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THE MORTALITY OF POST OFFICE PENSIONERS

by

P. R. COX, F.I.A., F.S.S., *and* L. V. MARTIN, F.I.A.
of the Government Actuary's Department

INTRODUCTORY

Most of the 350,000 persons who are actively engaged in the service of the General Post Office are established civil servants to whom the provisions of the Superannuation Acts, 1834-1957 apply. Arrangements for pensioning civil servants when they retire are of long standing, and the number of former Post Office employees drawing pension has now risen to about 70,000, most of whom are men.

A civil servant may be defined as a civilian whose pay and pension are voted annually by Parliament. The making of any advance financial provision for his superannuation would thus seem to be excluded by definition. The Post Office is, however, a Commercial Department, and a specific allowance for accruing pension costs (as opposed to current costs) is included as a separate item in the Commercial Accounts, and is provided for in the fixing of postal, telephone, telegraph and other charges. In order to assess these accruing pension costs, investigations are periodically undertaken by the Government Actuary.

One of the purposes of the actuarial investigations is to determine the rate of contribution, expressed as a percentage of salary, needed to support the benefits in the case of an average new entrant. Another is to make a valuation: although no monetary reserves are accumulated, a Hypothetical Superannuation Fund Account is maintained to show the balance that there would be in hand if contributions had been collected and if the balance not required to pay current benefits had been invested in selected Government securities. At each actuarial investigation, the amount of the Hypothetical Fund is compared with the estimated capital liabilities

for superannuation benefits, and if a deficiency is disclosed suitable additional charges are made.

Naturally the mortality experience of men and women on pension is one of the objects of study during the actuarial investigations. It is thought that an account of the results of the last two inquiries on this subject may be of interest to the profession, particularly in relation to male age pensioners, who outnumber male Life Office annuitants by about three to one. It will be remembered that the male Office annuitants' data have recently been specially intractable (*T.F.A.* 20, p. 280).

THE DATA

The quinquennial periods that the two most recent Post Office investigations into pensioners' mortality have covered are the calendar years 1947-51 and 1952-56.

The data for the 1947-51 investigation were compiled by means of punched cards specially prepared for the purpose. They showed (i) the numbers of pensioners at 31 December 1951 tabulated according to calendar year of birth and subdivided according to the following calendar years of retirement: 1951, 1950, 1949, and all earlier years; (ii) the numbers of awards of pension in each of the calendar years 1947-51 according to calendar year of birth; and (iii) the numbers of deaths of pensioners in each of the calendar years 1947-51, classified by calendar year of birth and by duration of pension in completed years; durations were obtained by deducting the calendar year and month of award from the calendar year and month of death.

The data for the 1952-56 investigation were prepared from a permanent punched-card record system that had been newly set up. It was possible to schedule them in a form similar to that for the 1947-51 statistics, with the important exception that only the calendar years of award and death were available.

Such internal and external checks as could be applied to the data showed that they were not wholly or even very closely consistent with one another or with other sources of information such as the record of retirements among active staff. Nevertheless the degree of inconsistency was not large in relation to the volume of the experience and it was decided that, subject to slight doubts of the value of the select experience if it were considered in isolation, the data were sufficiently trustworthy to justify a mortality investigation in full detail.

The following analysis (Table I) shows the aggregate exposures to risk and deaths in quinary age-groups for men who had retired on pension for reasons of age or ill-health :—

TABLE I *Men*

Attained ages	1947-51		1952–56	
	Exposures	Deaths	Exposures	Deaths
Age pensioners				
60–64	92,281	2,340	58,840	1,354
65–69	49,953	2,154	66,036	2,461
70–74	31,214	2,248	43,569	2,354
75–79	15,738	1,806	26,974	2,435
80–84	4,758	815	12,709	1,860
85 & over	901	256	4,130	911
TOTAL	194,845	9,619	212,258	11,375
Ill-health pensioners (aged 60 and over)				
60–64	11,440	587	10,920	604
65–69	8,763	498	8,864	563
70–74	4,996	376	5,682	457
75–79	3,047	312	2,878	336
80–84	1,646	265	1,434	235
85 & over	550	133	594	146
TOTAL	30,442	2,171	30,372	2,341

The rates of mortality derived from these data were q_x for the 1947-51 investigation and $q_{x+\frac{1}{2}}$ for the 1952-56 investigation, where x is an integral age.

