

MORTALITY OF IMPAIRED LIVES 1974-83

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INTRODUCTION

1.1 In 1965, Clarke and Preston submitted a paper to the Institute (*J.I.A.* 92, 37) which gave the results for the period 1947-63 of the mortality experienced by impaired lives who were issued policies by their office.

1.2 In 1978, Clarke presented a paper (*J.I.A.* 106, 15) reporting on the experience of the next 10 years, viz. 1964-73. The primary purpose of this paper is to report on the experience of a further 10 years, viz. 1974-83.

1.3 This is also by way of being a bridging report. After a debate spread over many years, with climaxes when the reports referred to above were submitted and discussed, it was at last decided to set up an investigation on an industry-wide basis under the auspices of the C.M.I. Bureau. The collection of data to investigate the mortality of impaired lives of the participating offices deals with the experience of holders of policies issued at non-standard rates as from 1.1.1983. Inevitably, a number of years must elapse before sufficient data is accumulated to enable significant results to be obtained. Hence, on the one hand, the obvious desirability of the present paper dealing with the experience of the period 1.1.74-31.12.83 with ready comparison with earlier corresponding experience (but see also § 3.1). On the other hand, with the setting-up of the 'all-offices' investigation, it would appear that there would no longer be a need for the maintenance of the one-office investigation. While there would clearly be some marginal benefit in continuing it for a further unspecified period, it would seem an unwarranted imposition on the office concerned for the potential gain. However, there are two further points to be made, one major and unexpected, the other less important.

1.3.1 At the end of the first year, over 60% of the all-office in-force data (both male and female) came from the one office. The reasons were obvious but these initial results caused alarm bells to ring and raised doubts whether it was worthwhile to expend all the energy required on an all-office project with just one office's figures so dominating. The position as at 1.1.1985 after two further years' experience has improved somewhat but still gives cause for concern. Analysing the in-force by duration, the percentages for males of the predominant office were 46 (duration 0), 46 (duration 1), 60 (duration 2) and 50 (in total). The corresponding percentages for females were 52, 52, 66 and 56. As a precautionary measure, the office concerned has agreed to maintain the machinery for a period so that the option is still available to base further report(s) on its own experience. A decision will be necessary in the light of further progress in the reduction of the office's dominating role.

1.3.2 It should be realized that it will not take only the first 10 years experience

for the production of valuable and continuing analysis. It would take a further 10 years' experience before it was possible to investigate and comment on the comparisons in the two decades' results based on comparable data.

2.1 In line with the 1978 paper, it is not intended to reproduce here the full coding system which was devised by Preston and which may be found in the 1965 paper. The list of impairment codes has been revised periodically applying to new business written from the respective dates of revision. Similarly, since certain impairments produced no significant extra mortality, there was clearly no point in pursuing the investigation of these categories. Also, publication is restricted to those codes for which there were sufficient deaths to yield significant results.

2.2 In the last report, it was stated that the experience of standard lives of the office concerned was very similar to the combined experience of all offices and consequently the A1967-70 table was used as appropriate for calculating expected deaths for males accepted at standard rates. In the present investigation, the experience of standard lives has closely approximated to A1967-70 rated down one year (a little lighter). Consequently A1967-70 rated down one year has been used as the control table for males for calculating expected deaths.

2.3 The table of results is set out in the Appendix. It covers male lives only and the percentage of actual to expected deaths relates to the experience for duration 2 and over only, the data for durations 0 and 1 again being of negligible proportions. The results are based on this body of experience, unless specifically referred to otherwise (see section 6 on impairment of the coronary arteries and section 17 on diabetes).

2.4 For female lives, although the amount of data is much larger than in the earlier experience, for most categories it is still deemed insufficient to yield much significant information. Nevertheless, where the available data is considered sufficient, the results have been tabulated. In calculating the expected deaths, the availability of FA1975-78 has obviated the necessity for constructing a special table as in the previous exercise (when a table was obtained by applying the ratios of female to male mortality of ELT No. 12 to the A1967-70 rates). FA1975-78 has been used as the control table for females for calculating expected deaths.

3.1 In the discussions following the earlier reports, continuity was rightly lauded as very important and worthwhile. The data on which the experience in each report has been based has been kept as homogeneous as possible. However, there is one statistical factor inherent in the ever-lengthening period of the investigation (and consequent time from the noting of the impairment) which I consider might significantly have influenced the results in any comparison.

The 1947-63 exposed to risk related to lives who had by definition a specified impairment at the time of issue of their policy, viz. 1947-63. The 1964-73 exposed to risk related to lives who had a specified impairment not just on a date within that same limited period 1964-73 but anything up to 17 years earlier. The point was mentioned in passing in the 1978 discussion. Equally, in the 1974-83 exposed to risk, lives are included on the basis of impairment determined as present up to

27 years earlier. In each ensuing report the lengthening potential and average period since impairment was noted should be realized.

Of course, the exposed to risk on which the results will be based using the all-office material will revert to a much shorter duration since only policies issued from 1.1.1982 will be involved.

3.2 Reference must be made to a very common theme in our literature, viz. the reliability of the data and our dependence on sources outside our control for the material on which our conclusions are based. We are severely limited by the material we have available to work on.

