ISSN 0954-2388
CMIR **16** (1998)

Continuous Mortality Investigation Reports

Number 16

Institute of Actuaries

Faculty of Actuaries

Published by the Institute of Actuaries
and the Faculty of Actuaries
1998

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as on 1 November 1998

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INTRODUCTION

The Executive Committee of the Continuous Mortality Investigation Bureau of the Institute of Actuaries and the Faculty of Actuaries has pleasure in presenting this, the sixteenth number of its reports.

This number is rather special in that its publication coincides with the 75th anniversary of the setting up of the C.M.I. Joint Committee, the 50th anniversary of its reconstitution after the Second World War, and the 25th anniversary of the publication of *C.M.I.R.* **1**. It contains several reports, most of which relate to the mortality experience of the 1991–94 quadrennium.

Since the last number of the C.M.I. Reports there have been several changes in personnel. Philip Bayliss has stepped down from the Executive Committee, though happily continuing in the PHI Sub-Committee where he has been a stalwart for many years. Spencer Leigh has retired from the Executive Committee and Sub-Committees, in particular the Impaired Lives Sub-Committee which he has chaired well and with great humour since 1991. Other "exits" from the Executive Committee are the two Presidents, Duncan Ferguson and Paul Grace, who deserve a special mention for the interest taken by them in the C.M.I. Also noteworthy was the retirement last year of Raymond Hayward after no less than 27 years of service to the C.M.I. The new members of the Executive Committee are David Grimshaw, whose particular task is the critical illness investigation, and Peter Nowell, fresh from his spell as Life Board Chairman. I extend a warm welcome to them both.

This year marked the retirement of the C.M.I.'s Secretary, Jillian Evans. Jillian's predecessor, Rodney Barnett, was a hard act to follow, but Jillian has done her job with such distinction, that she too has become a hard act to follow. Fortunately her successor, Tony Leandro, is in the same mould, and is already beginning to make his mark. I wish Jillian well in her retirement and welcome Tony to his role in the C.M.I.

Another event of note was the retirement at the turn of the year of Joyce Tallboy, the last of the "C.M.I. ladies" who were well known to the contributing offices and who have served the C.M.I. well. I wish her a long and happy retirement.

The first four reports in this number of C.M.I.R. record the mortality experience of assured lives, annuitants and pensioners for the quadrennium 1991–94. This follows the style of previous quadrennial reports, but with the tables placed at the end of each of the relevant sections.

There follows the first full quadrennial report into the experience of smokers and non-smokers, and confirms even more strongly the wide differentials reported in *C.M.I.R.* **14**.

The next report is on impaired lives, now on a rolling 12 year basis. This investigation may have implications for the workings of the Disability Discrimination Act 1995 as applied to contracts of assurance. The report incorporates the final results from the Pilot office – the C.M.I. are very grateful to this office for their support and assistance over all the years in which the C.M.I. impaired lives investigation has been run.

A report produced by David Wilkie and John McCutcheon forms the next part of this number and is an enlarged version of the report sent earlier this year to contributing offices. It is a proposed base table (i.e. without projections) for life office pensioners and will be followed at a later date by a full set of new standard tables based on the 1991–94 quadrennium.

Finally there is a report on the group PHI experience for the 1987–90 quadrennium.

The Executive Committee are conscious of the timelag between the closing date of an investigation and the production of the relevant report. This of course is partly a function of the date when the final lists of data are received for processing. With this in mind, we are planning an awareness campaign with a target of April 2000 for producing the results of the 1995–98 quadrennium. At the same time we hope that this speeding-up process will encourage more data from new and existing contributors, as it is vitally important that we have sufficient, and timely, data to underpin one of the important items in the actuary's tool kit, the mortality table.

It remains for me to thank all those involved in the work of preparing these reports, from those in contributing offices who submit the data, to the Secretariat of the Bureau in the firm of Barnett Waddingham, who are now responsible for the computing work for all the investigations, to Alden Press, and to the members of the Executive Committee and Sub-Committees who give so much of their time to the service of the profession.

November 1998

C G Kirkwood
Chairman, Executive Committee

CONTENTS

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THE MORTALITY OF HOLDERS OF PERMANENT (WHOLE LIFE AND ENDOWMENT) POLICIES OF ASSURANCE 1991–94

This report contains commentaries on three sets of data. Section 1 covers the male holders of permanent (whole life and endowment) policies issued in the United Kingdom. The policies are divided into six sub-sets relating to the type of product, the degree of underwriting and whether they were issued on a single or a joint life basis. Section 2 covers female policyholders, similarly subdivided into six sub-sets. Section 3 relates to policies written in the Republic of Ireland, subdivided by sex.

The exposed to risk and deaths over the last three quadrennia are shown for each sub-group in Table ASS 0.1. This, and subsequent tables relating to the text, will be found on pp 11 to 33. The effect of smoking on mortality for this class of business is covered in a separate report on pp 83 to 93.

1. MALE LIVES COVERED BY POLICIES ISSUED IN THE UNITED KINGDOM

The six experiences included in this section are:

1.1 Non linked assurances on single lives, based on standard medical evidence
1.2 Unit linked assurances on single lives, based on standard medical evidence
1.3 Joint life first death assurances, based on standard medical evidence
1.4 Assurances on single lives based on minimum medical evidence
1.5 Assurances on joint lives based on minimum medical evidence
1.6 Guaranteed acceptance assurances on single lives

The term "standard medical evidence" relates to policies where the life assured has undergone a full medical examination or has completed a comprehensive health questionnaire, with or without a Medical Attendant's Report. "Limited medical evidence" relates to policies issued after the completion of a short proposal form containing a small number of questions. "Guaranteed acceptance" relates to policies issued with no medical evidence at all.

Each of the experiences is compared against the AM80 table. Using one table throughout as a standard comparison basis helps point up the differences between the experiences. The summary table, ASS 1.0 shows for each investigation the number of actual deaths at durations 2 and over as a percentage of the number expected according to the standard table. It is interesting to note that, apart from the guaranteed acceptance experience, where the observed mortality

is comparatively heavy at all ages up to 60, the largest differences between the experiences occur at ages up to 45. At these ages the degree of underwriting and the addition of the second life appears to have a significant effect on the level of mortality recorded.

As well as the detailed reports covering recent experience, Section 1.1 also contains a note showing a longer term perspective detailing trends back to the quadrennium 1959–62.

1.1 *Non linked assurances on single lives, based on standard medical evidence*
This investigation (together with that into the mortality of immediate annuitants) is the longest running of those carried out by the Bureau. It is also, in terms of the number of policies covered, by far the largest. As can be seen from Table ASS 0.1, the long term fall in the exposed to risk, noted in *C.M.I.R.* **14**, has continued into the quadrennium 1991–94. In the main the decline is due to insufficient new business to replace that going out of the experience through deaths, maturities, surrenders and lapses. The list of offices contributing to the experience over the years has been generally stable, although over the latest quadrennium there has been the loss of a handful of small contributors and not all contributors were able to make returns for each year of the quadrennium. There does, however, seem to be a continued shift away from traditional with profit business to unit linked business and to policies requiring minimal underwriting.

The policies in this investigation are subdivided into those issued after a full medical examination, 'medical', and those issued after the completion of a full medical questionnaire, possibly with a Medical Attendant's Report, 'non medical'. Medical business formed 10% of the total exposure in this investigation over the quadrennium. However, at duration 0 such business formed less than 3% of the exposure reflecting a continued move away from the use of medical examinations in the selection process except in a small minority of cases.

There is also a 'paramedical' classification, for policies issued after certain tests administered by paramedical staff. However, the numbers returned under this category are very small and separate figures are not published for this group although they are included in the 'all data' figures.

Table ASS 1.1.1a shows for the whole data the actual deaths in 1991–94 and the ratio of the actual deaths to those expected using the AM80 table. Corresponding ratios for 1983–86 and 1987–90 are also shown. At durations 2 and over it can be seen from the table that the mortality experienced by policy holders between the ages of 41 and 65 has continued to fall. This is now a long established trend. At ages over 65 the level of mortality is still falling, but at a slower pace than is seen among the younger lives. Again this is part

of a long established trend. At ages below 40 the position is quite different. The deterioration in the level of mortality which started in 1989 (see *C.M.I.R.* **14**, 11) has continued through the quadrennium 1991–94. The differential changes within the three age bands indicate that the shape of the underlying mortality curve has now changed. There is, therefore, a strong case for new standard tables to reflect the changes.

At duration 1 there appears to be, overall, a slight deterioration in the experience. However closer inspection reveals that this is mainly concentrated at ages over 60. Below age 60 the experience has changed little over three quadrennia.

At duration 0, overall mortality is at much the same level as in the previous quadrennium. Some improvement in 1991–94 at ages 36–60 is offset by some deterioration at most other ages.

Tables ASS 1.1.1b and ASS 1.1.1c give, respectively, the analyses for the medical and the non medical data.

At durations 2 and over there appears overall to be little difference between the level of mortality in the medical and non medical experiences. However, in each quadrennium shown the experience divides into two halves. At most ages up to 55 (up to 45 in 1987–90 and 1983–86) the medical group suffers considerably heavier mortality than the non medical group. Above those ages the reverse is true. Traditionally one would have expected the mortality of those subject to a medical examination to be lighter than that of those selected by questionnaires alone or with a Medical Attendant's Report. It does look as though there could have been a widespread change of practice in the way a medical examination is used to accept or reject proposers for life assurance.

At durations 0 and 1 the numbers of deaths are too small for detailed reliable conclusions to be drawn. However, the kind of pattern observed at durations 2 and over is present at the earlier durations also in that the mortality of medically examined lives is, in general, the heavier at ages up to 50 whereas over that age the mortality of the non medically examined is the heavier.

Table ASS 1.1.2 shows, age group by age group, percentage ratios of actual deaths to those which would be expected using as a comparison basis the AM80 table back to 1959–62. For 1983–86 and earlier, these have been calculated by using 'bridging factors' derived from the report for the 1983–86 quadrennium (*C.M.I.R.* **11**), which showed 100A/E ratios using both the AM80 and A1967–70 mortality tables as comparison bases, and from the report for the 1971–74 quadrennium (*C.M.I.R.* **3**), which showed 100A/E ratios using both the A1967–70 and the A1949–52 mortality tables as comparison bases. Although there is necessarily an element of approximation in these calculations, it is likely that the errors are extremely small. The results at very high ages should obviously be interpreted with caution.

From the table the steady improvement in mortality at ages above 40 can clearly be seen. Between ages 40 and 65 the observed mortality rates in 1991–94 were roughly half those observed in 1959–62. Above age 65 the improvement tapers off but is still substantial. Below age 40, as discussed earlier, the pattern over the last two quadrennia appears to have changed, from one showing continued improvement to one indicating stabilisation, or even deterioration, in the rates experienced.

1.2 *Unit linked assurances on single lives, based on standard medical evidence*
Table ASS 1.2.1 shows, for the whole data, the deaths in 1991–94 and the ratios of actual deaths to those expected using the AM80 table, together with corresponding ratios for 1983–86 and 1987–90. The level of mortality recorded in 1991–94 was, at all durations and in nearly all age groups, heavier than that recorded in 1987–90. This deterioration is in marked contrast to the pattern of continuing improvement observed over several previous quadrennia. The main explanation almost certainly lies in the mix of offices contributing data to this particular investigation. There have been major changes in this area over the quadrennium 1991–94. New offices have joined the investigation while a handful of offices have left. It would probably, therefore, be unwise to read too much at this stage into the apparent turn-round in the experience. It is perhaps worth noting that, although heavier than in 1987–90, and heavier than the corresponding non linked experience, the mortality recorded at durations 2 and over is still well below that represented by the AM80 table and the shape of the underlying mortality curve appears very similar to that currently seen in the non linked section of the data.

1.3 *Joint life first death assurances, based on standard medical evidence*
The policies included in this investigation are those where payment is made on the occurrence of the first death only. It is also limited to policies set up on one male and one female life. As time has passed, in some cases, one of the lives has been deleted from the policy, the other life remaining in the experience on a single life basis.

Table ASS 1.3.1 shows the analyses for this group. As in the non linked experience, the changes in the level of mortality recorded vary according to age and over time. At ages up to 40 there is in general a continuing fall in the mortality recorded over the three quadrennia. The mortality of those in the joint life investigation was in 1991–94 substantially lower at these ages than that either in the linked or the non linked investigation. This was generally the case in earlier quadrennia, although not necessarily in every age group.

In the middle age groups, 41–60, there has been no real consistent change in the mortality recorded over the quadrennia shown. In 1991–94 the mortality in the joint life investigation fell between that of the linked and non linked single life investigations. At ages over 60 the mortality in 1991–94 was below that recorded in either of the single life investigations. It was also, for that age group as a whole, below that noted in previous quadrennia.

At duration 0 the rates of mortality for males in the joint life experience in 1991–94 were well below those experienced in either the linked or the non linked single life experience. It is difficult to discern clear patterns over time.

At duration 1 also, the mortality level in the joint life experience in 1991–94 was, overall, well below that in either of the single life experiences, although the pattern by age groups was not so clear. Again, it is difficult to discern patterns over time.

1.4 *Assurances on single lives, based on minimum medical evidence*

The analyses for this group are shown in Table ASS 1.4.1. The investigation only started on 1st January 1985, so the 100A/E ratios shown in the right hand column of the table only cover the two years 1985 and 1986. All other data columns cover a four year period.

Overall the level of mortality experienced by this group at durations 2 and over has, over time, been consistently above that observed in the fully underwritten, single life experience. The difference has been from 10 to 12 percentage points in the 100A/E ratios relative to the AM80 table. In the minimum evidence group there has been, overall, a consistent fall in the level of the mortality recorded over time. However, between 1987–90 and 1991–94 the improvement has been almost entirely at ages over 45. Below that age a deterioration in the mortality was recorded between the two quadrennia. The deterioration in mortality at younger ages is similar to that found in the single life, non linked experience.

At durations 0 and 1 the experience in 1991–94 was substantially heavier than that found in the single life, fully medically underwritten group. This feature was also noted in the 1987–90 experiences recorded in *C.M.I.R.* **14**.

1.5 *Assurances on joint lives, based on minimum medical evidence*

The experience for this group is to be found in Table ASS 1.5.1.

At durations 2 and over the mortality recorded in this group is broadly similar in pattern to that recorded in the joint life fully underwritten group, albeit at a slightly higher level. Up to age 45 the level of mortality is well below that found in the corresponding single life investigations. This is similar to the pattern found in the quadrennium 1987–90.

At durations 0 and 1 the level of mortality in the joint life experience is well below that of the corresponding single life experience. This holds virtually throughout the age range.

1.6 *Guaranteed acceptance assurances written on single lives*
The experience for this group is shown in Table ASS 1.6.1. It is now virtually a closed class having been superseded by assurances written on minimum medical evidence.

Although the level of mortality recorded has fallen over the three quadrennia shown, that observed in 1991–94 is still, in almost every age group, well above that recorded at duration 2 and over in both the fully medically underwritten and the minimum evidence investigations.

2. FEMALE LIVES COVERED BY POLICIES ISSUED IN THE UNITED KINGDOM

This section covers six different experiences, corresponding to those for male lives reviewed in Section 1.

The experiences are:

2.1 Non linked assurances on single lives, based on standard medical evidence
2.2 Unit linked assurances on single lives, based on standard medical evidence
2.3 Joint life first death assurances, based on standard medical evidence
2.4 Assurances on single lives, based on minimum medical evidence
2.5 Assurances on joint lives, based on minimum medical evidence
2.6 Guaranteed acceptance assurances on single lives

As for male lives, the term "standard medical evidence" relates to policies where the life assured has undergone a full medical examination or has completed a comprehensive health questionnaire, with or without a Medical Attendant's Report. "Limited medical evidence" relates to policies issued after the completion of a short proposal form containing a small number of questions. "Guaranteed acceptance" relates to policies issued with no medical evidence at all.

Each of the experiences is compared against the AF80 table. The summary table, ASS 2.0, shows, for each investigation, the percentage of actual deaths at durations 2 and over, to those expected using the standard table. As with males, the most significant differences between the experiences are at ages up to about 45 where the degree of underwriting and the addition of a second life appears to have a determining effect on the level of the mortality recorded.

As well as the detailed reports covering recent experience, Section 2.1 also contains a note showing a longer term perspective detailing trends back to

the quadrennium 1975–78, the first quadrennium for which data on female policyholders are available.

2.1 *Non linked assurances on single lives, based on standard medical evidence*
As in the corresponding male investigation, the policies in this section are subdivided into those issued on a 'medical' basis and those issued on a 'non medical' basis. The proportion of medical business in this class of policy has historically been lower for females than for males. For all ages combined it currently represents some $4\frac{1}{2}\%$ of the total exposure. However, at duration 0 it now matches the proportion in the male investigation at 3%.

Table ASS 2.1.1a shows for the whole data the actual deaths in 1991–94 and the ratio of the actual deaths to those expected using the AF80 table. Corresponding ratios for 1983–86 and 1987–90 are also shown.

From the table it can be seen that, at durations 2 and over, the mortality recorded in this investigation has, overall, continued the fall noted in previous quadrennia. Closer inspection shows that the fall is distributed over practically the full age range. This is in contrast to the experience in the two previous quadrennia where it appeared that mortality in the ages up to 45 or so may have been stabilising, any falls which were occurring being confined to the older end of the age scale. Although the downward trend at the younger ages may have been resumed, the hiatus over the previous two quadrennia means that the current shape of the mortality curve relative to the AF80 table has changed. This indicates that it may be advantageous to prepare a new standard table for this group.

At duration 1 there has been a fall in the level of mortality recorded over the last two quadrennia in all age groups except 76–85, but at duration 0 the fall is not so clear cut.

Tables ASS 2.1.1b and ASS 2.1.1c give, respectively, the analyses for the medical and the non medical data. At durations 2 and over exactly the same phenomenon noted in the male medical experience can be observed in the female medical experience, that is to say that, at almost all ages up to 55, in all three quadrennia shown, the mortality recorded in the medical experience is substantially heavier than that found in the non medical experience whereas above those ages the reverse is true.

The medical experience at durations 0 and 1 is too small for any conclusions to be drawn.

Table ASS 2.1.2 shows, age group by age group, percentage ratios of actual deaths to those which would be expected using as a comparison basis the AF80 table. For 1983–86 and earlier these have been calculated using bridging factors derived from the report for the 1983–86 quadrennium (*C.M.I.R.* **11**), which

showed 100A/E ratios for females using both the AF80 table and the A1967–70 table minus 4 years as comparison bases.

At ages over 45 there is continued steady improvement in the observed mortality over the five quadrennia shown. At ages up to 75, however, the improvement is less than that observed over the same period in the male experience. At ages over 75 the improvement in female mortality is the greater.

At ages below 45 the different pattern of the observed mortality over the last three quadrennia mentioned above is again evident.

2.2 *Unit linked assurances on single lives, standard medical evidence*

The experience for 1991–94 is shown in Table ASS 2.2.1. At durations 2 and over the level of mortality observed is not dissimilar to that found in the non linked experience although the linked experience looks heavy up to age 30. The similarity between the mortality observed in the female linked and non linked experiences has been noted in previous quadrennia although the pattern was interrupted in 1987–90 when the linked experience was the lighter.

At durations 0 and 1 the level of mortality observed in the linked experience is much heavier than that found in the non linked experience. This is a continuing feature of this investigation.

2.3 *Joint life assurances, standard medical evidence*

As was noted in Section 1.3, the commentary on the experience of male lives in such arrangements, the policies included in this investigation are those where payment is made on the occurrence of the first death only and are restricted to policies set up on one male and one female life.

The experience for 1991–94 is shown in Table ASS 2.3.1. At durations 2 and over the mortality observed in the three quadrennia shown has remained fairly stable. In all three quadrennia it is well below that observed in both the linked and the non linked single life investigations.

At durations 0 and 1, also, the joint life experience has almost always been well below that of the corresponding single life experiences.

2.4 *Assurances on single lives, based on minimum medical evidence*

The experience for this group is shown in Table ASS 2.4.1.

At durations 2 and over the level of mortality recorded in the minimum evidence experience for 1991–94 is, for all ages combined, above that found in the standard experience. Although this contrasts with what was found in the previous quadrennium, it is what would be expected on rational grounds. The excess mortality is found in most age groups up to age 65.

At durations 0 and 1 the numbers of deaths are too small for any reliable conclusions to be drawn.

2.5 *Assurances on joint lives, based on minimum medical evidence*
The experience is shown in Table ASS 2.5.1. At durations 2 and over the joint life experience is lighter than the corresponding single life experience. This is true virtually throughout the age range. At ages above 35 the minimum evidence joint life experience is not dissimilar to the standard joint life experience. Up to age 35 the minimum evidence experience shows the expected heavier mortality.

The numbers of deaths at durations 0 and 1 are too small to allow any reliable conclusions to be drawn.

2.6 *Guaranteed acceptance assurances issued on single lives*
This investigation is virtually a closed class, this type of policy being replaced in the main by policies issued on minimum medical evidence. The number of deaths is small allowing little scope for detailed analysis. Table ASS 2.6.1 gives the experience available. All that can be safely said is that the mortality suffered by this group is, overall, heavier than that suffered by other female policy holders in the investigations conducted by the Bureau.

3. POLICIES OF ASSURANCE ISSUED IN THE REPUBLIC OF IRELAND

This section contains commentary on the experience of holders of non linked, standard medical evidence policies of assurance written in the Republic of Ireland. In recent years the number of offices contributing to the Irish experiences has declined and the exposed to risk has been falling steadily. The situation is exacerbated by the fact that most business written in Ireland is now on a unit linked basis for which the Bureau does not currently run an investigation. However, the male investigation still includes a substantial number of deaths and it is therefore worthwhile continuing the tradition of reporting on the experience of these policies. The female investigation is small, but is included for completeness.

3.1 *Assurances on male lives*
This long established investigation is now a mature experience, with very little new business coming in. Table ASS 3.1.1 shows the analysis for 1991–94, together with results for previous quadrennia. The improvement in mortality between quadrennia, noted in the last report on this investigation (*C.M.I.R.* **14**) has continued. At durations 2 and over the improvement can be seen in almost all age groups up to age 75. The mortality experience for policies written

in Ireland has normally been heavier than that for policies written in the U.K. This is still true in the 1991–94 quadrennium at ages over 55 but below that age the U.K. experience is, on this occasion, the heavier.

3.2 *Assurances on female lives*

As noted earlier, the experience very small, with only 65,000 policies in the exposed to risk and a total of 86 deaths. The analyses are shown in Table ASS 3.2.1.

It was noted in the last report on this investigation (*C.M.I.R.* **14**) that the observed mortality for this group appeared extremely light in comparison with the corresponding U.K. experience. This has continued into 1991–94 where the Irish experience is again lighter over the whole age range.

4. CONCLUSION

The reports on the permanent assurance investigations cover a wide range of experiences. Each has its own peculiarities and, sometimes, oddities. From time to time it is suggested that an investigation be closed or certain investigations be amalgamated. However, with the exception of one or two very small investigations, each provides useful information on a particular facet of the insurance market. The Executive Committee hopes that this continues to be of value to those involved in the day to day operation of the business.

Table ASS 0.1. Permanent (whole life and endowment) assurances, combined, all durations: exposed to risk and deaths.

Investigation	1991–94		1987–90		1983–86	
	Exposed to risk (000)	Actual deaths	Exposed to risk (000)	Actual deaths	Exposed to risk (000)	Actual deaths
Males, UK						
Non linked, standard evidence	15,191	64,536	18,568	77,906	23,134	91,910
Linked, standard evidence	1,771	7,184	1,109	3,736	1,492	5,077
Joint life first death, standard evidence*	2,810	4,292	1,743	2,434	741	873
Minimum evidence**	2,126	2,920	1,810	1,865	279	260
Joint life first death, minimum evidence**	1,664	1,877	1,883	1,546	300	165
Guaranteed acceptance business	177	431	307	606	261	391
Total	**23,739**	**81,240**	**25,420**	**88,093**	**26,207**	**98,676**
Females, UK						
Non linked, standard evidence	5,587	12,047	5,102	10,639	5,507	9,715
Linked, standard evidence	1,077	2,964	497	1,382	517	2,095
Joint life first death, standard evidence*	2,766	2,139	1,707	1,072	741	363
Minimum evidence*	665	612	551	292	56	17
Joint life first death, minimum evidence**	1,657	999	1,850	726	300	81
Guaranteed acceptance business	60	100	101	132	77	69
Total	**11,812**	**18,861**	**9,808**	**14,243**	**7,198**	**12,340**
Males, Republic of Ireland						
Non linked, standard evidence	**308**	**1,320**	**536**	**2,126**	**843**	**3,868**
Females, Republic of Ireland						
Non linked, standard evidence*	**65**	**87**	**91**	**105**	**123**	**203**

* Investigation started 1st January 1982.

** Investigation started 1st January 1985.

Table ASS 1.0. Permanent assurances, males, 1991–94, all data, durations 2 and over: actual deaths as a percentage of those expected using the AM80 table.

Age group (nearest ages)	Standard medical evidence			Minimum medical evidence		Guaranteed acceptance
	Non linked	Linked	Joint life	Single life	Joint life	
26–30	92	109	66	91	66	128*
31–35	108	120	81	124	84	118
36–40	94	88	70	119	82	126
41–45	73	91	67	88	73	116
46–50	67	81	71	71	76	88
51–55	65	76	70	71	68	87
56–60	64	74	68	69	65	78
61–65	72	75	69	71	69*	72

* Ratio based on fewer than 10 actual deaths.

Table ASS 1.1.1a. Permanent assurances (non linked), males, 1991–94, standard medical evidence, all data: actual deaths and ratios of actual deaths to those expected using the AM80 table.

Age group (nearest ages)	Actual deaths 1991–94	100A/E 1991–94	100A/E 1987–90	100A/E 1983–86
Duration 0				
16–20	55	156	115	89
21–25	68	115	104	91
26–30	54	99	144	127
31–35	58	122	111	114
36–40	54	98	127	105
41–45	67	75	97	94
46–50	106	82	97	87
51–55	130	80	85	98
56–60	118	81	78	93
61–65	160	107	106	92
66–70	149	107	76	107
71–75	97	120	98	133
76–80	65	153	106	154
16–80	1,181	99	98	99
Duration 1				
16–20	25	92	118	89
21–25	51	82	95	96
26–30	62	96	87	91
31–35	56	99	121	106
36–40	67	99	110	85
41–45	84	73	87	98
46–50	166	96	82	84
51–55	184	81	85	85
56–60	196	89	77	88
61–65	188	100	88	98
66–70	208	99	99	107
71–75	148	123	120	128
76–80	90	137	139	121
16–80	1,525	95	92	93

Table ASS 1.1.1a. (continued).

Age group (nearest ages)	Actual deaths 1991–94	100A/E 1991–94	100A/E 1987–90	100A/E 1983–86
Durations 2 and over				
16–20	31	106	86	102
21–25	174	89	94	86
26–30	349	92	88	101
31–35	631	108	104	101
36–40	1,152	94	89	96
41–45	2,558	73	80	89
46–50	4,915	67	78	89
51–55	6,992	65	74	86
56–60	10,322	64	75	88
61–65	11,689	72	82	94
66–70	5,258	72	78	86
71–75	5,001	76	82	87
76–80	4,764	79	87	94
81–85	4,311	84	88	97
86–90	2,422	82	86	94
91–95	970	78	75	85
16–95	61,539	72	80	90

Note: a proportion of the data received for this investigation is returned with a combined medical code and a small amount is returned as paramedical. The figures in Table 1.1.1a are, therefore, greater than the sum of the corresponding figures in Tables 1.1.1b and 1.1.1c.

Table ASS 1.1.1b. Permanent assurances (non linked), males, 1991–94, medical data: actual deaths and ratios of actual deaths to those expected using the AM80 table.

