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CONTINUOUS MORTALITY INVESTIGATION

MORTALITY OF MEDICALLY EXAMINED AND NON-MEDICAL ASSURED LIVES, 1959-62

THE periodic reports on the Continuous Mortality Investigation into the experience of assured lives normally combine the medical and non-medical data, but it is interesting from time to time to look at the two classes separately.

Tables 1 and 2 compare the actual deaths in 1959–62 in the medical and non-medical experiences separately with the corresponding expected deaths according to the A 1949–52 table.

Percentages of actual to expected deaths for durations 0 and 1 and for broad age groups in durations 2 and over are shown below.

Duration and age group	Medical %	Non-Medical %
Duration 0: all ages	77	98
Duration 1: all ages	84	99
Durations 2 and over:		
ages up to 44½	79	79
ages 45½–59½	83	90
ages 60½–74½	90	99
ages 75½ and over	93	101

It is clear from these results that at the shortest durations medically examined lives show consistently lighter mortality than non-medical lives. At durations 2 and over the situation is more complex. It is usual to have an upper age limit at about 45 or 50 for entrants under a non-medical scheme. Consequently, at ages over 50, the non-medical data in the ultimate section must have a higher mean duration than the medical data and a heavier mortality experience for the non-medical class would be expected to result from this cause alone. At younger ages this feature does not apply; indeed, the increasing proportion of non-medical business transacted in recent years should have the effect of actually reducing the mean duration and it is accordingly not surprising that the medical and non-medical experiences should lie close together.

Since an analysis by individual durations is not available after duration 1, it is perhaps useless to speculate how a comparison between the two classes by durations would appear. It is possible, however, that after the first few years of duration had passed, the mortality of medical and non-medical lives would tend to merge.

Table 3 shows the central rates of mortality in quinary age groups (according to ages last birthday) at durations 5 and over, for the medical and non-medical experiences separately, for the two four-year periods 1959–62 and 1955–58. The main conclusion to be drawn is that the pattern

Assured Lives 1959–62: *comparison of actual and expected deaths by the A* 1949–52 *table* (*medical and non-medical separately*)

Table 1. Medical

Age group	Duration 0 Actual deaths	Duration 0 Expected deaths	Duration 0 100 A/E	Duration 1 Actual deaths	Duration 1 Expected deaths	Duration 1 100 A/E	Durations 2 and over Actual deaths	Durations 2 and over Expected deaths	Durations 2 and over 100 A/E
–19½	7	8	88	5	6	83	5	8	63
20½–24½	30	33	115	19	28	68	66	77	86
25½–29½	25	44	57	39	49	80	161	281	57
30½–34½	27	42	64	42	50	84	386	579	67
35½–39½	34	44	77	57	56	102	851	1,051	81
40½–44½	45	52	87	75	70	107	1,628	1,943	84
45½–49½	83	80	104	93	113	82	3,466	4,382	79
50½–54½	84	131	64	142	185	77	6,306	7,715	82
55½–59½	56	89	63	137	149	92	8,211	9,628	85
60½–64½	45	44	102	62	81	77	7,305	7,996	91
65½–69½	9	20	45	26	44	59	4,927	5,541	89
70½–74½							5,201	5,858	89
75½–79½							6,049	6,558	92
80½–84½							5,587	5,983	93
85½–89½	8	9	89	14	18	78	3,343	3,600	93
90½–94½							1,114	1,184	94
95½–99½							198	227	87
100½–							18	27	67
All ages	461	596	77	711	849	84	54,822	62,638	88

Table 2. Non-Medical

Age group	Duration 0 Actual deaths	Duration 0 Expected deaths	Duration 0 100 A/E	Duration 1 Actual deaths	Duration 1 Expected deaths	Duration 1 100 A/E	Durations 2 and over Actual deaths	Durations 2 and over Expected deaths	Durations 2 and over 100 A/E
–19½	83	77	108	52	52	100	59	67	88
20½–24½	182	161	113	132	137	96	313	357	88
25½–29½	97	139	70	134	150	89	499	807	62
30½–34½	86	114	75	102	128	80	841	1,203	70
35½–39½	113	123	92	142	142	100	1,414	1,770	80
40½–44½	133	141	94	173	178	97	2,371	2,752	86
45½–49½	199	185	108	257	248	104	4,791	5,617	85
50½–54½	124	121	102	206	196	105	7,668	8,752	88
55½–59½	76	72	106	133	119	112	9,077	9,607	94
60½–64½	38	28	136	52	48	108	5,292	5,277	100
65½–69½	21	13	162	19	23	83	1,422	1,457	98
70½–74½							1,070	1,138	94
75½–79½							931	905	103
80½–84½							478	487	98
85½–89½	5	3	167	3	5	60	208	216	96
90½–94½							39	37	105
95½–99½							2	3	67
100½–								–	–
All ages	1,157	1,177	98	1,405	1,426	99	36,475	40,452	90

of comparison between the two classes has not changed over the two periods.

(The group rates have been found by means of weightings equal to the standard population published in *J.I.A.* **83,** 154 and are therefore strictly comparable with the quinary group rates of mortality of assured lives shown in the series of notes by H. A. R. Barnett under the title *Population Mortality and Assured Lives' Mortality in Great Britain—A Comparison of Trends.*)

A final point to be borne in mind is that the medical experience at ages below 50 contains a certain number of lives who were originally proposed under the non-medical scheme and were then required to submit themselves to medical examination because of some unfavourable feature revealed by the answers entered on the proposal form. Although these lives were then subsequently accepted at normal rates (or otherwise they would be excluded from the C.M.I. altogether) they may still be expected to be a slightly less favoured class than lives accepted under the non-medical scheme outright and their inclusion in the medical data may have the effect of slightly worsening the experience.

Table 3. *Central rates of mortality,* 1955–58 *and* 1959–62: *C.M.I. assured lives' data, durations* 5 *and over* (*medical and non-medical separately*)

	1955–58		1959–62	
Ages last birthday	Medical	Non-medical	Medical	Non-medical
30–34	·0010	·0009	·0009	·0008
35–39	·0011	·0014	·0012	·0012
40–44	·0019	·0022	·0020	·0021
45–49	·0037	·0038	·0035	·0037
50–54	·0068	·0072	·0063	·0066
55–59	·0119	·0132	·0112	·0123
60–64	·0197	·0224	·0199	·0217
65–69	·0318	·0343	·0313	·0347
70–74	·0509	·0586	·0508	·0533
75–79	·0900	·0999	·0887	·1007

MORTALITY EXPERIENCED DURING DEFERMENT FOR THE PERIOD 1958–62 BY PURCHASERS OF RETIREMENT ANNUITIES UNDER THE PROVISIONS OF THE FINANCE ACT, 1956

DATA in respect of retirement annuity policies effected under the 1956 Finance Act have been collected since the beginning of 1958, and the statistics relating to the period of deferment for lives accepted without medical examination are now adequate for a report to be made on the experience. In the other sections of the investigation, i.e. medically examined lives and annuities in possession, the data are as yet insufficient for analysis.