It is worthwhile to spell out briefly some of the sources leading to heterogeneity in the basic material, some of which are peculiar to this investigation (in particular due to the length of the period since inception):

3.2.1 Changes in underwriting procedures and attitudes.

3.2.2 Development in non-medical business.

3.2.3 Changes in the approach by the medical profession in attributing cause of death.

3.2.4 Vagueness in description of cause of death on the death certificate and possible misinterpretation by the layman.

3.2.5 General lack of concern for accurate treatment for our purposes from a variety of documents of data which has no direct connection with the immediate requirement (e.g. full details of impairment when processing a proposal for issue of a policy or precise single cause of death when dealing with a claim).

3.3 Comparison with the results of allied investigations has been deliberately avoided in view of the special nature of our raw material and the very narrow field in which the investigation is of value.

3.4 After due consideration, my predecessor deemed it preferable to omit details of standard deviations. Since they were calculated and are available, it seems a pity not to provide them (subject to a warning regarding their use).

4. An analysis of death by cause has been made for impairment groups where the data was deemed to be sufficient and extra mortality judged to be significant.

ANALYSIS OF RESULTS

Hypertension

5.1 The pattern for the 1974-83 period is broadly consistent with the 1964-73 period with further modest improvement in the mortality experience. In the discussion on the 1978 paper several speakers expressed interest in the effect of hypotensive drugs on the mortality of these impaired lives. Presumably the results for the latest period will disappoint them.

5.2 Spelling out the salient features of the 1974-83 experience:

5.2.1 Moderate hypertension results in modest excess mortality.

5.2.2 Extending the table in the earlier report, relating to entry ages 40-59 for standard weight, incorporating the latest experience (Table 1):

Table 1

S.A.P.	D.A.P.	% of actual to expected deaths	
		1974-83	1964-73
155-170	under 95	138	126
155-170	95-105	153	160
155-170	over 105	153	203
over 170	under 95	189	206
over 170	95-105	191	236
over 170	over 105	261	293

Not surprisingly, policyholders with high blood pressure readings at entry, whether systolic or diastolic, subsequently suffer considerable excess mortality with the natural correlation.

5.2.3 Once again, for entry ages 60 or over, the percentage of actual to expected deaths was considerably less than for comparable categories at younger entry ages. However, it is worth noting that overall there has been no improvement for these entry ages for 1974-83 as compared with 1964-73.

5.2.4 The recent experience reinforces the earlier suggestion that overweight in conjunction with hypertension does not appear to add materially to the risk. Even the exception noted in the previous report comparing the effect in the experience of overweight (entry ages 60 or over, S.A.P. 160-175, D.A.P. under 100) was not repeated. In the 1974-83 experience, the percentage of actual to expected deaths was 92 for overweight cases against 119 for standard weight cases; for 1964-73 mentioned above the overweight figure was 143 and the standard weight figure was 107.

Impairment of the Coronary arteries

6. Experience for lives with a history of coronary artery disease when their policies were issued has again been very heavy. The table in the 1978 report has been extended to incorporate the latest experience (Table 2):

Table 2

Duration	Entry ages	Actual deaths	% of actual to expected deaths	
		1974-83	1974-83	1964-73
0	all	23	589	297
1	all	29	472	346
2 & over	under 50	32	877	1,146
2 & over	50 and over	159	237	388
2 & over	all	191	269	462

(These statistics are not all given in the Appendix.)

Superficially, it would appear that underwriting has been less stringent and the office has suffered accordingly under the revised regime. In fact many more policies have been issued but it will be appreciated that very strict underwriting criteria would have to be followed in these cases. There would be appropriate

adjustment in terms to cover the substantial extra risk. People with a serious impairment have been insured but the office has not necessarily suffered thereby due to offering insurance on mutually agreeable terms.

Peptic ulcer

7.1 When introducing the 1978 paper, the author specifically referred to the peptic ulcer group regarding inconsistencies and anomalies and the possibility of freak results. The 1974-83 results were, in fact, more in accord with common-sense.

7.2 The experience for 1974-83 of cases with a long history of peptic ulcer with either no complication or only a history of haematemesis (codes 210, 211, 214, 215) was broadly very satisfactory. In particular, the percentage of actual to expected deaths of 100 for category 'long history, no operation, no complication' (code 210) for 1974-83 is noteworthy because this figure was 90 for 1964-73 and the exposed to risk has been one of the largest in the whole investigation.

For 'long history, with operation, history of perforation' (code 216) the figure for 1974-83 was 150 compared with 134 for 1964-73 and 'long history, with operation, complications other than haematemesis or perforation' (code 217) the figure for 1974-83 was 175 compared with 123 for 1964-73.

7.3 The results for the short history categories can best be demonstrated using Table 3:

Table 3

Code	Actual deaths	% of actual to expected deaths		
	1974-83	1974-83	1964-73	1947-63
200	100	119	122	95
201	37	107	130	
204	29	85	107	165
206	33	120	149	

Code 200 is 'short history, no operation, no complication'.

Code 201 is 'short history, no operation, history of haematemesis'.

Code 204 is 'short history, with operation, no complication'.

Code 206 is 'short history, with operation, history of perforation'.

The surprise feature is the little improvement for code 200, apparently straightforward and based on a considerable amount of data. My instinct is that the 'no complication' element is misleading; with only a short history and no operation, underlying complications in some cases may not yet have had the time to become apparent when the policies were issued.

Cholecystitis

8. As before, the only category in the group which produced sufficient data to

yield significant results was 'cholecystitis with stones, cholecystectomy' (code 233). There were 52 deaths. As last time, actual mortality was less than expected. The percentage of actual to expected deaths was only 82 for 1974-83 compared with 94 for 1964-73 and 139 for 1947-63. Thus recent experience confirms the earlier conclusion that this impairment no longer presents any extra risk.