Age group (nearest ages)	Actual deaths 1991–94	100A/E 1991–94	100A/E 1987–90	100A/E 1983–86
Duration 0				
21–30	5	192*	127*	125*
31–40	5	185*	128*	41*
41–50	6	86*	100	86
51–60	12	107	58	95
61–70	12	71	72	74
71–80	8	72*	76	114
21–80	48	93	79	87
Duration 1				
21–30	7	200*	115*	119*
31–40	8	216*	119*	64*
41–50	9	86*	85	108
51–60	9	51*	89	82
61–70	17	74	75	79
71–80	17	90	85	112
21–80	67	86	84	89
Durations 2 and over				
21–30	17	106	65	106
31–35	32	153	124	124
36–40	49	80	99	113
41–45	240	89	96	93
46–50	546	73	77	86
51–55	894	65	71	82
56–60	1,445	60	69	82
61–65	1,989	68	74	84
66–70	1,430	69	72	79
71–75	1,826	69	79	84
76–80	2,200	74	85	91
81–85	2,411	82	86	97
86–90	1,566	83	86	94
91–95	618	79	78	85
21–95	15,263	72	78	88

* Ratio based on fewer than 10 actual deaths.

Table ASS 1.1.1c. Permanent assurances (non linked), males, 1991–94, non medical data: actual deaths and ratios of actual deaths to those expected using the AM80 table.

Age group (nearest ages)	Actual deaths 1991–94	100A/E 1991–94	100A/E 1987–90	100A/E 1983–86
Duration 0				
21–30	112	104	122	107
31–40	101	103	119	111
41–50	164	80	97	90
51–60	230	81	83	96
61–70	290	109	96	110
71–80	152	136	108	163
21–80	1,049	98	98	101
Duration 1				
21–30	104	87	90	93
31–40	113	96	114	95
41–50	233	86	84	88
51–60	357	85	81	88
61–70	368	101	97	109
71–80	221	134	145	143
21–80	1,396	96	91	94
Durations 2 and over				
21–30	497	91	90	95
31–35	589	107	103	99
36–40	1,083	95	88	94
41–45	2,251	72	78	89
46–50	4,214	67	78	90
51–55	5,829	64	75	88
56–60	8,489	65	77	90
61–65	9,224	73	85	98
66–70	3,511	73	82	92
71–75	2,802	81	86	93
76–80	2,154	84	89	101
81–85	1,480	89	90	98
86–90	513	78	81	93
91–95	224	84	64	86
21–95	42,860	71	80	92

Table ASS 1.1.2. Permanent assurances (non linked), males, standard medical evidence, all data, durations 2 and over: actual deaths 1959–94 as a percentage of those expected using the AM80 table.

Age group (nearest ages)	Quadrennium								
	1959–62	1963–66	1967–70	1971–74	1975–78	1979–82	1983–86	1987–90	1991–94
21–25	145	125	117	105	98	101	86	94	89
26–30	122	128	114	116	101	98	101	88	92
31–35	139	133	118	113	107	103	101	104	108
36–40	140	140	126	119	115	101	96	89	94
41–45	134	137	128	117	108	98	89	80	73
46–50	130	130	127	119	107	98	89	78	67
51–55	132	129	123	118	111	101	86	74	65
56–60	133	129	122	112	104	99	88	75	64
61–65	137	135	123	114	107	100	94	82	72
66–70	127	126	119	109	102	94	86	78	72
71–75	122	123	121	115	106	100	87	82	76
76–80	127	123	117	114	113	106	94	87	79
81–85	125	119	113	111	106	104	97	88	84
86–90	121	119	109	109	106	96	94	86	82
91–95	115	110	101	96	102	89	85	75	78
96–100	102	89	98	89	79	57	60	49	38
All ages*	132	129	122	114	107	100	90	80	71
Number of deaths*	91,297	96,973	94,271	93,008	91,884	90,941	88,442	75,095	61,806

* Figures contain a small number of deaths recorded at ages under 21 or over 100.

Table ASS 1.2.1. Linked contracts of life assurance, males, standard medical evidence, 1991–94, all data: actual deaths and ratios of actual deaths to those expected using the AM80 table.

Age group (nearest ages)	Actual deaths 1991–94	100A/E 1991–94	100A/E 1987–90	100A/E 1983–86
Duration 0				
16–20	9	173*	52*	70*
21–25	27	184	126	180
26–30	16	114	116	129
31–35	18	143	162	98
36–40	19	132	42*	95
41–45	18	82	66	100
46–50	42	136	81	73
51–55	48	126	80	76
56–60	64	155	111	88
61–65	57	154	116	130
66–70	10	103	135	127
71–80	11	200	184	147
81–90	6	300*	229	154
16–90	345	139	109	107
Duration 1				
16–20	6	167*	83*	59*
21–25	15	97	60*	105
26–30	23	143	95	99
31–35	21	142	66*	115
36–40	20	112	104	112
41–45	22	76	69	108
46–50	41	98	124	59
51–55	54	101	94	110
56–60	56	95	68	91
61–65	61	118	114	105
66–70	29	134	119	132
71–80	15	172	169	139
81–90	9	321*	177	275
16–90	372	111	101	110

* Ratio based on fewer than 10 actual deaths.

Table ASS 1.2.1. (continued).

Age group (nearest ages)	Actual deaths 1991–94	100A/E 1991–94	100A/E 1987–90	100A/E 1983–86
Durations 2 and over				
16–20	3	86*	120*	178*
21–25	34	80	88	90
26–30	81	109	71	86
31–35	104	120	91	129
36–40	110	88	77	80
41–45	247	91	59	78
46–50	440	81	70	83
51–55	701	76	60	72
56–60	1,146	74	62	71
61–65	1,421	75	71	70
66–70	1,155	77	64	73
71–75	550	71	68	71
76–80	262	81	80	91
81–85	117	65	95	86
86–90	66	81	74	63
91–95	24	100	136	115
16–95	6,461	77	68	76

* Ratio based on fewer than 10 actual deaths.

Table ASS 1.3.1. Joint life first death assurances, males, 1991–94, standard medical evidence, all data: actual deaths and ratios of actual deaths to those expected using the AM80 table.

Age group (nearest ages)	Actual deaths 1991–94	100A/E 1991–94	100A/E 1987–90	100A/E 1983–86
Duration 0				
21–25	8	57*	56	40
26–30	21	89	93	
31–35	20	77	97	80
36–40	27	86	96	62
41–45	32	71	67	32*
46–50	29	61	90	57
51–55	31	88	88	77
56–60	17	74	103	118
21–60	185	75	88	69
Duration 1				
21–25	8	55*	75	84
26–30	32	104	75	
31–35	34	99	91	106
36–40	27	62	81	131
41–45	65	99	76	100
46–50	55	76	81	87
51–55	45	80	78	81
56–60	30	80	71	73
21–60	296	83	76	90
Durations 2 and over				
21–25	13	62	76	77
26–30	82	66		
31–35	193	81	69	77
36–40	279	70	84	87
41–45	464	67	66	77
46–50	645	71	69	75
51–55	651	70	66	67
56–60	742	68	65	71
61–65	526	69	74	83
66–70	137	62	66	82
71–75	38	61	56	59
76–80	11	67	81	
21–80	3,781	69	69	76

* Ratio based on fewer than 10 actual deaths.

Table ASS 1.4.1. Minimum evidence assurances written on one life only, males, 1991–94: actual deaths and ratios of actual deaths to those expected using the AM80 table.

Age group (nearest ages)	Actual deaths 1991–94	100A/E 1991–94	100A/E 1987–90	100A/E 1985–86
Duration 0				
21–25	16	113	96	91
26–30	22	128	126	151
31–35	14	121	183	172
36–40	16	146	132	135
41–45	16	100	92	112
46–50	29	171	106	97
51–55	6	200*	105*	–
21–55	119	132	119	121
Duration 1				
21–25	18	110	96	61*
26–30	24	88	113	94
31–35	34	182	157	120
36–40	26	146	113	34*
41–45	32	123	82	143
46–50	25	80	98	78
51–55	9	102*	99	107*
21–55	168	115	106	91
Durations 2 and over				
21–25	32	87	51	142
26–30	175	91	118	
31–35	319	124	119	67
36–40	318	119	109	
41–45	371	88	87	128
46–50	458	71	78	106
51–55	474	71	72	94
56–60	226	69	64	
61–65	84	71	165	–
66–70	47	68	125*	–
71–75	60	96	–	–
76–80	33	88	–	–
81–85	28	87	–	–
21–85	2,625	84	90	101

* Ratio based on fewer than 10 actual deaths.

Table ASS 1.5.1. Minimum evidence assurances written on one male and one female life, males, 1991–94: actual deaths and ratios of actual deaths to those expected using the AM80 table.

Age group (nearest ages)	Actual deaths 1991–94	100A/E 1991–94	100A/E 1987–90	100A/E 1985–86
Duration 0				
21–25	4	50*	69	64
26–30	15	125	103	78
31–35	12	100	140	91
36–40	12	93	96	67
41–45	18	108	88	61
46–50	17	113	109	53
51–55	9	132*	163*	–
56–60	8	242*		
21–60	95	109	102	67
Duration 1				
21–25	3	38*	52	84*
26–30	14	88	105	73*
31–35	12	73	85	94*
36–40	21	109	85	76
41–45	23	86	73	107
46–50	29	108	90	74
51–55	11	91	54*	39*
56–60	7	121*		
21–60	120	91	82	83
Durations 2 and over				
21–25	8	65*	41	158*
26–30	66	66	74	
31–35	160	84	91	65*
36–40	216	82	87	
41–45	315	73	73	74*
46–50	435	76	73	
51–55	341	68	54	–
56–60	106	65	–	–
21–60	1,647	74	75	82

* Ratio based on fewer than 10 actual deaths.

Table ASS 1.6.1. Guaranteed acceptance assurances, males, 1991–94: actual deaths and ratios of actual deaths to those expected using the AM80 table.

Age group (nearest ages)	Actual deaths 1991–94	100A/E 1991–94	100A/E 1987–90	100A/E 1983–86
Durations 2 and over				
31–35	24	118	154	129
36–40	41	126	135	76
41–45	62	116	132	126
46–50	72	88	109	126
51–55	89	87	104	131
56–60	76	78	106	196
61–65	13	72	93	
31–65	377	93	117	125

Table ASS 2.0. Permanent assurances, females, 1991–94, all data, durations 2 and over: actual deaths as a percentage of those expected using the AF80 table.

Age group (nearest ages)	Standard medical evidence			Minimum medical evidence		Guaranteed acceptance
	Non linked	Linked	Joint life	Single life	Joint life	
26–30	84	125	59	124	67	63*
31–35	91	88	68	98	81	
36–40	91	86	73	105	72	116
41–45	89	123	70	80	80	97
46–50	88	85	82	91	78	95
51–55	81	79	76	90	67	93
56–60	77	77	64	65	69	91
61–65	75	74	64	130	125*	47*

* Ratio based on fewer than 10 actual deaths.

Table ASS 2.1.1a. Permanent assurances (non linked), females, 1991–94, standard medical evidence, all data: actual deaths and ratios of actual deaths to those expected using the AF80 table.

Age group (nearest ages)	Actual deaths 1991–94	100A/E 1991–94	100A/E 1987–90	100A/E 1983–86
Duration 0				
16–25	30	127	101	48
26–35	33	74	93	124
36–45	59	70	80	86
46–55	118	75	69	65
56–65	132	88	89	93
66–75	122	123	106	151
76–85	26	84	149	236
16–85	520	88	87	95
Duration 1				
16–25	13	57	111	99
26–35	47	80	84	87
36–45	75	66	89	86
46–55	180	75	83	83
56–65	194	73	77	78
66–75	128	61	81	86
76–85	59	71	66	89
16–85	696	70	81	84
Durations 2 and over				
16–20	7	111*	80*	62*
21–25	33	70	84	85
26–30	93	84	94	90
31–35	191	91	92	88
36–40	358	91	99	90
41–45	688	89	99	96
46–50	1,057	88	95	105
51–55	1,301	81	86	92
56–60	1,601	77	88	88
61–65	1,335	75	82	92
66–70	1,036	73	81	77
71–75	1,041	80	78	79
76–80	844	77	83	83
81–85	774	85	91	109
86–90	307	81	94	134
91–95	126	84	82	122
16–95	10,792	80	87	92

* Ratio based on fewer than 10 actual deaths.

Table ASS 2.1.1b. Permanent assurances (non linked), females, 1991–94, medical data: actual deaths and ratios of actual deaths to those expected using the AF80 table.

Age group (nearest ages)	Actual deaths 1991–94	100A/E 1991–94	100A/E 1987–90	100A/E 1983–86
Duration 0				
All ages	26	80	86	127
Duration 1				
All ages	46	70	58	83
Durations 2 and over				
26–35	14	175	173	126
36–40	26	198	160	105
41–45	38	120	132	101
46–50	58	100	89	101
51–55	110	123	98	108
56–60	121	92	89	69
61–65	111	75	78	73
66–70	122	63	70	67
71–75	197	70	68	66
76–80	220	62	76	70
81–85	301	76	85	92
86–90	156	68	78	130
91–95	59	64	87	114
26–95	1,533	76	82	82

Table ASS 2.1.1c. Permanent assurances (non linked), females, 1991–94, non medical data: actual deaths and ratios of actual deaths to those expected using the AF80 table.

Age group (nearest ages)	Actual deaths 1991–94	100A/E 1991–94	100A/E 1987–90	100A/E 1983–86
Duration 0				
16–25	25	112	104	46
26–35	33	78	87	122
36–45	52	66	77	85
46–55	110	75	70	65
56–65	127	91	87	93
66–75	113	128	119	148
76–85	23	92	177	274
16–85	483	89	87	92
Duration 1				
16–25	13	60	110	92
26–35	41	74	82	85
36–45	71	66	86	87
46–55	169	76	82	82
56–65	176	72	78	80
66–75	115	62	90	91
76–85	51	77	85	79
16–85	636	70	84	84
Durations 2 and over				
16–20	6	102*	55*	64*
21–25	32	72	78	88
26–30	88	84	95	87
31–35	180	91	88	87
36–40	327	88	97	89
41–45	631	88	96	96
46–50	976	88	95	106
51–55	1,135	78	84	91
56–60	1,408	75	87	91
61–65	1,164	75	82	97
66–70	834	74	85	80
71–75	751	83	84	89
76–80	540	84	89	95
81–85	389	89	101	136
86–90	96	96	116	145
91–95	36	109	62	136
16–95	8,593	80	88	94

* Ratio based on fewer than 10 actual deaths.

Table ASS 2.1.2. Permanent assurances (non linked), females, standard medical evidence, all data, durations 2 and over: actual deaths 1975–94 as a percentage of those expected using the AF80 table.

Age group (nearest ages)	Quadrennium				
	1975–78	1979–82	1983–86	1987–90	1991–94
21–25	105	92	85	84	70
26–30	130	102	90	94	84
31–35	108	98	88	92	91
36–40	116	90	90	99	91
41–45	128	98	96	99	89
46–50	128	105	105	95	88
51–55	117	111	92	86	81
56–60	105	101	88	88	77
61–65	104	92	92	82	75
66–70	95	88	77	81	73
71–75	104	91	79	78	80
76–80	122	93	83	83	77
81–85	121	134	109	91	85
86–90	120	116	134	94	81
91–95					
All ages*	113	100	92	87	80
Number of deaths*	4,666	6,368	8,571	9,610	10,830

* Figures contain a small number of deaths at ages under 21 and over 95.

Table ASS 2.2.1. Linked contracts of life assurance, females, 1991–94, standard medical evidence, all data: actual deaths and ratios of actual deaths to those expected using the AF80 table.

Age group (nearest ages)	Actual deaths 1991–94	100A/E 1991–94	100A/E 1987–90	100A/E 1983–86
Duration 0				
16–30	5	56*	115*	95*
31–45	30	149	97	89
46–60	65	132	102	67
61–75	26	86	116	115
76–90	10	182	356	515
16–90	136	119	151	162
Duration 1				
16–30	17	168	182*	58*
31–45	35	122	80	101
46–60	56	72	71	76
61–75	58	92	92	60
76–90	16	127	99	226
16–90	182	94	85	116
Durations 2 and over				
16–25	17	173	34*	146*
26–30	27	125	113*	127*
31–35	30	88	127	82
36–40	48	86	81	99
41–45	135	123	68	75
46–50	171	85	75	101
51–55	258	79	72	75
56–60	409	77	86	80
61–65	463	74	66	60
66–70	397	71	69	82
71–75	202	70	52	71
76–80	149	84	97	103
81–85	118	78	119	130
86–90	146	114	120	131
91–95	54	105	105	89
16–95	2,624	80	79	94

* Ratio based on fewer than 10 actual deaths.

Table ASS 2.3.1. Joint life first death assurances, females, 1991–94, standard medical evidence, all data: actual deaths and ratios of actual deaths to those expected using the AF80 table.

Age group (nearest ages)	Actual deaths 1991–94	100A/E 1991–94	100A/E 1987–90	100A/E 1983–86
Duration 0				
21–30	12	59	52	68*
31–40	22	69	83	11*
41–50	28	67	59	97
51–60	22	117	64	48
61–70	5	106*	22*	37*
21–70	89	76	64	57
Duration 1				
21–30	15	51	72	46*
31–40	50	98	48	53
41–50	53	77	59	77
51–60	29	81	53	68
61–70	6	59*	47*	71*
21–70	153	78	56	64
Durations 2 and over				
21–25	14	66	19*	36*
26–30	56	59	54	52
31–35	134	68	75	76
36–40	225	73	79	54
41–45	312	70	71	91
46–50	397	82	62	66
51–55	325	76	70	54
56–60	254	64	77	60
61–65	134	64	72	80
66–70	27	46	42	83*
71–75	13	86	71*	49*
21–75	1,891	71	70	66

* Ratio based on fewer than 10 actual deaths.

Table ASS 2.4.1. Minimum evidence assurances written on one life only, females, 1991–94: actual deaths and ratios of actual deaths to those expected using the AF80 table.

Age group (nearest ages)	Actual deaths 1991–94	100A/E 1991–94	100A/E 1987–90	100A/E 1985–86
Duration 0				
All ages	30	126	106	55
Duration 1				
All ages	34	86	94	95
Durations 2 and over				
26–30	38	124	89	
31–35	54	98	91	
36–40	68	105	89	
41–45	73	80	70	
46–50	110	91	82	
51–55	98	90	73	104
56–60	30	65	69*	
61–65	27	130	111*	
66–70	11	56	–	
71–75	10	50	–	
76–80	8	54*	–	
81–85	17	117	–	
26–85	544	90	81	104

* Ratio based on fewer than 10 actual deaths.

Table ASS 2.5.1. Minimum evidence assurances written on one male and one female life, females, 1991–94: actual deaths and ratios of actual deaths to those expected using the AF80 table.

Age group (nearest ages)	Actual deaths 1991–94	100A/E 1991–94	100A/E 1987–90	100A/E 1985–86
Duration 0				
All ages	37	90	70	70
Duration 1				
All ages	40	57	69	82
Durations 2 and over				
21–25	14	99	61	
26–30	54	67	52	
31–35	120	81	59	
36–40	142	72	75	55
41–45	220	80	85	
46–50	225	78	78	
51–55	116	67	51	
56–60	27	69	111*	
21–60	918	75	71	55

* Ratio based on fewer than 10 actual deaths.

Table ASS 2.6.1. Guaranteed acceptance assurances, females, 1991–94: actual deaths and ratios of actual deaths to those expected using the AF80 table.

Age group (nearest ages)	Actual deaths 1991–94	100A/E 1991–94	100A/E 1987–90	100A/E 1983–86
Durations 2 and over				
26–35	3	63*	178	107*
36–45	23	105	93	87*
46–55	36	94	121	136
56–65	21	80	107	70*
26–65	83	91	118	95

* Ratio based on fewer than 10 actual deaths.

Table ASS 3.1.1. Permanent assurances (non linked), policies issued in the Republic of Ireland, males, 1991–94, standard medical evidence, all data: actual deaths and ratios of actual deaths to those expected using the AM80 table.

Age group (nearest ages)	Actual deaths 1991–94	100A/E 1991–94	100A/E 1987–90	100A/E 1983–86
Duration 0				
All ages	18	82	87	140
Duration 1				
All ages	27	84	93	111
Durations 2 and over				
21–30	13	137	54*	117
31–40	28	65	86	91
41–45	45	63	89	91
46–50	77	54	100	97
51–55	135	64	84	93
56–60	204	69	82	115
61–65	251	79	97	114
66–70	119	83	95	128
71–75	113	85	96	99
76–80	121	116	97	121
81–85	98	110	67	117
86–90	57	118	74	82
91–95	12	65	103	102
21–95	1,273	78	89	107

* Ratio based on fewer than 10 actual deaths.

Table ASS 3.2.1. Permanent assurances (non linked), policies issued in the Republic of Ireland, females, 1991–94, standard medical evidence, all data: actual deaths and ratios of actual deaths to those expected using the AF80 table.

Age group (nearest ages)	Actual deaths 1991–94	100A/E 1991–94	100A/E 1987–90	100A/E 1983–86
Duration 0				
All ages	5	129*	72*	37*
Duration 1				
All ages	5	87*	52*	113
Durations 2 and over				
21–40	7	60*	81*	150
41–50	15	64	93	163
51–60	26	76	84	79
61–70	15	65	83	87
71–90	13	79	51	98
21–90	76	70	81	109

* Ratio based on fewer than 10 actual deaths.

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THE MORTALITY OF HOLDERS OF TEMPORARY ASSURANCES ISSUED IN THE UNITED KINGDOM, 1991–94

This report contains, for both males and females, commentaries on the mortality experiences of holders of traditional, standalone and temporary assurance policies (fully medically underwritten). The policies have been issued on standard terms following a full medical examination or after the completion of a full medical questionnaire, with or without a Medical Attendant's Report. There are also reports on the mortality of holders of temporary assurance policies effected in conjunction with personal pension policies under Section 637 (1) of the ICTA 1988. The investigation into the mortality of holders of temporary assurances effected in connection with retirement annuities under Section 621 of the ICTA 1988 was closed as from 1 January 1993. As the investigation ran only for six years, with a report on the first four years' experience (1987–90) in *C.M.I.R.* **14**, no further report has been prepared on this occasion.

1. TEMPORARY ASSURANCES ON MALE LIVES

1.1 *Traditional standalone policies written on standard medical evidence*

The policies included in this data set are subdivided into those issued after a full medical examination (medical) and those issued after the completion of a comprehensive medical questionnaire, with or without a Medical Attendant's Report (non medical). Tables TEMP 1.1.1a, TEMP 1.1.1b and TEMP 1.1.1c show the experience for, respectively, all the data, the medical data and the non medical data. The comparison basis is the TM80 table. In Table TEMP 1.1.2 a comparison using the AM80 table as basis is shown.

At duration 0, apart from the age group 61–75, there has been a steady improvement in the level of mortality recorded over the three quadrennia shown.

At durations 1 to 4 there has, in general, been a steady decline in the mortality recorded between ages 31 and 65. At ages up to 30 there appears to have been a sharp and consistent deterioration in the level of mortality experienced. At ages over 65 the picture is mixed.

At durations 5 and over there is a similar pattern with continued improvement recorded over the middle of the age range, the boundaries here being ages 51 to 65. Between ages 36 and 50, mortality rates have been almost constant. Up to age 35 there has been some deterioration, particularly in the age group 31 to 35. At ages above 65 the picture is again mixed.

From Table TEMP 1.1.2 it can be seen that at durations 0 and 1 temporary assurance mortality experience is well below that of standard evidence permanent assurances.

At durations 2 and over, above age 40 the two experiences are very similar. This contrasts with what has been observed in previous quadrennia where the temporary assurance experience has been considerably lighter than the permanent assurance experience. At ages below 40 clear differences between the two experiences have been recorded, the permanent assurance mortality being the lower up to age 30 with the position being reversed at ages 31 to 40.

1.2 *Assurances effected in conjunction with personal pensions under Section 637(1) of the ICTA 1988*

The experience is shown in Table TEMP 1.2.1. The investigation was started on 1 January 1989; 1991–94 is, therefore, the first full quadrennium for which data are available. The total number of deaths is still relatively small and does not allow firm conclusions to be drawn. However, the indications are that the experience is reasonably similar to that recorded in the standalone category.

2. TEMPORARY ASSURANCES ON FEMALE LIVES

2.1 *Traditional standalone policies written on standard medical evidence*

The experience is shown in Table TEMP 2.1.1. At duration 0 a consistent overall improvement in the level of mortality experienced has been recorded. However, the number of deaths is small and too much should not be read into this.

At durations 1 to 4 there appears, overall, to have been a gentle deterioration over the three quadrennia shown. There is no clear pattern at individual age groups where, again, the numbers of deaths are small and fluctuations in the experience are to be expected.

At durations 5 and over there is a useful number of deaths in most age groups. However, there is no evidence of a clear pattern in the experience recorded over the quadrennia.

2.2 *Assurances effected in conjunction with personal pensions under Section 637(1) of the ICTA 1988*

The experience is shown in Table TEMP 2.2.1. The number of deaths is too small for any conclusions to be drawn.

Table TEMP 1.1.1a. Temporary assurances, males, 1991–94, all data: actual deaths and ratios of actual deaths to those expected using the TM80 table.

Age group (nearest ages)	Actual deaths 1991–94	100A/E 1991–94	100A/E 1987–90	100A/E 1983–86
Duration 0				
16–30	26	88	108	153
31–45	107	88	102	111
46–60	187	79	89	92
61–75	73	115	91	127
16–75	393	87	95	107
Durations 1–4				
21–25	30	139	127	75
26–30	69	128	101	92
31–35	84	99	105	109
36–40	125	94	101	98
41–45	231	86	70	95
46–50	292	73	77	81
51–55	268	68	71	90
56–60	263	72	82	101
61–65	210	85	90	96
66–70	132	101	81	65
71–75	70	119	76	148
76–80	13	69	169	71*
21–80	1,787	82	82	93
Durations 5 and over				
26–30	22	93	103	91
31–35	104	111	108	95
36–40	259	94	96	98
41–45	683	80	81	88
46–50	1,175	71	71	88
51–55	1,201	64	73	82
56–60	1,279	63	76	87
61–65	1,059	69	78	88
66–70	433	81	78	84
71–75	185	82	94	82
76–80	58	96	70	36*
26–80	6,458	70	77	87

*Ratio based on fewer than 10 actual deaths.

Table TEMP 1.1.1b. Temporary assurances, males, 1991–94, medical data: actual deaths and ratios of actual deaths to those expected using the TM80 table.

Age group (nearest ages)	Actual deaths 1991–94	100A/E 1991–94	100A/E 1987–90	100A/E 1983–86
Duration 0				
All ages	67	75	67	103
Durations 1–4				
26–35	8	75	144	110
36–45	44	103	67	94
46–55	79	60	70	77
56–65	106	62	82	90
66–75	73	91	73	85
26–75	310	72	77	88
Durations 5 and over				
31–35	7	143*	155	105
36–40	13	57	129	93
41–45	90	90	86	88
46–50	194	81	63	75
51–55	176	59	75	85
56–60	218	61	66	72
61–65	209	58	75	82
66–70	133	70	78	85
71–75	75	70	93	72
76–80	37	96	70	46*
31–80	1,152	67	75	81

*Ratio based on fewer than 10 actual deaths.

Table TEMP 1.1.1c. Temporary assurances, males, 1991–94, non medical data: actual deaths and ratios of actual deaths to those expected using the TM80 table.