The experience under retirement annuities during deferment has a special interest in so far as these contracts cannot be surrendered. Thus there is no possibility of selective withdrawal such as may exist in an assured lives' experience. Although there is considerable variation in practice in the benefits payable on death, no sub-division on this account has been made in the investigation.

Table 1. *Mortality of retirement annuitants during period of deferment. Comparison of actual deaths* 1958–62 *with expected deaths according to the A* 1949–52 *and a*(55) *ultimate tables. Non-medical data, male lives*

Age group (nearest ages)	Actual deaths	Expected deaths (A 1949–52)	100 A/E	Expected deaths *a*(55)	100 A/E
–25	4	4·03	99	4·47	89
26–30	18	15·57	116	18·18	99
31–35	38	37·12	102	46·06	83
36–40	81	76·29	106	96·21	84
41–45	164	173·50	95	196·50	83
46–50	368	433·11	85	420·78	87
51–55	660	787·95	84	686·65	96
56–60	714	877·65	81	723·53	99
61–65	470	566·99	83	461·92	102
66–	161	238·72	67	196·35	82
Up to 45	305	306·51	100	361·42	84
46 and over	2,373	2,904·42	82	2,489·23	95
All ages	2,678	3,210·93	83	2,850·65	94

There is no standard mortality table available which can be regarded as suitable for calculating expected deaths for retirement annuity contracts. It was thought, however, that for male lives, offices would be interested in comparisons based on both the A 1949–52 and the *a*(55) ultimate tables, even though neither table can be regarded as relevant to the experience.

The results on these two bases are shown in Table 1, from which it can be seen that, broadly speaking, the experience has followed the A 1949–52 ultimate table up to age 45 and the *a*(55) ultimate table thereafter.

For the corresponding experience of female lives, Table 2 gives a comparison based on the *a*(55) ultimate table. Actual deaths in 1958–62 were generally between 70% and 75% of expected deaths, apart from those age groups where the data were too scanty to be of significance.

Table 2. *Mortality of retirement annuitants during period of deferment. Comparison of actual deaths* 1958–62 *with expected deaths according to a*(55) *ultimate table. Non-medical data, female lives*

Age group (nearest ages)	Actual deaths	Expected deaths	100 A/E
–40	4	8·88	45
41–45	8	12·57	64
46–50	19	26·53	72
51–55	32	42·50	75
56–60	31	41·78	74
61–65	15	21·44	70
66–	5	5·28	95
All ages	114	158·98	72

MORTALITY OF PENSIONERS UNDER LIFE OFFICE WORKS' PENSION SCHEMES: EXPERIENCE FOR 1961–63

IN the note recently published in *J.I.A.* **91,** 75 and *T.F.A.* **29,** 228 on *The Mortality of Pensioners under Life Office Pension Schemes: Experience for* 1959–62 it was observed that mortality by amounts for male lives was only 90% of the mortality by lives, the contrast being less marked for the females.

A subsidiary investigation was started in 1961 into the mortality experienced in schemes covering 'works' employees only and the committee decided to report on the data so far submitted (i.e. up to and including the 1963 experience), as soon as possible after the general note on pensioners' mortality. Only six offices are contributing the separate works data, and one of these did not start until 1964. Of the remaining five, only one office started submitting its works data as early as 1961, the first year of the subsidiary investigation; a further three started in 1962 and the fifth in 1963, so that for the period 1961–63 statistics are available for 10 'office years of experience'.

The data relating to all pension schemes combined have been subdivided to enable statistics to be deduced for these same 10 office years of experience and the 'works only' figures subtracted from them, so that a direct comparison may be made between 'works' and 'non-works'. (Note: the term 'non-works schemes' is used throughout this note to include not only schemes for office employees only, but also mixed schemes covering both office and works employees.) The comparison for those pensioners who retired at or after the normal pension age is given in Table 1.

For male pensioners the mortality experienced in non-works schemes was significantly lighter than in works schemes in three of the five age groups, whether investigated by lives or by amounts. In the 71–75 age group the mortality according to lives was slightly, but not significantly, higher in the non-works schemes, but the position was reversed in the analysis according to amounts. Only at the highest age group, 81 and over, was the non-works mortality significantly higher than the works.

It is interesting to note that the lower mortality according to amounts (as compared with lives) which had already been observed in the 1959–62 male experience in all pension schemes combined, is again featured in the figures for non-works schemes in 1961–63, whereas there is no pronounced difference between lives and amounts under the works schemes. This is only to be expected because there cannot be so much variation with regard to amounts within works schemes as within non-works schemes. Indeed, since the non-works schemes contain a mixture of works and staff personnel, there is greater heterogeneity than would exist in either a 'works only' or a 'staff only' investigation, and it is accordingly not surprising

Table 1. *Mortality of pensioners under 'works' and 'non-works' schemes* 1961–63. *Retirements at or after the normal age*

(*Expected deaths according to the English Life Table No.* 11)

	Works schemes						Non-works schemes					
	Lives			Amounts			Lives			Amounts		
Age group (nearest ages)	Actual deaths	Expected deaths	100 A/E	Actual deaths £	Expected deaths £	100 A/E	Actual deaths	Expected deaths	100 A/E	Actual deaths £	Expected deaths £	100 A/E
Males												
65 and under	59	53·74	109·8	2,323	2,213	105·0	218	204·43	106·6	30,035	35,124	85·5
66–70	743	701·05	106·0	33,400	31,424	106·3	2,158	2,429·76	88·8	269,306	328,362	82·0
71–75	512	580·51	88·2	16,159	19,043	84·9	2,315	2,605·43	88·9	243,714	299,152	81·5
76–80	341	345·93	98·6	8,161	8,830	92·4	1,536	1,708·03	85·4	137,292	178,554	76·9
81 and over	152	218·60	69·5	3,665	5,197	70·5	788	1,010·24	78·0	65,226	87,491	74·6
All ages	1,807	1,899·83	95·1	63,708	66,707	95·5	7,015	8,047·89	87·2	745,573	928,683	80·3
Females												
60 and under	4	1·09	367·0	249	40	622·5	11	13·51	81·4	1,296	1,045	124·0
61–65	13	18·80	69·1	318	601	52·9	153	189·12	80·9	6,857	11,691	58·7
66–70	13	15·26	85·2	356	326	109·2	163	233·98	69·7	7,116	11,854	60·0
71 and over	9	10·44	86·2	108	155	69·7	290	348·76	83·2	10,920	14,168	77·1
All ages	39	45·59	85·5	1,031	1,122	91·9	617	785·37	78·6	26,189	38,758	67·6

that a marked difference emerges in this section between the results by lives and the results by amounts.

In the female experience too, the works schemes exhibited generally higher mortality than the non-works schemes, and the differences between 'lives' and 'amounts' were only featured in the non-works schemes. However, the works statistics for females were based on only 39 deaths and no firm conclusions can be drawn.

Table 2 gives similar statistics for male pensioners who retired before the normal age. (Data for females are too scanty to reproduce.) Mortality in the works schemes appears to have been substantially higher at ages up to 70 than in the non-works schemes, possibly because early retirements among works employees include some who have been injured in industrial accidents.