Epilepsy

9. In the epilepsy group, there has been further striking improvement in mortality but grand mal experience is still significantly high. For grand mal (code 301), the percentage of actual to expected deaths has improved to 139 for 1974-83 compared with 213 for 1964-73 and 292 for 1947-63.

For petit mal (code 300), based on comparatively little data, the percentage improved to 113 for 1974-83 compared with 146 for 1964-73 (there was not enough data to yield any significant results for 1947-63). The recent experience is more in accord with Dr Preston's view that petit mal should not cause extra mortality; some people used the term petit mal because it sounded rather less serious than grand mal.

Head Injuries

10. The 1974-83 experience was lighter than standard mortality for both cerebral concussion, without fracture, mild (code 310) and fractures of skull, no operation (code 312). The decision to cease monitoring these impairments seems justified.

Psychoneuroses

11. Once again, the experience for 'mild' cases of psychoneuroses (code 320) was surprisingly light. With an exposed to risk of 85,000, the largest category and incidentally much larger than earlier numbers, the percentage of actual to expected deaths was 91 compared with 94 for 1964-73 and 127 for 1947-63. 'Moderate' psychoneuroses cases (code 321) experienced standard mortality compared with 116 for 1964-73 and 140 for 1947-63.

The 'severe' category (code 322) and 'with features suggestive of psychosis' (code 323) on the other hand, admittedly based on much less data, reversed the trend. Code 322 produced 160 compared with 101 for 1964-73 and an estimated 140 for 1947-63; code 323 produced 144 which was of the same order as the earlier experiences.

Migraine

12. The 1964-73 experience threw up unexpected results and Mr Clarke commented in his paper that it would appear that migraine was definitely a rateable impairment. However, the 1974-83 experience produced contrary results. The percentage of actual to expected deaths for 'mild migraine' (code 330) was 97 compared with 123 for 1964-73; for 'severe migraine' (code 331) the

figure for 1974-83 was 84 compared with 139 for 1964-73. There was not enough data to yield any significant results for migraine for 1947-63.

Non-pulmonary tuberculosis

13. Overall, this group of impairments produced very similar results for 1974-83 as for 1964-73 although there were very considerable variations according to site (Table 4):

Table 4

Code	% of actual to expected deaths		
	1974-83	1964-73	1947-63
400-409	119	120	103
420-423	82	71	143

Codes 400-409 are 'non-pulmonary tuberculosis' split according to site; the first period included each category but the second and third periods excluded insignificant categories. Similarly, codes 420-423 are all the 'fistula in ano' categories for the first period but the only significant category for the second and third periods.

Surprisingly, for codes 400-409, the 1974-83 experience showed the same level of increased mortality as the 1964-73 experience and was somewhat heavier than the standard 1947-63 experience. Similarly, for code 420, the lighter than standard mortality for 1964-73 was repeated for 1974-83 whereas the experience was much worse for 1947-63.

Summarizing, although overall there is some increased mortality over standard, it was not unreasonable to discontinue monitoring this impairment.

Pleurisy and spontaneous pneumothorax

14. Lighter than standard mortality has again been experienced in this group including 'pleurisy, dry or indeterminate, standard weight' (code 434) where percentage of actual to expected deaths was 86 compared with 110 for 1964-73. For 'spontaneous pneumothorax' (code 438) the figure for 1974-83 was 119 compared with 108 for 1964-73. Similar justification for ceasing monitoring as for non-pulmonary tuberculosis.

Pulmonary tuberculosis

15. All categories except one (which deteriorated marginally) experienced markedly improved mortality. For 1974-83, the percentage of actual to expected deaths in each category could not be judged to be significantly high. Even the worst experienced only 113, based on few deaths (23). The category 'mild cases, weight standard, or over standard' (code 440) produced a suspiciously low percentage of 66 actual to expected but investigation provided no logical explanation.

Glycosuria

16. There was not sufficient data to arrive at any reliable conclusions but, for what it is worth, the mortality was very light. Hence, ceasing monitoring this impairment was justified.

Diabetes

17.1 As previously, after impairment of the coronary arteries, diabetes provides the most serious risk covered by our investigation. The pattern of mortality closely follows that shown in the last period but in general is somewhat higher. It is worthwhile setting out a comparison of the mortality experienced for this impairment in the respective periods in tabular form (Table 5):

Table 5

Entry ages	Weight	Actual deaths	% of actual to expected deaths		
		1974-83	1974-83	1964-73	1947-63
Under 30	all	30	466	420	833
30-50	standard	117	336	290	352
30-50	underweight	37	294	228	
30-50	overweight	26	421	353	
over 50	standard	38	167	146	174
over 50	underweight	7	174	212	
over 50	overweight	9	161	159	

Note: For consistency with past practice, all durations have been combined for those cases with entry ages under 30.

17.2 Summarizing the points emerging from scrutiny of the results since the start of the investigation:

17.2.1 The improvement in mortality noted in the second period has been reversed in the latest period for all entry ages.

17.2.2 Consistent strong correlation of extra mortality with age at entry; for the latest period, as a broad approximation from the limited rough figures available, the percentage of actual to expected deaths decreased from 600 for entry age 20 to 150 for entry age 60.

17.2.3 For entry ages 30-50 (codes 523-5) the heavier the weight at entry, the greater the mortality experienced. Thus, for the 1974-83 period, the percentage was 294 for underweight cases (code 524), 336 for standard weight cases (code 523) and 421 for overweight cases (code 525).