The substantial fall in the numbers of exposures and deaths of male age pensioners in the age-group 60-64 between the first and second period is attributable to deferment of retirement. Civil servants are pensionable from age 60 onwards but in certain circumstances can work to a later age ; the provisions of the Superannuation Act 1949 made it possible for the first time to earn additional pension for service in excess of 40 years rendered after reaching age 60, and this and other factors have encouraged deferment of retirement. The rise in the exposures and deaths for older male age pensioners reflects the general growth of the Post Office in past years. The numbers of ill-health pensioners have remained relatively unchanged.

For women, the total numbers of exposures and deaths were much smaller—about 40,000 and 1,000 respectively for all classes of pensioner together.

SELECTION

At the 1947-51 investigation, the whole of the mortality experience was analysed in select form, with a durational period of three years, but for age pensioners it was found that mortality varied little with the length of time retired. At duration 0, the select rates differed from the ultimate rates by only about 5 per cent., and the select annuity-value at retirement differed from the ultimate annuity-value for the same attained age by only about 1 per mille. Consequently, for the 1956 investigation, age pensioners' mortality was measured only in aggregate form.

The number of exposures and deaths for male ill-health pensioners under age 60 were as shown in Table 2

TABLE 2 *Men*

Age at retirement	1947–51				1952–56			
	0	1	2	3 & over	0	1	2	3 & over
				Exposures				
Under 40	149	138	135	610	76	130	123	836
40–49	482	492	572	3,674	281	504	452	2,881
50–59	2,466	2,065	1,945	13,158	1,346	2,703	2,437	16,462
TOTAL	3,097	2,695	2,652	17,442	1,703	3,337	3,012	20,179
				Deaths				
Under 40	15	3	2	12	3	2	4	8
40–49	52	15	18	72	12	19	14	63
50–59	291	146	101	546	106	214	132	665
TOTAL	358	164	121	630	121	235	150	736

Ill-health pensioners' mortality is very heavily influenced by selection. The following ratios of select to ultimate mortality were adopted at the two investigations (Table 3):

TABLE 3

Number of years elapsed since retirement	1947–51		1952–56	
	Men	Women	Men	Women
0	3½ to 8*	3½ to 9*	3	5½ to 7½*
1	2	1½	2	3
2	1½	1¼	1½	2

* According to age at retirement : the younger the age, the higher the ratio.

In considering these rates it should be borne in mind that:

(i) the significance of "duration" varies between the two investigations; for 1947-51, the ratios apply respectively to the first 11½ months after retirement, the next twelve months and the next twelve months again, whereas for 1952-56 they apply respectively to deaths in the calendar year of retirement, deaths in the following year and the one after;

(ii) the data for male ill-health retirements at ages under 50 are not very plentiful, while the corresponding data for women are scanty at all ages.

GRADUATION

At the 1947-51 investigation, it was decided to make a trial graduation of the ultimate rates for male age pensioners, excluding the first three years from award, by reference to the ultimate section of the $a(55)$ table for males—using the formula $aq_x + b$, where a and b are independent of age. Two equations were derived from the first and second summations of actual and expected deaths. Their solution gave values of 1·1809 for a and ·00112 for b. By surprisingly good fortune, these values gave an entirely satisfactory graduation and no further trials were therefore undertaken.

A similar procedure for women, using the $a(55)$ table for females, gave $a = 1{\cdot}2969$ and $b = -{\cdot}00787$ and a satisfactory fit for all ages 67 and over. At ages 63-66 the graduated rates appeared to be too low and over this short range a suitable arbitrary adjustment was made.

The ill-health pensioners' ultimate mortality rates proved, not surprisingly, to have a shape so different from that of $a(55)$ that graduation by reference was out of the question. A graphic method was adopted for both sexes.

