339

TABLE 6 (continued)

Code No.	Occupation (Short Title)	(1) Number of Deaths from all Accidents	(2) Number Exposed in Thousands	(3) (1)÷(2) Death Rate per 1,000	(4) Adjusted* (Col. 3 Divided by Death Rate from Basic Tables)	(5) Present Average Company Ratings
(A47)	Mine machinists and mechanics — not underground.....	11	8.8	1.25±.25	2.46±.44	No
(A48)	Mine machinists and mechanics—underground	22	11.3	1.95±.28	3.84±.49	No
(A49)	Safety engineers and Government mine inspectors.	17	6.1	2.79±.45	5.35±.79	3
(A50)	Mine stationary engineers and hoistmen, etc.—not underground.....	11	6.9	1.59±.32	3.04±.56	3
(A51)	Mine stationary engineers and hoistmen					

TABLE 6 (continued)

Code No.	Occupation (Short Title)	(1) Number of Deaths from all Accidents	(2) Number Exposed in Thousands	(3) (1)+(2) Death Rate per 1,000	(4) Adjusted* (Col. 3 Divided by Death Rate from Basic Tables)	(5) Present Average Company Ratings
(052)	Tailors.....	27	101.7	.27 ± .03	.50 ± .05	1
(053)	Semi-skilled operatives in clothing manufacture (not hats).....	23	97.8	.24 ± .03	.46 ± .05	1
(055)	Bakers.....	30	44.3	.68 ± .08	1.30 ± .14	1
(090, 092)	Carriage riders, doggers, block-setters and other semi-skilled operatives in saw and planing mills..	26	20.0	1.30 ± .17	2.54 ± .30	3
(						

TABLE 6 (continued)

Code No.	Occupation (Short Title)	(1) Number of Deaths from all Accidents	(2) Number Exposed in Thousands	(3) (1)÷(2) Death Rate per 1,000	(4) Adjusted* (Col. 3 Divided by Death Rate from Basic Tables)	(5) Present Average Company Ratings
a(452)	Others and not specified builders and building con- tractors in general con- struction.....	22	25.8	.85 ± .12	1.36 ± .19	1
a(457)	Brick and stone masons. . .	21	23.0	.91 ± .13	1.71 ± .21	2
a(459)	Carpenters.....	105	123.3	.85 ± .06	1.55 ± .10	2
a(473)	Painters and varnishers (house).....	38	61.0	.62 ± .07	1.14 ± .11	2
a(482)	Miscellaneous labor					

TABLE 6 (continued)

Code No.	Occupation (Short Title)	(1) Number of deaths from all Accidents	(2) Number Exposed in Thousands	(3) (1)÷(2) Death Rate per 1,000	(4) Adjusted* (Col. 3 Divided by Death Rate from Basic Tables)	(5) Present Average Company Ratings
(675)	Truck chauffeurs (not deliverymen).....	39	50.9	.77 ± .08	1.50 ± .14	2
(677)	Draymen, teamsters and expressmen.....	59	66.5	.89 ± .08	1.69 ± .14	2
a(691-701)	Officers on ocean, Great Lakes, and river and harbor craft.....	30	16.1	1.86 ± .23	3.37 ± .37	3
a(731-733)	Longshoremen and freight handlers.....	14	6.6	2.12 ± .38	4.02 ± .61	No
(746						

TABLE 7

**PRINCIPAL CLASSES IN WHICH THERE IS A CONSIDERABLE DIFFERENCE
BETWEEN THE AVERAGE OF COMPANY RATINGS AND THE
MORTALITY EXPERIENCED**

Class No.	Occupation	Mortality Experienced	Company Ratings
(A40-A42)	Officials and mining engineers in mines, and ore dressing and concentrating mills.....	167% ± 5*	125%
(A43)	Foremen in mines, etc.—not underground.....	230% ± 15	120%
(A60)	Coal-mine operatives—not underground.....	191% ± 8	135%
(A61)	Skilled coal-miners—underground.....	313% ± 10	195%
(A64)	Not specified operatives in coal mines—underground.....	258% ± 3	195%
(A68-A71)	Copper mine operatives—underground.....	346% ± 9	190%
(A75-A78)	Gold and silver mine operatives—underground.....		

In surveying the results of this investigation, an element becomes apparent which is difficult to analyse, namely, the effect of the social status and physical and mental condition in attracting men into a particular line of work. A discussion of this matter would lead rather far afield from the immediate purpose of this investigation. It has been discussed extensively in the Registrar General's Decennial Supplement, England and Wales, 1921, Part II, published in London, 1927. Those interested in this subject are also referred to the valuable summary of that report which was given by Mr. Rollo H. Britten in Public Health Reports for June 22, 1928.

SUMMARY OF RESULTS

Code No.	Occupation (short title)	Entering	Exposed	Actual Deaths	Expected Deaths	Ratio of Actual to Expected	P. E.
(106)	Chippers of metal (not ship).....	880	3,380	38	14.14	269%	± 18
(107)	Core-makers and sand molders (metals).....	2,024	7,377	32	22.65	141%	± 14
(111-114)	Grinders of metals.....	2,356	8,428	46	28.65	161%	± 12
(121)	Tool-makers (not in tool factory), die-setters and sinkers.....	5,071	22,355	75	77.34	97%	± 8
(123-125)	Welders.....	4,022	14,377	69	43.96	157%	± 10
(131, 13							

ERRORS AND OMISSIONS

Page		
3		Add "In charge of Central Bureau, Walter G. Bowerman."
11	691-701	Under "Decrease," instead of "20" read "30."
20	A60	Column (5), instead of "No" read "3."
22	482	Column (5), instead of "No" read "3."
22	552, 557	Column (5), instead of "No" read "3."
63	791	Line (1), instead of "causes" read "caused."
109-111	Six classes	Instead of " $(2) + (3)$ " read " $(2) \div (3)$."
112	421, 421A, 421B, heading,	instead of "foreman" read "foremen."
166	696	Line (3), instead of "posts" read "ports."
175		Line (7), instead of "of the" read "or the."
176		Line (4), instead of "combines" read "combined."
1		