Age group (nearest ages)	Actual deaths 1991–94	100A/E 1991–94	100A/E 1987–90	100A/E 1983–86
Duration 0				
All ages	324	91	101	109
Durations 1–4				
26–35	141	111	101	101
36–45	299	86	86	97
46–55	462	72	79	87
56–65	352	82	91	106
66–75	125	119	80	85
26–75	1,379	84	81	95
Durations 5 and over				
26–30	19	87	98	89
31–35	94	111	106	94
36–40	230	95	93	100
41–45	563	79	80	89
46–50	927	70	74	92
51–55	951	64	72	82
56–60	990	63	78	94
61–65	780	73	80	94
66–70	278	88	78	85
71–75	103	95	101	88
76–80	20	104	100	–
26–80	4,955	71	78	90

Table TEMP 1.1.2. Temporary assurances, males, 1991–94, all data: comparison of temporary assurance mortality with that for permanent assurances using the AM80 table for both data sets.

Age group (nearest ages)	100A/E Temporary assurances	100A/E Permanent assurances
Duration 0		
16–75	79	100
Duration 1		
21–80	68	96
Durations 2 and over		
21–25	107	89
26–30	106	92
31–35	99	108
36–40	83	94
41–45	76	73
46–50	67	67
51–55	61	65
56–60	60	64
61–65	65	72
66–70	72	72
71–75	72	76
76–80	67	79
21–80	67	70

Table TEMP 1.2.1. Temporary assurances effected under section 637(1) of the ICTA 1988 (i.e. in conjunction with personal pensions), males, 1991–94, all data: actual deaths and ratios of actual deaths to those expected using the TM80 table.

Age group (nearest ages)	Actual deaths 1991–94	100A/E 1991–94	100A/E 1989–90
Duration 0			
16–30	12	150	
31–45	15	62	55
46–60	28	88	
16–60	55	86	55
Durations 1–4			
21–30	16	88	
31–35	18	97	
36–40	26	107	
41–45	31	79	57
46–50	39	78	
51–55	37	95	
56–60	21	78	
61–65	14	130	
21–65	202	89	57
Durations 5 and over			
All ages	16	65	–

Table TEMP 2.1.1. Temporary assurances, females, 1991–94, all data: actual deaths and ratios of actual deaths to those expected using the AF80 table.

Age group (nearest ages)	Actual deaths 1991–94	100A/E 1991–94	100A/E 1987–90	100A/E 1983–86
Duration 0				
All ages	85	65	70	80
Durations 1–4				
21–25	10	88	61*	77
26–30	19	51	90	64
31–35	55	87	84	85
36–40	65	76	62	62
41–45	93	83	69	78
46–50	94	81	71	67
51–55	76	77	75	55
56–60	44	52	60	57
61–65	52	80	99	73
66–70	54	103	76	36
71–75	17	47	71	94
76–80	24	91	50*	
21–80	603	76	72	68
Durations 5 and over				
26–30	12	81	55*	60
31–35	60	88	114	59
36–40	131	80	81	77
41–45	239	81	93	91
46–50	232	73	90	96
51–55	204	87	71	76
56–60	143	74	83	80
61–65	98	81	56	99
66–70	53	74	91	
71–75	41	84	40*	58
76–80	12	56	–	
26–80	1,225	79	84	82

* Ratio based on fewer than 10 actual deaths.

Table TEMP 2.2.1. Temporary assurances effected under Section 637(1) of the ICTA 1988 (i.e. in conjunction with personal pensions), females, 1991–94, all data: actual deaths and ratios of actual deaths to those expected using the AF80 table.

Age group (nearest ages)	Actual deaths 1991–94	100A/E 1991–94	100A/E 1989–90
Duration 0			
All ages	9	65*	38*
Durations 1–4			
All ages	27	54	30*
Durations 5 and over			
All ages	3	87*	–

* Ratio based on fewer than 10 actual deaths.

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THE MORTALITY OF IMMEDIATE ANNUITANTS, HOLDERS OF RETIREMENT ANNUITY POLICIES, AND HOLDERS OF PERSONAL PENSION PLANS 1991–94

The first part of this report contains analyses of the mortality of immediate annuitants over the quadrennium 1991–94. This is followed by commentaries on the experience of holders of retirement annuity contracts written under Chapter III of Part XIV of the ICTA 1988 and of personal pension policies issued under Chapter IV of Part XIV of the same Act. There is then a discussion as to which experience should be used as a basis for standard tables. The final part of the report, on pp 52 to 64, contains all the tables referred to in the earlier parts.

A good spread of offices has for many years contributed to both the immediate annuitant and the retirement annuitant investigations. When comparing the results for 1991–94 with those of earlier quadrennia it should be remembered that a handful of substantial contributors have not been able to contribute data for each year of the quadrennium. Nevertheless, the pattern of the results year by year over the quadrennium does not appear to be affected by the presence or absence in the experience of data from particular offices.

The number of offices contributing to the personal pension investigation is much smaller. The investigation started in 1989 and, apart from two offices who contributed for the first year only, the list of offices participating has been constant throughout. The policies covered by the investigation are still of relatively short duration and the experience may not be indicative of that to be expected in a mature experience.

1. MALE IMMEDIATE ANNUITANTS

Tables ANN 1.1a and ANN 1.1b show the experiences for 1991–94, on the basis of lives and amounts respectively, using as a comparison basis the projected rates for calendar year 2010 from the IM80 table. Comparisons for 1983–86 and 1987–90 are also shown.

Between 1983–86 and 1987–90, at durations 1 and over, there was some improvement in overall mortality. However, this was not consistent as between lives and amounts, neither was it consistent through the individual age groups. Between 1987–90 and 1991–94, in contrast, there has been a consistent fall in the level of mortality recorded. A similar fall occurred on both a lives and an amounts basis and the fall was seen in practically every age group. The fall

was greatest at the younger ages, which is consistent with the pattern found among life office pensioners. It should be noted that at ages up to 80 on an amounts basis, and up to 75 on a lives basis, the experience was below that forecast for year 2010 in the IM80 table.

The experience at duration 0 is consistent with that at durations 1 and over. It is worth noting that in almost all age groups the actual deaths on a lives basis are less than the number expected using the rates forecast for the year 2010. This indicates that if it is desired to allow for further improvement the use of rates applicable to a calendar year beyond 2010 may be necessary.

Table ANN 1.2 compares the experience at durations 1 and over on the basis of lives with that expected for the relevant calendar year according to the IM80 projected table. This shows a consistent fall in the level of mortality recorded over the years 1990 to 1994, following a number of years of relatively stable experience. As hinted earlier above, this could be influenced in part by the mix of offices contributing data, but deeper investigation shows that this is unlikely to be the full explanation. The experience rates do appear to be diverging further from the projections underlying the IM80 table, particularly in the younger age groups. Care should be taken to ensure that any tables actually used are appropriate for the purpose in hand.

2. FEMALE IMMEDIATE ANNUITANTS

The experience recorded for female annuitants is shown in Tables ANN 2.1a and ANN 2.1b (lives and amounts respectively) using as a comparison basis the projected rates for calendar year 2010 from the IF80 table. Corresponding figures for 1983–86 and 1987-90 are also shown.

At durations 1 and over improvements in the level of mortality experienced between 1987–90 and 1991–94 have been largely below age 80 on a lives basis. Above this age the experience has been relatively stable. This pattern, showing greater improvement at the younger end of the age range, seems to be appearing in a number of experiences covering elderly lives. At ages below 75 the mortality on an amounts basis is well below that on a lives basis. This feature has been present over the last three quadrennia. Since the numbers of deaths at these ages are relatively small so too much should not be read into this. It is perhaps worthy of note, however, that the mortality recorded on an amounts basis at ages 66 to 80 in 1991–94 is less than that expected on the projected rates for calendar year 2010.

At duration 0 it is difficult to discern any real pattern, except to say that the improvement in mortality at younger ages over the past quadrennium can be observed here too.

Table ANN 2.2 compares the experience at durations 1 and over on a lives basis with that expected for the relevant calendar year according to the IF80 table. As is the case in the male experience, it looks as though there has been considerable improvement over that built into the IF80 table over the years 1991-94 following several years of stability. As was noted in the last report on these experiences (*C.M.I.R.* **14**), for some years the recorded experience over most age groups has been running below that projected in the IF80 table.

3. MALE HOLDERS OF RETIREMENT ANNUITY CONTRACTS

The experience of male holders of retirement annuity contracts in 1991–94 is shown in Tables ANN 3.1a and ANN 3.1b for policies in deferment and in payment respectively. The 'in deferment' mortality is compared against the ultimate rates from the AM80 table. The 'in payment' mortality is compared against the projected ultimate rates for the calendar year 2010 from the IM80 table. The combined experience of the in deferment policies and the in payment policies, compared with the projected ultimate rates for calendar year 2010 from the IM80 table, is shown in Table ANN 3.2. Comparative figures for 1983–86 and 1987–90 are also shown. In addition, for 1991–94 only, there is a comparison against the projected rates for 1992 from the IM80 table.

From Table ANN 3.1a it can be seen that for the in deferment section the strong improvement in mortality at all ages noted between 1983–86 and 1987–90, has not been maintained. Such improvement as there has been is mainly confined to the age groups 46 to 65. Below age 60 the mortality experience is not dissimilar to that for assured lives. However, at ages over 60 the retirement annuitant policyholders experience much lighter mortality than assured lives indicating that the less healthy lives have almost certainly transferred to the in payment section.

In Table ANN 3.1b it can clearly be seen that the mortality suffered by the retirees at the younger ages is extremely heavy. This confirms the view from the previous paragraph that at these ages there is selective retirement of the less healthy lives.

In general for the in payment group there has been continued substantial improvement in the level of mortality recorded. At ages over 75 it is well below the level found in the immediate annuitant investigation. This feature has been present in earlier quadrennia. It should be noted that, at those ages in 1991–94, the mortality recorded was generally close to that projected for calendar year 2010 in the IM80 table.

The combined experience (Table ANN 3.2) shows some interesting features. Combining the in deferment and in payment sections suppresses the effect of

selective early retirement and gives a smooth progression of the 100A/E ratios through the age range. It should be noted that, in all age groups except one, the mortality recorded was below that projected for the calendar year 1992 in the IM80 table. For almost all age groups over age 50, it is very close to, but just below, that projected for calendar year 2010 in the same table.

4. FEMALE HOLDERS OF RETIREMENT ANNUITY CONTRACTS

The experience of female holders of retirement annuity contracts in 1991–94 is shown in Tables ANN 4.1a and ANN 4.1b for policies in deferment and in payment respectively. The in deferment mortality is compared against the ultimate rates from the AF80 table. The in payment mortality is compared against the rates for the calendar year 2010 from the IF80 table. The combined experience of the in deferment and the in payment policies, compared with the projected ultimate rates for the calendar year 2010 from the IF80 table, is shown in Table ANN 4.2. Comparative figures for 1983–86 and 1987–90 are also shown. In addition, for 1991–94 only, there is a comparison against the projected rates for 1992 from the IF80 table.

From Table ANN 4.1a it can be seen that for the in deferment section there has been some small improvement in the mortality experienced at ages up to 40 and a slightly greater improvement at ages over 55. At ages up to 55 the experience is fairly similar to that of female assured lives at policy durations 2 and over. Above age 55 the in deferment retirement annuity experience is, however, much lighter, suggesting that, as in the male experience, the less healthy lives have almost certainly transferred to the in payment section.

From Table ANN 4.1b it can be seen that the mortality suffered by the young retirees is very heavy. This bears out the view that those retiring early will be the less healthy lives.

Overall there has been no improvement between 1987–90 and 1991–94 in the level of mortality experienced in the in payment section. Inspection of the individual age groups reveals a fairly consistent pattern throughout the range. Nevertheless, in 1991–94 at all ages above 65, the mortality of female retirement annuitants is generally below that of female immediate annuitants. Even so, the projected rates for calendar year 2010 from the IF80 table still contain a margin for future improvement.

The combined experience (Table ANN 4.2) shows slightly different characteristics to the males. As was also noted in the 1987–90 quadrennium, the 100A/E ratios against IF80 C10 for 1991–94 tend to fall with advancing age suggesting that the underlying shape of the IF80 curve may no longer be applicable to female retirement annuitants.

The above is confirmed by the comparison against the projected rates for 1992 from the IF80 table shown in Table ANN 4.2. It should also be noted that on this basis the 100A/E ratios for almost all age groups above age 55 were less than 100.

5. MALE HOLDERS OF PERSONAL PENSION CONTRACTS

The experience of male holders of personal pension contracts is shown in Tables ANN 5.1a and ANN 5.1b for policies in payment and in deferment respectively. The in deferment mortality is compared against the ultimate rates from the AM80 table. The in payment mortality is compared against the projected ultimate rates for calendar year 2010 from the IM80 table.

Table ANN 5.1a shows that in deferment the mortality experienced is very similar to that found among retirement annuitants in deferment. The rates are not very different from those found among assured lives at ages up to 60. Above that age the rates compared to assured lives are very light.

In the in payment section (Table ANN 5.1b) the mortality recorded is well below that of retirement annuitants in payment although the pattern, with relatively heavy mortality at the younger ages, is very similar. Personal pensions were introduced only in 1988, so the policies studied will all still be of short duration. Too much should therefore not be read into the experience as recorded so far; several factors could be operating which may influence the experience in these early years.

6. FEMALE HOLDERS OF PERSONAL PENSION CONTRACTS

The experience of female holders of personal pension contracts is shown in Tables ANN 6.1a and ANN 6.1b for policies in deferment and in payment respectively. The in deferment mortality is compared against the ultimate rates from the AF80 table. The in payment mortality is compared against the projected rates for the calendar year 2010 from the IF80 table.

Table ANN 6.1a shows that the in deferment mortality experienced by personal pension contract holders is lighter than that observed among retirement annuity contract holders. The shape of the mortality curve is, however, the same.

The mortality recorded for personal pensions in payment (Table ANN 6.1b) is, age group for age group, considerably lighter than that recorded among the retirement annuitants, reflecting the pattern observed among their male counterparts. The same cautions as to the possibility of special factors operating apply here also.

7. STANDARD TABLES

Consideration of the special characteristics of the three groups of annuitants covered by this report raises the question as to which should be used as the basis for future standard tables. Table ANN 7 shows the exposed to risk and deaths for the immediate annuitant and the in payment section of the retirement annuitant and personal pension investigations.

Traditionally, standard tables have been based on the experience of immediate annuitants. As can be seen from the table above, for males, in terms of the exposed to risk, this is now the smallest investigation. It is also heavily skewed towards the upper end of the age range, the median being approximately 80. This explains the high crude death rate. Although there is a good number of deaths, only a very small proportion, less than ten per cent, is at ages up to 75, which is where most of the mortality improvement appears to be taking place. The retirement annuity investigation is substantially larger, both in terms of exposed to risk and deaths. It is also on average much younger, the median age for the exposed to risk being approximately 70. Holders of retirement annuity policies are now, however, a closed class, although the population receiving annuities will continue to be fed by new retirees for some time to come.

As personal pensions have only been available since 1988, it follows that, in 1991–94, the average time for which a policyholder will have drawn a pension is short. This means that while the exposure is greater than that in the immediate annuitant investigation it is mainly concentrated at the younger ages, over 90% of the exposure being at ages up to 70. This explains the small number of deaths and low crude death rate.

The arguments above relate equally to the female investigations. However, different factors may be operating among the female immediate annuitant and retirement annuitant populations from those noted in the corresponding male populations. The average age of the female immediate annuitants is higher than that of their male counterparts, the median age in the exposure being about 83, with more than 90% of the deaths occurring at ages over 80. The experience, however, is a large one, considerably larger in terms of deaths than the female retirement annuitant population.

The latter is growing rapidly and has a much younger age distribution, considerably younger on average than their male counterparts. This probably reflects the fact that it is only in relatively recent years that significant numbers of women have been in business on their own behalf and have taken out retirement annuity contracts. It will therefore be a while before these women come to retire and the retirement annuitant population fully matures.

The question remains, therefore, as to whether standard tables should continue to be based only on the immediate annuitant experiences or whether a switch to using the retirement annuitant experiences would be appropriate, the personal pensioner population having few deaths and being too immature to provide a sensible basis for a standard.

Table ANN 1.1a. Immediate annuitants, males, lives, 1991–94: actual deaths and ratios of actual deaths to those expected using the projected rates for calendar year 2010 from the IM80 table.

Age group (nearest ages)	Actual deaths 1991–94	100A/E 1991–94	100A/E 1987–90	100A/E 1983–86
Duration 0				
61–70	11	73	161	134
71–75	13	98	119	83
76–80	18	120	131	163
81–85	33	99	132	102
86–90	19	99	100	146
61–90	94	103	128	126
Durations 1 and over				
61–65	15	100	135	221
66–70	72	92	131	139
71–75	158	92	124	120
76–80	442	107	126	124
81–85	780	108	123	126
86–90	821	106	110	122
91–95	444	113	104	114
96–100	123	107	112	107
61–100	2,855	107	118	128

Table ANN 1.1b. Immediate annuitants, males, amounts, 1991–94: actual deaths and ratios of actual deaths to those expected using the projected rates for calendar year 2010 from the IM80 table.

Age group (nearest ages)	Actual deaths 1991–94 (£000 pa)	100A/E 1991–94	100A/E 1987–90	100A/E 1983–86
Duration 0				
61–70	19	69	151	113
71–75	31	103	143	54
76–80	37	55	108	158
81–85	133	107	113	66
86–90	143	145	150	82
61–90	363	105	126	96
Durations 1 and over				
61–65	26	90	95	235
66–70	93	85	138	155
71–75	196	87	108	110
76–80	587	96	108	137
81–85	1,087	101	118	105
86–90	1,128	101	116	115
91–95	741	114	114	124
96–100	288	143	131	77
61–100	4,146	103	116	117

Table ANN 1.2. Immediate annuitants, males, durations 1 and over, lives, 1983–94: actual deaths for individual years expressed as a percentage of those expected using the projected rates for the relevant calendar year from the IM80 table.

Age group (nearest ages)	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
61–65	200	161	133*	132*	130*	166*	110*	71*	38*	140*	89*	0*
66–70	95	85	126	116	93	122	110	88	72	82	60	62
71–75	88	94	97	94	97	89	123	99	98	83	62	65
76–80	88	107	102	105	112	109	99	106	104	87	100	80
81–85	107	100	113	102	107	106	104	110	103	91	85	88
86–90	101	94	119	108	95	108	100	91	101	90	91	94
91–95	103	98	104	105	86	80	106	109	102	122	101	86
96–100	91	110	65	136	96	91	103	125	84	98	99	120
61–100	98	100	108	105	102	102	104	104	100	94	90	87

* Ratio based on fewer than 10 actual deaths.

Table ANN 2.1a. Immediate annuitants, females, lives, 1991–94: actual deaths and ratios of actual deaths to those expected using the projected rates for calendar year 2010 from the IF80 table.

Age group (nearest ages)	Actual deaths 1991–94	100A/E 1991–94	100A/E 1987–90	100A/E 1983–86
Duration 0				
71–75	8	94*	87	91
76–80	15	72	125	123
81–85	33	76	99	111
86–90	47	100	84	94
91–95	31	136	106	170
96–100	11	190	78	92
71–100	145	98	99	115
Durations 1 and over				
61–65	12	122	212	206
66–70	46	132	136	140
71–75	125	111	122	136
76–80	362	97	109	116
81–85	1,084	107	112	121
86–90	1,782	104	109	118
91–95	1,635	109	106	118
96–100	694	109	109	117
61–100	5,740	106	110	120

* Ratio based on fewer than 10 actual deaths.

Table ANN 2.1b. Immediate annuitants, females, amounts, 1991–94: actual deaths and ratios of actual deaths to those expected using the projected rates for calendar year 2010 from the IF80 table.

Age group (nearest ages)	Actual deaths 1991–94 (£000 pa)	100A/E 1991–94	100A/E 1987–90	100A/E 1983–86
Duration 0				
71–75	12	49	66	86
76–80	57	85	96	101
81–85	152	87	116	101
86–90	261	117	79	94
91–95	166	130	113	195
96–100	67	147	87	80
71–100	715	108	97	110
Durations 1 and over				
61–65	14	111	164	156
66–70	36	71	125	125
71–75	151	90	112	114
76–80	535	94	97	106
81–85	1,628	103	101	125
86–90	2,644	103	109	120
91–95	2,252	117	113	118
96–100	761	109	117	120
61–100	8,021	106	108	119

Table ANN 2.2. Immediate annuitants, females, durations 1 and over, lives, 1983–94: actual deaths for individual years expressed as a percentage of those expected using the projected rates for the relevant calendar year from the IF80 table.

Age group (nearest ages)	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
61–65	123*	115*	218	136*	216*	29*	206*	189*	118*	100*	67*	53*
66–70	113	100	95	106	111	109	114	91	148	82	106	123*
71–75	107	100	120	93	96	92	105	112	105	87	99	96
76–80	99	95	94	87	84	109	86	95	94	93	68	91
81–85	103	101	96	108	94	97	101	101	107	84	90	103
86–90	111	91	108	101	97	94	96	103	98	104	81	79
91–95	112	98	113	100	107	95	98	91	96	96	101	94
96–100	116	106	105	108	95	106	110	100	98	103	92	92
61–100	108	97	105	101	97	98	99	99	99	96	90	91

* Ratio based on fewer than 10 actual deaths.

Table ANN 3.1a. Retirement annuity policies in deferment, males, 1991–94: actual deaths and ratios of actual deaths to those expected using the ultimate rates from the AM80 table.

Age group (nearest ages)	Actual deaths 1991–94	100A/E 1991–94	100A/E 1987–90	100A/E 1983–86
21–25	21	77	61	90
26–30	83	84	73	86
31–35	204	94	100	106
36–40	417	90	86	99
41–45	947	79	79	92
46–50	1,779	73	75	88
51–55	2,529	69	72	81
56–60	3,595	65	72	86
61–65	3,565	63	70	77
66–70	1,210	56	54	65
71–75	302	56	50	55
21–75	14,652	67	71	81

Table ANN 3.1b. Retirement annuity policies in course of payment, males, 1991–94: actual deaths and ratios of actual deaths to those expected using the ultimate rates for the calendar year 2010 from the IM80 table.

Age group (nearest ages)	Actual deaths 1991–94	100A/E 1991–94	100A/E 1987–90	100A/E 1983–86
51–55	140	627	1,017	1,486
56–60	361	344	414	558
61–65	1,877	139	164	183
66–70	4,504	104	122	130
71–75	4,996	105	117	125
76–80	4,085	99	112	123
81–85	2,729	99	112	122
86–90	1,165	101	104	106
91–95	242	97	95	85
96–100	28	76	88	50*
51–100	20,127	107	121	130

* Ratio based on fewer than 10 actual deaths.

Table ANN 3.2. Retirement annuity policies, in deferment and in payment combined, males, 1991–94: actual deaths and ratios of actual deaths to those expected using the ultimate rates from the IM80 table for the calendar years 1992 and 2010.

Age group (nearest ages)	Actual deaths$^{\varphi}$ 1991–94	100A/E 1991–94 C1992	100A/E 1991–94 C2010	100A/E 1987–90 C2010	100A/E 1983–86 C2010
21–25	21	81	105	81	118
26–30	85	93	118	100	118
31–35	208	105	132	137	145
36–40	422	98	124	119	135
41–45	964	87	110	109	126
46–50	1,821	81	102	105	122
51–55	2,669	79	99	102	114
56–60	3,956	75	95	104	122
61–65	5,442	78	96	108	115
66–70	5,714	80	95	109	114
71–75	5,298	88	103	112	119
76–80	4,085	87	99	112	123
81–85	2,729	89	99	112	122
86–90	1,165	93	101	104	106
91–95	242	91	97	89	79
96–100	28	74	76		
21–100	34,849	83	99	108	118

φ Includes deaths among retirees at ages below 50.

Table ANN 4.1a. Retirement annuity policies in deferment, females, 1991–94: actual deaths and ratios of actual deaths to those expected using the ultimate rates from the AF80 table.

Age group (nearest ages)	Actual deaths 1991–94	100A/E 1991–94	100A/E 1987–90	100A/E 1983–86
21–30	9	71*	51	94*
31–35	22	82	86	104
36–40	46	78	81	101
41–45	122	81	78	85
46–50	271	90	75	100
51–55	357	78	78	76
56–60	412	65	82	85
61–65	283	65	72	79
66–70	116	58	59	66
71–75	31	56	66	101
21–75	1,669	72	76	84

* Ratio based on fewer than 10 actual deaths.

Table ANN 4.1b. Retirement annuity policies in course of payment, females, 1991–94: actual deaths and ratios of actual deaths to those expected using the ultimate rates for calendar year 2010 from the IF80 table.

Age group (nearest ages)	Actual deaths 1991–94	100A/E 1991–94	100A/E 1987–90	100A/E 1983–86
51–55	28	875	1,000	692*
56–60	85	425	322	379
61–65	396	150	146	135
66–70	502	108	115	150
71–75	532	103	103	111
76–80	447	95	106	106
81–85	392	103	99	127
86–90	239	114	94	128
91–95	52	93	89	84*
96–100	10	79	83*	
51–100	2,683	112	112	125

* Ratio based on fewer than 10 actual deaths.

Table ANN 4.2. Retirement annuity policies, in deferment and in payment combined, females, 1991–94: actual deaths and ratios of actual deaths to those expected using the ultimate rates for the calendar years 1992 and 2010 from the IF80 table.

Age group (nearest ages)	Actual deaths$^{\varphi}$ 1991–94	100A/E 1991–94 C1992	100A/E 1991–94 C2010	100A/E 1987–90 C2010	100A/E 1983–86 C2010
21–25	3	150*	150*	78	147
26–30	6	75	100		
31–35	22	105	129	141	166
36–40	47	100	127	128	161
41–45	125	105	133	125	137
46–50	279	117	148	122	162
51–55	385	104	131	128	123
56–60	497	92	116	135	139
61–65	679	98	120	123	122
66–70	618	84	100	106	129
71–75	563	86	101	101	113
76–80	447	83	95	106	106
81–85	392	93	103	99	127
86–90	239	105	114	94	128
91–95	52	87	93	83	85
96–100	10	77	77		
21–100	4,364	93	111	114	128

* Ratio based on fewer than 10 actual deaths.

φ Includes deaths among retirees at ages below 50.

Table ANN 5.1a. Personal pension policies in deferment, males, 1991–94: actual deaths and ratios of actual deaths to those expected using the AM80 table.

Age group (nearest ages)	Actual deaths 1991–94	100A/E 1991–94	100A/E 1989–90
21–25	260	97	40
26–30	306	85	63
31–35	363	95	43
36–40	412	84	57
41–45	676	78	41
46–50	906	70	46
51–55	887	67	42
56–60	971	63	41
61–65	720	57	40
66–70	223	47	29
71–75	72	43	15
21–75	5,796	69	42

Table ANN 5.1b. Personal pension policies in payment, males, 1991–94: actual deaths and ratios of actual deaths to those expected using the ultimate rates for calendar year 2010 from the IM80 table.

Age group (nearest ages)	Actual deaths 1991–94	100A/E 1991–94	100A/E 1989–90
51–55	57	167	
56–60	95	131	140
61–65	141	95	
66–70	183	78	97
71–75	59	66	
76–80	19	54	–
51–80	554	90	112

Table ANN 6.1a. Personal pension policies in deferment, females, 1991–94: actual deaths and ratios of actual deaths to those expected using the ultimate rates from the AF80 table.

Age group (nearest ages)	Actual deaths 1991–94	100A/E 1991–94	100A/E 1989–90
21–25	57	67	54
26–30	70	58	38
31–35	107	82	22
36–40	130	76	26
41–45	205	76	41
46–50	228	71	44
51–55	210	66	46
56–60	142	51	50
61–65	65	49	46
66–70	20	40	34*
71–75	9	44*	47*
21–75	1,243	65	41

* Ratio based on fewer than 10 actual deaths.

Table ANN 6.1b. Personal pension policies in payment, females, 1991–94: actual deaths and ratios of actual deaths to those expected using the ultimate rates for calendar year 2010 from the IF80 table.

Age group (nearest ages)	Actual deaths 1991–94	100A/E 1991–94	100A/E 1989–90
51–55	15	234	
56–60	31	182	
61–65	29	85	75*
66–70	20	95	
71–80	11	71	
51–80	106	113	75*

* Ratio based on fewer than 10 actual deaths.