At the 1952-56 investigation, the experience of the preceding five years was compared with the expectation based on the ultimate rates adopted in 1951, and for male age pensioners in the aggregate the ratio of actual to expected deaths at all ages proved to be ·99. The shape of the mortality curve appeared, however, to have changed; actual deaths exceeded the expectation by almost 2 per cent. at ages under 70 whereas they were smaller by about 5 per cent. at ages 70 to 80. A graphic method was therefore used

to adjust the 1951 rates. For female age pensioners, mortality had fallen fairly uniformly at all ages and a good fit to the experience was obtained by reducing the 1951 rates by about 6½ per cent. throughout.

The deaths of male ill-health pensioners in 1952-56, excluding the first 3 calendar years of retirement, exceeded the expectation on the 1951 basis by about 3 per cent. in total. Most of the excess occurred at ages 60-75 and indeed there was a deficit at ages greater than 80. For women ill-health pensioners, actual deaths in the ultimate period were about ten per cent. below the 1951 rates. Thus for both sexes the trend of the experience was not very different from that for age pensioners. A graphic method of graduation was again adopted.

The graduated rates, adopted as representing the experience of 1947-51 and 1952-56 outside any select period, are shown in Tables 4 and 5, one of which relates to age pensioners at ages 60 to 89 and the other to ill-health pensioners at ages 40 to 84. Beyond these age-ranges the data were comparatively slender and the rates were derived by reference to standard mortality tables.

TIME-TRENDS

The successive investigations of Post Office pensioners' mortality, from 1921 onwards, do not disclose any steady trend in the rates for ill-health pensioners. The experience of this select class depends so greatly on the manner in which retirement policy is exercised that this is not surprising. In these circumstances, mortality projection has seemed inappropriate, and at each actuarial investigation it has been assumed that the latest recorded experience would be repeated at all times in the future.

For age pensioners, however, a steady downward trend in mortality over the past forty years has been readily observable at many ages, and it has been thought desirable to make allowance for the continuance of this trend in assessing the value of the pension liabilities both for active staff and for pensioners. The extent of the likely fall is naturally greater for persons not yet of pension age than for those over that age. In order to examine all the tendencies as thoroughly as possible, a study was made not only of the Post Office data but also of corresponding information for the general population, for Life Office annuitants, for Government annuitants (that is, those who have purchased annuities from the National Debt Office or the Post Office) and for teacher pensioners.

TABLE 4

Rates of Mortality (q_x) Adopted in 1951 *and* 1956

Post Office Age Pensioners

Age x	MEN		WOMEN	
	1951* (Ultimate)	1956 (Aggregate)	1951* (Ultimate)	1956 (Aggregate)
60		·0200		·0082
1		·0212		·0086
2		·0227		·0091
3	·0234	·0246	·0100	·0096
4	·0257	·0269	·0110	·0103
65	·0282	·0295	·0120	·0112
6	·0311	·0323	·0130	·0121
7	·0342	·0354	·0141	·0132
8	·0377	·0386	·0165	·0154
9	·0415	·0418	·0191	·0178
70	·0457	·0453	·0220	·0205
1	·0504	·0490	·0253	·0236
2	·0555	·0531	·0289	·0270
3	·0611	·0577	·0330	·0308
4	·0672	·0632	·0375	·0350
75	·0739	·0697	·0425	·0397
6	·0813	·0772	·0480	·0448
7	·0893	·0857	·0541	·0505
8	·0979	·0952	·0608	·0567
9	·1074	·1056	·0682	·0637
80	·1176	·1168	·0764	·0713
1	·1286	·1286	·0853	·0796
2	·1404	·1409	·0951	·0888
3	·1531	·1538	·1057	·0987
4	·1667	·1674	·1174	·1096
85	·1812	·1817	·1300	·1213
6	·1965	·1969	·1436	·1340
7	·2126	·2129	·1582	·1477
8	·2296	·2298	·1740	·1624
9	·2473	·2475	·1908	·1781

* Excluding the first three years after retirement.

