

## AN INVESTIGATION INTO THE DISTRIBUTION OF POLICIES PER LIFE ASSURED IN THE CAUSE OF DEATH INVESTIGATION 1991–94

The continuous investigation into the mortality of assured lives is based on policies and not lives. Consequently the death of a policyholder carrying  $n$  policies appears as  $n$  deaths in the data. In order to estimate the standard deviations needed to test differences between actual and expected deaths, information is required about the distribution of policies per life assured. This information is *not contained in the data* submitted to the main assured lives investigations but is included in the data for deaths in the cause of death investigation. This data has been used as a proxy for direct information about the distribution of duplicates in the assured lives investigations, for the purpose of the graduations described elsewhere in this edition of *C.M.I.R.*

The last report by the C.M.I. Committee into the distribution of duplicates amongst deaths in the cause of death investigation was contained in *C.M.I.R.* 8, 49–58 (1986). The work described in that report to analyse the cause of death experience was repeated for the 1991–94 experience. Table 1 shows for U.K. males, at durations 2 and over, the ‘variance ratios’ in quinary age groups and at all ages combined. This is the ratio of the variance of a distribution where there are duplicates to that of a straightforward binomial variance. As previously reported, this can be approximated by  $m_1/m_2$  where  $m_1$  and  $m_2$  are the first and second moments about zero of the duplicates’ distribution.

Table 2 shows the number of deaths with  $n$  policies contained in the data. The values of  $m_1$  and  $m_2$  shown in Table 1 can be calculated directly from this table.

The total number of policies held by lives who died in the period, as reported in Table 1, is 49,353. This compares with 68,963 deaths in the assured lives investigation in the same period. The difference is represented by offices who did not contribute data to the cause of death investigation and by offices who were not able to provide death certificates for all deaths.

Table 1 shows values that are, in all cases except the two indicated, lower than those reported in *C.M.I.R.* 8 for the investigation period 1981–82. The reason for the decline in the number of duplicate policies per life is not clear. It does not seem to accord with the perception that the insured population takes out more policies as inflation erodes the value of their existing contracts. The number of lives in both the cause of death and assured lives investigation has been declining and it is not known how this has affected the results shown in Table 2.

Table 1. First and second moments about zero together with the variance ratios of the distribution of duplicates in the cause of death investigation: assured lives (whole-life and endowment), males, U.K., durations 2 and over, 1991-94.

Age group	$m_1$	$m_2$	$m_1/m_2$	Number of lives	Number of policies
Under 25	1.080	1.277*	1.18*	112	121
25-29	1.113	1.466	1.32	204	227
30-34	1.155	1.532	1.33	361	417
35-39	1.230	1.979	1.61	662	814
40-44	1.263	2.100	1.66	1,304	1,647
45-49	1.312	2.292	1.75	2,754	3,612
50-54	1.301	2.195	1.69	4,012	5,219
55-59	1.281	2.107	1.65	6,079	7,785
60-64	1.216	1.814	1.49	8,220	9,995
65-69	1.113	1.399	1.26	4,274	4,755
70-74	1.079	1.284	1.19	3,695	3,988
75-79	1.106	1.402	1.27	3,407	3,768
80-84	1.088	1.326	1.22	3,472	3,776
85-89	1.103	1.356	1.23	1,875	2,068
90 and over	1.104	1.429	1.29	1,052	1,161
All ages	1.190	1.736	1.46	41,483	49,353

Values marked with \* are bigger than the equivalent calculated from the 1981-82 data.

Table 2. Numbers of deaths with  $n$  policies in the 1991-94 cause of death investigation: assured lives (whole-life and endowment), males, U.K., durations 2 and over.

	Number of policies per life ( $n$ )									
	1	2	3	4	5	6	7	8	9	10+
Under 25	105	5	2	-	-	-	-	-	-	-
25-29	189	11	1	2	1	-	-	-	-	-
30-34	315	38	6	2	-	-	-	-	-	-
35-39	556	79	20	4	-	-	1	1	1	-
40-44	1,066	176	40	15	3	-	1	1	1	1
45-49	2,173	404	125	35	4	6	1	3	1	2
50-54	3,176	594	165	45	20	8	2	1	-	1
55-59	4,871	879	230	63	21	6	4	2	1	2
60-64	6,897	1,010	228	54	17	8	5	-	-	1
65-69	3,873	346	42	8	2	1	1	-	1	-
70-74	3,455	203	28	6	2	-	-	-	1	-
75-79	3,133	216	43	8	3	3	-	-	1	-
80-84	3,235	197	24	9	4	2	1	-	-	-
85-89	1,717	131	20	6	1	-	-	-	-	-
90 and over	975	61	8	4	2	-	2	-	-	-
All ages	35,736	4,350	982	261	80	34	18	8	7	7