Table ANN 7. Immediate annuitants (lives), retirement annuitants and personal pensioners.
Exposed to risk and deaths over recent quadrennia.

		1991–94	1987–90	1983–86
Males				
	Immediate annuitants			
	Exposed to risk (000)	40	50	53
	Deaths	2,990	4,060	4,066
	Crude death rate	.075	.081	.076
	Retirement annuities in payment			
	Exposed to risk (000)	641	648	411
	Deaths	20,200	22,731	15,563
	Crude death rate	.032	.035	.038
	Personal pensions in payment*			
	Exposed to risk (000)	50	2	–
	Deaths	564	25	–
	Crude death rate	.011	.013	–
Females				
	Immediate annuitants			
	Exposed to risk (000)	74	101	119
	Deaths	6,009	7,752	8,566
	Crude death rate	.081	.076	.072
	Retirement annuities in payment			
	Exposed to risk (000)	151	133	74
	Deaths	2,695	2,345	1,451
	Crude death rate	.018	.018	.020
	Personal pensions in payment*			
	Exposed to risk (000)	20	0.6	–
	Deaths	110	2	–
	Crude death rate	.006	.003	–

* Investigation started 1st January 1989.

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THE MORTALITY OF PENSIONERS IN INSURED GROUP PENSION SCHEMES 1991–94

This report contains commentaries on the experience recorded over 1991–94 for male and female pensioners, and for widows and widowers of pensioners. As has always been the case in the C.M.I. investigations the pensioners concerned are those covered by schemes under which the benefits are insured through life offices. The database does not currently include pensioners who are members of self administered schemes. The tables supporting the text can be found on pp 71 to 82.

When comparing results for the quadrennium 1991–94 with those for earlier quadrennia, it should be noted that, while the list of contributors to the investigations has remained largely unchanged over many years, a handful of offices were not able to contribute for every year of the 1991–94 quadrennium and that two offices which, in the past, have always provided data were unable to contribute at all.

The experiences, both male and female, are large. With such large experiences it is surprising how much variation there is in the mortality recorded from year to year. A certain amount of volatility is to be expected with amounts data, but the same phenomenon is also present in the lives experience. This is not new; it is a long standing feature of the investigation. It cannot depend on the mix of offices contributing in any particular year since, as previously observed, this has been relatively stable. Further investigation shows that the phenomenon is reflected over most of the contributing offices. It seems that the mortality experience of older people varies from year to year more than that of those in the younger age groupings.

It is also worth considering the structure of the investigation. The experiences are divided into those where the pensioner retired at or after the normal age (referred to for simplicity as 'normal' retirements) and those who retired before the normal age (referred to as 'early' retirements). Up until the mid 1980s this was more or less equivalent to a split between healthy retirements and ill health retirements. Since the mid 1980s, however, an increasing proportion of healthy lives have been retiring early. This could have two effects. Firstly, the mortality experienced by early retirees would be expected to improve relative to that of normal retirees. There is some evidence that this may be happening at ages up to 60. In time this phenomenon could work up into the higher age groups.

Secondly, the fact that a number of healthy lives are now entering the early retirement group means that the normal retirement group is missing a

substantial number of persons who would, in other circumstances, have been included in it. This raises the question as to whether these 'missing' people are typical of the group as a whole or whether, once they are removed, we are, in fact, being left with a normal experience containing a select body of lives which exhibit different characteristics from those previously observed. These remarks simply highlight the fact that these are complex experiences where a number of inter-related factors are very probably operating. Due consideration should be given to all these factors when relying on the results from the experiences to select a basis for use in connection with any individual portfolio.

1. MALE PENSIONERS

Tables PEN 1.1a, PEN 1.2a and PEN 1.3a give the experience for the quadrennium 1991–94 on the basis of lives for, respectively, normal retirements, early retirements and all retirements combined. Tables PEN 1.1b, PEN 1.2b and PEN 1.3b give the corresponding experience on the basis of amounts. Each table uses as a comparison basis the projected mortality rates for the calendar year 2010 from the PMA80 table. A comparison of the actual experience for normal retirements year by year, on an amounts basis, against the projected rates for the corresponding year from the PMA80 table can be found in Table PEN 1.4. Tables PEN 1.5a and PEN 1.5b show the size of the experiences together with the average pensions in payment.

From tables PEN 1.1a and PEN 1.1b it can be seen that the fall in levels of male pensioner mortality, noted over previous quadrennia, has continued. However, closer inspection reveals that in 1991–94 the most significant improvements have been concentrated at ages below 80. A continuing feature of the experience which can clearly be seen from comparison between the two tables is the gap between the levels of mortality recorded on a lives basis and on an amounts basis, the amounts basis mortality being the lighter. The gap is reasonably stable over time. Looked at age group by age group the gap is largest at the young ages and decreases as age increases.

It should be noted that, in 1991–94 in the amounts experience, in all age groups but one up to age 85 the actual deaths were 100% or less of those expected on PMA80C10 and that for all ages combined 100A/E on the same basis was 98. This indicates that, if the PMA80 table is used for valuation or pricing, then a projection period ending beyond 2010 may be appropriate for use in practice. Just how far the amounts experience has moved from the projections introduced with the PMA80 table can be seen in Table PEN 1.4, where the actual deaths year by year are compared with those expected using

the relevant projected rates. Although the ratios do not run smoothly, the overall trend can clearly be seen, as can the relatively greater than projected improvement at the younger ages. It was noted in the report on the 1987–90 experiences that the lives experience had been more or less as projected. Over 1991–94 this has changed and the mortality rates for lives are now falling below those expected using the projections published with the lives table. Bearing in mind such mortality improvements are continuing to occur, the Committee has produced proposed new base tables for pensioners (see pp 113 to 141).

The experience of pensioners who retired before the normal age is shown in Tables PEN 1.2a and PEN 1.2b (lives and amounts respectively). As would be expected, the overall level of mortality is considerably heavier than that of pensioners retiring at or after the normal age; the difference is greatest at the younger ages and tails off, becoming negative in the lives experience above age 80. This pattern has been consistent over a number of quadrennia, and the size of the differential has been remarkably steady over time. With an increasing number of healthy retirees in the early retirement exposed to risk, we might expect the differential to fall, but there is so far little evidence of this except in the age groups up to age 60. The gap between the experience as measured by lives and amounts, observed among normal and late retirees, is present here also and is of a similar size.

Tables PEN 1.3a and PEN 1.3b (lives and amounts respectively) give the experience for all pensioners combined. It is salutary to note that, at ages over 65, on an amounts basis, the observed rates have already virtually fallen to those projected for the calendar year 2010 on the PMA80 table. The amounts experience has also been compared in the Bureau with the projected rates for 1992 from the PCMA80 table, the base rates for which were published in *C.M.I.R.* **13** (comparisons not shown); at all but the highest ages the actual experience is well below the projection, particularly so at the younger ages.

Tables PEN 1.5a and PEN 1.5b show the size of the data, on a normal retirements and an early retirements basis respectively, together with average pensions per annum. A long standing feature is the substantial rise in the amount of average pensions, quadrennium by quadrennium. This reflects not only inflation (pre and post retirement) but also the increasing maturity of funds. Average pensions for normal retirees were, in almost all cases age for age, greater than those for early retirees. Also, within each age group (except at the oldest ages) average pensions among the exposed to risk were greater than those for pensioners in the same group who had died. Both features have been noted before and form part of a now expected pattern.

2. FEMALE PENSIONERS

Tables PEN 2.1a, PEN 2.2a and PEN 2.3a respectively, give the experience for the quadrennium 1991–94 on the basis of lives for normal retirements, early retirements and all retirements combined. Tables PEN 2.1b, PEN 2.2b and PEN 2.3b give the corresponding experience on the basis of amounts. Each table uses as a comparison basis the projected mortality rates for the calendar year 2010 from the PFA80 table. A comparison of the actual experience year by year on an amounts basis, against the projected rates for the corresponding year, can be found in Table PEN 2.4. Tables PEN 2.5a and PEN 2.5b show the size of the experiences together with the average pensions in payment.

In Tables PEN 2.1a and PEN 2.1b it can be seen that the improvement in mortality among those retiring at or above the normal age, which was noted over earlier quadrennia, has continued into the current quadrennium. However, on both a lives and an amounts basis, the projected rates for calendar year 2010 still contain a margin for future improvement in mortality over current levels. The gap between the level of mortality recorded on a lives basis and the level recorded on an amounts basis, noted in the male experience, is present in the female experience also. It is much smaller among the females than among the males.

The experience, on an amounts basis, measured against the projected rates year by year, shown in Table PEN 2.4, indicates that, overall, the projections issued with the PFA80 table are not unreasonable. Looked at age group by age group the experience is more volatile and it is difficult to identify persistent trends. On a lives basis using the PFL80 table, the experience over the quadrennium was virtually 100 per cent of projection. However, it was a quadrennium of two halves, the mortality in 1991 and 1992 being in excess of that expected for those years and that for 1993 and 1994 being lighter than projected. The lighter than projected mortality has continued into 1995, the last year for which results were available at the time of writing.

The mortality experience of pensioners retiring before the normal age is shown in Tables PEN 2.2a and PEN 2.2b (lives and amounts respectively). The improvement in mortality for this group, noted over previous quadrennia, has continued. Even so, the mortality level is still considerably higher than that recorded for normal retirees. On an age by age basis the difference is greatest at the younger ages and tails off as age increases, disappearing altogether by the mid 70's or so. As is the case with normal retirees, the gap between the experience on a lives basis and the experience on an amounts basis is smaller than the corresponding gap recorded in the male experience.

The level of mortality recorded for all pensioners combined shown in Tables PEN 2.3a and PEN 2.3b (lives and amounts respectively) is, as would be

expected, between that of the normal and late retirees and the early retirees. On both a lives and an amounts basis it is well above that projected for the calendar year 2010 in the PFA80 table. When compared against the projected rates for the quadrennium from the PCFA80 combined pensioners table (comparisons not shown) the experience for all ages combined shows the actual deaths, on an amounts basis, were 100% of those expected. However, the rates in the PCFA80 table do not reflect the experience age by age, being too low for ages 66 to 75 and too high elsewhere.

The exposed to risk and deaths, on the basis of both lives and amounts, is shown for normal retirements in Table PEN 2.5a and for early retirements in Table PEN 2.5b, both of which also give average pensions. As was seen in the male experience, average pensions have continued the rise over time, as was noted in earlier quadrennia. They are, however, considerably lower on average than those payable to their male counterparts. This almost certainly reflects the lower average salaries earned by women and a shorter than average period of qualifying service. Following the established pattern, average pensions paid to the normal and late retirees were, in almost all cases, age for age greater than those paid to the early retirees. Also, average pensions among the exposed to risk were generally greater than those for pensioners who had died.

3. WIDOWS OF PENSIONERS

Tables PEN 3.1a and PEN 3.1b show the mortality experience of pensioners' widows over the quadrennium 1991–94 on the basis of lives and amounts respectively. Comparisons are shown on two bases, WA80 and PFA80. In each case the projected rates for calendar year 2010 are used.

As can be seen from the tables, the mortality experienced by this group continues to improve, although the improvement is mainly confined to the age groups over 70. For all ages combined, on both a lives and an amounts basis, it is still heavier than that experienced by women drawing pensions in their own right who retired at or after their normal age. The excess, however, is distinctly age related. For ages 56 to 80 the widows' mortality is the heavier, the difference tapering off as age increases. At ages over 80 the mortality of women drawing pensions in their own right is higher than that for widows. This indicates that while there is still some degree of leeway in PFA80 for this group as a whole, care should be exercised if the portfolio is heavily weighted towards the older ages.

The comparisons against WA80 indicate that the rates in the standard table at the upper ages are far too heavy. They show somewhat more clearly the differential improvement of the younger and older age groups. The shape of

the underlying curve clearly does not reflect current experience and the table now contains no margin for future improvement.

4. WIDOWERS OF PENSIONERS

The experience for widowers is shown in Tables PEN 3.2a and PEN 3.2b utilising the projected rates for the calendar year 2010 from the PMA80 table as a comparison basis. It is still very limited with only 100 deaths in total. The apparent deterioration of the experience over the quadrennium 1987–90 looks to have been reversed. On a lives basis there seems to have been some improvement in almost all age groups. The amounts figure shows no clear pattern, a not unexpected result. The experience is still too small to allow firm conclusions to be drawn, apart from the overall indication that widowers experience heavier mortality than males drawing pensions in their own right.

Table PEN 1.1a. Pensioners, males, normal retirements, lives, 1991–94: actual deaths and ratios of actual deaths to those expected using the projected rates for calendar year 2010 from the PMA80 table.

Age group (nearest ages)	Actual deaths 1991–94	100A/E 1991–94	100A/E 1987–90	100A/E 1983–86
51–55	27	203	333	289*
56–60	123	181	197	226
61–65	773	138	166	175
66–70	5,721	127	140	156
71–75	9,767	124	138	145
76–80	16,635	120	129	137
81–85	16,898	116	122	130
86–90	9,899	111	114	123
91–95	3,253	106	109	112
96–100	462	88	96	109
51–100	63,558	118	127	138

* Ratio based on fewer than 10 actual deaths.

Table PEN 1.1b. Pensioners, males, normal retirements, amounts, 1991–94: actual deaths and ratios of actual deaths to those expected using the projected rates for calendar year 2010 from the PMA80 table.

Age group (nearest ages)	Actual deaths 1991–94 (£000 pa)	100A/E 1991–94	100A/E 1987–90	100A/E 1983–86
51–55	44	80	207	210
56–60	315	101	66	259
61–65	2,014	94	117	153
66–70	8,026	93	107	125
71–75	10,605	97	111	117
76–80	11,474	97	106	117
81–85	8,305	100	103	119
86–90	4,194	118	110	116
91–95	1,000	106	105	117
96–100	119	89	104	114
51–100	46,096	98	108	121

Table PEN 1.2a. Pensioners, males, early retirements, lives, 1991–94: actual deaths and ratios of actual deaths to those expected using the projected rates for calendar year 2010 from the PMA80 table.

Age group (nearest ages)	Actual deaths 1991–94	100A/E 1991–94	100A/E 1987–90	100A/E 1983–86	Ratio Early/Normal*
51–55	122	304	301	511	1.50
56–60	481	243	277	342	1.34
61–65	1,613	178	207	243	1.29
66–70	3,802	163	178	199	1.28
71–75	5,694	147	157	164	1.19
76–80	5,207	126	135	147	1.05
81–85	3,693	111	120	131	.96
86–90	1,409	102	107	117	.92
91–95	258	97	92	122	.92
96–100	30	86	103	114	.98
51–100	22,309	135	155	180	1.14

* Ratio of 100A/E for early retirements to 100A/E for normal retirements 1991–94.

Table PEN 1.2b. Pensioners, males, early retirements, amounts, 1991–94: actual deaths and ratios of actual deaths to those expected using the projected rates for calendar year 2010 from the PMA80 table.

Age group (nearest ages)	Actual deaths 1991–94 (£000 pa)	100A/E 1991–94	100A/E 1987–90	100A/E 1983–86	Ratio Early/Normal*
51–55	111	188	180	379	2.35
56–60	679	164	217	267	1.62
61–65	2,920	129	149	200	1.37
66–70	4,661	107	143	152	1.15
71–75	5,138	111	134	140	1.14
76–80	3,640	111	121	132	1.14
81–85	1,814	104	117	130	1.04
86–90	526	97	102	108	.82
91–95	79	106	85	187	1.00
96–100	5	73	111	79	.82
51–100	19,573	113	139	162	1.15

* Ratio of 100A/E for early retirements to 100A/E for normal retirements 1991–94.

Table PEN 1.3a. Pensioners, males, normal and early retirements combined, lives, 1991–94: actual deaths and ratios of actual deaths to those expected using the projected rates for calendar year 2010 from the PMA80 table.

Age group (nearest ages)	Actual deaths 1991–94	100A/E 1991–94	100A/E 1987–90	100A/E 1983–86
51–55	149	279	304	498
56–60	604	227	269	335
61–65	2,386	163	196	229
66–70	9,523	139	155	170
71–75	15,461	132	143	149
76–80	21,842	122	130	138
81–85	20,591	115	121	130
86–90	11,308	109	113	122
91–95	3,511	105	108	112
96–100	492	88	91	109
51–100	85,867	122	134	147

Table PEN 1.3b. Pensioners, males, normal and early retirements combined, amounts, 1991–94: actual deaths and ratios of actual deaths to those expected using the projected rates for calendar year 2010 from the PMA80 table.

Age group (nearest ages)	Actual deaths 1991–94 (£000 pa)	100A/E 1991–94	100A/E 1987–90	100A/E 1983–86
51–55	155	136	185	369
56–60	994	137	193	266
61–65	4,934	112	138	186
66–70	12,687	98	120	134
71–75	15,743	101	117	123
76–80	15,114	100	109	119
81–85	10,119	101	105	120
86–90	4,720	115	109	116
91–95	1,079	106	104	119
96–100	124	88	104	113
51–100	65,669	102	116	132

Table PEN 1.4. Pensioners, males, normal retirements, amounts 1983–94: actual deaths for individual years expressed as a percentage of those expected using the projected rates for the relevant calendar year from the PMA80 table.

Age group (nearest ages)	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
61–65	94	112	108	120	80	91	92	98	56	77	80	79
66–70	94	99	95	86	82	90	89	77	81	75	73	65
71–75	91	93	96	87	96	88	91	88	66	85	79	83
76–80	101	90	90	97	92	91	91	87	84	83	85	85
81–85	103	106	100	93	94	86	94	82	78	87	88	86
86–90	107	99	103	98	105	101	96	91	107	102	106	76
91–95	100+	106+	120+	93+	96	89	114	85	110	117	88	77
96–100					100	107	108	67	95	93	61	75
61–100	97*	97*	96*	92*	92	90	92	85	78	84	83	79

+ Ages 91 and over.
* All ages.

Table PEN 1.5a. Pensioners, males, normal retirements, 1991–94: exposed to risk, deaths and average pensions.

	Exposed to Risk			Deaths		
Age group (nearest ages)	Lives	Amounts (£000 pa)	Average Pension (£pa)	Lives	Amounts (£000 pa)	Average Pension (£pa)
51–55	3,897	15,859	4,069	27	44	1,616
56–60	11,623	53,198	4,577	123	315	2,562
61–65	50,908	203,662	4,001	773	2,014	2,605
66–70	239,170	460,256	1,924	5,721	8,026	1,403
71–75	235,327	334,590	1,422	9,767	10,605	1,086
76–80	238,522	208,818	875	16,635	11,474	690
81–85	159,005	91,457	575	16,898	8,305	491
86–90	63,922	25,627	401	9,899	4,194	424
91–95	15,341	4,757	310	3,253	1,000	307
96–100	1,880	483	257	462	119	258
51–100	1,019,595	1,398,707	1,372	63,558	46,096	725

Table PEN 1.5b. Pensioners, males, early retirements, 1991–94: exposed to risk, deaths and average pensions.

	Exposed to Risk			Deaths		
Age group (nearest ages)	Lives	Amounts (£000 pa)	Average Pension (£pa)	Lives	Amounts (£000 pa)	Average Pension (£pa)
51–55	11,719	17,006	1,451	122	111	906
56–60	33,934	70,127	2,067	481	679	1,412
61–65	85,897	214,997	2,503	1,613	2,920	1,810
66–70	123,191	235,704	1,913	3,802	4,661	1,226
71–75	117,692	142,340	1,209	5,694	5,138	902
76–80	72,380	58,927	814	5,207	3,640	699
81–85	36,622	19,482	532	3,693	1,814	491
86–90	10,067	3,961	393	1,409	526	373
91–95	1,352	382	283	258	79	306
96–100	126	24	189	30	5	158
51–100	492,980	762,950	1,548	22,309	19,573	877

Table PEN 2.1a. Pensioners, females, normal retirements, lives, 1991–94: actual deaths and ratios of actual deaths to those expected using the projected rates for calendar year 2010 from the PFA80 table.

Age group (nearest ages)	Actual deaths 1991–94	100A/E 1991–94	100A/E 1987–90	100A/E 1983–86
51–55	18	321	267*	357*
56–60	69	218	201	177
61–65	545	162	179	191
66–70	1,189	158	168	164
71–75	1,995	141	152	143
76–80	2,524	124	128	130
81–85	3,086	117	117	122
86–90	2,379	108	115	118
91–95	1,194	117	120	134
96–100	247	121	127	120
51–100	13,246	124	132	136

* Ratio based on fewer than 10 actual deaths.

Table PEN 2.1b. Pensioners, females, normal retirements, amounts, 1991–94: actual deaths and ratios of actual deaths to those expected using the projected rates for calendar year 2010 from the PFA80 table.

Age group (nearest ages)	Actual deaths 1991–94 (£000 pa)	100A/E 1991–94	100A/E 1987–90	100A/E 1983–86
51–55	31	306	926	221
56–60	60	123	130	132
61–65	620	143	166	171
66–70	1,021	123	132	135
71–75	1,333	134	123	127
76–80	946	99	121	114
81–85	856	104	110	103
86–90	468	101	113	119
91–95	228	117	130	138
96–100	35	129	128	142
51–100	5,598	117	127	127

Table PEN 2.2a. Pensioners, females, early retirements, lives, 1991–94: actual deaths and ratios of actual deaths to those expected using the projected rates for calendar year 2010 from the PFA80 table.

Age group (nearest ages)	Actual deaths 1991–94	100A/E 1991–94	100A/E 1987–90	100A/E 1983–86	Ratio Early/Normal*
51–55	34	315	317	365	.98
56–60	149	277	257	303	1.27
61–65	343	218	227	245	1.35
66–70	517	178	217	198	1.13
71–75	541	157	160	157	1.11
76–80	442	128	126	136	1.03
81–85	348	101	116	112	.86
86–90	247	108	111	127	1.00
91–95	92	101	115	109	.86
96–100	29	140	73**	147**	1.16
51–100	2,742	145	167	178	1.17

* Ratio of 100A/E for early retirements to 100A/E for normal retirements 1991–94.
** Ratio based on fewer than 10 actual deaths.

Table PEN 2.2b. Pensioners, females, early retirements, amounts, 1991–94: actual deaths and ratios of actual deaths to those expected using the projected rates for calendar year 2010 from the PFA80 table.

Age group (nearest ages)	Actual deaths 1991–94 (£000 pa)	100A/E 1991–94	100A/E 1987–90	100A/E 1983–86	Ratio Early/Normal*
51–55	55	484	171	285	1.58
56–60	161	266	173	263	2.16
61–65	272	190	203	230	1.33
66–70	247	140	173	171	1.14
71–75	202	131	131	153	.98
76–80	141	131	94	122	1.32
81–85	59	82	90	100	.79
86–90	37	106	123	125	1.05
91–95	7	58	173	123	.50
96–100	2	112	100	134	.87
51–100	1,183	153	157	190	1.31

* Ratio of 100A/E for early retirements to 100A/E for normal retirements 1991–94.

Table PEN 2.3a. Pensioners, females, normal and early retirements combined, lives, 1991–94: actual deaths and ratios of actual deaths to those expected using the projected rates for calendar year 2010 from the PFA80 table.

Age group (nearest ages)	Actual deaths 1991–94	100A/E 1991–94	100A/E 1987–90	100A/E 1983–86
51–55	52	317	308	377
56–60	218	256	242	274
61–65	888	180	196	207
66–70	1,706	163	179	171
71–75	2,536	144	153	145
76–80	2,966	124	128	130
81–85	3,434	115	117	121
86–90	2,626	108	115	119
91–95	1,286	115	119	137
96–100	276	123	124	121
51–100	15,988	128	137	142

Table PEN 2.3b. Pensioners, females, normal and early retirements combined, amounts, 1991–94: actual deaths and ratios of actual deaths to those expected using the projected rates for calendar year 2010 from the PFA80 table.

Age group (nearest ages)	Actual deaths 1991–94 (£000 pa)	100A/E 1991–94	100A/E 1987–90	100A/E 1983–86
51–55	86	400	339	277
56–60	221	203	159	224
61–65	892	155	176	186
66–70	1,268	126	140	141
71–75	1,535	133	124	130
76–80	1,087	103	119	115
81–85	915	103	109	103
86–90	505	102	114	119
91–95	235	113	132	137
96–100	37	128	127	142
51–100	6,781	122	132	136

Table PEN 2.4. Pensioners, females, normal retirements, amounts 1983–94: actual deaths for individual years expressed as a ratio of those expected using the projected rates from the relevant calendar year from the PFA80 table.

Age group (nearest ages)	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
61–65	132	139	132	92	151	140	109	108	95	143	103	183
66–70	146	100	87	83	131	110	97	84	93	144	82	96
71–75	95	97	104	100	101	85	106	105	80	138	119	172
76–80	93	104	100	77	93	93	113	115	93	77	84	89
81–85	84	86	95	83	93	96	106	86	137	92	68	113
86–90	115	94	104	102	94	95	106	116	109	104	86	61
91–95	90[+]	183[+]	130[+]	98[+]	129	120	112	114	150	104	112	82
96–100					103	130	161	85	144	137	75	74
61–100	108[*]	105[*]	103[*]	88[*]	110	102	107	101	100	115	92	120

[+] Ages 91 and over.
[*] All ages.

Table PEN 2.5a. Pensioners, females, normal retirements, 1991–94: exposed to risk, deaths and average pensions.

	Exposed to Risk			Deaths		
Age group (nearest ages)	Lives	Amounts (£000 pa)	Average Pension (£pa)	Lives	Amounts (£000 pa)	Average Pension (£pa)
51–55	2,836	5,156	1,818	18	31	1,731
56–60	9,121	14,311	1,569	69	60	873
61–65	60,063	77,137	1,284	545	620	1,137
66–70	77,432	86,488	1,117	1,189	1,021	859
71–75	79,720	57,447	721	1,995	1,333	668
76–80	58,678	28,083	479	2,524	946	375
81–85	42,106	13,296	316	3,086	856	277
86–90	21,464	4,543	212	2,379	468	197
91–95	6,887	1,315	191	1,194	228	191
96–100	1,033	137	133	247	35	141
51–100	359,340	287,913	801	13,246	5,598	423

Table PEN 2.5b. Pensioners, females, early retirements, 1991–94: exposed to risk, deaths and average pensions.

	Exposed to Risk			Deaths		
Age group (nearest ages)	Lives	Amounts (£000 pa)	Average Pension (£pa)	Lives	Amounts (£000 pa)	Average Pension (£pa)
51–55	5,344	5,615	1,051	34	55	1,615
56–60	16,202	18,270	1,128	149	161	1,084
61–65	28,287	26,162	925	343	272	792
66–70	30,184	18,701	620	517	247	479
71–75	19,980	9,107	456	541	202	374
76–80	10,134	3,238	320	442	141	320
81–85	5,543	1,168	211	348	59	168
86–90	2,243	339	151	247	37	149
91–95	616	84	136	92	7	77
96–100	106	7	70	29	2	57
51–100	118,639	82,691	697	2,742	1,183	431

Table PEN 3.1a. Widows, lives, 1991–94: actual deaths and ratios of actual deaths to those expected using the projected rates for calendar 2010 from the WA80 table and the PFA80 table.

Age group (nearest ages)	Actual deaths 1991–94	100 A/E by WA80 C10			100A/E by PFA80 C10		
		1991–94	1987–90	1983–86	1991–94	1987–90	1983–86
41–50	14	159	229	257	237	339	383
51–55	29	175	172	182	258	253	268
56–60	99	205	157	189	298	228	274
61–65	221	146	148	147	210	213	211
66–70	601	143	132	161	202	187	228
71–75	1,041	122	125	118	159	163	155
76–80	1,311	110	105	112	126	122	130
81–85	1,129	99	113	118	106	120	126
86–90	704	97	100	95	104	107	102
91–95	243	79	103	97	87	114	107
96–100	55	100	109	117*	109	120	128*
41–100	5,447	111	117	127	129	140	154

* Ratio based on fewer than 10 actual deaths.