Goitre

18. Once again, there was not sufficient data to arrive at any reliable conclusions. Altogether, mortality was less than expected and it would not appear to be reasonable to attach any special significance to the one category 'simple or unclassified with operation' (code 541) where mortality was higher

than standard (based on 12 deaths). Hence ceasing monitoring this impairment seems justified.

Underweight

19. The categories for which there was sufficient data to enable us to reach conclusions on which we can place some reliance are entry ages 30 and over and 20-30% underweight (codes 610-622). For these categories, there has been marked improvement in mortality. It is clear that a reasonable degree of underweight (up to 30%) in itself no longer presents any reason for concern in underwriting.

Overweight

20.1 Overall, there has been no significant change in mortality experience for 1974-83 as compared with 1964-73. Hence, it would clearly be imprudent to pay too much attention to apparently major changes in results in any section. This should be borne in mind when considering the commentary in the various sections.

20.2 For entry ages under 30, the wide fluctuations experienced last time were not repeated. However, it seemed worth investigating in greater detail the odd fluctuation in the mortality experience for the category which had the largest exposed to risk, viz. 20-30% overweight, not medically examined (code 652). For the 1974-83 period the percentage of actual to expected deaths was 121 compared with 88 for 1964-73. The excess deaths occurred mainly in the age-group at death 40-49 (the rest in the 50-59 group), i.e. policies at least 11 years old and on average more like 18-20. It seems clear that the good experience in 1964-73 was compensated for by the extra mortality in the surviving lives in the following 10 years. Of course, too much should not be made of the point anyway; there were only 30 deaths in the category in 1964-73 and 4 more would have resulted in standard mortality.

20.3 For entry ages 30-50, also, the wide fluctuations experienced for 1964-73 were not repeated. Excluding the most extreme cases of 'over 40% overweight and unsatisfactory girth' (code 667), the range was 112%-136%.

20.4 For entry ages over 50, the previous experience of surprisingly light mortality was repeated.

20.5 Two general trends which are in accord with common sense seem noteworthy:

20.5.1 For otherwise similar large categories, the greater the excess weight at entry the greater the extra risk.

20.5.2 Similarly 'unsatisfactory girth' at entry usually resulted in heavier mortality than 'satisfactory girth'.

Respiratory impairments

21.1.1 The experience for bronchial asthma has again improved dramatically (Table 6):

Table 6

Code	Entry ages	% of actual to expected deaths		
		1974–83	1964–73	1947–63
701	under 30	81	114	276
711	30–49	100	138	200
721	over 49	86	136	154

21.1.2 The improvement last time was attributed by the author, and in the discussion, possibly to changes in treatment over the two previous decades and in particular to the armoury of modern drugs.

21.1.3 Another possible contributory factor towards the improvement in mortality might be the 1956 Clean Air Act. There could be three helpful consequences of the Act over a period.

21.1.3.1 It seems reasonable to assume that the traditional old English ‘pea-soupers’ had a serious impact on bronchial asthmatics and caused some deaths or at least deterioration in their condition. Quite clearly the virtual elimination of these adverse conditions would have reduced the number of deaths arising directly therefrom.

21.1.3.2 Next, there would have been a more steady but still significant improvement in the quality of life for these sufferers which would have a beneficial effect on their condition.

21.1.3.3 More controversially, the most serious cases at risk in the earlier days may well have been overcome directly due to the adverse climatic conditions. The survivors might have been a hardier breed who would tend to enjoy a lower mortality than might otherwise have been expected.

21.2 Turning to chronic bronchitis Table 7 sets out the data:

Table 7

Code	Entry ages	% of actual to expected deaths		
		1974–83	1964–73	1947–63
712	30–49	198	128	201
722	over 49	131	170	229
713	30–49	143	323	458
723	over 49	147	196	169

Code 712 is ‘chronic bronchitis without emphysema for entry ages 30–49’.

Code 722 is ‘chronic bronchitis without emphysema for entry ages over 49’.

Code 713 is ‘chronic bronchitis with emphysema for entry ages 30–49’.

Code 723 is ‘chronic bronchitis with emphysema for entry ages over 49’.

No consistent pattern is discernible from Table 7. On the one hand, the experience of codes 722 and 713 shows steadily improving mortality over the

years. On the other hand, code 712 (the same impairment as code 722 but for younger entry ages) had a big improvement in mortality experience for 1964-73 as compared with 1947-63 followed by a deterioration for 1974-83 to the 1947-63 level. Equally, code 723 (the same impairment as code 713 but for older entry ages) had a deterioration for 1964-73 as compared with 1947-63 followed by an improvement for 1974-83 beyond the 1947-63 level.

In the light of the figures shown, it seems difficult to draw any meaningful conclusions regarding general improvement in mortality with any degree of confidence. All that can be said is that the mortality for this impairment is still considerably greater than standard.

21.3 For emphysema without bronchitis there is insufficient data to give useful results.

Urinary impairments

22. Only one of the three categories which previously experienced substantial extra mortality continued to do so. The percentage of actual to expected deaths for the category 'albuminuria not orthostatic' (code 842) was 159 for 1974-83 (based on only 19 deaths) compared with 183 for 1964-73.