TABLE 5

Rates of Mortality (q_x) Adopted in 1951 and 1956
Post Office Ill-health Pensioners
(Ultimate)*

Age x	MEN		WOMEN	
	1951	1956	1951	1956
40	·0158	·0140	·0080	·0060
1	·0160	·0140	·0080	·0060
2	·0162	·0140	·0080	·0060
3	·0165	·0140	·0080	·0060
4	·0167	·0140	·0080	·0060
45	·0170	·0150	·0080	·0060
6	·0174	·0165	·0080	·0060
7	·0179	·0179	·0080	·0060
8	·0184	·0194	·0080	·0060
9	·0191	·0209	·0090	·0060
50	·0200	·0224	·0100	·0070
1	·0212	·0240	·0110	·0085
2	·0228	·0256	·0120	·0095
3	·0248	·0273	·0130	·0105
4	·0273	·0292	·0140	·0115
55	·0300	·0312	·0150	·0125
6	·0326	·0334	·0160	·0135
7	·0352	·0357	·0170	·0145
8	·0378	·0382	·0180	·0155
9	·0404	·0408	·0190	·0165
60	·0430	·0434	·0200	·0170
1	·0455	·0460	·0210	·0175
2	·0479	·0486	·0220	·0180
3	·0502	·0513	·0230	·0185
4	·0526	·0541	·0240	·0190
65	·0550	·0570	·0250	·0195
6	·0574	·0599	·0260	·0205
7	·0598	·0630	·0270	·0215
8	·0623	·0663	·0280	·0225
9	·0650	·0698	·0300	·0240
70	·0680	·0734	·0320	·0260
1	·0714	·0772	·0340	·0285
2	·0753	·0813	·0360	·0315
3	·0797	·0857	·0390	·0345
4	·0846	·0906	·0420	·0380
75	·0900	·0962	·0460	·0425
6	·0962	·1026	·0510	·0480
7	·1040	·1098	·0570	·0550
8	·1137	·1178	·0650	·0640
9	·1257	·1265	·0750	·0745
80	·1400	·1360	·0860	·0855
1	·1550	·1465	·0970	·0965
2	·1710	·1580	·1090	·1075
3	·1872	·1705	·1210	·1185
4	·2035	·1840	·1340	·1295

* Excluding the first three years after retirement

It is thought that the trend analyses may be of some interest in so far as they relate to the Post Office pensioners, the Life Office annuitants and the general population of England and Wales. The comparison of the last two of these may be of special interest, as it corresponds in some measure to the recent work of Mr. H. A. R. Barnett (*T.F.A.* 25, p. 98 and 26, p. 115) in contrasting the mortality experience of Assured Lives and of the British population. The periods chosen for illustration here are the calendar years 1932-36, 1947-51 and 1952-56. The data of Life Offices' exposures and deaths for these periods have been specially supplied by courtesy of the Joint Mortality Investigation Committee. Those for the general population, however, were already available in the various publications of the Registrar General for England and Wales.

Table 6 shows for the five age-groups 60-64, 65-69, 70-74, 75-79 and 80-84 the (ungraduated) average mortality rates during the three periods and their ratios expressed as percentages of the rates for the first period.

All the data relate to calendar years except those for the Post Office for the first period, which relate to the span from 1 April 1932 to 31 March 1937. The Life Office data refer to durations 5 and over since purchase, whereas all exposures and deaths are included within the other two experiences. Where necessary—for instance for the Life Office data—the rates for average age x have been obtained by interpolation from statistics at half-ages.

In the first period the Post Office pensioners' rates were lighter than those of the general population by about one-quarter at ages up to 70, and by smaller fractions at more advanced ages. The Post Office rates were also rather lower than those for Office annuitants up to age 70 but they were higher thereafter. Between the first period and the second, 15 years later, the trend for the Post Office pensioners was broadly the same as that for the general population; there had been only a slight improvement at ages 60-69 but an improvement of 7 to 10 per cent. from ages 70 to 84. The Office annuitant experience had, however, shown a very different trend, for in the sixties (where the data are fairly small) the improvement had been over 20 per cent. though there was little change at higher ages.