Table PEN 3.1b. Widows, amounts, 1991–94: actual deaths and ratios of actual deaths to those expected using the projected rates for calendar 2010 from the WA80 table and the PFA80 table.

Age group (nearest ages)	Actual deaths 1991–94 (£000 pa)	100 A/E by WA80 C10			100A/E by PFA80 C10		
		1991–94	1987–90	1983–86	1991–94	1987–90	1983–86
41–50	25	131	206	223	195	307	332
51–55	58	186	198	140	274	291	206
56–60	142	188	110	138	274	159	201
61–65	274	140	182	151	201	261	216
66–70	543	117	107	147	166	152	209
71–75	952	115	99	120	150	129	157
76–80	935	93	97	92	107	112	106
81–85	749	88	99	101	94	105	108
86–90	432	94	109	100	100	117	106
91–95	137	86	71	97	95	78	107
96–100	26	122	131	77	134	144	84
41–100	4,273	104	109	122	124	135	155

Table PEN 3.2a. Widowers, lives, 1991–94: actual deaths and ratios of actual deaths to those expected using the projected rates for calendar year 2010 from the PMA80 table.

Age group (nearest ages)	Actual deaths 1991–94	100A/E 1991–94	100A/E 1987–90	100A/E 1983–86
61–65	9	231*	296*	178
66–70	23	186	179	
71–75	31	156	170	166*
76–80	18	105	190	
81–85	9	86*	303	192
86–90	10	190	265	
61–90	100	145	237	179

* Ratio based on fewer than 10 actual deaths.

Table PEN 3.2b. Widowers, amounts, 1991–94: actual deaths and ratios of actual deaths to those expected using the projected rates for calendar year 2010 from the PMA80 table.

Age group (nearest ages)	Actual deaths 1991–94 (£000 pa)	100A/E 1991–94	100A/E 1987–90	100A/E 1983–86
61–65	4.5	129	166	100
66–70	14.5	147	87	
71–75	7.2	41	147	94
76–80	27.2	171	85	
81–85	3.9	56	168	131
86–90	4.4	72	260	
61–90	61.7	103	136	116

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THE MORTALITY OF SMOKERS AND NON-SMOKERS 1991–1994

The investigation by the Bureau into the comparative mortality of smokers and non-smokers was started on 1 January 1988 and a report on the experience for 1988–90 was published in *C.M.I.R.* **14**. The present report, for the period 1991–94 is, therefore, the first to cover data for a full quadrennium. The offices which contribute data split by smoking status form a subset of all the contributing offices. Over 1991–94 a total of nine offices contributed data to the permanent, single life experience, although not all contributed for each year of the quadrennium. This compares with six offices for the corresponding 1988–90 experience. In the temporary assurance experience seventeen offices contributed at some time during the period 1991–94, compared to nine during the period 1988–90. For 1991–94, data is available for the first time from five offices in respect of holders of joint life first death policies.

It is extremely encouraging that a number of new contributing offices have been able to submit data for this particular investigation. The more offices who contribute the greater the credibility of the results, both in statistical terms and as reflecting the industry as a whole. As always, further contributors will be most welcome and will help to enhance the validity and credibility of the results.

The categorisation of the data into 'smoker' and 'non-smoker' is linked primarily to the terms upon which the policies were issued. 'Non-smokers' are those where preferential terms have been offered on account of their non-smoking status. This may be a monetary or percentage reduction against the standard premium or the use of an age deduction when determining the premium rate. 'Smokers' are those whose smoking habits do not conform to the criteria for non-smoking terms.

The definition of 'non-smoker' may vary from office to office but the most frequent requirement appears to be that the proposer has not smoked cigarettes for at least twelve months prior to the date of the proposal. For 'smokers' there is no information on the number of cigarettes smoked.

The report includes sections, for both males and females, on the experience of holders of permanent (whole life and endowment) assurances and temporary assurances on single lives and joint life first death assurances.

1. ASSURANCES ON MALE LIVES

1.1 *Permanent assurances*

The exposed to risk over the quadrennium was 473,454 in the smoker category and 1,358,771 in the non-smoker category, a ratio of 2.9 to 1 in favour of

non-smokers compared with a ratio of 2.2 to 1 in the last report. 'Combined' figures have been omitted from this report as the changed distribution between the component parts could make such comparisons misleading.

The experience is shown in Table SMOK 1.1. The comparison basis is the AM80 table. At duration 1 and at durations 2 and over the pattern of the results and the size of the Excess Mortality Index is very similar to that found in 1988–90. There does not appear to be the improvement in mortality between 1988–90 and 1991–94 among the smoker and non-smoker lives which has been observed in the main combined assured lives experiences between 1987–90 and 1991–94 reported on earlier (see pp 1 to 33). This may partly be explained by the increasing average duration of the policies in force in the smoker and non-smoker investigation, compared to a more stable durational distribution in the combined investigation. It could also be partly due to the different mix of offices in the smoker and non-smoker investigation. It may also be the case that the improvement in the aggregate mortality of all insured lives is due, in part, to the reduced proportion of lives who smoke.

At duration 0 the smoker mortality experience is much heavier, and the non-smoker experience much lighter, than was recorded in 1988–90. At other durations there has been relatively little change in the overall levels of mortality for the two groups.

1.2 *Temporary assurances*

The exposed to risk for smokers was 225,220 and for non-smokers was 1,057,648 a ratio of 4.7 to 1. Both of these amounts have increased substantially over those reported for the 1988–90 experience. The results for 1991–94 are shown in Table SMOK 1.2. The comparison basis is the TM80 table. The differential mortality between smokers and non-smokers, as measured by the Excess Mortality Index, is much greater in 1991–94 than was recorded in 1988–90. The experiences are, of course, not directly comparable, as the mix of offices included in each is very different. For this class of business the Excess Mortality Index exhibits a quite different pattern by duration to that shown for permanent assurances.

1.3 *Joint life first death assurances*

This is now a substantial experience with 199,916 in the 'smoker' exposed to risk and 680,360 in the 'non-smoker' exposed to risk. In 1988–90 there was no data in this category. The experience is shown in Table SMOK 1.3. The comparison basis is the AM80 table.

2. ASSURANCES ON FEMALE LIVES

2.1 *Permanent assurances*

The exposed to risk in the smoker category was 284,229 with 1,067,012 in the non-smoker category. This is a ratio of 3.8 to 1 in favour of non-smokers compared with a corresponding ratio of 3.2 to 1 in 1988–90. The experience is shown in Table SMOK 2.1. The comparison basis is the AF80 table.

The pattern overall is very similar to that observed in 1988–90 and corresponds with the findings in respect of the male permanent experience. There is little difference, at duration 0 and at durations 2 and over, between the level of mortality recorded in 1988–90 and that recorded in 1991–94; there does appear to have been some improvement at duration 1. The different mix of offices and the increasing average duration of the policies in force may be the explanation for these apparent anomalies.

2.2 *Temporary assurances*

This is now a fairly large experience with exposed to risk in the quadrennium 1991–94 of 175,980 in the smoker category and 696,428 in the non-smoker category. The results are shown in Table SMOK 2.2. The comparison basis is the AF80 table. It is interesting to note that, in contrast to the male experience, the Excess Mortality Index is, at all durations, significantly lower for temporary assurances than for permanent assurances. This is in line with the results for the corresponding experiences in 1988–90 shown in *C.M.I.R.* **14**.

2.3 *Joint life first death assurances*

The experience for 1991–94 is shown in Table SMOK 2.3. The comparison basis is the AF80 table. The exposed to risk was 146,924 in the smoker category and 735,674 in the non-smoker category. There is no corresponding data available for the period 1988–90.

Apart from duration 0, where the number of deaths is small, the Excess Mortality Index is lower overall for the joint life experience than for the corresponding single life experience.

3. CONCLUSION

Table SMOK 3.1 shows summary results for the 1991–94 quadrennium and compares them with the equivalent results for the 1988–90 period as reported in *C.M.I.R.* **14**.

The six experiences making up this investigation are each large enough to provide statistically useful results. There are differences in the levels of mortality

recorded, as there are between the (much larger) undifferentiated standard lives' experiences. However, the conclusion to the 1988–90 report, "that, for this data pool at least, smoking as an indicator is linked to a very serious additional mortality risk" is inescapable.

Table SMOK 1.1. Permanent assurances (non linked), males, full underwriting, 1991–94: actual deaths for smokers and non-smokers and ratios of actual deaths to those expected using the AM80 table.

Age group (nearest ages)	Smokers		Non-smokers		Excess Mortality Index[φ] (per cent)
	Actual deaths	100A/E	Actual deaths	100A/E	
Duration 0					
21–30	10	125	21	82	52
31–40	10	147	15	64	130
41–50	19	119	28	53	125
51–60	34	156	39	54	189
61–70	40	229	57	85	169
71–80	8	211*	19	88	140
21–80	121	164	179	68	141
Duration 1					
21–30	10	123	26	91	35
31–40	12	158	24	89	78
41–50	30	151	36	55	175
51–60	38	126	60	59	114
61–70	41	182	58	65	180
71–80	12	222	31	94	136
21–80	143	153	235	68	125
Durations 2 and over					
21–25	11	121	34	71	70
26–30	21	123	68	99	24
31–35	32	146	78	97	51
36–40	39	107	88	78	37
41–45	95	108	142	64	69
46–50	198	108	193	51	112
51–55	196	72	261	49	47
56–60	319	82	358	45	82
61–65	325	89	348	48	85
66–70	161	86	272	50	72
71–75	124	107	237	56	91
76–80	75	93	152	57	63
81–85	55	93	96	61	52
86–90	32	78	18	48	63
21–90	1,683	90	2,345	53	70

[φ] The percentage by which the Standardised Mortality Ratio for smokers exceeds the corresponding ratio for non-smokers i.e. $100 \times \left(\frac{\text{100A/E Smokers}}{\text{100A/E Non-smokers}} - 1 \right)$.

* Ratio based on fewer than 10 actual deaths.

Table SMOK 1.2. Temporary assurances, males, full underwriting, 1991–94: actual deaths of smokers and non-smokers and ratios of actual deaths to those expected using the TM80 table.

Age group (nearest ages)	Smokers		Non-smokers		Excess Mortality Index[φ] (per cent)
	Actual deaths	100A/E	Actual deaths	100A/E	
Duration 0					
16–30	5	114*	6	49*	133
31–45	22	124	46	69	80
46–60	32	107	95	63	70
61–75	12	171	45	101	69
16–75	71	120	192	70	71
Durations 1–4					
26–30	12	179	23	108	66
31–35	16	151	30	81	86
36–40	20	121	55	89	36
41–45	40	129	97	73	77
46–50	57	125	130	61	105
51–55	62	143	121	55	160
56–60	48	135	116	54	150
61–65	42	169	102	69	145
66–70	21	194	52	69	181
71–75	9	243*	30	90	170
26–75	327	143	756	65	120
Durations 5 and over					
31–35	8	129*	23	107	21
36–40	19	157	46	100	57
41–45	35	138	66	62	123
46–50	53	124	113	56	121
51–55	48	102	111	47	117
56–60	64	131	111	39	236
61–65	45	108	129	56	93
66–70	24	140	71	72	94
71–75	16	286	24	49	484
31–75	312	127	694	54	135

[φ] The percentage by which the Standardised Mortality Ratio for smokers exceeds the corresponding ratio for non-smokers i.e. $100 \times \left(\frac{\text{100A/E Smokers}}{\text{100A/E Non-smokers}} - 1 \right)$.

* Ratio based on fewer than 10 actual deaths..

Table SMOK 1.3. Joint life first death assurances, males, full underwriting, 1991–94: actual deaths of smokers and non-smokers and ratios of actual deaths to those expected using the AM80 table.

Age group (nearest ages)	Smokers		Non-smokers		Excess Mortality Index[φ] (per cent)
	Actual deaths	100A/E	Actual deaths	100A/E	
Duration 0					
21–60	36	142	42	52	173
Duration 1					
21–60	42	124	83	70	77
Durations 2 and over					
26–30	6	109*	15	57	91
31–35	24	182	40	72	153
36–40	21	87	57	64	36
41–45	59	136	68	45	202
46–50	55	89	125	62	44
51–55	92	104	131	56	86
56–60	178	103	178	45	129
61–65	146	107	135	51	110
66–70	34	98	37	52	88
26–70	615	106	786	53	100

[φ] The percentage by which the Standardised Mortality Ratio for smokers exceeds the corresponding ratio for non-smokers i.e. $100 \times \left(\frac{\text{100A/E Smokers}}{\text{100A/E Non-smokers}} - 1 \right)$.

* Ratio based on fewer than 10 actual deaths.

Table SMOK 2.1. Permanent assurances (non linked), females, full underwriting, 1991–94: actual deaths of smokers and non-smokers and ratios of actual deaths to those expected using the AF80 table.

Age group (nearest ages)	Smokers		Non-smokers		Excess Mortality Index[φ] (per cent)
	Actual deaths	100A/E	Actual deaths	100A/E	
Duration 0					
21–50	24	133	25	41	224
51–60	22	171	31	68	151
61–70	22	237	40	110	115
21–70	68	169	96	67	152
Duration 1					
21–40	5	60*	18	56	7
41–50	16	110	27	55	100
51–60	30	146	36	50	192
61–70	19	112	36	55	104
21–70	70	116	117	53	119
Durations 2 and over					
26–30	8	138*	24	96	44
31–35	9	89*	34	85	5
36–40	18	108	45	72	50
41–45	30	95	62	56	70
46–50	74	140	99	56	150
51–55	76	106	147	62	71
56–60	101	119	170	58	105
61–65	105	143	141	55	160
66–70	70	123	94	45	173
71–75	45	122	110	65	88
76–80	20	69	83	53	30
81–85	25	117	96	68	72
26–85	581	118	1,105	59	100

[φ] The percentage by which the Standardised Mortality Ratio for smokers exceeds the corresponding ratio for non-smokers i.e. $100 \times \left(\frac{\text{100A/E Smokers}}{\text{100A/E Non-smokers}} - 1 \right)$.

* Ratio based on fewer than 10 actual deaths.

Table SMOK 2.2. Temporary assurances, females, full underwriting, 1991–94: actual deaths of smokers and non-smokers and ratios of actual deaths to those expected using the AF80 table.

Age group (nearest ages)	Smokers		Non-smokers		Excess Mortality Index[φ] (per cent)
	Actual deaths	100A/E	Actual deaths	100A/E	
Duration 0					
31–60	18	120	30	56	114
Durations 1–4					
21–30	8	118*	12	48	146
31–40	13	72	43	58	24
41–50	33	118	69	62	90
51–60	24	99	48	54	83
61–70	17	137	33	59	132
21–70	95	106	205	58	83
Durations 5 and over					
31–40	14	109	35	63	73
41–50	24	93	82	69	35
51–60	28	140	58	72	94
61–70	14	141	25	64	120
31–70	80	117	200	68	72

[φ] The percentage by which the Standardised Mortality Ratio for smokers exceeds the corresponding ratio for non-smokers i.e. $100 \times \left(\frac{\text{100A/E Smokers}}{\text{100A/E Non-smokers}} - 1 \right)$.

* Ratio based on fewer than 10 actual deaths.

Table SMOK 2.3. Joint life first death assurances, females, full underwriting, 1991–94: actual deaths of smokers and non-smokers and ratios of actual deaths to those expected using the AF80 table.

Age group (nearest ages)	Smokers		Non-smokers		Excess Mortality Index[φ] (per cent)
	Actual deaths	100A/E	Actual deaths	100A/E	
Duration 0					
26–60	15	172	22	58	197
Duration 1					
26–60	18	126	46	73	73
Durations 2 and over					
26–35	13	107	37	50	114
36–45	31	89	100	54	65
46–55	71	107	173	65	65
56–65	70	98	134	54	81
26–65	185	100	444	57	75

[φ] The percentage by which the Standardised Mortality Ratio for smokers exceeds the corresponding ratio for non-smokers i.e. $100 \times \left(\frac{\text{100A/E Smokers}}{\text{100A/E Non-smokers}} - 1 \right)$.

Table SMOK 3.1. Values of the Excess Mortality Index and ratios of actual deaths to those expected using the relevant tables, for the periods 1991–94 and 1988–90.

	Smokers 100A/E		Non-smokers 100A/E		Excess Mortality Index	
	1991–94	1988–90	1991–94	1988–90	1991–94	1988–90
Permanent assurances, males, all ages.*						
Duration 0	164	146	68	84	141	74
Duration 1	153	157	68	67	125	134
Durations 2 and over	90	94	53	56	70	68
Permanent assurances, females, all ages.**						
Duration 0	169	169	67	63	152	168
Duration 1	116	138	53	69	119	100
Durations 2 and over	118	119	59	58	100	105
Temporary assurances, males, all ages.***						
Duration 0	120	174	70	48	71	262
Durations 1–4	143	87	65	54	120	61
Durations 5 and over	127	90	54	46	135	96
Temporary assurances, females, all ages.**						
Duration 0	120	107	56	44	114	143
Durations 1–4	106	114	58	61	83	87
Durations 5 and over	117	91	68	62	72	47

* Expected deaths based on the AM80 table.
** Expected deaths based on the AF80 table.
*** Expected deaths based on the TM80 table.

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THE MORTALITY OF IMPAIRED ASSURED LIVES, 1983–94

The investigation into the mortality of impaired assured lives was started on 1 January 1982 and includes only policies written on or after that date. The first report on the experience recorded in the investigation covered the period 1983–86 (1982 being a trial year) and was published in *C.M.I.R.* **11**, 91. For the second report (*C.M.I.R.* **14**, 105) a further four years' experience, 1987–90, were added to that in the earlier report giving an eight year span, 1983–90. On this occasion data for the years 1991–94 have been added to that studied in the earlier reports, giving a total of twelve years' experience, 1983–94. The Committee believes that this period maximises the number of deaths available for investigation while still being short enough to preclude secular changes in mortality from having too big an influence on the results. The present intention is that future reports will cover periods of no more than twelve years. The annual reports to contributing offices will in future be on a rolling twelve year basis with formal reports continuing to be issued to coincide with those for standard lives.

The earlier reports contained, as well as the recent C.M.I. experience, reports on the experience of one large office which had maintained a similar investigation for many years and on which it had published a series of reports. It had always been the intention that the C.M.I. investigation should stand on its own and the Committee believes it is now able to do so. The C.M.I., and the profession as a whole, are greatly indebted to the 'pilot' office for its generosity in sharing its experience over the years. For comparisons with previous reports, but probably for the last time, this report gives a summary of the result of the pilot office for the same period.

The sections that follow cover the data build up, the results in general, and commentaries on a number of impairments with sufficient data to allow more detailed study. The tables relating to the text are placed together at the end of the report on pp 100 to 111.

1. THE DATA

Tables IMP 1a and IMP 1b show, for males and females respectively, the exposed to risk and the deaths in the same impairment groups as were shown in the last report. The only impairment group for which changes have been made over the period is that for tumours. Since 1991 the group which included tumours of the breast and uterine fibroids has been divided and extended. There

are now categories covering all malignant tumours except cervical tumours and rodent ulcers. Benign tumours of the breast and uterine fibroids have their own groups.

The investigation covers policies, separately coded, from each of the major categories of life assurance business investigated by the Bureau. These are single life permanent (whole life and endowment), both linked and non linked, and temporary, plus joint life first death. However, again in order to maximise the data, all classes are combined for the purposes of this report. The exposed to risk is building up well and a number of groups have produced sufficient deaths to give a good indication of the degree of additional risk involved.

2. THE RESULTS – GENERAL COMMENTS

The results are presented in Tables IMP 2a and IMP 2b. These show, for broad impairment groups, the exposed to risk, the actual deaths and the percentage ratios of the actual deaths to those which would have been expected using the AM80 table for males, and the AF80 table for females. An index showing the additional mortality per 1000 exposed to risk is also given.

When studying the results, it should be borne in mind that the experience of unrated lives has moved away from that represented by AM/AF 80 select. The median point for the impaired lives data probably lies somewhere around the end of 1990. At this point the level of mortality of unrated lives against AM/AF 80 was approximately 78% for males and 84% for females. It is also worth noting that, since the impaired lives investigation only covers policies issued on or after 1 January 1982, the average duration in force of the impaired lives data is probably considerably shorter than that of the unrated lives. Nevertheless, the ratios shown above probably give a good indication against which to judge the recorded experience of the impaired lives.

While for many impairment groups there is only enough data to give results for all durations combined, for some groups an analysis by duration is possible. The results are shown in Tables IMP 3a and IMP 3b. These support the view, put forward in the last report on impaired lives, that for the conditions listed, apart from early onset diabetes, the additional risk is heavily front loaded. In the case of early onset diabetes, the additional risk again appears to be more evenly spread.

Table IMP 4 shows, for male lives, the experience of the same groups compared against the ultimate rates of the AM80 table. The different pattern with regard to duration of the rated lives as compared to the unrated lives can clearly be seen.

Tables IMP 5a and IMP 5b show summary results for the same period for the pilot office. For contracts written after 1 January 1982 this data is included in

the C.M.I. investigation. However, Tables IMP 5a and IMP 5b include data for policies written before that date and the business is, consequently, more mature than that represented by the C.M.I. data.

It should always be kept in mind that the results in most impairment groups are based on a limited number of deaths, and that there are wide variations between the sub-groups in each category. However, it is fair to say that the steady accretion of data year by year has in all categories tended to reinforce earlier indications rather than refute them.

An indication of the relative sizes of the C.M.I.B. investigation and the pilot office investigation can be seen by examining the amounts of exposed to risk for impairments where the policy duration is recorded. For example, amongst the ischaemic heart disease cases with a duration under six years, some 60% of the C.M.I.B.'s data comes from the pilot office.

3. THE RESULTS BY IMPAIRMENT

The following paragraphs cover only those groups of impairment where there are sufficient data to provide significant results.

3.1 *Hypertension*

For all age groups it is clear that hypertension is a significant extra risk both for males and females. For both sexes it appears that the lower the age at entry the higher the additional risk. For males, the additional risk within age groups increases with the severity of the hypertension; for females the data are too few to allow a full analysis.

3.2 *Ischaemic heart disease without surgery*

The additional risk is very heavy among males entering at ages below 50. In contrast, for females at those ages the additional risk is much smaller. At ages over 50 the additional risk for males falls and that for females rises, converging at a point for both sexes about twice the mortality recorded for standard lives.

3.3 *Ischaemic heart disease with surgery*

There are a significant number of deaths among the males and the additional mortality recorded is certainly severe. A similar, albeit slightly lower, additional mortality is recorded among the females, with the caution that the number of deaths on which this conclusion is based is small.

3.4 *Nervous disorders*

As in the last report on impaired lives (*C.M.I.R.* **14**) there is a distinct difference, for both males and females, between those whose disorder is defined as mild or

moderate and those whose disorder is severe. For both sexes those with a mild or moderate diagnosis experience a level of mortality very similar to that experienced by standard lives. Those with a severe diagnosis suffer a significant additional risk, particularly in the case of females. The severe category covers a variety of conditions but the data are too few to allow a meaningful analysis other than for the group as a whole.

3.5 *Peptic ulcer*

For males, where the data allow a distinction between cases with or without surgery, it appears that for the without surgery cases there is virtually no extra risk. There is some extra risk for cases with surgery; logic would suggest that these are the more serious cases. The number of female deaths is small, but the indications are of some additional risk.

3.6 *Epilepsy*

The recorded additional risk for both males and females is severe. Since most epileptics whose symptoms are well controlled are accepted on standard terms, the implication must be that only the rated cases are being submitted in the statistics supplied by offices.

3.7 *Diabetes mellitus*

Among males there is a clear distinction between the mortality experience of early onset and late onset cases, that of early onset being much the heavier. This confirms current medical thinking in this area. For females, where the number of deaths is smaller, there appears to be no distinction between the two groups.

3.8 *Respiratory disorders*

There is some additional risk for males suffering bronchial asthma. Where this degenerates to chronic bronchitis the risk is heavier. However, the really defining extra risk factor is the presence of emphysema where the additional mortality recorded is extremely high. The female experience is still too small to give an adequate split by condition; overall a fairly heavy additional risk is indicated.

3.9 *Tumours*

The additional risk for both sexes for malignant tumours appears to be extremely high. Where the tumours are non-malignant there appears to be no additional risk.

3.10 *Overweight*

For females, where there is no impairment other than being overweight, there appears to be little additional risk unless the insured is more than 40% overweight. There is insufficient data to give a breakdown by entry age. For males the additional risk appears significant where the entry age is 30 to 50 and the insured is more than 30% overweight. At other entry ages and degrees of being overweight the evidence is conflicting and inconclusive.

4. CONCLUSIONS

The exposed to risk is still building and should continue to do so for some time yet. At the same time the experience will mature as the average duration in force becomes longer. Nevertheless, it is interesting to note, as mentioned earlier, that the additional data which have become available have for virtually every impairment served to reinforce tentative conclusions drawn in earlier reports.

While the investigation is yielding what the Executive Committee believes to be useful results, their credibility would be greatly enhanced if more offices were to join the investigation. The passing of the Disability Discrimination Act in December 1996 predicates a need for reliable industry data to justify ratings for impairments. A truly comprehensive independent study, such as that provided by the Bureau, could be invaluable in this regard.

It remains to thank those offices who have faithfully contributed data over the years. Others could show their appreciation by offering to join them in this enterprise. The Bureau would be pleased to discuss this with anyone interested.

Table IMP 1a. Impaired lives, 1983–94, males: deaths and exposed to risk in impairment groups, by curtate duration.

Impairment	Duration 0		Duration 1		Durations 2 & over		All durations	
	Deaths	Exposed to risk	Deaths	Exposed to risk	Deaths	Exposed to risk	Deaths	Exposed to risk
Hypertension	39	7,234	51	7,045	421	32,373	511	46,652
IHD without surgery	133	6,340	119	5,950	689	23,407	941	35,697
IHD with surgery	13	998	14	869	77	2,712	104	4,579
Cerebrovascular disease	14	600	5	547	48	2,134	67	3,281
Nervous disorders	13	5,474	10	4,917	83	20,989	106	31,380
Disseminated sclerosis	4	529	3	508	18	2,184	25	3,221
Peptic ulcer	9	3,412	12	3,395	80	16,106	101	22,913
Ulcerative colitis	2	1,120	6	1,086	15	4,583	23	6,789
Crohn's disease	0	686	3	658	12	2,730	15	4,074
Epilepsy	7	1,706	4	1,583	29	6,559	40	9,848
Diabetes mellitus	36	7,016	37	6,528	217	23,800	290	37,344
Respiratory disorders	36	10,051	33	8,888	193	32,497	262	51,436
Urinary disorders	2	845	3	871	27	4,382	32	6,098
Malignant tumour*	3	118	2	76	2	172	7	366
Overweight	14	16,852	24	14,020	144	46,084	182	76,956
All impairments in investigation	325	62,981	326	56,941	2,055	220,712	2,706	340,634

* Breast only to 1990, all sites from 1991.

Table IMP 1b. Impaired lives, 1983–94, females: deaths and exposed to risk in impairment groups, by curtate duration.