The main conclusion from the data so far accumulated in this investigation is that the mortality of pensioners under works schemes is substantially heavier than under non-works schemes. For male pensioners retiring at, or after, the normal age (who form the bulk of the lives in the investigation) the works mortality shows an over-all excess of 9% over the non-works level on a lives basis and 19% on an amounts basis.

Table 2. *Mortality of pensioners under 'works' and 'non-works' schemes* 1961–63. *Retirements before the normal age (male lives only)*

(*Expected deaths according to the English Life Table No.* 11)

	Works schemes						Non-works schemes					
	Lives			Amounts			Lives			Amounts		
Age group (nearest ages)	Actual deaths	Expected deaths	100 A/E	Actual deaths £	Expected deaths £	100 A/E	Actual deaths	Expected deaths	100 A/E	Actual deaths £	Expected deaths £	100 A/E
65 and under	116	40·54	286·1	4,131	1,602	257·9	461	220·31	209·3	49,897	31,149	160·2
66–70	44	24·26	181·4	2,229	990	225·2	295	219·48	134·4	28,913	25,145	115·0
71 and over	14	15·02	93·2	247	289	85·6	238	255·15	93·3	20,617	19,408	106·2
All ages	174	79·82	218·0	6,607	2,881	229·4	994	694·94	143·0	99,427	75,702	131·3

MORTALITY UNDER GROUP LIFE ASSURANCE SCHEMES

A SPECIAL investigation, limited to three years, has been undertaken into the mortality experienced among employees covered by group life assurance schemes. It is to be expected that the lives concerned will exhibit what is often referred to as 'active service mortality'.

The three years covered ran from scheme anniversaries in 1958 to scheme anniversaries in 1961. As it is in the nature of group business that scheme revisions sometimes take place considerably in arrear, it was not possible to collate the data until the early months of 1965.

Seven life offices transacting group business on a substantial scale participated in the investigation. Data were supplied on both a 'lives' basis and an 'amounts' basis.

For male lives the total exposed to risk were 2,089,264 with sums assured exceeding £1,570 millions. The deaths numbered 11,490 with sums assured of over £8 millions. Expected deaths were calculated on the English Life Table No. 11, on the A 1949–52 ultimate table and also on the basis of the assured lives' experience at durations 2 and over for the four years 1959–62. The results are set out in Table 1, from which it can be seen that the experience groups itself naturally into three broad age groups of 15 years each. The percentages of actual to expected deaths within these three groups are as follows:

	E.L.T. No. 11		A 1949–52 Ultimate		1959–62 Assured lives (durations 2 and over)	
Age group	Lives	Amounts	Lives	Amounts	Lives	Amounts
	%	%	%	%	%	%
20–34	54	52	72	71	105	103
35–49	70	62	104	92	125	111
50–64	79	73	110	102	121	113

These results show that, while neither of the standard tables fits the experience very well, the A 1949–52 table is much closer than E.L.T. No. 11. On a 'lives' basis the experience lies above A 1949–52 at all ages over 35; but on an 'amounts' basis the experience does not exceed the expectation by A 1949–52 until age 50 is reached and even in the age group 50–64 the excess is only 2%. When the results are compared with the contemporaneous experience of assured lives under ordinary life assurance policies, the group scheme mortality appears substantially higher.

When mortality by 'lives' is compared with 'amounts' there is little difference at ages under 35. From 35 onwards, however, the 'amounts' experience is appreciably lighter and it is already known from the pensioners' investigation that this feature continues into old age.

Table 1. *Group life assurance mortality experience* 1958–61. *Exposed to risk, deaths and percentages of actual to expected deaths on three bases*

Male Lives

					Percentages of actual to expected deaths					
	Exposed to risk		Actual deaths		E.L.T. No. 11		A1949–52 Ultimate		Assured lives 1959–62	
Age group	Lives	Amounts £	Lives	Amounts £	Lives %	Amounts %	Lives %	Amounts %	Lives %	Amounts %
20–24	99,994	51,106,192	89	38,757	65	55	79	68	92	78
25–29	213,498	140,939,680	150	104,325	48	50	62	65	102	107
30–34	268,199	201,247,678	253	182,351	55	53	78	75	113	109
35–39	308,562	238,381,810	478	340,056	68	62	103	95	129	119
40–44	269,059	212,282,966	686	443,584	71	58	108	89	127	104
45–49	289,890	230,647,696	1,252	905,976	70	64	102	92	123	112
50–54	271,818	212,945,891	2,258	1,654,683	78	73	110	103	130	122
55–59	227,775	175,261,347	3,189	2,256,900	79	73	110	102	123	113
60–64	140,469	107,319,415	3,135	2,234,259	80	74	108	101	114	106
20–64	2,089,264	1,570,132,675	11,490	8,160,891	76	70	106	98	122	113

Table 2 shows the results for female lives. The exposed to risk totalled 264,703 with corresponding sums assured of over £116 millions. There were 477 deaths with sums assured of £200,000. The only table of female mortality available for calculating expected deaths was the English Life Table No. 11 and the percentages of actual to expected deaths on this basis are given in the table. There is little difference between the results for 'lives' and 'amounts'—a conclusion which has already been drawn from the female pensioners' investigation. The overall percentage of actual to expected deaths is only 51% on a 'lives' basis. This is much lower than the corresponding percentage (76) for male lives and suggests that female active service mortality is more affected by selection than the male experience, i.e. unfit female lives are more likely to withdraw from the experience than are unfit males. So far as the older ages are concerned, it is possible that a woman whose health is failing is more likely to drop out of employment than a man in comparable circumstances.

Table 2. *Group life assurance mortality experience* 1958–61. *Exposed to risk, deaths and percentages of actual to expected deaths according to the English Life Table No.* 11

	Female Lives					
	Exposed to risk		Actual deaths		Percentage of actual to expected deaths	
Age group	Lives	Amounts	Lives	Amounts	Lives	Amounts
		£		£	%	%
20–24	22,144	8,819,350	4	1,450	20	18
25–29	31,698	14,697,725	9	4,412	25	26
30–34	33,160	15,020,337	18	7,733	39	37
35–39	38,286	17,029,922	42	17,600	59	56
40–44	35,288	15,419,323	56	23,793	59	57
45–49	39,850	17,385,935	81	34,365	50	49
50–54	36,520	15,863,468	126	56,258	55	57
55–59	27,757	12,260,534	141	59,138	53	50
20–59	264,703	116,496,594	477	204,749	51	50

ABSTRACT OF THE DISCUSSION ON THE PRECEDING AND ON THE PREVIOUS THREE REPORTS IN VOL. 91, PP. 68–79

Mr A. D. Wilkie, F.F.A., in introducing the seven reports, which were in the nature of progress reports, outlined the main features of each one. Report 1, on assured lives, showed the mortality for the period 1959–62 and, as in the previous report which had shown the results for 1953–58, comparisons were made with the A1949–52 table. There had been no remarkable change in the previous trend. Overall, assured lives' mortality was about 91% of the level of A1949–52; the improvement had been greatest at the younger ages, while above age 55 there had been less improvement. That was in line with what had been happening in the general population. It seemed likely that, unless there were some dramatic developments in medical research which would cure or prevent either cancer or coronary heart disease, those gentle trends would continue steadily.