A comparison of the second and third periods shows that the general population mortality hardly changed at all. The Post Office pensioners showed a substantial deterioration at ages 60-69, so that the 1952-56 rates were 7 per cent. higher than in 1932-36—this may be associated with the greater degree of deferment of retire-

TABLE 6 *Men*

Age-group	Experience	Approximate number of deaths per period	1932-36		1947-51		1952-56	
			Rate	Index	Rate	Index	Rate	Index
60–64	Post Office Pensioners	1,000	·0210	100	·0195	93	·0225	107
	Office Annuitants	100	·0237	100	·0185	78	·0300	127
	General Population	130,000	·0285	100	·0283	99	·0275	96
65–69	Post Office Pensioners	2,000	·0336	100	·0334	99	·0360	107
	Office Annuitants	200	·0422	100	·0327	77	·0342	81
	General Population	160,000	·0442	100	·0423	96	·0428	97
70–74	Post Office Pensioners	2,000	·0594	100	·0554	93	·0514	87
	Office Annuitants	600	·0592	100	·0564	95	·0564	95
	General Population	180,000	·0705	100	·0646	92	·0648	92
75–79	Post Office Pensioners	2,000	·0953	100	·0851	89	·0857	90
	Office Annuitants	900	·0907	100	·0892	98	·0796	88
	General Population	180,000	·1112	100	·0999	90	·1008	91
80–84	Post Office Pensioners	1,500	·1550	100	·1380	89	·1399	90
	Office Annuitants	1,000	·1304	100	·1318	101	·1307	100
	General Population	120,000	·1623	100	·1507	93	·1515	93

ment—though the rates are still less than the general population rates; but at ages 70-74 there was a small improvement. The Office annuitants showed some odd fluctuations, there being a considerable increase in the rate at ages 60-64 and a 10 per cent. decrease at 75-79, but little change in the other three age groups.

A direct comparison of the death rates of Office annuitants and of the general population over the period 1931-48 appears in *T.F.A.* 20, p. 282, and a somewhat similar comparison for pensioners under Life Office pension schemes is given in *T.F.A.* 25, p. 324.

The period 1947-51 is of special interest because of its wide variations in mortality from year to year. The data for men for individual calendar years are given below in a form similar to that for the quinquennia except that the Post Office data are ultimate (and so, in the first age-group, relate only to ages 63 and 64); the indexes are percentages of the rates for 1932-36.

Table 7 illustrates the considerable variations in the mortality of elderly men that occur from year to year; thus for the general population mortality in 1951 was higher than in 1948 by percentages ranging from 14 at ages 60-64 to 25 at ages over 75. The Post Office pensioners' mortality showed variations corresponding closely to those for the general population, but the Office annuitants did not show the same degree of correspondence. The annuitants' data are, however, scanty and this may well account for the divergences.

The data for women age pensioners for the three quinquennial periods were as shown in Table 8.

The women's rates and indexes for individual years 1947-51 are given in Table 9 for Office annuitants and the General Population only, as the Post Office experience is too small to be suitable for sub-division in this detail.

Little can be said about the trend for the Post Office pensioners as there were so few deaths, but it is clear that since 1932-36 the mortality of female Office annuitants has improved less than female mortality in Great Britain as a whole. It is also evident that the improvement in female mortality over the age-range 60-84 has been considerably greater than that in male mortality.

It was deduced from these and other data that the general trend of Post Office pensioners' mortality was more akin to that of the general population than to that of Life Office annuitants and other groups. Accordingly, the projection of the Post Office pensioners' rates into the future was made by reference to the most recent mortality projections for the general population that were available. For active staff as a whole, the period of projection was taken as 15 years, as representing broadly the average time elapsing between the middle of active life and the beginning of life as a pensioner, *plus* the number of years elapsed since retirement. An average retirement age of 62 was assumed, and thus for the mortality rate at age 70 the total period of projection assumed was 15 + 8, or 23, years.

In this way the following specimen rates for future age pensioners were arrived at in the 1956 investigation (Table 10).