Impairment	Duration 0		Duration 1		Durations 2 & over		All durations	
	Deaths	Exposed to risk	Deaths	Exposed to risk	Deaths	Exposed to risk	Deaths	Exposed to risk
Hypertension	13	3,277	18	3,276	186	15,761	217	22,314
IHD without surgery	20	1,511	23	1,420	117	5,796	160	8,727
IHD with surgery	2	132	1	118	8	392	11	642
Cerebrovascular disease	4	345	6	308	23	1,256	33	1,909
Nervous disorders	16	7,468	21	6,756	82	26,999	119	41,223
Disseminated sclerosis	0	661	3	648	23	2,667	26	3,976
Peptic ulcer	1	687	2	644	15	2,742	18	4,073
Ulcerative colitis	1	715	1	682	4	2,664	6	4,061
Crohn's disease	1	688	2	626	5	2,226	8	3,540
Epilepsy	0	1,388	4	1,231	14	4,584	18	7,203
Diabetes mellitus	13	3,183	9	2,903	76	10,924	98	17,010
Respiratory disorders	15	8,390	12	7,054	74	21,842	101	37,286
Urinary disorders	1	450	1	452	5	2,118	7	3,020
Tumour*	10	1,246	9	1,200	67	4,710	86	7,156
Overweight	25	27,613	15	21,289	98	57,406	138	106,308
All impairments in investigation	122	57,754	127	48,607	797	162,087	1,046	268,448

* Breast tumours and uterine fibroids to 1990: all malignant tumours, except cervical, plus non-malignant breast tumours and uterine fibroids from 1991.

Table IMP 2a. Impaired lives, 1983–94, males, all investigations and all durations combined: exposed to risk, actual deaths, percentage ratios of actual deaths to those expected using the AM80 select table (100A/E) and excess deaths per 1000 exposed to risk (A–E ‰).

Impairment			Exposed to risk	Actual deaths	100 A/E	A–E ‰
Hypertension						
Entry ages	SAP	DAP				
Under 40	all	all	9,570	18	130	0.4
40–59	under 155	95 & over	5,636	36	107	0.4
40–59	155 & over	under 95	7,452	67	129	2.0
40–59	155 & over	95–105	11,615	81	105	0.3
40–59	155 & over	over 105	4,888	54	151	3.7
40–59	all	all	29,591	238	120	1.3
60 & over	160 & over	under 100	3,807	118	95	–
60 & over	160 & over	100–110	3,148	106	112	3.6
60 & over	under 160	100 & over				
60 & over	160 & over	over 110	536	31	178	25.3
60 & over	all	all	7,491	255	108	2.6
Ischaemic heart disease (without surgery)						
Entry ages	Onset					
Under 50	within 4 years		4,866	63	427	9.9
Under 50	4 years & over		4,111	52	359	9.1
50 & over	within 2 years		6,096	164	179	11.9
50 & over	2–4 years		5,602	172	198	15.2
50 & over	4–6 years		4,904	153	204	15.9
50 & over	6 years & over		10,118	337	175	14.3
Ischaemic heart disease (with surgery)			4,579	104	243	13.4
Cerebrovascular disorders			3,281	67	183	9.3
Nervous disorders						
Mild or moderate			21,447	66	72	–
Severe (including schizophrenia and attempted suicide)			9,933	40	104	0.1
Disseminated sclerosis			3,221	25	211	4.1
Peptic ulcer						
Without surgery			17,171	66	70	–
With surgery			5,742	35	88	–
Ulcerative colitis			6,789	23	105	0.1
Crohn's disease			4,074	15	165	1.5

Table IMP 2a. (Continued).

Impairment		Exposed to risk	Actual deaths	100 A/E	A–E ‰
Epilepsy		*9,848*	*40*	*148*	*1.3*
Diabetes mellitus					
Entry age	Years since diagnosis				
Under 50	all	27,317	88	213	1.7
50 & over	under 10	6,150	110	124	3.5
50 & over	10 & over	3,877	92	193	11.5
Respiratory disorders					
Bronchial asthma		47,118	152	107	0.2
Chronic bronchitis without emphysema		2,615	46	128	3.8
Chronic bronchitis with emphysema		1,290	54	232	23.8
Emphysema without bronchitis		413	10	229	13.7
Urinary disorders		6,098	32	112	0.6
Tumours					
Breast, malignant		366	7	333	13.4
Overweight					
Entry ages	Overweight %				
Under 30	20–30	17,725	5	46	–
Under 30	over 30	10,032	0	–	–
30–49	20–30	21,597	39	108	0.1
30–49	over 30	18,604	49	140	0.8
50 & over	20–30	5,165	57	97	–
50 & over	over 30	3,833	32	69	–

Table IMP 2b. Impaired lives, 1983–94, females, all investigations and all durations combined: exposed to risk, actual deaths, percentage ratios of actual deaths to those expected using the AF80 select table (100A/E) and excess deaths per 1000 exposed to risk (A–E ‰).

Impairment			Exposed to risk	Actual deaths	100 A/E	A–E ‰
Hypertension						
Entry ages	SAP	DAP				
Under 40	all	all	3,085	5	158	0.6
40–59	all	all	12,304	56	114	0.5
60 & over	all	all	6,925	156	96	–
All	all	all	22,314	217	101	0.1
Ischaemic heart disease (without surgery)						
Entry ages	Onset					
Under 50	all durations		1,483	3	96	–
50 & over	within 4 years		3,217	76	208	12.3
50 & over	4 years & over		4,027	81	144	6.2
Ischaemic heart disease (with surgery)			642	11	217	9.2
Cerebrovascular disorders			1,909	33	255	10.5
Nervous disorders						
Mild or moderate			28,325	64	91	–
Severe (including schizophrenia and attempted suicide)			12,898	55	196	2.1
Disseminated sclerosis			3,976	26	283	4.2
Peptic ulcer						
With or without surgery			4,073	18	103	0.1
Ulcerative colitis			4,061	6	99	–
Crohn's disease			3,540	8	198	1.1
Epilepsy			7,203	18	174	1.1
Diabetes mellitus						
Entry age	Years since diagnosis					
Under 50	all		13,366	22	201	0.8
50 & over	under 10		1,986	42	227	11.8
50 & over	10 or more		1,658	34	246	12.2

Table IMP 2b. (Continued).

Impairment		Exposed to risk	Actual deaths	100 A/E	A–E ‰
Respiratory disorders		37,286	101	144	0.8
Urinary disorders		3,020	7	141	0.7
Tumours					
Breast, malignant		4,977	83	304	11.2
Breast, non-malignant and uterine fibroids		2,179	3	56	–
Overweight					
Entry ages	Overweight %				
All	20–40	75,112	83	82	–
All	over 40	31,196	55	106	0.1
All	all	106,308	138	90	–

Table IMP 3a. Males: percentage ratios of actual deaths to those expected using the AM80 select table, by duration in force, for significant impairments.

	Duration			
Impairment	0	1	2 & over	All
Hypertension	151	141	109	114
IHD without surgery	390	265	174	198
Diabetes mellitus – early onset	224	229	196	202
– late onset	251	154	108	110
Respiratory disorders	208	156	116	128
Unrated lives 1990	105	80	78	78

Table IMP 3b. Females: percentage ratios of actual deaths to those expected using the AF80 select table, by duration in force, for significant impairments.

	Duration			
Impairment	0	1	2 & over	All
Hypertension	141	94	100	101
IHD without surgery	349	212	148	167
Unrated lives 1990	94	74	84	84

Table IMP 4. Males: percentage ratios of actual deaths to those expected using the AM80 ultimate table, by duration in force, for significant impairments.

	Duration			
Impairment	0	1	2 & over	All
Hypertension	81	94	109	105
IHD without surgery	199	169	174	176
Diabetes mellitus – early onset	136	173	196	185
– late onset	127	98	108	109
Respiratory disorders	118	110	116	115
Unrated lives 1990	63	60	78	77

Table IMP 5a. Pilot office, impaired lives, 1983–94, males, all investigations and all durations combined: exposed to risk, actual deaths, percentage ratios of actual deaths to those expected using the AM80 select table (100A/E) and excess deaths per 1000 exposed to risk (A–E ‰).

Impairment			Exposed to risk	Actual deaths	100 A/E	A–E ‰
Hypertension						
Entry ages	SAP	DAP				
Under 40	all	all	34,681	171	129	1.1
40–59	155 & over	under 95	12,987	174	111	1.3
40–59	155 & over	95–105				
40–59	under 155	95 & over	32,173	336	106	0.6
40–59	155 & over	over 105	7,549	123	165	6.4
40–59	all	all	87,390	804	118	1.4
60 & over	160 & over	under 100	4,399	214	99	–
60 & over	160 & over	100–110	3,109	143	109	3.8
60 & over	under 160	100 & over				
60 & over	160 & over	over 110	527	29	123	10.3
60 & over	all	all	8,036	386	104	1.9
Ischaemic heart disease (without surgery)						
Entry ages	Onset					
Under 50	within 4 years		3,701	47	355	9.1
Under 50	4 years & over		2,973	46	398	11.6
50 & over	within 2 years		3,087	85	173	11.6
50 & over	2–4 years		3,033	111	211	19.3
50 & over	4–6 years		3,288	97	164	11.5
50 & over	6 years & over		6,581	251	178	16.7
Ischaemic heart disease (with surgery)			2,086	69	339	23.3
Cerebrovascular disorders			1,693	44	220	14.2
Nervous disorders						
Mild or moderate			119,308	534	79	–
Severe (including schizophrenia and attempted suicide)			24,255	148	130	1.4
Disseminated sclerosis			966	9	265	5.8
Peptic ulcer						
Without surgery			22,701	83	78	–
With surgery			8,332	42	81	–
Ulcerative colitis			5,047	14	79	–
Crohn's disease			2,967	12	172	1.7

Table IMP 5a. (Continued).

Impairment		Exposed to risk	Actual deaths	100 A/E	A–E ‰
Epilepsy		15,012	46	134	0.8
Diabetes mellitus		15,485	234	259	9.3
Respiratory disorders					
Bronchial asthma		63,412	156	101	0.0
Chronic bronchitis without emphysema		4,108	58	159	5.2
Chronic bronchitis with emphysema		2,538	91	209	18.7
Emphysema without bronchitis		550	13	213	12.5
Urinary disorders		40,111	230	83	–
Tumours					
Breast, malignant		140	1	73	–
Overweight					
Entry ages	Overweight %				
Under 30	20–30	74,782	157	89	–
Under 30	over 30	38,986	96	127	0.5
30–49	20–30	71,951	471	116	0.9
30–49	over 30	45,363	249	126	1.1
50 & over	20–30	5,569	96	78	–
50 & over	over 30	3,764	61	84	–

Table IMP 5b. Pilot office, impaired lives, 1983–94, females, all investigations and all durations combined: exposed to risk, actual deaths, percentage ratios of actual deaths to those expected using the AF80 select table (100A/E) and excess deaths per 1000 exposed to risk (A–E ‰).

Impairment			Exposed to risk	Actual deaths	100 A/E	A–E ‰
Hypertension						
Entry ages	SAP	DAP				
Under 40	all	all	4,278	8	153	0.6
40–59	all	all	14,718	92	115	0.8
60 & over	all	all	7,030	223	93	–
All	all	all	26,026	323	99	–
Ischaemic heart disease (without surgery)						
Entry ages	Onset					
50 & over	within 4 years		1,159	44	244	22.4
50 & over	4 years & over		1,530	43	149	9.2
Ischaemic heart disease (with surgery)			137	6	399	32.8
Cerebrovascular disorders			626	10	222	8.8
Nervous disorders						
Mild or moderate			55,253	141	88	–
Severe (including schizophrenia and attempted suicide)			15,480	60	143	1.0
Disseminated sclerosis			1,081	8	463	5.8
Peptic ulcer						
With or without surgery			3,088	13	110	0.4
Ulcerative colitis			2,025	6	163	1.1
Crohn's disease			1,836	4	179	1.0
Epilepsy			6,726	22	224	1.8
Diabetes mellitus			1,951	22	344	8.0
Respiratory disorders			26,833	68	128	0.6
Urinary disorders			7,800	21	100	0.0

Table IMP 5b. (Continued).

Impairment		Exposed to risk	Actual deaths	100 A/E	A–E ‰
Tumours					
Breast, malignant		1,280	21	269	10.3
Breast, non-malignant and uterine fibroids		1,464	10	78	–
Overweight					
Entry ages	Overweight %				
All	20–40	101,244	142	88	–
All	over 40	37,272	51	84	–
All	all	138,516	193	87	–

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PROPOSED NEW TABLES FOR LIFE OFFICE PENSIONERS, NORMAL, MALE AND FEMALE, BASED ON THE 1991–94 EXPERIENCES

INTRODUCTION

The investigation into the mortality of life office pensioners (i.e. pensioners insured by life offices) is one of the largest carried out by the Bureau. It is carried out for both sexes, on the basis of both lives and amounts, and is subdivided into those who retired at or after the normal retirement age for their scheme (referred to as 'normal') and those who retired before their normal retirement age (referred to as 'early').

The investigation is carried out by what is intended to be select duration since retirement. However, the number of those at select duration 0 at ages well above 65 is surprisingly large, and it must be doubted whether offices code this correctly, possibly coding the duration since the bulk purchase by scheme trustees of annuities for pensioners, or possibly coding the duration since the last increment. Superficially the mortality experience by the separate select durations seems to show very little pattern (although this has not been tested formally), and only the "all durations" experience is considered in this report. Please note that this and the next report are the only reports in *C.M.I.R.* **16** which have tables embedded in the text.

THE DATA

The experience is a large one. The total numbers of exposed to risk and of deaths are shown in Table 1, and compared with the corresponding numbers for the 1979–82 experience.

One can see that the male experience, as measured by the number of lives exposed to risk, has declined substantially since 1979–82, though the female experience has increased slightly. Both the amounts experiences have increased several-fold; this reflects both inflation and higher pensions coming through as schemes mature.

The data is predominantly at higher ages, i.e. above retirement age, but not wholly so. The age range of the data, and the continuous age range within which the central exposed to risk is greater than or equal to 100, and the continuous age range within which the number of deaths is greater than or equal to 10 are shown in Table 2.

Table 1. Pensioners, normal, males and females, lives and amounts: comparison of (central) exposed to risk and deaths for 1991–94 and for 1979–82, all durations.

	1979–82	1991–94
Males		
Lives		
Central exposed	1,377,059.5	989,283.9
Deaths	85,426	63,614
Amounts £		
Central exposed	446,740,045.5	1,379,231,516.2
Deaths	20,021,034	46,124,571
Females		
Lives		
Central exposed	336,887.0	354,628.5
Deaths	10,536	13,272
Amounts £		
Central exposed	64,781,941.0	289,720,365.4
Deaths	1,445,796	5,620,576

Comparison with Pxx80C92

Just as the '80' series mortality tables, based on the data for 1979–82 were taken as being centred on the year from mid-1980 to mid-1981, so the experience for 1991–94 can be taken as being centred on the year from mid-1992 to mid-1993. It is therefore appropriate to compare the experience for the quadrennium with the forecast rates, according to the '80' series tables for 1992, those denoted by the suffix C92.

Table 3 shows the overall values of 100A/E, i.e. actual deaths as a percentage of expected deaths, for the four experiences, where the expected is calculated according to the corresponding Pxx80C92 table, where xx = ML, MA, FL and FA for males lives, males amounts, females lives and females amounts respectively.

Table 2. Age ranges.

	Range of data	Exposed ≥ 100	Deaths ≥ 10
Males	25–108	50–100	57–101
Females	25–108	44–98	60–100

Table 3. Values of 100 A/E when the experience for 1991–94 is compared with the corresponding Pxx80C92 table.

	Lives	Amounts
Males	93	86
Females	100	102

From this one can see that the experience for females for 1991–94, for both lives and amounts, is very close to that projected at the time the '80' series projections were made, whereas the experience for males is considerably lower than what was projected at the time. There is therefore a good reason to construct a new base table, at least for males, appropriate to the years 1991–94. The corresponding table for females may be expected to be similar to that projected for calendar year 1992, and for amounts the rates might perhaps be a little higher. It will be seen that this is indeed the case.

The lives experience for 1991–94

As for the 1979–82 graduations the methodology was to use central exposed to risk, fit a formula of the $\mu_x = \mathrm{GM}(r,s)$ class, and choose the parameters by maximum likelihood. The same diagnostic tests as were used previously were also considered.

When the lives experiences for 1979–82, for both sexes, were graduated it was found that the formula $\mu_x = \mathrm{GM}(1,3)$ was the most satisfactory. This formula was also the best for the amounts experiences. It was therefore reasonable to try this formula first on this occasion. However, it was also appropriate to consider alternative orders of formula, i.e. different values of r and s in the $\mathrm{GM}(r,s)$ formula. The following pairs of values were used: $(0,2)$, $(0,3)$, $(1,2)$, $(0,4)$, $(1,3)$, $(2,2)$, i.e. each combination for which $r+s \leq 4$ and $s \geq 2$. (There is no point in even trying formulae with $s = 0$ or 1 for a mortality graduation, because the underlying shape is always of Gompertz, $\mathrm{GM}(0,2)$, type.)

Note that, for example, the $\mathrm{GM}(2,3)$ formula (which is used later) is parameterised as:

$$a_1 + a_2 t + \exp\{b_1 + b_2 t + b_3(2t^2 - 1)\}$$

where $t = (x - 70)/50$. The first two terms of this formula can be described as the "r" part, with two terms, and the exponential can be described as the "s" part, with three terms inside the parentheses.

Table 4. Values of log likelihood and of χ^2 for lives graduations.

	GM(0,4)	GM(1,3)	GM(2,2)
Males			
Log likelihood	−222,920.5	−222,920.4	−222,948.6
χ^2	115.43	106.77	151.23
Females			
Log likelihood	−51,740.5	−51,741.1	−51,746.1
χ^2	96.85	96.22	100.65

It was quickly clear that for both sexes the lower order formulae, with $r+s \leq 3$, provided an unsatisfactory fit to the data, but that all the formulae with $r+s=4$ were possibly satisfactory. Critical values are shown in Table 4.

None of the three formulae is parameterised as a subset of any other, so one must be careful when comparing log likelihood and χ^2 values. We see, however, that for males the GM(0,4) and GM(1,3) formulae have almost the same values of the log likelihood, but the latter has the lower value of χ^2. GM(2,2) is rather less satisfactory. For females GM(0,4) has the better likelihood, but not by much, whereas GM(1,3) has the lower value of χ^2, but not by much. GM(2,2) is poorer than either of the others, but by much less than it is for males. The diagnostic tests of goodness of fit, however, are passed by all three formulae, for each sex, except as noted below for males, so none can be excluded on those grounds.

There is very little doubt about the appropriate graduated mortality rates for ages 60 or so to 90 or so, regardless of the formula used; all give similar values. However, a further consideration is whether the shape of the resulting curve, either of q_x or of μ_x, outside these ages, is a suitable "shape", that is whether the resulting values of q_x or of μ_x are reasonable, having regard to what is known from other experiences about mortality rates at younger and older ages, and also having regard to the relative mortality rates of the four experiences under consideration. In this respect the GM(1,3) formula is best, for both sexes, since both GM(0,4) and GM(2,2) show mortality rates falling from age 20 to a minimum in the range 40 to 55 before rising again, whereas for GM(1,3) the mortality rates are almost level below age 50. Falling mortality rates at lower ages are a normal feature nowadays, but one expects a minimum in the 20s of age, not in the 40s or 50s.

The same graduation statistics as were shown for the 1979–82 graduations are shown in Table 5, for both sexes, and for both lives and amounts. Specimen

Table 5. Pensioners, normal, lives and amounts, males and females: statistics for graduations of $\mu_x = \mathrm{GM}(r, s)$.

	Lives		Amounts	
Sex	*Males*	*Females*	*Males*	*Females*
Formula	GM(1,3)	GM(1,3)	GM(1,3)	GM(1,3)
Values of parameters at optimum point				
$100a_1$	0.544795	0.349690	0.184743	0.168716
T-ratio	6.88	4.47	3.79	2.16
b_1	−5.807256	−5.454073	−5.122673	−4.264064
T-ratio	−31.24	−16.93	−24.62	−10.83
b_2	6.834540	6.656803	6.707623	5.783419
T-ratio	34.92	18.98	34.98	14.71
b_3	−2.105858	−1.258590	−1.236631	0.000548
T-ratio	−13.67	−4.72	−6.69	0.0016
Sign test: p(pos)	0.2950	0.2442	0.0182	0.0352
Runs test: p(runs)	0.0076	0.1850	0.0066	0.1387
K-S test: $p(KS)$	0.3124	0.9035	0.1462	0.0182
Serial correlation test				
T-ratio 1	2.52	0.16	2.31	−0.21
T-ratio 2	0.14	0.02	1.19	0.35
T-ratio 3	−1.03	−0.12	−0.80	−1.28
χ^2 test:				
χ^2	106.77	96.22	222.12	526.12
Degrees of freedom	51	48	48	48
$p(\chi^2)$	0.000008	0.000045	0.0000	0.0000

values of q_x, at decennial ages from 20 to 110, and percentage standard errors, are shown in Table 6. One can observe that in the males lives table the *T*-ratio for the first serial correlation coefficient is rather large, at 2.52 (note that these values should be compared with a unit normal distribution). Further, the probability value for the runs test, p(runs), is rather low, at 0.0076. These two features suggest that there are groups of ages where the actual deaths deviate too greatly from the expected, and possibly that a higher order formula would be better. Inspection of the individual values does not disclose any group of ages that stands out conspicuously, and extension of the $\mathrm{GM}(r, s)$

Table 6. Pensioners, normal, lives and amounts, males and females: specimen values of q_x and percentage standard errors.

	Lives		Amounts	
Sex Formula	Males GM(1,3)	Females GM(1,3)	Males GM(1,3)	Females GM(1,3)
Age 20	0.005434	0.003493	0.001848	0.001732
percentage s.e.	13.37	20.56	24.20	38.52
Age 30	0.005441	0.003507	0.001868	0.001831
percentage s.e.	13.31	20.25	23.63	33.73
Age 40	0.005534	0.003614	0.002011	0.002149
percentage s.e.	12.75	18.65	20.55	24.36
Age 50	0.006334	0.004255	0.002874	0.003157
percentage s.e.	9.66	12.96	11.24	11.65
Age 60	0.011179	0.007356	0.007076	0.006354
percentage s.e.	3.19	4.18	2.37	3.24
Age 70	0.031385	0.019413	0.023526	0.016453
percentage s.e.	0.70	1.46	0.76	1.58
Age 80	0.087534	0.056421	0.074262	0.047886
percentage s.e.	0.53	1.23	0.79	1.87
Age 90	0.186086	0.143337	0.192491	0.141318
percentage s.e.	0.79	1.40	1.54	2.81
Age 100	0.287127	0.292519	0.388145	0.381729
percentage s.e.	2.87	4.64	4.39	7.41
Age 110	0.329981	0.471634	0.605089	0.782494
percentage s.e.	6.77	9.92	7.56	8.98

formula to the set where $r + s = 5$, i.e. GM(0, 5), (1, 4), (2, 3) and (3, 2), shows an improvement in the likelihood values, but no improvement in the runs test or serial correlation test, and also leads to unsuitable values of q_x at low ages (e.g. almost zero below age 50), and for GM(2, 3) also at high ages (reducing above age 100). Thus the GM(1, 3) formula appears as satisfactory as can be achieved.

The high values of χ^2 for the lives investigations suggest that there may still be some duplicate lives included in the data, even though this is expected to be much less of a problem than with assured lives. Some individuals may draw pensions from more than one insured scheme, possibly from different offices. However, they are unlikely to have a great many such pensions, whereas an individual may well have a considerable number of separate life assurance policies, possibly with different offices.

Table 7. Average amounts per life, 1979–82 and 1991–94.

	1979–82	1991–94
Males	£324.42	£1,394.17
Females	£192.30	£816.97

The amounts experience for 1991–94

Before graduating the data for the amounts experience, the numbers of exposed to risk and of deaths were divided by the average amount per life in the central exposed to risk for each investigation. These average amounts are shown in Table 7, along with those for the 1979–82 experience. One can see by how much the average amounts have risen.

The expected number of deaths according to the suggested graduated rates for the lives experience were compared with the actual number of deaths with the results shown in Table 8. As is usual, the amounts experiences show lighter mortality then the corresponding lives experiences.

For the amounts data for both sexes in the 1979–82 experience a GM(1, 3) formula was found to be the best fit. On this occasion the same series of orders of formula was investigated as for the lives experiences. For males a GM(1, 3) formula was again found to be the most satisfactory, although the log likelihood for GM(0, 4) was a little larger. For females the parameter b_3 in the GM(1, 3) formula was very small (0.000548), and the results were extremely close to those for the GM(1, 2) formula (Makeham). However, because of the adjustment process described in the next section, it was convenient to retain the GM(1, 3) formula.

The critical values for the graduations of amounts, corresponding to those shown for lives in Table 4, are shown in Table 9. However, it should be noted

Table 8. Amounts experience: actual deaths compared with those expected according to the rates from the graduated lives experience.

	Actual deaths (units)	Expected deaths (units)	100A/E
Males	33,586.0	41,859.1	80.2
Females	6,941.2	8,030.8	86.4

Table 9. Values of log likelihood and of χ^2 for amounts graduations.

	GM(0,4)	GM(1,3)	GM(2,2)
Males			
Log likelihood	−134,213.3	−134,217.9	−134,227.5
χ^2	217.55	222.12	248.12
Females			
Log likelihood	−31,426.5	−31,425.9	−31,425.8
χ^2	528.12	526.12	530.46

that the "overdispersion", caused by the unequal amounts per life, produces values of log likelihood and of χ^2 that are much greater for the amounts experience than for the lives. This is to be expected.

The results for the GM(1,3) graduations, for both sexes, for the amounts experience are shown in Tables 5 and 6 alongside those for the lives experiences.

Adjustments

After the 1979–82 experiences had been graduated, it was found necessary to adjust the graduated rates by various methods, mainly at the extreme ages, so that the various mortality tables for the different investigations and experiences bore the "normal" relationships to each other. In particular, since over the main range of ages, the mortality rates in the lives experiences are higher than those in the corresponding amounts experiences, one might assume that this relationship should hold throughout the full range of ages considered. Similarly, since the male mortality rates are higher than the corresponding female rates over the main age range, this relationship too should hold for the full range of ages.

A further consideration taken into account in the construction of the '80 series' tables was the relationship between the mortality rates for pensioners and those for assured lives. Since the pensioners' experiences are being considered before the assured lives' experiences, it is not possible to blend the rates for pensioners into those for assured lives. However, the assured lives rates in the AM80 and AF80 tables have been taken into account, along with the overall experience for assured lives for 1991–94, as described below.

The process carried out required consideration first of the high ages, then of the low ages. It then became recursive, with small adjustments to the parameters

to satisfy the requirements at both ends of the table. However, the process will be described as if the high ages were dealt with first, and then remained unchanged while the low ages were adjusted.

Thus, the high ages are considered first. One can see from Table 6 that the value of q_{100} produced for females lives exceeds that for males lives; and also that q_{110} for females amounts exceeds that for males amounts. Likewise by age 90 the males amounts rates exceed the males lives rates, and this occurs for females by age 100.

The rates at the highest ages are substantially affected by the value of the quadratic term in the exponential, the "*s*" part, of the formula, the term whose coefficient is denoted b_3. The "*r*" part, which in a GM(1, 3) formula consists of the single term a_1, is negligible at high ages. For the females amounts table the value of b_3 is almost zero, so the "curve" of $\log \mu_x$ plotted against x, is almost a straight line. For the other three experiences the value of b_3 is negative, so the graph of $\log \mu_x$ or $\log q_x$ at high ages curves down as compared with the straight line defined by b_1 and b_2. If we wish to lower the values of q_x at the highest ages, we can make b_3 negative, or more negative; and if we wish to increase the rates we can make it less negative.

The statistical methodology of maximum likelihood estimation allows us to calculate the standard errors of the parameter estimates at the maximum likelihood point, and these standard errors have been used to calculate the *T*-ratios shown in Table 5. It would certainly not be unreasonable to change the value of any of the parameters by up to twice the standard error, in either direction. The maximum likelihood estimate is no more precise than this anyway. To change the value of a parameter by more than this is less justifiable, but perhaps no worse than the *ad hoc* adjustments carried out on the 1979–82 graduations. A change of two standard errors corresponds to a change of 2 in the log likelihood and of 4 in the value of χ^2, both theoretically and empirically. Since the log likelihood is approximately quadratic in the region of the maximum, a change of four standard errors corresponds to changes of 8 and 16 respectively; these also hold empirically, approximately.