Tumours

23. The percentage of actual to expected deaths for 'innocent tumours (confirmed)' (code 960) was 138 for 1974-83 compared with 119 for 1964-73. For 'malignant tumours' (code 962) the percentage was 147 for 1974-83 compared with 208 for 1964-73. Comparable experience for codes 960 and 962 in 1974-83 might appear surprising but it is liable to be due to especially careful underwriting in the case of malignant tumours as well as improved procedures of treatment. Also it should be borne in mind that the data on which the results were based was not very large.

Osteomyelitis

24. Standard mortality. Thus, ceasing monitoring this impairment seems justified.

Re-appraisal of certain impairments

25.1 As referred to in the analysis of results for various impairments, a number of codes were discontinued as impaired lives as from 1.1.1980; and these have been marked with an asterisk in the Appendix. The experience for most of the discontinued codes justifies the exclusion of those codes from special consideration as impaired lives. The one impairment which was discontinued that might elicit some surprise is non-pulmonary tuberculosis. Here for some codes the percentage of actual to expected deaths is still consistently of the order of 150 though admittedly the actual excess number of deaths is comparatively small.

25.2 In the case of some other impairments, the sub-divisions were revised as from 1.1.1980 and these have been marked with a double asterisk in the

Appendix. This was achieved by the new policies issued as from 1.1.1980 being allocated new codes; policies issued prior to 1.1.1980 have been dealt with in every respect as previously, experience up to 31.12.1983 being included in the usual way.

Redefinition of the codes in any impairment group makes policies issued subsequent to the date of changeover incompatible with those issued earlier. Thus the data in respect of policies in those impairment groups issued on or after 1.1.1980 has been excluded. Since virtually all the analysis has been in respect of durations 2 and over, very little data has been lost and there would be no significant effect in any conclusions arrived at in this report due to the exclusion of this data.

FEMALE LIVES

26. Although female data has increased over the years, in most areas it is still insufficient to produce useful results. In any event, with the setting up of the investigation on an industry-wide basis, it is not worthwhile reporting on at best inconclusive evidence for the anticipated one occasion. However, for the sake of completeness, I have updated the figures for the codes previously commented on.

27. For the category '20-30% underweight, entry ages 30-50, not medically examined' (code 612), the percentage of actual to expected deaths was 92 (based on 28 deaths) for 1974-83 compared with 122 for 1964-73. The comparable 1974-83 male figure was 95.

28. For the category 'bronchial asthma, entry ages 30-49' (code 711), the percentage of actual to expected deaths was 134 (based on only 11 deaths) for 1974-83 compared with 243 for 1964-73. The comparable 1974-83 male figure was 100.

29. There were references to two significant female-orientated impairments previously. For the category 'non-malignant tumours of the breast' (code 932), the percentage of actual to expected deaths was 87 (based on only 6 deaths) for 1974-83 compared with 233 for 1964-73. For the category 'uterine fibroids (confirmed)' (code 940), the figures were 88 (based on 17 deaths) compared with 126.

CAUSES OF DEATH

30.1 An analysis of deaths by cause was again carried out for the various impairment codes. No commentary was justified in other than a very limited number of categories because of paucity of data or because excess mortality was not considered sufficient for an analysis to serve any useful purpose. In any event, the paucity of data necessitated the amalgamation of the cause of death into a very few broad groups.

30.2 In the following tables, details for specific causes of death are provided where:

30.2.1 the data was considered adequate;

30.2.2 extra mortality was judged to be significant.

Thus, 'other causes' covers those which did not satisfy these criteria and also includes causes where further analysis was not available.

30.3 Where comparison with standard experience was required, I used the results set out in the report on mortality in 1975-78 of male lives under whole life and endowment assurances, according to cause of death (*CMIR 5*, 37). It does not matter that the standard table is different from that used in the earlier part of this report. Only the broadest of criteria are necessary for this exercise, and the table used was considered the most appropriate.

Hypertension

31.1 See section 5. Among the hypertension impairment groups, results for 1974-83 are consistent with the statements made in the earlier reports that the excess mortality can be attributed to circulatory causes. In the analyses, deaths have therefore been sub-divided into just circulatory causes and other causes.

31.2 For age at death under 45, there were only 21 deaths of which 11 arose from circulatory causes. Although data is clearly inadequate, the expected number would be 6 rather than 11.

31.3 It is most advantageous to follow previous practice in setting out the data for deaths at age 45 and above. For age at death 45-59, using the same format for 1974-83 as for 1964-73 the more detailed analysis according to impairment code is provided in Table 8:

Table 8
Age at death 45-59

Code	Circulatory causes			Other causes			All causes		
	Expected deaths	Actual deaths	100 A/E	Expected deaths	Actual deaths	100 A/E	Expected deaths	Actual deaths	100 A/E
110/2/8	20.8	42	202	20.9	22	105	41.7	64	153
130	10.3	14	136	10.4	18	173	20.7	32	155
131/3/4/5	14.3	47	329	14.3	25	175	28.6	72	252
132	11.8	28	237	11.8	16	136	23.6	44	186
138	10.3	20	194	10.4	14	135	20.7	34	164
140-148	12.7	26	204	13.0	18	138	25.7	44	171

The corresponding data for 1964-73 was:

110/2/8	17.2	37	215	14.6	11	75	31.8	48	151
130	20.1	34	169	17.0	22	123	37.1	56	151
131/3/4/5	15.1	65	430	12.9	18	140	28.0	83	296
132	20.4	45	221	17.3	19	110	37.7	64	170
138	18.0	37	206	15.4	14	91	33.4	51	153
140-148	20.8	40	192	17.6	17	97	38.4	57	148

Not surprisingly, as noted in the last report, the most outstanding feature is the mortality rate where either the systolic pressure exceeds 170 or the diastolic pressure exceeds 105, or both (codes 131/3/4/5). Making the point regarding the

1964-73 period, of the 55 extra deaths in this group, no less than 50 were due to circulatory causes and only 5 to other causes. There could scarcely be a more striking illustration of the importance of hypertension and its close connection with death from diseases of the circulatory system. Although the same feature is very evident for 1974-83, it is not as outstanding as previously. Thus, using the same criterion, of the 43 extra deaths in this group, 33 were due to circulatory causes and 10 to other causes.