TABLE 7 *Men*

Age-group	Experience	1947		1948		1949		1950		1951	
		Rate	Index	Rate	Index	Rate	Index	Rate	Index	Rate	Index
60–64	Post Office	·0264	(126)	·0250	(119)	·0231	(110)	·0270	(129)	·0276	(131)
	Office Annuitants	·0192	81	·0164	69	·0196	83	·0101	43	·0282	119
	General Population	·0282	99	·0267	94	·0281	99	·0279	98	·0304	107
65–69	Post Office	·0355	(106)	·0293	(87)	·0346	(103)	·0349	(104)	·0365	(109)
	Office Annuitants	·0308	73	·0265	63	·0343	81	·0367	87	·0375	89
	General Population	·0412	93	·0392	89	·0421	95	·0424	96	·0468	106
70–74	Post Office	·0533	90	·0522	88	·0537	90	·0556	94	·0622	105
	Office Annuitants	·0577	97	·0500	84	·0620	105	·0582	98	·0543	92
	General Population	·0644	91	·0591	84	·0645	91	·0644	91	·0706	100
75–79	Post Office	·0882	93	·0724	76	·0883	93	·0831	87	·0920	97
	Office Annuitants	·0846	93	·0873	96	·0797	88	·0936	103	·1011	111
	General Population	·1012	91	·0893	80	·0982	88	·0995	89	·1107	100
80–84	Post Office	·1600	103	·1213	78	·1370	88	·1291	83	·1441	93
	Office Annuitants	·1415	108	·1301	100	·1294	99	·1262	97	·1320	101
	General Population	·1565	96	·1330	82	·1479	91	·1497	92	·1655	102

TABLE 8 *Women*

Age-group	Experience	Approximate number of deaths per period	1932-36		1947-51		1952-56	
			Rate	Index	Rate	Index	Rate	Index
60–64	Post Office	50	·0076	100	·0079	104	·0088	116
	Office Annuitants	200	·0141	100	·0126	89	·0107	76
	General Population	90,000	·0206	100	·0158	77	·0143	69
65–69	Post Office	80	·0240	100	·0148	62	·0162	68
	Office Annuitants	600	·0235	100	·0218	93	·0209	89
	General Population	130,000	·0326	100	·0260	80	·0239	73
70–74	Post Office	80	·0381	100	·0279	74	·0220	58
	Office Annuitants	1,500	·0396	100	·0343	87	·0317	80
	General Population	170,000	·0537	100	·0449	84	·0409	76
75–79	Post Office	80	·0787	100	·0468	59	·0487	62
	Office Annuitants	2,600	·0622	100	·0568	91	·0558	90
	General Population	190,000	·0861	100	·0757	88	·0699	81
80–84	Post Office	70	·0865	100	·0929	107	·0813	94
	Office Annuitants	3,400	·1085	100	·0940	86	·0932	86
	General Population	160,000	·1334	100	·1208	91	·1155	87

TABLE 9 *Women*

Age-group	Experience	1947		1948		1949		1950		1951	
		Rate	Index	Rate	Index	Rate	Index	Rate	Index	Rate	Index
60–64	Office Annuitants	·0139	99	·0143	101	·0100	71	·0127	90	·0117	83
	General Population	·0161	78	·0151	73	·0158	77	·0157	76	·0162	79
65–69	Office Annuitants	·0219	93	·0225	96	·0221	94	·0195	83	·0228	97
	General Population	·0261	80	·0241	74	·0262	80	·0259	79	·0275	84
70–74	Office Annuitants	·0357	90	·0321	81	·0316	80	·0346	87	·0378	95
	General Population	·0457	85	·0412	77	·0458	85	·0443	82	·0471	88
75–79	Office Annuitants	·0612	98	·0496	80	·0538	87	·0576	93	·0616	99
	General Population	·0764	89	·0679	79	·0760	88	·0763	89	·0811	94
80–84	Office Annuitants	·1031	95	·0756	70	·0918	85	·0987	91	·1060	98
	General Population	·1217	91	·1058	79	·1201	90	·1217	91	·1337	100

TABLE 10

Age	Men	Women
60	·0168	·0064
65	·0246	·0086
70	·0376	·0160
75	·0602	·0322
80	·1062	·0614
85	·1732	·1162
90	·2627	·1950

For persons in receipt of pension on the valuation date, somewhat higher rates were used, as a shorter period of projection was appropriate.