The value of b_3 for each investigation was therefore changed by twice the standard error, then by four times, then by six times, so as to lower the mortality rates at high ages for the amounts experiences and to increase them for the lives experiences. The three other parameters were then optimised to give conditional maximum likelihood estimates. The following adjustments to b_3, which were heavily rounded, were judged to be suitable:

Males Lives: increase by six standard errors, to −1.2 from −2.11;
Females Lives: increase by less than one standard error, to −1.0 from −1.26;

Table 10. Values of q_{110} after adjustment to values of b_3

	Males	Females
Lives	0.46	0.45
Amounts	0.44	0.37

Males Amounts: reduce by two standard errors, to −1.6 from −1.24;
Females Amounts: reduce by four standard errors, to −1.15 from zero.

This produced the approximate values for q_{110} shown in Table 10. Note that these are the values after the adjustments at low ages had also been incorporated, but these made rather little difference. The mortality rates for ages below 110 fell into place appropriately.

The values of q_x at young ages had borne reasonable relationships to one another before these adjustments, but the change in the values of b_3 had consequential effect at the younger ages. It was not necessarily the case that an increase in the value of b_3, which on its own would increase the mortality rates at both high age and low ages, necessarily did so at the low ages; this is because the values of the other parameters were also changed to achieve a conditional maximum likelihood best fit.

It was therefore necessary to make compensating adjustments to achieve the desired values of q_x at lower ages. For all the experiences the values of q_x levelled out to become almost constant below age 40, but these rates were not at all consistent with, for example the assured lives data at ages up to 40. However, the original graduations had produced values of q_{40} that seemed rather too high. This is not too surprising: probably the normal pensioners' data includes, erroneously, some cases of early retirements that might be expected to have relatively high mortality rates.

The 1991–94 experiences for assured lives, for durations 2 and over, were considered. For males up to age 40 the actual deaths were 98.8% of those expected according to the AM80 table; for females up to age 40 the corresponding figure was 88.9%. The objective chosen was therefore to blend in the rates for males to 100% of those of AM80, and the rates for females to 90% of those of AF80. Previously the rates for amounts had been blended in with those for assured lives, but on this occasion it was decided to blend the lives rates into the assured lives rates, and adjust the amounts rates afterwards.

The formula used for the assured lives rates when the 1979–82 experience was graduated was a GM(2, 2). This formula has two terms in the "r" part, $a_1 + a_2 t$,

where $t = (x - 70)/50$. The purpose of the a_2 term is to represent the decline in the mortality rates from age 17 to the mid or late twenties of age. To introduce this feature meant increasing the order of the formulae for pensioners to GM(2, 3).

It was decided that the desirable criteria were as follows. First the age at which q_x attains its minimum value in the twenties of age was determined: $xm = 29$ for males in AM80, 23 for females in AF80. Then the value of q_{xm} was observed: $q_{xm} = 0.000553$ for males in AM80, and 0.000280 for females in AF80. Then values equal to 100% of q_{xm} for males and 90% of q_{xm} for females were calculated, giving "target" values: $q_{29} = 0.000553$ for males and $q_{23} = 0.000252$ for females. Then values of a_1 and a_2 were chosen which, firstly, reproduced the target values of q_x and, secondly, allowed for the highest slope of the curve of q_x from 20 to xm consistent with q_x still attaining its minimum value at age xm. This sounds complicated: the reason for this procedure was that the first criteria selected were to match the target values at age xm and at age 20; but this produced too steeply sloping a curve for μ_x so that the minimum value of q_x moved up into the thirties of age. It was considered that a slightly too low value for q_{20} was preferable to a minimum value of q_x at too high an age. In any case, at young ages the values of q_x are very low, and have almost no effect on the values of pensions (unlike their effect on premium rates for term assurances).

Values of a_1 and a_2 were found, by a systematic process of "trial and error" or what might be described as a graphical method of graduation by use of a spreadsheet, which met the desired criteria. First, appropriate, but approximate, values of a_1, a_2 and b_3 were chosen; then optimal (conditional) values of b_1 and b_2 were found by maximum likelihood estimation, so that the graduated values of μ_x passed through the body of the data with as good a fit as possible, conditional on the "ends" being more or less fixed. The new values of b_1 and b_2 did not necessarily reproduce the desired target values of q_x, so the values of a_1, a_2 and b_3 were adjusted slightly until the desired target values were reproduced. Note that at low ages the "s" part of the formula is very small, so the value of μ_x is determined mainly by a_1 and a_2.

The results of the adjusted GM(2, 3) graduations for the four experiences are shown in Tables 11 and 12, which correspond with Tables 5 and 6 for the original graduations. Necessarily for each experience the value of the log likelihood (not shown) is poorer for the adjusted graduations, as is the value of χ^2 (shown). None of the experiences shows satisfactory values of χ^2; but none of them did originally. The other diagnostic tests do not show too bad a deterioration in the fit; indeed in some cases the fit is improved. The discrepancies occur mainly at the lowest and highest ages where the adjustments are most pronounced.

Table 11. Pensioners, normal, lives and amounts, males and females: statistics for adjusted, GM(2, 3), graduations of $\mu_x = \mathrm{GM}(r, s)$.

	Lives		Amounts	
Sex Formula	Males GM(2,3)	Females GM(2,3)	Males GM(2,3)	Females GM(2,3)
Values of parameters at optimum point				
$100a_1$	−0.0081	0.0108	0.0230	0.0119
$100a_2$	−0.0700	−0.0140	−0.0110	−0.0080
b_1	−4.675089	−4.972246	−5.397782	−5.261103
T-ratio	−682.3	−353.9	−713.2	−361.7
b_2	5.629188	5.884075	6.622746	5.982521
T-ratio	199.0	110.4	167.6	79.4
b_3	−1.2	−1.0	−1.6	−1.15
Sign test: p(pos)	0.6611	0.5573	0.5561	0.7200
Runs test: p(runs)	0.0346	0.0137	0.0030	0.0197
K-S test: $p(KS)$	0.5720	0.2512	0.0006	0.0000
Serial correlation test				
T-ratio 1	3.15	1.87	2.87	0.38
T-ratio 2	0.94	1.63	2.08	1.48
T-ratio 3	0.90	0.96	0.05	−0.75
χ^2 test:				
χ^2	163.50	142.53	324.40	626.26
Degrees of freedom	47	43	45	42
$p(\chi^2)$	0.0000	0.0000	0.0000	0.0000

The values of q_x from ages 70 to 90 are little changed by the adjusted graduations, except for the females amounts experience, where they are noticeably lower than previously.

Ratios of the calculated values of q_x for amounts over lives for the two sexes, and of females over males for the two investigations, all for quinquennial ages, are shown in Table 13. The values of q_x for the four graduated tables for single ages from 20 to 120 are shown in Table 14, and graphed in Figure 1. Figure 2 shows the ratios of the rates for each table to the rates for males lives.

It can be noted that the values retain their "proper" relative places, though only just, except that the females lives rates at ages above 110 exceed the males lives rates.

Table 12. Pensioners, normal, lives and amounts, males and females: specimen values of q_x and percentage standard errors for adjusted, GM(2, 3), graduations.

	Lives		Amounts	
Sex Formula	Males GM(2,3)	Females GM(2,3)	Males GM(2,3)	Females GM(2,3)
Age 20	0.000623	0.000254	0.000340	0.000203
percentage s.e.	0.01	0.04	0.00	0.03
Age 30	0.000553	0.000270	0.000333	0.000217
percentage s.e.	0.10	0.26	0.04	0.22
Age 40	0.000817	0.000482	0.000443	0.000382
percentage s.e.	0.39	0.82	0.24	0.79
Age 50	0.002583	0.001563	0.001315	0.001271
percentage s.e.	0.61	1.22	0.58	1.24
Age 60	0.009753	0.005849	0.005914	0.004965
percentage s.e.	0.66	1.32	0.70	1.37
Age 70	0.032142	0.019885	0.023901	0.017371
percentage s.e.	0.65	1.34	0.72	1.39
Age 80	0.086639	0.057690	0.075464	0.050800
percentage s.e.	0.63	1.32	0.70	1.37
Age 90	0.187460	0.139514	0.179664	0.121470
percentage s.e.	0.60	1.26	0.66	1.32
Age 100	0.324539	0.276762	0.321209	0.234995
percentage s.e.	0.54	1.15	0.60	1.23
Age 110	0.457684	0.448729	0.444014	0.369403
percentage s.e.	0.48	0.99	0.54	1.11

Ratios of the values of q_x for the four new graduated tables to the corresponding values from the tables projected for calendar year 1992 from the '80' series tables, PML80C92, PMA80C92, PFL80C92 and PFA80C92, are shown in Table 15 and graphed in Figure 3. The new rates for males are well below the 1992 projected rates. However, the new rates for females exceed the 1992 projected rates at ages between 62 and 80 (lives) and 62 and 78 (amounts). This is consistent with the results shown in Table 3.

Details of each of the final graduations are shown in Tables 16 to 19. In these tables R_x represents the exposed to risk, A_x the actual deaths and E_x the deaths expected according to the graduated table. The value of μ_x is also shown for each age; this is the value for the integral age, since the data are grouped in effect by age nearest birthday. Dev_x is the difference $A_x - E_x$, $(V_x)^{1/2}$ is the

Table 13. Ratios of values of q_x in proposed tables.

Age	Males Amounts/Lives	Females Amounts/Lives	Lives Females/Males	Amounts Females/Males
20	0.5457	0.7992	0.4077	0.5971
25	0.5812	0.8024	0.4415	0.6096
30	0.6022	0.8037	0.4882	0.6517
35	0.5901	0.7970	0.5455	0.7367
40	0.5422	0.7925	0.5900	0.8623
45	0.5048	0.7986	0.6073	0.9608
50	0.5091	0.8132	0.6051	0.9665
55	0.5478	0.8316	0.6000	0.9109
60	0.6064	0.8489	0.5997	0.8395
65	0.6739	0.8633	0.6058	0.7760
70	0.7436	0.8736	0.6187	0.7268
75	0.8107	0.8794	0.6385	0.6927
80	0.8710	0.8806	0.6659	0.6732
85	0.9212	0.8775	0.7010	0.6678
90	0.9584	0.8707	0.7442	0.6761
95	0.9812	0.8609	0.7952	0.6976
100	0.9897	0.8491	0.8528	0.7316
105	0.9853	0.8363	0.9153	0.7768
110	0.9701	0.8232	0.9804	0.8320
115	0.9459	0.8102	1.0465	0.8964
120	0.9133	0.7969	1.1129	0.9711

standard deviation, calculated as $\sqrt{E_x}$ or $\sqrt{\sum E_x}$ where ages are grouped, and z_x is the normalised difference, calculated as $Dev_x/(V_x)^{1/2}$. Ages are grouped so that the value of E_x for the group is at least 5. The calculations and notation are the same as in the paper by Forfar, McCutcheon and Wilkie (*J.I.A.*, **115**, 1–149, 1988 and *T.F.A.*, **41**, 97–269, 1990).

The Committee recommends the adjusted graduations as a satisfactory basis for "base tables" for the projection of mortality rates for future years for life office pensioners. Following the naming convention established for the '80' series tables these new tables will be known as the '92' series.

Table 14. Values of q_x for proposed pensioners' normal 1991–94 tables.

	Males		Females	
Age	Lives	Amounts	Lives	Amounts
20	0.000623	0.000340	0.000254	0.000203
21	0.000612	0.000338	0.000253	0.000202
22	0.000601	0.000337	0.000253	0.000202
23	0.000591	0.000335	0.000252	0.000202
24	0.000581	0.000334	0.000252	0.000202
25	0.000573	0.000333	0.000253	0.000203
26	0.000565	0.000332	0.000255	0.000204
27	0.000560	0.000331	0.000257	0.000206
28	0.000555	0.000331	0.000260	0.000209
29	0.000553	0.000332	0.000265	0.000212
30	0.000553	0.000333	0.000270	0.000217
31	0.000556	0.000335	0.000278	0.000222
32	0.000562	0.000338	0.000287	0.000230
33	0.000572	0.000343	0.000299	0.000238
34	0.000586	0.000349	0.000313	0.000249
35	0.000605	0.000357	0.000330	0.000263
36	0.000631	0.000367	0.000351	0.000279
37	0.000663	0.000380	0.000376	0.000298
38	0.000704	0.000396	0.000405	0.000321
39	0.000755	0.000417	0.000441	0.000349
40	0.000817	0.000443	0.000482	0.000382
41	0.000892	0.000475	0.000532	0.000421
42	0.000982	0.000514	0.000589	0.000468
43	0.001089	0.000561	0.000657	0.000522
44	0.001216	0.000619	0.000736	0.000586
45	0.001365	0.000689	0.000829	0.000662
46	0.001541	0.000774	0.000936	0.000750
47	0.001746	0.000876	0.001061	0.000852
48	0.001985	0.000997	0.001205	0.000972
49	0.002262	0.001142	0.001371	0.001110
50	0.002583	0.001315	0.001563	0.001271
51	0.002953	0.001519	0.001783	0.001456
52	0.003378	0.001761	0.002036	0.001670
53	0.003865	0.002045	0.002326	0.001917
54	0.004422	0.002379	0.002657	0.002200

Table 14. (Continued).

	Males		Females	
Age	Lives	Amounts	Lives	Amounts
55	0.005058	0.002771	0.003035	0.002524
56	0.005780	0.003228	0.003466	0.002894
57	0.006600	0.003759	0.003955	0.003317
58	0.007527	0.004376	0.004510	0.003799
59	0.008574	0.005090	0.005139	0.004345
60	0.009753	0.005914	0.005849	0.004965
61	0.011076	0.006861	0.006650	0.005667
62	0.012559	0.007947	0.007553	0.006458
63	0.014217	0.009189	0.008567	0.007350
64	0.016065	0.010604	0.009704	0.008352
65	0.018120	0.012211	0.010977	0.009476
66	0.020400	0.014032	0.012399	0.010734
67	0.022923	0.016088	0.013985	0.012138
68	0.025708	0.018402	0.015751	0.013703
69	0.028775	0.020998	0.017711	0.015442
70	0.032142	0.023901	0.019885	0.017371
71	0.035831	0.027137	0.022289	0.019505
72	0.039862	0.030732	0.024943	0.021861
73	0.044253	0.034713	0.027867	0.024455
74	0.049025	0.039105	0.031081	0.027306
75	0.054197	0.043935	0.034607	0.030432
76	0.059787	0.049227	0.038467	0.033849
77	0.065811	0.055006	0.042682	0.037577
78	0.072286	0.061292	0.047276	0.041632
79	0.079225	0.068106	0.052271	0.046035
80	0.086639	0.075464	0.057690	0.050800
81	0.094538	0.083379	0.063554	0.055946
82	0.102929	0.091862	0.069886	0.061488
83	0.111815	0.100917	0.076705	0.067441
84	0.121196	0.110544	0.084032	0.073817
85	0.131071	0.120739	0.091884	0.080629
86	0.141431	0.131492	0.100278	0.087885
87	0.152267	0.142786	0.109228	0.095594
88	0.163563	0.154599	0.118745	0.103761
89	0.175302	0.166903	0.128838	0.112386

Table 14. (Continued).

	Males		Females	
Age	Lives	Amounts	Lives	Amounts
90	0.187460	0.179664	0.139514	0.121470
91	0.200011	0.192841	0.150773	0.131009
92	0.212925	0.206389	0.162615	0.140996
93	0.226167	0.220257	0.175034	0.151420
94	0.239700	0.234389	0.188021	0.162267
95	0.253482	0.248727	0.201561	0.173519
96	0.267471	0.263206	0.215636	0.185155
97	0.281620	0.277762	0.230224	0.197150
98	0.295880	0.292327	0.245296	0.209477
99	0.310203	0.306832	0.260821	0.222103
100	0.324539	0.321209	0.276762	0.234995
101	0.338835	0.335389	0.293080	0.248115
102	0.353042	0.349305	0.309730	0.261424
103	0.367107	0.362893 .	0.326664	0.274879
104	0.380983	0.376091	0.343834	0.288437
105	0.394621	0.388838	0.361186	0.302054
106	0.407973	0.401079	0.378665	0.315684
107	0.420997	0.412763	0.396216	0.329280
108	0.433649	0.423842	0.413781	0.342795
109	0.445890	0.434272	0.431304	0.356185
110	0.457684	0.444014	0.448729	0.369403
111	0.468997	0.453033	0.466001	0.382406
112	0.479798	0.461297	0.483064	0.395150
113	0.490060	0.468780	0.499869	0.407594
114	0.499756	0.475459	0.516366	0.419700
115	0.508865	0.481313	0.532508	0.431431
116	0.517368	0.486326	0.548254	0.442752
117	0.525248	0.490484	0.563564	0.453630
118	0.532489	0.493776	0.578402	0.464038
119	0.539080	0.496194	0.592739	0.473947
120	0.545009	0.497733	0.606545	0.483333

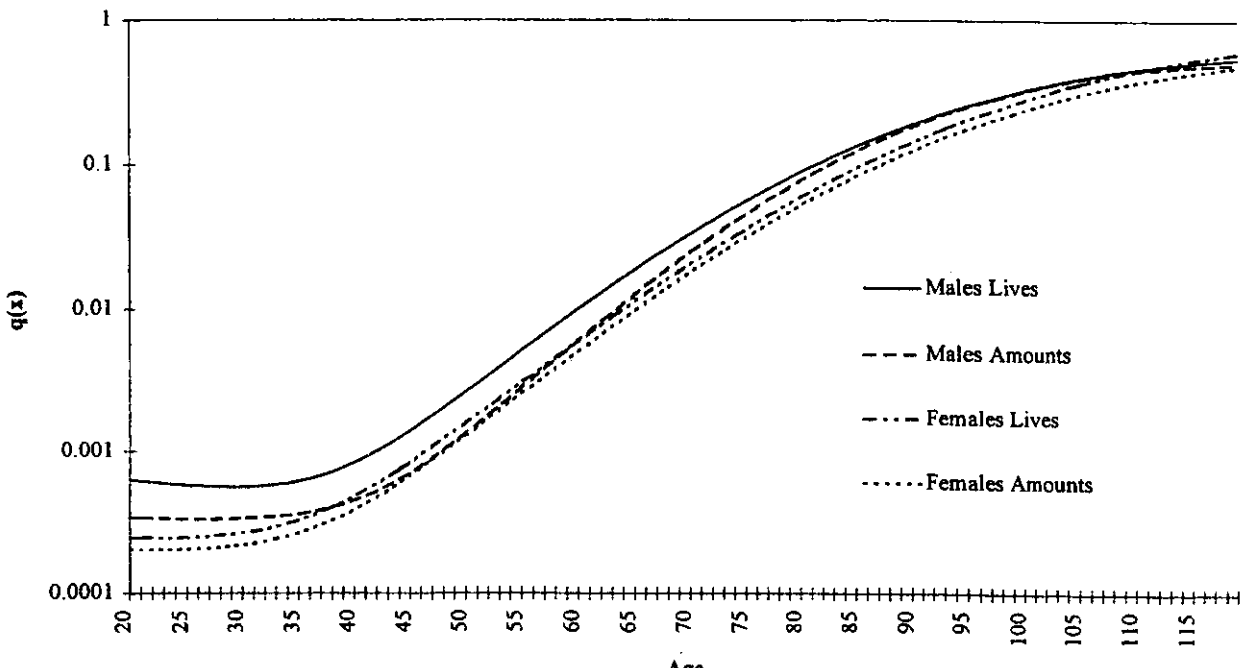

Figure 1. Values of q_x for proposed tables for pensioners, 1991–94.

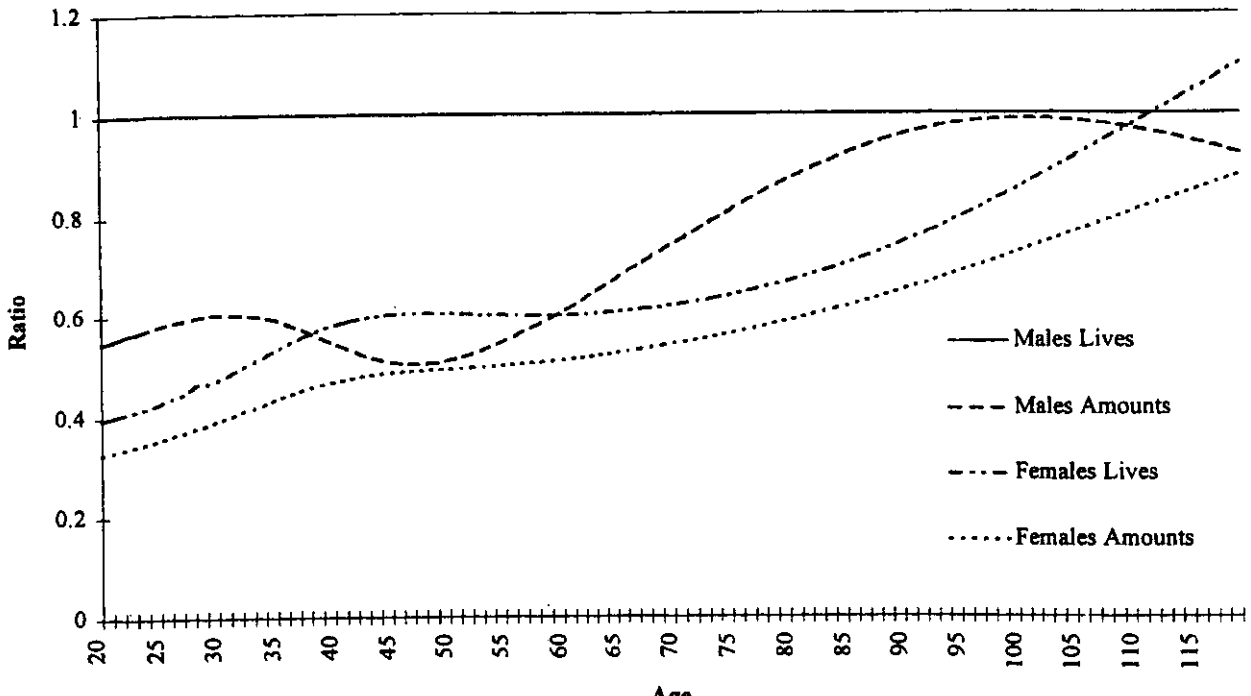

Figure 2. Ratios of values of q_x for proposed tables for pensioners, 1991–94, to values of q_x for males lives.

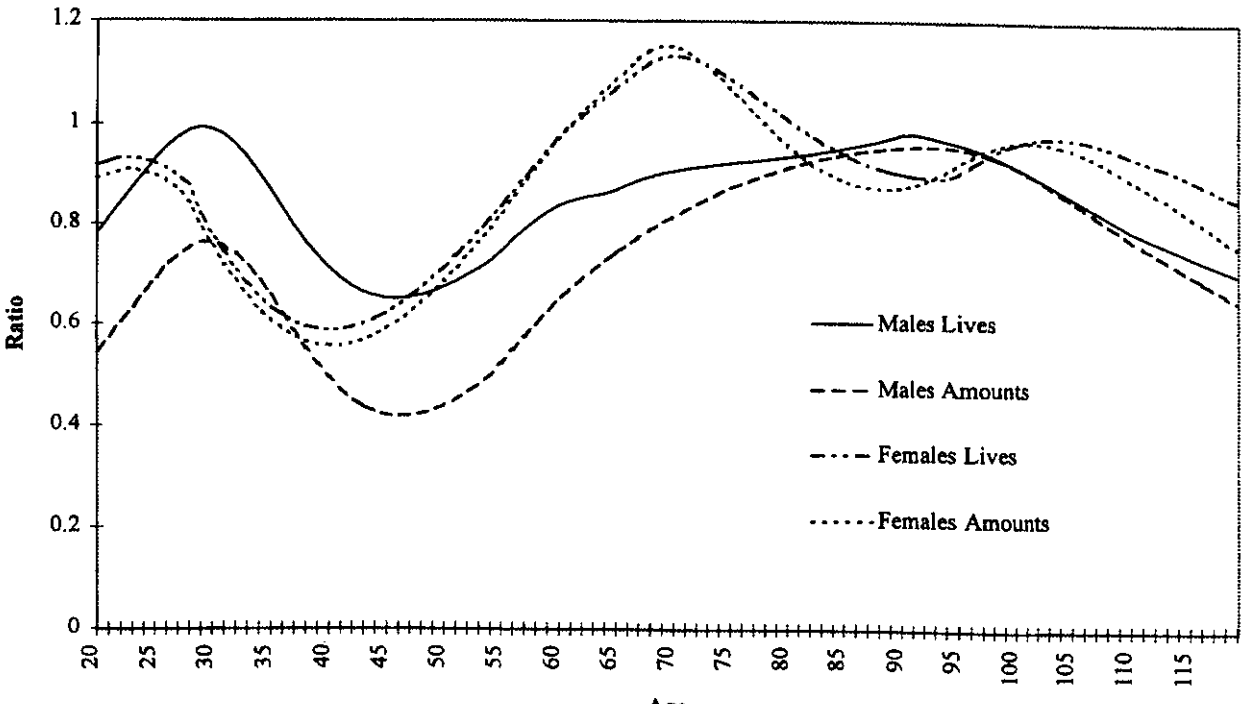

Figure 3. Ratios of values of q_x for proposed pensioners tables, 1991–94, to values of q_x for Pxx80C92 projected tables.

Table 15. Ratios of values of q_x in proposed tables to those in corresponding Pxx80C92 table.

	Males		Females	
Age	Lives	Amounts	Lives	Amounts
20	0.7807	0.5449	0.9179	0.8904
25	0.9287	0.6894	0.9211	0.8982
30	0.9893	0.7620	0.7774	0.7561
35	0.8668	0.6538	0.6326	0.6074
40	0.7098	0.4917	0.5852	0.5552
45	0.6494	0.4188	0.6206	0.5890
50	0.6716	0.4370	0.7110	0.6837
55	0.7429	0.5199	0.8339	0.8176
60	0.8344	0.6459	0.9683	0.9680
65	0.8650	0.7389	1.0676	1.0841
70	0.9039	0.8125	1.1321	1.1510
75	0.9206	0.8693	1.0903	1.0703
80	0.9332	0.9112	1.0092	0.9582
85	0.9513	0.9393	0.9397	0.8867
90	0.9792	0.9540	0.9003	0.8737
95	0.9606	0.9522	0.9023	0.9226
100	0.9157	0.9150	0.9633	0.9649
105	0.8551	0.8499	0.9730	0.9510
110	0.7882	0.7705	0.9380	0.8909
115	0.7378	0.7023	0.8930	0.8204

Table 16. Details of graduation for males lives.