Report 2 dealt with ordinary annuitants, and the level of mortality at ages over 60, which provided almost all the data, had remained stationary for the previous fifteen or more years. However, there had been a quite marked change in the experience at short durations since the 1956 Finance Act made purchased annuities a much more attractive financial proposition. There seemed to have been a substantial decrease in the level of mortality for both sexes for entrants from 1957 onwards. It was possible that that was associated with a new style of annuitant. There had also been an increase in the numbers of exposed to risk at the early durations. The Committee would continue to investigate pre-1956 and post-1956 business separately for some years.

Report 3 drew attention to a slow improvement in the mortality of male pensioners under life office pension schemes; their mortality lay between that of ordinary annuitants and that of the general population. The striking feature of the report, which was also mentioned in Report 6, was the difference between the mortality by lives and by amounts.

Report 4 dealt with medical and non-medical assured lives. The data for the two groups were recorded separately although they were amalgamated in the assured lives' report. The report showed what might have been expected: medical mortality was lighter than non-medical at durations 0 and 1, but thereafter there was not much difference. There was considerable difficulty in getting any further useful information out of the results. In the first place, the expansion of non-medical business meant that its duration on the whole was less than that of medical business; and, in the second, a certain number of those who were rejected for a non-medical policy were later accepted at ordinary rates in the medical section of the business.

He then went on to the three new investigations, the first of which, Report 5, dealt with 1956 Finance Act personal retirement pensions. It was interesting in a theoretical way because there were no withdrawals. The mortality during the period of active service appeared to follow the A1949–52 table up to age 45 and the $a(55)$ table up to age 65, but after that age, i.e. in retirement, the data petered out. There had not been sufficient time since 1956 for many retired people to appear. Since the two tables crossed over at about age 45 the experience effectively followed the lower of them.

The important fact in Report 6 was that the pensioners' mortality in 'works' schemes was higher than that in schemes with a mixture of works and staff. Similarly, in the general pensioners' experience, mortality by lives was higher than by amounts. Clearly occupational class affected mortality among pensioners; the Registrar-General had known that for some time for the general population. The Committee had not been

able to stratify the results for pensioners according to the size of pension. In any case, unless individuals were identified it would be difficult to consolidate the several pensions that might be payable to one man. Theoretically, however, that would be desirable—to see whether the trend to lighter mortality with larger pension continued all the way uniformly or whether there was a true discontinuity between works and staff-type schemes, or whether indeed the trend was reversed at the highest levels of pension.

Finally, in Report 7 there were group life assurance schemes and the results were not unexpected; the level of active service mortality in group life assurance schemes was found to lie between that of the general population and that of assured lives. For some time it had been found by offices that active service mortality was exceptionally light, but the experience in Report 7 did not support that conclusion. Two things might have affected that: the extension of group life assurance to works schemes would have been expected to introduce a poorer class of life, and the practice of employers as to how long a sick man should be kept covered by a group life scheme might have been changing. Again, on an 'amounts' basis the mortality had been found to be lower than on a 'lives' basis.

It would not surprise him to find that feature present in all the reports but that had not been investigated for assured lives and ordinary annuitants. Generally, the better mortality was found among the more prosperous persons, and that appeared to apply throughout life, from infancy to old age.

Mr H. M. Stewart, in opening the discussion, declared his interest in the subject as a tutor in mortality and stated that many of his observations would be made from the point of view of the student. He thought that a mortality experience, in actuarial parlance, was a sort of passive experiment in mortality rates. That was a very important point for the student to grasp. They could not put assured lives or annuitants into a test tube. They could not get hold of one million male lives all born on 1 January 1926 and make them all take out a policy on 1 January 1966. If they could, it would make life easier in one way but then, as so often happened in an active experiment, the experimenter would affect the results. All they could do was to sit back and observe, keeping their eyes and minds open, and see what assured lives, for example, did to their insurance companies—and then speculate, conjecture, analyse and test.

It was interesting to see how many features which the mortality student had to learn about were illustrated in the reports. He was warned about heterogeneity. The simultaneous view which was provided by the reports brought home forcibly how many different mortalities there were, even within the insurance industry, and what the lives involved did to their insurance companies and how they did it differently in their capacities as assured lives, annuitants, and so on. Then again, the average student imagined that, if he were asked to analyse an experience and compare it with some standard, he could calculate and graduate some rates and compare them with the standard ones. The seven reports were a classical illustration of the technique of comparing actual and expected deaths which could be applied to experiences too small to produce reliable graduated rates. They could thus subdivide their data and examine them for heterogeneity and then decide what subdivisions they could recombine in order to produce reasonable rates for graduation. For instance, the assured lives' experience (Report 1) was analysed into with-medical and non-medical categories (Report 4), but, on the basis of previous experiences, the with-profit and non-profit, and whole-life and endowment assurance subdivisions were no longer analysed. Similarly, annuitants were being analysed into pre-1956 and post-1956 in Report 2, although the

post-1956 ultimate data were still insufficient. Report 5 was a new report and dealt with purchasers of retirement annuities under the 1956 Finance Act, a body of lives which might be expected to conform neither to assured lives' mortality nor to that of private annuitants. The data were compared with A1949–52 and *a*(55) ultimate tables and an intermediate level of mortality was confirmed. Comparable data for vested retirement annuities should prove interesting when they became numerous enough to publish. Report 3 dealt with pensioners under life office schemes in two subdivisions. The first compared early retirements with normal and late retirements and the second, a new subdivision, considered the effect of weighting by the size of pension and strongly indicated a difference between works and staff mortality. As Mr. Wilkie had said, they did not have a stratification by actual size of pension nor would it be practical to do so with members possibly drawing pensions from different offices and schemes. Reports 6 and 7 were new reports based on returns from a small number of offices only and served to confirm the differences between works and staff mortalities. Report 6 dealt with works and non-works pensioners and was, in effect, an analysis of the returns for Report 3 from the offices concerned. Report 7 dealt with group life assurance, the results being analysed with and without a weighting by sum assured. One most important case of heterogeneity which was not, or could not be, really dealt with in those reports was inter-office variations. In their written reply to the discussion of the A1949–52 tables (*J.I.A.* **82,** 77) the Committee had suggested that part of the worse non-medical experience might well be due to an undue weighting by heavy offices.

Selection, in its widest sense, had been defined as the operation of any factor, other than age, which tended to affect mortality rates. The combined effect of the seven reports was to provide the student with examples of nearly every type of selection which he had been taught about. In dealing with heterogeneity he had already mentioned many types of class selection and would add the obvious differences between males and females. An interesting example of class selection linked to the calendar was the change in the class of annuitants since 1956 for which they now had evidence. Then there was time selection and the secular trends such as those compared with population trends by Mr Barnett. Temporary initial selection was examined for assured lives and annuitants. There were examples of negative temporary initial selection among the pensioners, both early retirements and others. Early retirements were clearly self-selected and that that selection might be temporary was perhaps evidenced by the tendency to approach the normal and late retirements at the older ages. Selective withdrawal was mentioned in Report 5 on retirement annuities—where it could not occur. The possibility of spurious selection was touched on in Report 4 where the heavier non-medical experience at old ages was considered as possibly due to the higher mean duration.

