

## CONTINUOUS MORTALITY INVESTIGATION: PENSIONERS UNDER LIFE-OFFICE PENSION SCHEMES

At the beginning of 1948 the Continuous Mortality Investigation was extended to pensioners who had retired under life-office pension schemes. Thirty offices agreed to contribute data, which for the most part are derived from pension schemes issued as 'group' business, although data for pension schemes operated by means of individual contracts are also included.

The contributing offices were requested to exclude schemes which provided a cash option in lieu of pension. Apart from this ban, however, all types of pension are included in the investigation, whether single-life or last-survivor and whether guaranteed for a minimum period or dependent only upon life. Where more than one life is involved in the contract, account is taken only of the pensioner life, the existence of the second life being ignored.

The experience is subdivided according to sex, and within each sex there are two classes, viz. early retirements and age-retirements. Age-retirements are those which occur either at or after the normal retiring age.

The investigation is conducted on an aggregate basis and the census method is employed. The returns of data consist of the 'In Force' on 1 January of each year and the deaths during the year, each tabulated according to nearest age. Thus the rates of mortality are obtained from the formula

$$q_{x-i} = 2\theta_x / (P_x^0 + P_x^1 + \theta_x),$$

where  $P_x^0$  and  $P_x^1$  are respectively the 'In Force' at age  $x$  at the beginning and end of the year and  $\theta_x$  is the deaths during the year. The first returns to be submitted related to the 'In Force' on 1 January 1948.

The experience for male lives over the three years 1948-50 has now become available, and the results are shown in Tables 1-6. The data for female lives have so far proved insufficient to warrant publication.

### AGE-RETIREMENTS

Tables 1-4 relate to retirements which have occurred at or after the normal retiring age. From Table 1 it can be seen that during the period there were 45,763 years of exposure and 2133 deaths, and that 60% of the years of exposure were concentrated in the age-group 65½ to 69½.

Table 2 shows the experience at individual ages from 65½ to 79½. A high proportion of the lives enter at age 65 and the experience does not yield reliable rates of mortality at ages below 65½. It will be noted that the actual deaths were in total 111% of those expected on the  $a(m)$  ultimate table and that this percentage shows no significant trend with age.

In Table 3 the percentages of the actual deaths to the deaths expected by the  $a(m)$  ultimate table are given in three quinary age-groups for each of the calendar years included in the period. It will be seen that there is no significant variation from one year to another.

Table 4 shows, for the same three quinary age-groups, the percentages of the actual deaths during the triennium to those expected on

- (i) the  $a(m)$  ultimate table,
- (ii) the mortality experienced during 1948-50 by male annuitants (durations 5 and over) in the C.M.I., and
- (iii) the mortality experienced during 1948-50 by assured lives (durations 5 and over) in the C.M.I.

Table 1. Summary of data

Year	Exposed to risk	Deaths
1948	11,816	552
1949	15,102	697
1950	18,845	884
1948-50	45,763	2,133
Age-group		
Under 65½	4,861	150
65½-69½	27,313	1,086
70½-74½	10,898	635
75½-79½	2,291	218
Over 79½	400	44
All ages	45,763	2,133

Table 2. Rates of mortality and comparison of actual and expected deaths

Age $x$	Exposed to risk	Actual deaths	$q_x$	Expected deaths by $a(m)$ ultimate	Percentage of actual to expected deaths
65½	7,312	282	·039	232	122
66½	6,785	240	·035	232	103
67½	5,443	217	·040	201	108
68½	4,226	191	·045	168	114
69½	3,547	156	·044	152	103
70½	3,155	151	·048	146	103
71½	2,631	156	·059	132	118
72½	2,141	124	·058	117	106
73½	1,694	116	·068	101	115
74½	1,277	88	·069	83	106
75½	927	78	·084	67	116
76½	584	61	·104	47	130
77½	362	35	·097	32	109
78½	244	17	·070	23	74
79½	174	27	·155	18	150
65½-79½	40,502	1,939		1,751	111

It is interesting to notice that, whereas the male pensioners' experience in 1948-50 can reasonably be represented as a level 11% above the  $a(m)$  ultimate table, in comparison with both the male annuitants and the assured lives for the same period the percentages are more variable. In particular, the percentage in the age-group  $65\frac{1}{2}$ - $69\frac{1}{2}$  is significantly higher than in the age-group  $70\frac{1}{2}$ - $74\frac{1}{2}$ , and this may reflect the existence of 'negative selection' among the pensioners during the period immediately following retirement. However, as explained in the final section, it is not possible from the present investigation to reach reliable conclusions on this question.