The same pattern is clearly discernible in the comparisons for the other codes. Summarizing:

31.3.1 The total percentages of actual to expected deaths in each group are high.

31.3.2 The pattern of the total percentages is remarkably close for 1974-83 to that for 1964-73.

31.3.3 The split into circulatory and other causes of death is still predominantly circulatory but is nowhere near as overwhelming as previously.

31.4 For age at death 60 and over, the corresponding figures (excluding codes 110/2/8) are shown in Table 9:

Table 9
Age at death 60 and over

Code	Circulatory causes			Other causes			All causes		
	Expected deaths	Actual deaths	100 A/E	Expected deaths	Actual deaths	100 A/E	Expected deaths	Actual deaths	100 A/E
130	39.4	52	132	34.2	46	135	73.6	98	133
131/3/4/5	20.7	41	198	17.8	23	129	38.5	64	166
132	29.4	42	143	25.6	34	133	55.0	76	138
138	26.0	30	115	22.6	30	133	48.6	60	123
140-148	22.1	35	158	19.1	16	84	41.2	51	124

The corresponding data for 1964-73 was:

130	50.2	65	129	41.7	39	94	91.9	104	113
131/3/4/5	20.6	56	272	17.2	17	99	37.8	73	193
132	37.5	79	211	31.2	27	87	68.7	106	154
138	33.3	66	198	27.7	18	65	61.0	84	138
140-148	24.7	46	186	20.6	21	102	45.3	67	148

Summarizing the main features:

31.4.1 The total percentages of actual to expected deaths are a little less for 1974-83 than for 1964-73.

31.4.2 The totals pattern is again remarkably close for 1974-83 to that for 1964-73.

31.4.3 The percentages are again less than for the younger age deaths.

31.4.4 Once again, the group 131/3/4/5 stands out above all the other codes but not as markedly.

31.4.5 There has been a substantial increase in the percentage of actual to expected deaths due to other than circulatory causes. As a result, although

overall it is still true there are more deaths due to circulatory than other causes, the split is comparatively even.

Impairment of the Coronary arteries

32. See section 6. There were 191 deaths for durations 2 and over and 126 were attributed to coronary artery disease. This is consistent with the 269% mortality experience quoted in section 6 after allowing for an appropriate proportion to be expected in any case and demonstrates that the whole of the extra mortality may reasonably be attributed to this impairment. Comparable results were forthcoming for 1964–73 when there were 64 deaths attributed to coronary artery disease out of 81 deaths and the mortality experience for this code was 462%.

Psychoneuroses

33. See section 11. There were 265 deaths for codes 321–323 of which 23 were suicides. The expected number would be 4 so that there were approximately 6 times as many deaths by suicide as expected. This is consistent with the previous findings.

On the other hand, there were 11 deaths from accident compared with 15 expected whereas for 1964–73 there was some extra mortality from accidents also.

Diabetes

34.1 See section 17. Because of the small number of deaths in the individual categories, all the data for diabetics has been combined to provide a table splitting the numbers of deaths according to age at death and cause of death (Table 10):

Table 10

Cause of death	Age at death					
	0–44		45–59		60 and over	
	1974–83	1964–73	1974–83	1964–73	1974–83	1964–73
Circulatory causes	17	10	75	49	37	35
Cancer	2	6	8	11	6	7
Diabetes	6	9	8	4	1	4
All other causes	34	15	51	13	32	5
Total	59	40	142	77	76	51

34.2.1 The 1964–73 figures have been included for comparison purposes and to illustrate the wide fluctuation of results.

34.2.2 The comparatively large number of deaths from ‘all other causes’ was apparent for 1964–73. The position was much worse for 1974–83. Clearly this must be taken into account when considering the validity of any conclusions.

34.2.3 Naturally, there was a significant number of deaths from diabetes.

34.2.4 Looking at the other specified causes of death, it is clear that a large

proportion of the extra mortality experience was attributable to circulatory causes with comparatively few deaths from cancer.

34.2.5 In view of the statements sometimes made that diabetics are accident prone, it might be mentioned that, as previously, very few of the deaths were due to either accident or suicide.

Overweight

35.1 See section 20. For comparison purposes, using the same code and age at death combinations as in the last report, the numbers of deaths are shown in Table 11:

Table 11						
<i>Age at death under 60</i>						
Code	Circulatory causes		Other causes		Total	
	1974-83	1964-73	1974-83	1964-73	1974-83	1964-73
660	75	105	90	67	165	172
661	16	29	20	22	36	51
662	63	91	72	63	135	154
663-5	41	61	57	52	98	113
Total	195	286	239	204	434	490
<i>Age at death 60 and over</i>						
660	39	31	54	22	93	53
661	12	14	14	17	26	31
662	26	25	34	10	60	35
663-5	22	14	31	8	53	22
Total	99	84	133	57	232	141

35.2 In the last report, it was stated 'most of the excess mortality was due to circulatory diseases' and 'The main inference from these results is clear, i.e. that circulatory disease is the primary risk for overweight lives.' Taking the figures at face value, these statements are no longer valid. For example, using age at death 60 and over, total figures there were 99 deaths from circulatory causes out of 232 (43%) for 1974-83 compared with 84 out of 141 (60%) for 1964-73. A reasonably comparable statistic based on the *CMIR 5* report for 1975-78 experience gives 54%.