In Report 1, on assured lives, there were two interesting examples of graduation by reference to a standard table. In Report 4, which dealt with the subdivision of assured lives into medical and non-medical, the impression he had from the ultimate rates in Table 3 was that medical and non-medical rates were rather closer together in 1959–62 than in 1955–58. Another impression he had was that there could be two kinds of initial selection in connexion with life assurance, which might be called 'medical' and 'underwriting'; it was noticeable that the with-medical experience was a good deal lighter in the first year. He did not entirely agree with the last paragraph on page 4. He thought it needed qualifying in that it referred only to the select experience; surely the ultimate medical experience even at high ages would include some non-medical proposers who were accepted at ordinary rates only after a medical examination. Earlier in Report 4 (page 2) it was stated that an analysis by individual duration was not available after

duration 1. Why not? His understanding was that returns were made at durations 0 to 4 separately. Admittedly the A1949–52 table only gave rates by duration for durations 0 and 1, but was there any reason why the deaths at durations 2, 3 and 4 should not be compared with, for example, the expected on ultimate rates? Indeed, that was precisely what had been done with the annuitants. In Table 3 of Report 2 (Vol. 91, p. 74) the actual deaths were compared with expected using select rates at duration 0 and ultimate at all other durations. The difference between those two treatments made him think that there were two distinct ways in which the comparison of actual and expected deaths could be regarded. The first was to see how well an existing table was being borne out in a later experience, and there the actual deaths had to conform exactly to the classification of the tabular rates. The second was to compare the actual deaths with any standard table, either to compare two sets of actual deaths with each other or, possibly, to see how well the actual experience might be represented by the standard table. The two references above (p. 2 and Vol. 91, p. 74) seemed to represent those two points of view. In the final paragraph of Report 2 (Vol. 91, p. 72) he quite agreed that the recent experience at duration 0 could hardly be put forward as an adequate basis for determining adjustments to the $a(55)$ table if only because the select rates in $a(55)$ were themselves somewhat arbitrary adjustments of the ultimate rates.

One interesting feature of Report 3 was that if the figures for pensioners by amount, as opposed to by lives, for 1959–62 were inserted in the table on page 76 (Vol. 91) they would be found to be very similar to the figures for annuitants. Reports 3, 6 and 7 all bore each other out that lighter mortality was associated with higher benefits.

Report 7 would be particularly interesting to those of them who were concerned with group life assurance because it provided some firm statistics based on a wide experience, albeit from seven offices only. There were several peculiar features of active service mortality. One was the variation from scheme to scheme which could not be brought out by the report. A harsh employer who sacked his sick employees might give rise to light mortality in his scheme. Some schemes, particularly works schemes, had chronically poor mortality. One works scheme known to himself consistently produced mortality of 160% of A1949–52 ultimate. Why? He just did not know which came first, the chicken or the egg. Were the conditions so malignant that they killed off the employees? Or were they just so unpleasant that only the dregs of the labour market would work there? Some of the substandard works schemes had been consistently at the same level for 15 or 20 years without sign of improving mortality. Was an underlying improvement masked by an increasing proportion of employees of a different class, such as immigrants, with worse mortality? Other schemes showed fluctuations, sometimes a worsening following expansion or the purchase of subsidiary companies. In that slippery area, with wide variations between schemes, not to say different insurance companies, it was a relief to find his own impressions borne out in a wider experience. Some years earlier he had had occasion to look at the experience of a fairly small group of non-works schemes. They had the same features of mortality, about 100% of A1949–52 ultimate at age 65, falling to less than 100% at the younger ages. It appeared that their mortality could be represented by multiplying q_x on A1949–52 ultimate by a factor of the type $1-{\cdot}005\ (65-x)$—in other words, a scaling off. The present experience kept near 100% for most ages in the range 35–65 but that included works employees too. So far as secular trend was concerned, it was interesting to note what Pingstone wrote after the discussion on the A1949–52 table in 1956 (*J.I.A.* **82,** 76). In the experience which he reported for a considerable group of large pension (rather than life assurance) schemes in the policy year ending in 1954, mortality was close to A1949–52 ultimate in the

age-range 45–59, but was appreciably lighter at younger ages and appreciably heavier from 60–65. If anything, therefore, the new experience showed a worsening, at least in the range 35–45. In view of all that, he found some of the group life assurance rates allegedly obtainable in the market interesting, to say the least. They should not forget the growing tendency to provide cover during early retirement.

Having concluded his remarks on the seven reports, he went on to make one or two suggestions for future C.M.I. reports. First, would the Committee consider making available an up-to-date memorandum on its requirements and instructions, with notes on some of the practical decisions it had made on how to deal with awkward cases? At present they had to go right back to the original memorandum of 30 July 1924 (which could be found in the reprinted discussions on the A1924–29 tables) plus correspondence since 1924. That was confusing not only to the student but even to the qualified actuary not familiar with the work of the C.M.I. Bureau. Secondly, could the ages used in the various reports be given consistently? In Report 1 there was, for example, age-group $60\frac{1}{2}$–$64\frac{1}{2}$, in Report 2 age-group 61–65 (nearest ages), and so on. Presumably those were intended to mean the same thing. Could it also be stated for clarity that those were ages at death? All reports except No. 7 were based on the census method; and deaths described as 'age $60\frac{1}{2}$' or 'age 61 nearest' would give rise to rates for age $60\frac{1}{2}$ exact. Those unfamiliar with the work might imagine that rates derived from 'age 61 nearest' would approximate to q_{61} exact, which was, indeed, the situation in Report 7, which was based on the policy year with the ages for the deaths being nearest age on the previous policy anniversary. Thirdly, he suggested, as others had, that the next assured lives' table might be issued before the annuitants' table so as to provide an up-to-date guide to annuitants' rates at younger ages. Fourthly, would it be possible, without breaking any confidences, to give an indication of the variation between offices in each report as was done in Appendix 1 to the report on the A1949–52 tables? Perhaps the time had come for the publication of an A1949–52 Light Table. Fifthly, would the Committee indicate in their reports any suggested age ratings which they might notice and consider appropriate? That was one of the easiest practical ways to adjust an available table with interest functions already calculated. Finally, in their investigation of pensioners the Committee omitted a very large body of possibly relevant lives, namely, those under private funds. Would it be impracticable to obtain figures from that source too? He feared that it would.

Mr C. S. S. Lyon welcomed the publication of an active service mortality experience, even though it was limited in its scope. The volume of group pension and life assurance business was such that he could not help remarking that an investigation into active service mortality ought to have been undertaken much earlier than 1958. The larger offices transacting the business had, of course, been able to analyse their own experience, but there was no doubt in his mind that had the C.M.I. been extended to active service mortality earlier it would have been of much benefit to those offices, some of them new to the field of pension business, which had cut their group life assurance rates to utterly uneconomic levels. As it was, they were asked to follow suit on the grounds that group life assurance would be regarded as a 'loss leader'.