Table 3. Percentages of actual to expected deaths in calendar years

Age-group	Percentage of actual to expected deaths by the $a(m)$ ultimate table			
	1948	1949	1950	1948-50
$65\frac{1}{2}$ - $69\frac{1}{2}$	115	111	107	110
$70\frac{1}{2}$ - $74\frac{1}{2}$	107	109	112	110
$75\frac{1}{2}$ - $79\frac{1}{2}$	111	127	112	117
$65\frac{1}{2}$ - $79\frac{1}{2}$	112	112	109	111

Table 4. Percentages of actual to expected deaths on various bases

Age-group	Actual deaths	Basis for expected deaths					
		$a(m)$ ultimate		1948-50 male annuitants (durations 5 and over)		1948-50 assured lives (durations 5 and over)	
		Expected deaths	$100 \frac{A}{E}$	Expected deaths	$100 \frac{A}{E}$	Expected deaths	$100 \frac{A}{E}$
$65\frac{1}{2}$ - $69\frac{1}{2}$	1086	985	110	884	123	882	123
$70\frac{1}{2}$ - $74\frac{1}{2}$	635	579	110	597	106	566	112
$75\frac{1}{2}$ - $79\frac{1}{2}$	218	187	117	190	115	180	121
$65\frac{1}{2}$ - $79\frac{1}{2}$	1939	1751	111	1671	116	1628	119

### EARLY RETIREMENTS

Tables 5 and 6 summarize the experience of pensioners who have retired before the normal age. The exposed-to-risk in this class is about one-seventh of the age-retirements.

Table 5. Summary of data

Year	Exposed to risk	Deaths
1948	1692	101
1949	2151	138
1950	2596	165
1948-50	6439	404

As would be expected in an experience relating to persons who for the most part have retired from active employment on account of ill health, the mortality at the younger ages is very heavy. From the figures shown, however, it would appear that the adverse selection at entry into the experience tends to wear off with increasing age.

Table 6. Percentages of actual to expected deaths

Age-group	Exposed to risk	Actual deaths	Expected deaths by $a(m)$ ultimate	Percentage of actual to expected deaths
Under 60½	1112	68	18	378
60½-64½	2767	206	71	290
65½-69½	1849	91	66	138
Over 69½	711	39	41	95
All ages	6439	404	196	206

### CONCLUSION

The body of lives included in the present investigation is extremely heterogeneous in comparison with the classes of assured lives and annuitants with which the Continuous Mortality Investigation has hitherto been concerned. A considerable proportion of the lives entering group pension schemes is drawn from that section of the community which normally comes within the scope of Industrial rather than Ordinary life assurance. As a result, the experience is an amalgam of many social classes and this heterogeneity renders interpretation peculiarly difficult.

The possibility of 'negative selection' at retirement has already been referred to. So far, the evidence marshalled consists merely of a comparison with the simultaneous experience of assured lives and annuitants and, in view of the marked difference in the class of life involved, it is not possible on such evidence to draw reliable inferences concerning the existence of an element of selection within the pensioners' experience itself.

It has accordingly been decided by the Joint Mortality Committee that some further investigation is necessary before any pronouncements on this and other questions can be made. It had been hoped that an occupational subdivision might have been introduced into the experience, but enquiries that have been made of the offices have shown that this is not practicable. However, there seem to be good prospects of extending the data by replacing the present aggregate investigation with one that is select in form. As a preliminary step certain offices have agreed to provide select data over a period which goes back to 1947, and the examination of the statistics is now in progress. As a result it should be possible to test the existence of selection with more certainty and to judge whether mortality varies with age at retirement as well as with attained age.