Bronchial Asthma

36. See § 21.1. There was no point in analysing the causes of death for other than entry ages 30-49 in view of the very light mortality experienced for them; the mortality even for this category of entry age 30-49 was standard. As in the 1964-73 experience, deaths in the residual group of 'all other causes' was far in excess of expectation. There were 73 deaths out of 152 in this category in the 1974-83 period compared with 30 out of 113 in the 1964-73 period. A possible explanation would be that some deaths were attributed to 'asthma' (which is not

a specified category) rather than an associated cause of death. The line of thought is not worth pursuing as the original source of the data is no longer available.

Urinary Calculus removed by nephrotomy or nephrectomy:

Female lives, Uterine Fibroids (confirmed)

37. See sections 22 and 29. In the latest experience, mortality was standard or less based on comparatively small data in each category. Thus there is no longer any point in analysing the causes of death for these categories.

Conclusion

38. I make no apologies for the length of this report in comparison with its predecessors. I admit when I first approached this project I thought it would be merely an up-date report, the third of a series and as I said in the introduction just a bridging exercise. But I felt that, if there was to be any real virtue in its being part of a series and the very continuity repeatedly stressed, then there must be a sense of progress and development, a comparison with earlier results and appropriate references to the past discussions. The expansion inevitably followed.

39. Finally, I would like to acknowledge my debt to my predecessors Dr T. W. Preston and Mr R. D. Clarke who set up the investigation and devoted many years to its continuation. Also Messrs S. F. Margutti, H. Rice and G. R. Robilliard for preparing and checking the data on which this report has been based. I would also like to thank on behalf of the whole industry the Prudential Assurance Company Limited for allowing the data to be published and the use of its resources these many years.

APPENDIX

Medical Bureau 1974-83

MALE LIVES

Percentages of Actual to Expected Deaths
(Duration 2 and over)

Code	Description				Exposed to risk	Actual deaths	$\frac{100 A}{E}$	σ
HYPERTENSION								
	<i>Entry ages</i>	<i>Weight</i>	<i>SAP</i>	<i>DAP</i>				
110	under 40	standard	150-165	under 95	11,032	52	126	15
130	40-59	standard	155-170	under 95	5,561	131	138	10
131	40-59	standard	over 170	under 95	705	15	189	35
132	40-59	standard	155-170	95-105	5,728	121	153	11
133	40-59	standard	over 170	95-105	1,955	44	191	21
134	40-59	standard	155-170	over 105	1,555	24	153	25
135	40-59	standard	over 170	over 105	2,108	55	261	22
138	40-59	standard	under 155	95 or over	5,128	94	135	12
140	40-59	20% overweight	155-170	under 95	1,356	21	123	24
142	40-49	20% overweight	155-170	95-105	1,501	28	164	24
144/5	40-59	20% overweight	155 or over	over 105	1,264	22	149	23
148	40-59	20% overweight	under 155	95 or over	1,825	24	111	21
150	60 or over	standard	160-175	under 100	1,164	84	119	11
151	60 or over	standard	over 175	under 100	324	22	155	26
152	60 or over	standard	160-175	100-110	349	28	138	21
153	60 or over	standard	over 175	100-110	347	17	118	26
158	60 or over	standard	under 160	100 or over	162	8	95	34
160	60 or over	20% overweight	160-175	under 100	162	8	92	33
IMPAIRMENT OF THE CORONARY ARTERIES								
180	Impairment of the coronary arteries				6,696	191	269	12
PEPTIC ULCER								
200	Short history, no operation, no complication				18,542	100	119	11
201	Short history, no operation, history of haematemesis				5,837	37	107	17
204	Short history, with operation, no complication				4,560	29	85	17
206	Short history, with operation, history of perforation				2,926	33	120	19
210	Long history, no operation, no complication				45,983	316	100	6
211	Long history, no operation, history of haematemesis				6,846	44	104	15
214	Long history, with operation, no complication				16,017	173	108	8
215	Long history, with operation, history of haematemesis				2,414	18	84	21
216	Long history, with operation, history of perforation				4,045	50	150	17
217	Long history, with operation, other complications				1,147	16	175	33
CHOLECYSTITIS*								
230	Without stones, no operation				854	7	109	39
233	With stones, cholecystectomy				5,586	52	82	13
EPILEPSY**								
300	Petit mal				5,985	18	113	25
301	Grand mal				19,563	69	139	14