He did not find the commentary on the experience particularly helpful. There was, for example, no definition of 'age-group', nor was there any indication of whether the data included in the experience were likely to be representative of group life assurance business as a whole. Examination of the table suggested that, with an average sum assured for males of less than £800, the data would be heavily weighted with schemes

for works employees. His own office, which probably accounted for a quarter of the exposed-to-risk, submitted data for a limited section of its business comprising mostly schemes with at least 1000 members, and they knew that that section included relatively more works employees than the remainder of their business.

It might be thought that for that reason the mortality experience now published was heavier than that generally experienced, particularly among staff employees. However, in their own case that did not appear to be so. Indeed, there were clear indications from their own experience that mortality by amounts under schemes for staff employees varied with the size of the scheme, reaching a peak well in excess of A1949–52 ultimate mortality overall for schemes of between 100 and 300 lives. They had not so far found a satisfactory explanation for that feature, which did not appear to be present in the mortality experience of works employees, and it would be interesting to know whether it had been observed by others. It might be related to the heavy mortality experience at younger ages by people who effected retirement annuities under Section 22 of the 1956 Finance Act. Those were obviously professional people for the most part. It was strange to find experience above, or at the level of, 100% of A1949–52 at the younger ages there.

There was another area of active service mortality not covered by the report—that represented by endowment assurance schemes. Those did not comprise a homogeneous group any more than did group life assurance schemes, but in general they contained a higher proportion of senior executives. In non-works endowment schemes they had again found evidence of mortality varying with size of scheme, the largest schemes showing the lightest mortality, but their investigation was not yet sufficiently extensive for any accurate assessment of the magnitude of that feature to be made. What did seem clear was that the overall experience of non-works endowment schemes by amounts was appreciably lighter than that of non-works group life assurance schemes.

In considering active service mortality it had to be remembered that employees leaving service usually had the option to continue their cover in one form or another without evidence of health. The cost of the option ought to be borne in mind when considering the mortality of those who remained. The question was how important financially was the continuation option. In a paper by L. Levinson read to the Society of Actuaries in 1962 it was concluded that, on the basis of American experience, an additional reserve averaging about 10% of the sum assured was required to cover the extra mortality risk at the commencement of a whole-life assurance effected under the continuation option. That reserve would be released over a period of years. It was needed to meet extra mortality of over 1000% in the first year, reducing to about 700% in the second year, 500% in the third year, and so on. He did not know whether anyone had attempted a similar investigation in Great Britain—perhaps that was something the Committee might take up—but assuming the experience was similar there, what was the effect of spreading the extra reserve over all group life assurance premiums? If the figures for his own office were anything to go by, continuation policies accounted for not much more than ·1% of the group life assurance in force each year, so the cost of the option might be about 3d.% or, say, 2½% of premiums.

The shape of the active service mortality curve, as evidenced by the published experience of group life assurance, did not correspond closely with either the A1949–52 ultimate or the E.L.T. No. 11 table. It could be related much better to Table 14 in the Government Actuary's Third Quinquennial Review of the National Insurance Scheme. That table showed assumed rates of mortality in Great Britain in 1962–63, and the male group life assurance experience throughout the age range was of the order of 85% (lives) and just under 80% (amounts) of what he would term 3QR(M). For females the

experience, by lives and by amounts, was generally about two-thirds of 3QR(F), although appreciably higher between ages 35 and 45. He thought that result was of sufficient interest to justify an examination of some of the other experiences under discussion to see whether they could be related to the same mortality curve. An obvious choice was the experience of male pensioners, and there he was rather surprised to find that in the period 1959–62 the mortality of pensioners who retired at or after normal pension age was between 79% and 85% of 3QR(M) throughout the range when measured by amounts. By lives the range was 89% to 95% except below age 65, where it was appreciably higher.

The assured lives' non-medical experience for 1959–62 at durations 2 and over followed very closely 70% of 3QR(M) throughout the age-range 25 to 60, while the medical experience was equally close to 67% of 3QR(M) for the same age-range. Above age 60 both percentages increased, the non-medical experience corresponding to that of pensioners above age 75.

He was tempted to suggest that the effect of selection, whether by social class, as was to a considerable degree the case with members of pension schemes, or by a combination of social class and evidence of health, as with assured lives, might simply be to cause the mortality experience during working lifetime to be reduced by a fairly constant percentage below that of the population as a whole. The maximum extent of that reduction, after the initial period of selection, was currently about one-third for males.

Mr W. Perks, could not understand why the Committee had confined its comparisons of group life experience (in Report 7) to E.L.T. No. 11 and assured lives' mortality. He thought that current population mortality would be more appropriate and in that respect Martin's tables in the *Journal* could help. Mr Lyon had in fact made a suitable comparison but the Committee should have done it. He also referred to the select experience for the assured lives' mortality. In spite of analysing selection for only two years the Committee had compared medical and non-medical business. They were aware that their comparison was faulty so why had they not made use of the data at longer select periods? The offices made returns for each of the first five years of duration but the Committee just did not give the information. In studying the difference between the mortality of medical and non-medical business, selection was the essence of the matter. Mr Wilkie, the spokesman for the Committee, had referred to the investigation of the annuity experience as separating the pre-1956 business from the post-1956 business. The figures given did not do anything of the sort. The analysis was by years of experience, not by years of entry. The table on page 71 (Vol. 91) was very confusing to anybody wishing to make a comparison between business entered before the 1956 Finance Act and business entering after that Act, and, indeed, that was the essence of that part of the report—whether or not something significant had happened to the mortality of annuitants as a result of the 1956 Finance Act. The Committee had speculated and suggested that there might have been a different class of annuitant life entering since the 1956 Act. The use of the word 'class' immediately raised in the mind of any actuary who was trained in the Eldertonian period the idea of class selection, and there was a tendency to overlook that there might be a more significant element of temporary selection in the question of the effect of the 1956 Act.

It was desirable, if they were going to speculate about that, to remember that for quite a number of years before the 1956 Act there was a steady tendency for immediate annuity business to decline because self-selected annuitants tended, for tax reasons, to buy annuities-certain and deferred annuities. Immediate annuities tended more and

more to be written only in special circumstances such as when required under a will or on termination of employment. Support for that suggestion of a declining volume of business was in fact given in the tables, where it was seen that, for both males and females, the actual deaths for durations 5 and over in the period 1959–62 were significantly fewer than in the period 1955–58. That meant that the element of self-selection was diminishing up to 1956. From 1956 onwards the element of self-selection probably returned in full force and he would have expected a consequent improvement in the mortality at the early durations; indeed, that was precisely what was apparent from the table on page 71 (Vol. 91)—particularly for duration 0. The position was a little confusing in the data for durations 1, 2, 3 and 4 because it was not possible to separate pre-1956 business from post-1956 business exactly, but a view could be obtained fairly well. The numbers of deaths were relatively small at each duration over each period and random variation to some extent obscured the trends, but taking the mean between the percentages for durations 1 and 2 and the mean between those for durations 3 and 4, a fairly good idea of the mortality of those two groups was obtained. For the males for durations 1 and 2 combined, the percentages were 91, 75, 72, 65—a steady decline. The female percentages were 78, 76, 73, 68—again a steady decline. For durations 3 and 4, for males the percentages were 96, 81 (out of line), 91 and 82; and for the females, 87, 86, 86 and 75. Out of those 16 percentages only one was out of line, and he felt confident that there had been a steady decline in the mortality for durations 1 to 4. On the other hand, there was no evidence of decline in the percentages for duration 4 alone. His hypothesis, supported by the table, was that the phenomenon the Committee had been investigating was largely, if not entirely, a short period temporary selection phenomenon and not a class phenomenon in terms of mortality. For duration 5 and over it looked as if mortality was constant but there were no post-1956 entries in the experience for durations 5 and over so that no conclusions on the matter at issue could really be drawn from the ultimate data.

Mr A. J. Gunson said that in order to see more clearly the underlying trends in mortality it was of value to compare actual deaths with those expected according to the actual mortality experience between 1949 and 1952. Making such comparisons between Table 2 of Report 1 (Vol. 91, p. 70) and the corresponding table in *J.I.A.* **87**, 86, it was seen that once again there had been a large improvement in mortality in the age-group 25½ to 34½, but thereafter to about age 50 the improvement was much smaller than previously. However, the most important feature of the data for the assured lives' mortality was, in his opinion, the large improvement between 50½ and 59½. The ratio A/E had fallen from 92% to 83% for age-group 50½ to 54½ and from 99% to 92% for age-group 55½ to 59½. That would seem to represent a real improvement in mortality at those ages, and was borne out by the experience for both medical and non-medical business, and to a lesser extent by the male population mortality over that period. It would be remembered that previously the slope of the mortality curve had been accentuated between ages 40 and 55 by the changes in mortality during 1953–58. The changes during the more recent period would lessen the slope slightly and alter its position to a higher age level.

Turning to the mortality of pensioners, he found it noteworthy that the mortality of male pensioners retiring at or after the normal age had dropped substantially at the younger age-groups, although, of course, it was still relatively high at those ages. The fall in that mortality seemed large enough to be statistically significant and was rather remarkable as there had been little fall in population or assured lives' mortality at those

ages. That suggested to him that there had been a fall in the degree of adverse selection among the lives entering at the normal retirement age. He wondered if that was due to a smaller proportion of fit men continuing in work after normal retirement age. He believed that there had in fact been a general reduction in the proportion of men continuing in employment after retirement age.

The data on the mortality of pensioners under works and non-works pension schemes led to conclusions which might be anticipated. He had wondered whether some of the extra mortality among works schemes might be due to a greater proportion in geographical areas where mortality for the population as a whole was higher than the average for the nation.

Mr H. A. R. Barnett referred to a number of requests made by the opener. The first related to up-to-date instructions. That was something he had himself had in mind as a possibility—to have a memorandum which would summarize everything that had ever been sent out—but he had immediately come up against one very large snag which was that, prior to 1939, there did not appear to be any records; they might have been destroyed in the war. He felt, therefore, that the memorandum could only be compiled if they had the assistance of some of the offices in letting the Committee have back some of the original circulars! But he could assure the Committee on behalf of the Bureau that, if they wished it to be done, it could, in his opinion, be undertaken.

On the question of consistency as to ages, had the opener looked back at some of the previous reports he would have seen that they had always been inconsistent, but the inconsistency had not been brought into such high relief previously because everything had not been so nicely synchronized. The Committee felt (and he agreed with them) that it would be useful to have all the different sorts of mortality reported upon in respect of approximately the same periods so that they could be compared, and no matter how useless the comparison was, it was always nice to be able to compare any mortality with that of the general population. The seven reports had all been more or less synchronized and the comparisons were being made, and that was a good thing, for it would bring the Committee and those who worked with them down to earth, and they might well adopt some sort of consistent terminology, although he would not like to say whether he preferred half ages or nearest ages. From the point of view of the deaths it was more easily understandable to say 'deaths at nearest age 61' since it was not possible to have a 'death at age $60\frac{1}{2}$ last birthday'. On the other hand, the student had to work out what the q_x referred to, and the reports, where they referred to half ages, were probably originally put forward on that basis with the student in mind.

The question of having an assured lives' table before an annuitants' table was one of supply and demand, and if the next standard table which happened to be demanded were an annuitants' table, he was quite certain the Committee would not compile an assured lives' table simply to get it out first. But they would by all means bear the opener's comments in mind, for even if the Committee did not first compile an assured lives' standard table, they could always have a look at the mortality of assured lives over the last few available years if that would help. Although he had not been working for the Committee at the time, he believed that the $a(55)$ table was compiled initially on the basis of the experience of 1947, when there were no up-to-date assured lives' figures which could have been regarded as reliable in view of the effects of the War years.

He would leave to the Committee the question of variation between offices, because that was a very ticklish one. The Committee, as was known, always preserved strict anonymity of offices, and some anonymous way of describing the groups of offices

would have to be found; even then the clever reader could usually detect which was the office putting the greatest weight behind a certain group.

On the question of the combination of durations 2 and over in the medical and non-medical experience, it had seemed unnecessary, from the point of view of the progress report, to sub-divide the two component parts in more detail than the two together had been subdivided. (For ordinary assured lives, the main comparison had been with the last standard table, which did not distinguish between durations 2, 3, 4, 5 and over.) He agreed that if the Committee had in mind producing a standard table based on either medical or non-medical or both, they would have wanted the computing staff to separate durations 2, 3 and 4, and it was perfectly correct that the data were available. But it would take a tremendous amount of work to separate the figures, and he did not think the Committee would feel it was justified unless they were likely to be considering producing a standard table.

The answer to Mr Perks's criticisms of the table on page 71 (Vol. 91) was that the data had been combined in order to reduce the space required in the *Journal*. However, had the years 1948–56 been set out in detail they would have shown a sharp drop when passing from 1955–56 to 1957–58.

Mr V. W. Hughff said that the various types of mortality in the seven reports were all within their experience, and that demonstrated the change in emphasis which had taken place over the previous 15 years in the business of life assurance. There was another shift in emphasis which was taking place (although not as strongly as in other countries where there was no tax relief on premiums) and that was the switch from what used to be called main-class business to temporary insurance, with the saving element invested elsewhere. He would very much like to see some move made to start collecting data. It was, he believed, a developing trend and there was sure to be a mass of data already on the files of the various life assurance companies about temporary insurance classes. With computers being introduced it would be particularly helpful for the needs of the Committee to be known at the time the programmes were arranged, because they became very rigid very soon after they were introduced.