Code	Description	Exposed to risk	Actual deaths	$\frac{100 A}{E}$	σ	
HEAD INJURIES*						
310	Cerebral concussion without fracture or operation, mild	24,110	66	84	11	
312	Fracture of skull, no operation, no sequelae	8,483	35	81	15	
PSYCHONEUROSES						
320	Mild	85,113	287	91	6	
321	Moderate	37,134	169	99	8	
322	Severe	6,974	54	160	17	
323	With features suggestive of psychosis	6,582	42	144	19	
MIGRAINE						
330	Mild	22,422	76	97	11	
331	Severe	3,038	12	84	27	
NON-PULMONARY TUBERCULOSIS*						
400	Of spine	1,931	16	154	31	
401	Of hip	1,456	12	167	37	
402	Of other bones or joints	1,846	11	107	31	
403	Of glands	9,329	44	103	15	
407	Of kidney	1,137	9	134	38	
420	Fistula in ano	2,818	25	82	18	
PLEURISY AND SPONTANEOUS PNEUMOTHORAX*						
430	Pleurisy with effusion	7,921	36	83	15	
434	Pleurisy, dry or indeterminate, standard weight	11,215	83	86	10	
435	Pleurisy, dry or indeterminate, underweight	2,645	29	97	18	
438	Spontaneous pneumothorax	8,897	36	119	18	
PULMONARY TUBERCULOSIS**						
440	Mild cases, weight standard or over standard	14,325	42	66	13	
441	Mild cases, underweight	2,803	17	110	25	
444	Moderate or severe cases, weight standard or over standard	19,905	93	90	10	
445	Moderate or severe cases, underweight	3,615	23	113	22	
450	Treated by artificial pneumothorax	5,558	48	108	15	
454	Treated by major surgical procedures	7,885	53	105	14	
GLYCOSURIA*						
503/513	Glycosuria	1,731	12	57	20	
DIABETES**						
	<i>Entry ages</i>					
	<i>Weight</i>					
523	30-50	standard	7,215	117	336	17
524	30-50	underweight	2,717	37	294	28
525	30-50	overweight	1,219	26	421	40
526	over 50	standard	1,156	38	167	21
527	over 50	underweight	222	7	174	49
528	over 50	overweight	297	9	161	42

Code	Description		Exposed to risk	Actual deaths	$\frac{100 A}{E}$	σ	
GOITRE*							
541	Simple or unclassified with operation		904	12	125	32	
543	Thyroid adenoma etc. with operation		1,162	4	49	35	
550	Exophthalmic, no special treatment		974	2	31	39	
551	Exophthalmic, with surgical treatment		2,860	13	72	24	
UNDERWEIGHT (20-30%)							
Entry ages							
610	30-50	chest satisfactory	11,471	81	103	11	
612	30-50	not medically examined	21,071	85	95	11	
620	over 50	chest satisfactory	1,443	54	99	13	
622	over 50	not medically examined	1,501	17	70	20	
OVERWEIGHT							
Entry ages		Overweight	Girth				
650	under 30	20-30%	satisfactory	24,373	43	104	16
652	under 30	20-30%	not medically examined	46,365	77	121	13
653	under 30	30-40%	satisfactory	16,281	25	109	21
656	under 30	over 40%	satisfactory	10,023	13	113	30
660	30-50	20-30%	satisfactory	35,849	258	112	7
661	30-50	20-30%	unsatisfactory	6,625	62	127	14
662	30-50	20-30%	not medically examined	25,024	195	135	8
663	30-50	30-40%	satisfactory	15,190	95	119	11
664	30-50	30-40%	unsatisfactory	5,135	43	128	17
665	30-50	30-40%	not medically examined	1,707	13	120	30
666	30-50	over 40%	satisfactory	5,421	34	136	20
667	30-50	over 40%	unsatisfactory	3,557	37	198	23
670	over 50	20-30%	satisfactory	2,105	60	97	13
671	over 50	20-30%	unsatisfactory	1,043	43	102	15
672	over 50	20-30%	not medically examined	295	5	106	46
673	over 50	30-40%	satisfactory	671	17	109	25
674	over 50	30-40%	unsatisfactory	631	15	80	23
677	over 50	over 40%	unsatisfactory	238	4	66	40
RESPIRATORY IMPAIRMENTS							
Entry ages							
701	under 30	bronchial asthma**	54,569	51	81	13	
711	30-49	bronchial asthma**	38,488	152	100	8	
712	30-49	chronic bronchitis without emphysema	3,767	47	198	21	
713	30-49	chronic bronchitis with emphysema	1,525	15	143	31	
721	over 49	bronchial asthma**	2,047	30	86	17	
722	over 49	chronic bronchitis without emphysema	870	26	131	22	
723	over 49	chronic bronchitis with emphysema	652	26	147	24	
724	over 49	emphysema without bronchitis	118	7	154	46	

Code	Description	Exposed to risk	Actual deaths	$\frac{100 A}{E}$	σ
URINARY IMPAIRMENTS					
800	Urinary calculus; no operation	4,622	26	105	20
801	Urinary calculus; voided or removed	13,817	64	92	12
802	Urinary calculus; nephrotomy	3,723	30	101	18
803	Urinary calculus; nephrectomy	880	6	71	34
804	Renal colic	14,875	50	74	12
820	Cystitis without calculus	13,735	71	108	12
821	Pyelitis without calculus	4,727	25	106	21
842	Albuminuria, not orthostatic	2,167	19	159	29
843	Albuminuria with history of nephritis	7,792	22	79	19
TUMOURS (MISCELLANEOUS)**					
960	Innocent tumours (confirmed)	3,483	26	138	23
962	Malignant tumours	1,832	21	147	26
963	Enlargement of the prostate	342	10	64	25
OSTEOMYELITIS					
990	Osteomyelitis	7,262	37	100	16

* The impairments marked with an asterisk were discontinued as impairment codes as at 31.12.1979.

** The impairments marked with a double asterisk were revised as impairment codes as from 1.1.1980.