Mr F. M. Redington, in closing the discussion, said that it was not often that the C.M.I. Executive Committee could speak to the profession, and he, as its Chairman, wished to make a few remarks on the work of the Committee, which did in part answer some of the points raised in the discussion. As a young man he and a number of his generation had been somewhat critical of the work of the C.M.I. He had the feeling that there was less criticism than in the past, partly because the present Committee had been luckier in that more suitable subjects for examination had presented themselves, as the seven reports showed. Also he felt that they had become more conscious of the very practical limitations of their work, and they were more ready not only to admit, but where necessary to emphasize those limitations. The outstanding example of that was the $a(55)$ tables. When the Committee came to the conclusion that the $a(f)$ and $a(m)$ tables needed replacing, the very last thing in their mind was to use the aggregate forecasting system of the $a(f)$ and $a(m)$ tables which had come in for rather extensive criticism in the past. In the event, however, they had come to the conclusion that that system was still the best practical expedient, however unscientific it might be. But they had presented it very differently, stressing its limitations and giving as much information as they could by which its *invalidity* could be tested, and they had not come in for the same criticism, he believed, for that reason.

He thought that most members of the Committee joined it with a measure of scientific enthusiasm and he would like to think the enthusiasm remained, but the emphasis undoubtedly shifted. It was not easy for the Committee to embark on any general scientific research which would be relevant to their purpose. The function of the Committee was to examine the mortality of the life offices which contributed. There was, therefore, nothing random in the selection of their data. The Committee existed because the data were *not* random; otherwise they could use national tables of some sort. Right at its centre, therefore, the work of the Committee did not lend itself to any general scientific or sociological purpose.

A similar point was that their data were far from homogeneous. The Committee never knew the mortality of any individual office. That was kept within the confidence of the Secretariat. But on rare occasions it was important to know the degree of heterogeneity, and once or twice the Secretariat had given them some indication of the spread for different types of office—not individual offices. He could only emphasize over and over again that the spread was very wide and that nothing the Committee did could absolve actuaries of particular companies from responsibility for the mortality they used. The Committee's aggregate figures and tables were not representative of any individual office.

However, though the information which came before them did not lend itself to scientific research, the Committee were interested in such work and were always ready to consider any suggestions and, if need be, to recommend to the profession or the contributing offices that a particular project was worthy of support.

Those being his main general remarks, he turned to some of the immediate criticisms which had been made. The opener had made some very helpful suggestions. He was sure that it would be worth while, as the opener suggested, making a 'Consolidating Act' of the regulations of the Committee. It would probably mean a lot of work but the Committee would certainly look at it. He very much sympathized with the point about consistent ages and clear definitions, but, like Mr Barnett, he could not promise that they would produce an assured lives' table before an annuitants' table.

With regard to the variations between offices, each office had its own data, of course, and in an earlier report the Committee had commented on the fact that it was not worth publishing a 'light offices' table because a quick and ready approximation was a two-year rating down in age. He was sure that such a general indication was more useful to the profession than large volumes of bulky alternative tables which again, even if they took the light offices as a group, did not apply to any particular office. He did not know about the possibilities of getting data of pensioners' mortality from self-administered schemes.

Mr Lyon had made the point that the group life assurance report had been delayed too long. The Committee had been in very grave doubt whether to embark on it at all. The problem was that the data were very heterogeneous and he did not know any simple way of getting representative data. Their present thoughts were not to continue with that investigation; it was done once, more as a curiosity than with faith in its applicability in any particular situation. If any member had any suggestions as to what the Committee might usefully do they would be happy to look at them. Mr Perks had enquired why the Committee had used English Life Table No. 11 as a base in Report 7 and not current population mortality. The Committee spent more time in discussing what their bases of reference should be than almost any other subject. There were always half a dozen possible bases of reference which might be of interest for some purpose or other, but they were anxious not to flood the profession with excessive information, in which the really important things would get lost. In general they thought that offices

liked to have for the main base table a complete published table with mortality functions and so on, so that adjustments could be made, rather than broad figures like those prepared annually by Martin.

He felt that the Committee should bow its head over Report 4 and he admitted that its publication was an afterthought. Since they had amalgamated all the data for assured lives it was necessary from time to time to test whether the subdivisions were showing any signs of a different trend from previous investigations. On the basis of a private report, the Committee had come to the conclusion that the medical and non-medical experience was not departing from previous patterns, but had felt that the profession might be interested in the report. It had been dealt with a little casually, perhaps, because the phrase 'Since an analysis by individual durations is not available after duration 1' was a remark made to the Committee, meaning that the analysis had not been carried out. The data were, of course, available.

Mr Perks's most important point concerned the change in annuitant mortality since 1956. First of all, on behalf of the Committee, he admitted that they could have used a better phrase than 'the change in the class of life purchasing annuities', for the word 'class' had overtones that were not intended. It was a question of the character of lives and the circumstances in which they effected annuities. He admitted that because it was definitely not proven that there was a change in the class. There was clearly an alteration in the initial selection, which he believed was quite proven, but the Committee felt that it was still a very open question whether the change went beyond that. They would have to go on exploring to see whether there was a change in the class of life. His personal hunch was that there was.

Looking at the table on page 71 (Vol. 91) males only, and taking the first line, 1948–56, and comparing it with the last, 1961–62, there was evidence of very big improvements at durations 0, 1, 2 and 3 and the improvements did not slacken off with duration; but looking at duration 4, there was little improvement. A decision could not be made on one figure alone and they would not know the complete answer for some years, i.e. until they saw what happened to the '5 and over' group. The view of the Committee was that the investigation of that matter had to go on for the time being.

He wanted to express a very warm word of gratitude to the Offices which had been very co-operative in joining in special investigations and providing the necessary data.

In reply to Mr Hughff, he doubted whether the Committee would be able to get data on temporary insurance; again it was a question of heterogeneity and the Committee would have to consider the point.

The matter had not been raised in the discussion but the formula near the top of page 69 (Vol. 91) for measuring improvement was little more than a simple mnemonic and should not be taken as scientifically significant. In particular it was not suggested that the constant (·0002) had remained unchanged over the years.

One point not made by any speaker was that the rapid advances in biochemistry made the future very obscure. The effects of drugs like thalidomide and fertility pills showed that science was touching people's innermost mechanisms, and a recent article by Alex Comfort in *The Observer*, stating that soon it might be possible to influence longevity, brought more uneasiness than surprise. The warning should be noted.

The President (Sir Herbert Tetley, K.B.E., C.B.) said that he was sure the Committee would be most gratified by the reception given to the seven reports. The Committee had felt that it was high time the profession as a whole was told something of what was going on, how things were shaping, and what tentative conclusions seemed to be

emerging from the examination of the data. That was really the reason for the progress report. He was sure that the Committee would feel, when they came to examine the text of the discussion, that it had really helped them in their work.

He congratulated Mr Gunson, who had joined in the discussion on the very evening on which he received his Fellowship diploma, and also Mr Stewart for his excellent opening.

In moving a vote of thanks to the members of the Continuous Mortality Investigation team, both past and present, he mentioned by name Mr Redington, the Chairman, Mr R. D. Clarke, the Secretary, Mr Barnett, and Mr Ogborn who did most devoted work until his membership of the committee ceased in June.