Age	R_x	μ_x	A_x	E_x	Dev_x	$(V_x)^{1/2}$	z_x	100A/E
25	0.5	0.000577	0	0.00	0.00			
26	0.0	0.000569	0	0.00	0.00			
27	0.0	0.000562	0	0.00	0.00			
28	0.0	0.000557	1	0.00	1.00			
29	1.1	0.000554	0	0.00	0.00			
30	2.8	0.000553	0	0.00	0.00			
31	3.5	0.000554	0	0.00	0.00			
32	3.1	0.000558	0	0.00	0.00			
33	4.3	0.000566	0	0.00	0.00			
34	6.8	0.000578	0	0.00	0.00			
35	25.2	0.000595	0	0.01	−0.01			
36	65.3	0.000617	0	0.04	−0.04			
37	81.9	0.000646	0	0.05	−0.05			
38	75.7	0.000683	0	0.05	−0.05			
39	111.7	0.000728	1	0.08	0.92			
40	75.1	0.000784	0	0.06	−0.06			
41	76.4	0.000852	0	0.07	−0.07			
42	72.4	0.000935	0	0.07	−0.07			
43	77.7	0.001033	0	0.08	−0.08			
44	77.9	0.001149	0	0.09	−0.09			
45	63.7	0.001287	0	0.08	−0.08			
46	68.5	0.001449	2	0.10	1.90			
47	75.4	0.001640	1	0.12	0.88			
48	69.2	0.001861	1	0.13	0.87			
49	65.2	0.002119	2	0.14	1.86			
50	185.0	0.002418	3	0.45	2.55			
51	432.5	0.002763	6	1.19	4.81			
52	594.1	0.003161	3	1.88	1.12			
53	754.4	0.003617	3	2.73	0.27			
25–53	3,069.4		23	7.44	15.56	2.73	5.71	309.3
54	918.4	0.004140	6	3.80	2.20			
55	1,184.8	0.004738	9	5.61	3.39			
54–55	2,103.2		15	9.42	5.58	3.07	1.82	159.3
56	1,556.8	0.005418	5	8.44	−3.44	2.90	−1.18	59.3
57	1,819.3	0.006192	19	11.27	7.73	3.36	2.30	168.7
58	2,046.0	0.007070	25	14.46	10.54	3.80	2.77	172.8
59	2,403.9	0.008062	28	19.38	8.62	4.40	1.96	144.5
60	3,735.6	0.009182	46	34.30	11.70	5.86	2.00	134.1
61	6,067.0	0.010443	65	63.36	1.64	7.96	0.21	102.6
62	6,861.5	0.011860	75	81.38	−6.38	9.02	−0.71	92.2
63	7,524.6	0.013448	85	101.19	−16.19	10.06	−1.61	84.0
64	7,761.3	0.015223	116	118.15	−2.15	10.87	−0.20	98.2
65	22,307.9	0.017203	432	383.77	48.23	19.59	2.46	112.6
66	44,112.5	0.019408	854	856.13	−2.13	29.26	−0.07	99.8

Table 16. (Continued).

Age	R_x	μ_x	A_x	E_x	Dev_x	$(V_x)^{1/2}$	z_x	100A/E
67	46,855.8	0.021856	1,029	1,024.10	4.90	32.00	0.15	100.5
68	48,029.9	0.024569	1,129	1,180.07	−51.07	34.35	−1.49	95.7
69	48,385.7	0.027569	1,268	1,333.95	−65.95	36.52	−1.81	95.1
70	48,926.1	0.030878	1,441	1,510.74	−69.74	38.87	−1.79	95.4
71	50,127.3	0.034520	1,744	1,730.40	13.60	41.60	0.33	100.8
72	49,028.2	0.038520	1,829	1,888.55	−59.55	43.46	−1.37	96.8
73	46,140.2	0.042902	1,894	1,979.50	−85.50	44.49	−1.92	95.7
74	43,373.9	0.047692	2,024	2,068.61	−44.61	45.48	−0.98	97.8
75	41,774.4	0.052918	2,276	2,210.60	65.40	47.02	1.39	103.0
76	43,583.1	0.058604	2,677	2,554.13	122.87	50.54	2.43	104.8
77	46,719.6	0.064777	3,107	3,026.36	80.64	55.01	1.47	102.7
78	48,367.1	0.071464	3,584	3,456.52	127.48	58.79	2.17	103.7
79	47,401.3	0.078691	3,681	3,730.07	−49.07	61.07	−0.80	98.7
80	44,133.6	0.086483	3,586	3,816.82	−230.82	61.78	−3.74	94.0
81	39,565.1	0.094865	3,763	3,753.34	9.66	61.26	0.16	100.3
82	34,502.9	0.103859	3,541	3,583.44	−42.44	59.86	−0.71	98.8
83	29,646.4	0.113488	3,427	3,364.52	62.48	58.00	1.08	101.9
84	25,448.5	0.123772	3,201	3,149.82	51.18	56.12	0.91	101.6
85	21,392.9	0.134729	2,966	2,882.24	83.76	53.69	1.56	102.9
86	17,688.7	0.146374	2,591	2,589.16	1.84	50.88	0.04	100.1
87	14,352.4	0.158720	2,244	2,278.01	−34.01	47.73	−0.71	98.5
88	11,352.0	0.171777	2,016	1,950.01	65.99	44.16	1.49	103.4
89	8,834.9	0.185551	1,692	1,639.32	52.68	40.49	1.30	103.2
90	6,744.3	0.200044	1,356	1,349.16	6.84	36.73	0.19	100.5
91	5,026.8	0.215255	1,103	1,082.04	20.96	32.89	0.64	101.9
92	3,621.6	0.231178	841	837.23	3.77	28.94	0.13	100.5
93	2,447.4	0.247801	575	606.47	−31.47	24.63	−1.28	94.8
94	1,609.6	0.265110	430	426.72	3.28	20.66	0.16	100.8
95	1,008.8	0.283083	304	285.57	18.43	16.90	1.09	106.5
96	643.9	0.301693	203	194.26	8.74	13.94	0.63	104.5
97	407.6	0.320909	105	130.80	−25.80	11.44	−2.26	80.3
98	279.3	0.340694	77	95.16	−18.16	9.75	−1.86	80.9
99	190.3	0.361003	41	68.70	−27.70	8.29	−3.34	59.7
100	128.5	0.381789	36	49.06	−13.06	7.00	−1.86	73.4
101	74.7	0.402995	19	30.10	−11.10	5.49	−2.02	63.1
102	39.8	0.424563	6	16.90	−10.90	4.11	−2.65	35.5
103	25.9	0.446426	8	11.56	−3.56	3.40	−1.05	69.2
104	13.1	0.468514	6	6.14	−0.14	2.48	−0.06	97.8
105	9.4	0.490750	3	4.61	−1.61			
106	5.8	0.513054	1	2.98	−1.98			
107	4.7	0.535343	1	2.52	−1.52			
108	3.4	0.557526	1	1.90	−0.90			
105–108	23.3		6	12.00	−6.00	3.46	−1.73	50.0
Totals	989,283.9		63,614	63,610.85	3.15			100.0

Table 17. Details of graduation for males amounts.

Age	R_x	μ_x	A_x	E_x	Dev_x	$(V_x)^{1/2}$	z_x	100A/E
25	0.2	0.000333	0.00	0.00	0.00			
26	0.0	0.000332	0.00	0.00	0.00			
27	0.0	0.000332	0.00	0.00	0.00			
28	0.0	0.000331	0.18	0.00	0.18			
29	0.5	0.000332	0.00	0.00	0.00			
30	1.6	0.000332	0.00	0.00	0.00			
31	1.5	0.000334	0.00	0.00	0.00			
32	5.1	0.000337	0.00	0.00	0.00			
33	9.6	0.000340	0.00	0.00	0.00			
34	10.8	0.000345	0.00	0.00	0.00			
35	38.4	0.000352	0.00	0.01	−0.01			
36	111.8	0.000361	0.00	0.04	−0.04			
37	145.9	0.000373	0.00	0.05	−0.05			
38	137.7	0.000388	0.00	0.05	−0.05			
39	235.9	0.000406	0.01	0.10	−0.08			
40	160.0	0.000429	0.00	0.07	−0.07			
41	148.2	0.000458	0.00	0.07	−0.07			
42	172.1	0.000493	0.00	0.08	−0.08			
43	170.0	0.000536	0.00	0.09	−0.09			
44	139.8	0.000589	0.00	0.08	−0.08			
45	118.9	0.000652	0.00	0.08	−0.08			
46	96.1	0.000729	3.36	0.07	3.29			
47	111.6	0.000822	0.14	0.09	0.05			
48	108.0	0.000933	1.13	0.10	1.03			
49	138.2	0.001066	2.42	0.15	2.27			
50	469.4	0.001224	3.43	0.57	2.85			
51	1,075.5	0.001412	5.06	1.52	3.54			
52	1,592.0	0.001634	3.02	2.60	0.42			
25–52	5,198.7		18.75	5.85	12.90	2.42	5.34	320.8
53	2,107.1	0.001897	4.23	4.00	0.23			
54	2,810.7	0.002206	9.23	6.20	3.03			
53–54	4,917.9		13.45	10.20	3.26	3.19	1.02	131.9
55	3,774.0	0.002568	9.77	9.69	0.07	3.11	0.02	100.8
56	5,117.6	0.002992	4.88	15.31	−10.43	3.91	−2.67	31.9
57	5,894.6	0.003486	43.69	20.55	23.14	4.53	5.10	212.6
58	6,543.6	0.004061	30.31	26.57	3.74	5.15	0.73	114.1
59	7,719.7	0.004727	64.48	36.49	27.99	6.04	4.63	176.7
60	12,768.9	0.005498	82.70	70.20	12.50	8.38	1.49	117.8
61	22,936.1	0.006386	169.57	146.47	23.10	12.10	1.91	115.8
62	26,222.5	0.007407	185.80	194.23	−8.42	13.94	−0.60	95.7
63	27,459.8	0.008577	227.94	235.53	−7.58	15.35	−0.49	96.8
64	27,364.2	0.009915	339.01	271.30	67.71	16.47	4.11	125.0
65	41,376.4	0.011439	522.25	473.29	48.96	21.76	2.25	110.3
66	64,961.0	0.013170	927.33	855.56	71.77	29.25	2.45	108.4

Table 17. (Continued).

Age	R_x	μ_x	A_x	E_x	Dev_x	$(V_x)^{1/2}$	z_x	100A/E
67	68,111.9	0.015133	1,144.25	1,030.71	113.55	32.10	3.54	111.0
68	67,144.3	0.017349	1,217.28	1,164.90	52.38	34.13	1.53	104.5
69	64,607.0	0.019846	1,082.13	1,282.20	−200.06	35.81	−5.59	84.4
70	62,425.9	0.022650	1,385.75	1,413.97	−28.23	37.60	−0.75	98.0
71	59,494.7	0.025791	1,480.92	1,534.42	−53.50	39.17	−1.37	96.5
72	53,874.3	0.029297	1,565.35	1,578.37	−13.01	39.73	−0.33	99.2
73	46,953.0	0.033201	1,512.37	1,558.87	−46.50	39.48	−1.18	97.0
74	40,146.9	0.037533	1,549.57	1,506.84	42.74	38.82	1.10	102.8
75	35,719.9	0.042327	1,498.60	1,511.93	−13.33	38.88	−0.34	99.1
76	33,364.3	0.047617	1,642.01	1,588.70	53.31	39.86	1.34	103.4
77	32,162.7	0.053435	1,649.57	1,718.61	−69.04	41.46	−1.67	96.0
78	30,377.7	0.059815	1,744.38	1,817.03	−72.65	42.63	−1.70	96.0
79	26,878.2	0.066789	1,619.58	1,795.17	−175.59	42.37	−4.14	90.2
80	22,881.4	0.074390	1,574.11	1,702.15	−128.04	41.26	−3.10	92.5
81	18,772.1	0.082648	1,463.45	1,551.48	−88.03	39.39	−2.23	94.3
82	14,951.4	0.091591	1,280.00	1,369.42	−89.43	37.01	−2.42	93.5
83	11,895.6	0.101247	1,146.58	1,204.39	−57.82	34.70	−1.67	95.2
84	9,486.0	0.111637	1,055.13	1,058.99	−3.86	32.54	−0.12	99.6
85	7,515.9	0.122781	1,012.01	922.81	89.20	30.38	2.94	109.7
86	5,644.7	0.134696	916.96	760.32	156.64	27.57	5.68	120.6
87	4,161.8	0.147392	775.28	613.41	161.86	24.77	6.54	126.4
88	3,119.6	0.160875	539.18	501.86	37.32	22.40	1.67	107.4
89	2,295.8	0.175145	446.31	402.09	44.22	20.05	2.21	111.0
90	1,655.4	0.190195	330.47	314.84	15.63	17.74	0.88	105.0
91	1,210.6	0.206013	270.55	249.39	21.16	15.79	1.34	108.5
92	816.0	0.222578	165.38	181.63	−16.26	13.48	−1.21	91.0
93	518.1	0.239862	123.78	124.28	−0.50	11.15	−0.05	99.6
94	321.4	0.257830	108.55	82.87	25.68	9.10	2.82	131.0
95	187.5	0.276436	48.74	51.83	−3.09	7.20	−0.43	94.0
96	125.2	0.295629	31.96	37.00	−5.04	6.08	−0.83	86.4
97	78.8	0.315348	19.88	24.83	−4.95	4.98	−0.99	80.1
98	54.1	0.335524	16.41	18.16	−1.75	4.26	−0.41	90.3
99	29.2	0.356079	10.80	10.41	0.40	3.23	0.12	103.8
100	16.7	0.376929	6.57	6.27	0.29	2.50	0.12	104.7
101	13.4	0.397980	3.83	5.32	−1.50	2.31	−0.65	71.9
102	7.8	0.419135	0.72	3.25	−2.53			
103	5.8	0.440286	1.53	2.56	−1.03			
104	1.7	0.461323	3.60	0.80	2.80			
105	1.3	0.482130	0.33	0.63	−0.30			
106	0.5	0.502588	0.02	0.24	−0.23			
107	0.3	0.522576	0.02	0.14	−0.11			
108	0.4	0.541970	0.01	0.20	−0.19			
102–108	17.7		6.22	7.81	−1.59	2.79	−0.57	79.6
Totals	989,283.9		33,083.85	33,074.53	9.32			100.0

Table 18. Details of graduation for females lives.

Age	R_x	μ_x	A_x	E_x	Dev_x	$(V_x)^{1/2}$	z_x	100A/E
25	0.5	0.000253	0	0.00	0.00			
26	1.5	0.000254	0	0.00	0.00			
27	3.1	0.000256	0	0.00	0.00			
28	6.3	0.000258	0	0.00	0.00			
29	10.3	0.000262	0	0.00	0.00			
30	9.4	0.000267	0	0.00	0.00			
31	10.3	0.000274	0	0.00	0.00			
32	13.0	0.000282	0	0.00	0.00			
33	13.7	0.000293	0	0.00	0.00			
34	18.0	0.000305	0	0.01	−0.01			
35	22.8	0.000321	0	0.01	−0.01			
36	33.2	0.000340	0	0.01	−0.01			
37	40.9	0.000363	0	0.01	−0.01			
38	46.8	0.000390	0	0.02	−0.02			
39	69.3	0.000422	0	0.03	−0.03			
40	66.9	0.000460	0	0.03	−0.03			
41	71.3	0.000506	2	0.04	1.96			
42	83.3	0.000559	0	0.05	−0.05			
43	98.4	0.000622	0	0.06	−0.06			
44	114.6	0.000695	0	0.08	−0.08			
45	134.2	0.000781	0	0.10	−0.10			
46	139.3	0.000880	0	0.12	−0.12			
47	160.4	0.000996	0	0.16	−0.16			
48	186.8	0.001130	0	0.21	−0.21			
49	196.2	0.001285	1	0.25	0.75			
50	264.9	0.001463	0	0.39	−0.39			
51	391.5	0.001669	4	0.65	3.35			
52	454.0	0.001906	1	0.87	0.13			
53	536.9	0.002177	5	1.17	3.83			
54	655.5	0.002487	3	1.63	1.37			
25–54	3,853.3		16	5.91	10.09	2.43	4.15	270.5
55	789.3	0.002842	5	2.24	2.76			
56	963.7	0.003246	7	3.13	3.87			
55–56	1,753.0		12	5.37	6.63	2.32	2.86	223.4
57	1,107.6	0.003707	8	4.11	3.89			
58	1,210.4	0.004230	10	5.12	4.88			
57–58	2,318.0		18	9.23	8.77	3.04	2.89	195.1
59	1,341.3	0.004823	7	6.47	0.53	2.54	0.21	108.2
60	4,463.9	0.005495	37	24.53	12.47	4.95	2.52	150.9
61	9,874.0	0.006253	52	61.74	−9.74	7.86	−1.24	84.2
62	11,223.5	0.007109	94	79.79	14.21	8.93	1.59	117.8
63	12,219.3	0.008073	106	98.64	7.36	9.93	0.74	107.5
64	12,886.4	0.009155	130	117.98	12.02	10.86	1.11	110.2
65	13,587.8	0.010370	163	140.91	22.09	11.87	1.86	115.7
66	14,384.4	0.011731	185	168.74	16.26	12.99	1.25	109.6

Table 18. (Continued).

Age	R_x	μ_x	A_x	E_x	Dev_x	$(V_x)^{1/2}$	z_x	100A/E
67	14,840.3	0.013251	200	196.65	3.35	14.02	0.24	101.7
68	15,256.5	0.014948	234	228.05	5.95	15.10	0.39	102.6
69	15,764.8	0.016838	271	265.45	5.55	16.29	0.34	102.1
70	16,591.5	0.018939	299	314.23	−15.23	17.73	−0.86	95.2
71	17,537.6	0.021271	439	373.04	65.96	19.31	3.41	117.7
72	17,422.7	0.023855	365	415.61	−50.61	20.39	−2.48	87.8
73	16,222.4	0.026711	387	433.32	−46.32	20.82	−2.23	89.3
74	14,639.3	0.029865	416	437.20	−21.20	20.91	−1.01	95.2
75	12,900.8	0.033339	388	430.11	−42.11	20.74	−2.03	90.2
76	12,030.6	0.037161	428	447.07	−19.07	21.14	−0.90	95.7
77	11,950.7	0.041356	453	494.23	−41.23	22.23	−1.85	91.7
78	11,690.9	0.045953	490	537.24	−47.24	23.18	−2.04	91.2
79	11,221.7	0.050982	534	572.10	−38.10	23.92	−1.59	93.3
80	10,522.8	0.056472	619	594.24	24.76	24.38	1.02	104.2
81	9,752.3	0.062455	675	609.08	65.92	24.68	2.67	110.8
82	8,947.6	0.068963	611	617.05	−6.05	24.84	−0.24	99.0
83	8,109.8	0.076029	657	616.58	40.42	24.83	1.63	106.6
84	7,316.4	0.083686	585	612.28	−27.28	24.74	−1.10	95.5
85	6,437.6	0.091969	558	592.06	−34.06	24.33	−1.40	94.2
86	5,542.4	0.100911	552	559.29	−7.29	23.65	−0.31	98.7
87	4,716.7	0.110547	509	521.42	−12.42	22.83	−0.54	97.6
88	4,029.2	0.120911	482	487.17	−5.17	22.07	−0.23	98.9
89	3,308.0	0.132036	458	436.77	21.23	20.90	1.02	104.9
90	2,678.7	0.143955	378	385.61	−7.61	19.64	−0.39	98.0
91	2,149.0	0.156700	325	336.75	−11.75	18.35	−0.64	96.5
92	1,641.6	0.170302	305	279.57	25.43	16.72	1.52	109.1
93	1,167.6	0.184790	256	215.76	40.24	14.69	2.74	118.7
94	795.7	0.200190	190	159.29	30.71	12.62	2.43	119.3
95	536.5	0.216528	118	116.17	1.83	10.78	0.17	101.6
96	354.8	0.233826	76	82.96	−6.96	9.11	−0.76	91.6
97	240.6	0.252103	85	60.66	24.34	7.79	3.13	140.1
98	155.5	0.271375	40	42.20	−2.20	6.50	−0.34	94.8
99	99.6	0.291653	28	29.05	−1.05	5.39	−0.19	96.4
100	59.1	0.312946	18	18.50	−0.50	4.30	−0.12	97.3
101	39.1	0.335257	8	13.11	−5.11	3.62	−1.41	61.0
102	28.1	0.358586	2	10.08	−8.08	3.17	−2.54	19.8
103	14.1	0.382925	9	5.40	3.60			
104	6.1	0.408263	0	2.49	−2.49			
105	1.7	0.434582	3	0.74	2.26			
106	1.2	0.461859	0	0.55	−0.55			
107	1.0	0.490063	1	0.49	0.51			
108	1.0	0.519158	0	0.52	−0.52			
103–108	25.1		13	10.19	2.81	3.19	0.88	127.6
Totals	354,628.5		13,272	13,269.44	2.56			100.0

Table 19. Details of graduation for females amounts.

Age	R_x	μ_x	A_x	E_x	Dev_x	$(V_x)^{1/2}$	z_x	100A/E
25	0.1	0.000203	0.00	0.00	0.00			
26	0.6	0.000204	0.00	0.00	0.00			
27	1.2	0.000205	0.00	0.00	0.00			
28	17.9	0.000207	0.00	0.00	0.00			
29	24.7	0.000210	0.00	0.01	−0.01			
30	20.4	0.000214	0.00	0.00	0.00			
31	26.3	0.000219	0.00	0.01	−0.01			
32	39.6	0.000226	0.00	0.01	−0.01			
33	28.6	0.000234	0.00	0.01	−0.01			
34	46.1	0.000244	0.00	0.01	−0.01			
35	44.5	0.000256	0.00	0.01	−0.01			
36	76.2	0.000270	0.00	0.02	−0.02			
37	115.4	0.000288	0.00	0.03	−0.03			
38	132.9	0.000309	0.00	0.04	−0.04			
39	203.1	0.000334	0.00	0.07	−0.07			
40	185.6	0.000365	0.00	0.07	−0.07			
41	182.5	0.000401	9.55	0.07	9.48			
42	196.9	0.000443	0.00	0.09	−0.09			
43	284.7	0.000494	0.00	0.14	−0.14			
44	382.7	0.000553	0.00	0.21	−0.21			
45	446.8	0.000622	0.00	0.28	−0.28			
46	492.8	0.000704	0.00	0.35	−0.35			
47	602.7	0.000799	0.00	0.48	−0.48			
48	691.1	0.000909	0.00	0.63	−0.63			
49	638.4	0.001038	2.62	0.66	1.95			
50	738.2	0.001187	0.00	0.88	−0.88			
51	995.6	0.001360	4.93	1.35	3.57			
25–51	6,615.3		17.09	5.43	11.66	2.33	5.01	314.9
52	1,104.0	0.001560	0.00	1.72	−1.72			
53	1,151.8	0.001790	3.48	2.06	1.42			
54	1,376.4	0.002054	2.67	2.83	−0.15			
52–54	3,632.2		6.16	6.61	−0.45	2.57	−0.18	93.1
55	1,664.2	0.002357	27.05	3.92	23.13			
56	2,033.7	0.002705	12.43	5.50	6.93			
55–56	3,697.9		39.48	9.42	30.06	3.07	9.79	419.0
57	2,434.2	0.003101	9.00	7.55	1.45	2.75	0.53	119.2
58	2,646.3	0.003554	14.20	9.40	4.80	3.07	1.56	151.0
59	2,974.0	0.004069	7.95	12.10	−4.15	3.48	−1.19	65.7
60	7,392.2	0.004653	30.12	34.40	−4.28	5.87	−0.73	87.6
61	15,064.3	0.005316	82.00	80.08	1.92	8.95	0.21	102.4
62	17,846.8	0.006065	140.62	108.24	32.38	10.40	3.11	129.9
63	19,510.1	0.006910	200.29	134.82	65.47	11.61	5.64	148.6
64	20,229.4	0.007863	167.45	159.06	8.39	12.61	0.67	105.3
65	21,388.2	0.008933	168.04	191.05	−23.02	13.82	−1.67	88.0
66	22,598.6	0.010133	204.98	228.99	−24.01	15.13	−1.59	89.5

Table 19. (Continued).

Age	R_x	μ_x	A_x	E_x	Dev_x	$(V_x)^{1/2}$	z_x	100A/E
67	22,293.1	0.011476	251.41	255.84	−4.42	15.99	−0.28	98.3
68	21,345.7	0.012976	230.53	276.99	−46.46	16.64	−2.79	83.2
69	20,117.3	0.014649	301.44	294.69	6.75	17.17	0.39	102.3
70	18,885.0	0.016509	261.46	311.77	−50.31	17.66	−2.85	83.9
71	17,677.2	0.018573	610.87	328.32	282.55	18.12	15.59	186.1
72	15,962.6	0.020860	276.15	332.98	−56.84	18.25	−3.11	82.9
73	14,042.9	0.023388	306.54	328.43	−21.90	18.12	−1.21	93.3
74	11,983.7	0.026176	252.59	313.69	−61.10	17.71	−3.45	80.5
75	9,834.6	0.029245	186.02	287.61	−101.59	16.96	−5.99	64.7
76	8,438.0	0.032616	220.89	275.21	−54.32	16.59	−3.27	80.3
77	7,645.5	0.036310	194.09	277.61	−83.52	16.66	−5.01	69.9
78	6,754.1	0.040351	224.42	272.53	−48.11	16.51	−2.91	82.3
79	5,861.3	0.044761	211.16	262.35	−51.19	16.20	−3.16	80.5
80	5,096.2	0.049563	307.57	252.58	54.99	15.89	3.46	121.8
81	4,306.8	0.054781	254.09	235.93	18.16	15.36	1.18	107.7
82	3,598.4	0.060439	211.21	217.48	−6.28	14.75	−0.43	97.1
83	3,084.0	0.066560	229.51	205.27	24.24	14.33	1.69	111.8
84	2,636.9	0.073168	190.10	192.94	−2.84	13.89	−0.20	98.5
85	2,124.8	0.080286	163.06	170.59	−7.53	13.06	−0.58	95.6
86	1,617.3	0.087935	140.73	142.21	−1.49	11.93	−0.12	99.0
87	1,230.4	0.096138	133.54	118.28	15.26	10.88	1.40	112.9
88	983.1	0.104914	135.40	103.14	32.26	10.16	3.18	131.3
89	795.3	0.114282	88.64	90.89	−2.25	9.53	−0.24	97.5
90	648.4	0.124258	74.85	80.57	−5.72	8.98	−0.64	92.9
91	505.2	0.134858	72.18	68.13	4.05	8.25	0.49	105.9
92	391.5	0.146095	69.74	57.20	12.54	7.56	1.66	121.9
93	285.2	0.157978	59.76	45.05	14.70	6.71	2.19	132.6
94	175.6	0.170514	52.43	29.94	22.49	5.47	4.11	175.1
95	113.0	0.183707	24.40	20.77	3.63	4.56	0.80	117.5
96	64.6	0.197559	12.83	12.77	0.06	3.57	0.02	100.5
97	38.2	0.212065	10.37	8.10	2.27	2.85	0.80	128.1
98	22.8	0.227218	6.73	5.19	1.54	2.28	0.68	129.7
99	12.9	0.243008	4.10	3.13	0.97			
100	8.1	0.259418	8.63	2.10	6.53			
99–100	21.0		12.73	5.23	7.50	2.29	3.28	243.4
101	5.6	0.276427	1.01	1.55	−0.53			
102	3.6	0.294011	0.18	1.05	−0.88			
103	8.5	0.312139	13.49	2.65	10.84			
104	0.9	0.330776	0.00	0.31	−0.31			
105	0.5	0.349883	0.13	0.18	−0.05			
106	0.1	0.369413	0.00	0.05	−0.05			
107	0.1	0.389316	0.16	0.02	0.13			
108	0.1	0.409539	0.00	0.03	−0.03			
101–108	19.4		14.97	5.84	9.13	2.42	3.78	256.3
Totals	354,628.5		6,879.79	6,873.30	6.50			100.1

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SICKNESS EXPERIENCE 1987–90 FOR GROUP PHI POLICIES

EXECUTIVE SUMMARY

This report presents the results of an analysis of the claims experience for group PHI policies for the quadrennium 1987–90. The analysis is based on the mathematical model for the analysis of PHI data described in *C.M.I.R.* **12** (1991). The methods of analysis used for claim inceptions and claim terminations are those described in two reports in *C.M.I.R.* **15** (1996).

The key points arising from the analysis are described below.

- Volumes of data submitted have increased substantially from those submitted for 1983–86. This is particularly marked for the unit costed group business. Unlike previous quadrennia the unit costed and individually costed business have been analysed separately in this report.
- Inception rates on individually costed business were lower than in previous quadrennia.
- Recovery rates are somewhat higher for unit costed business than for individually costed business.
- Recovery rates were generally higher than in the previous quadrennium.
- Male death rates were generally lower than in the previous quadrennium.
- The differences from previous quadrennia may be explained, at least partially, by changes in the mix of business by office, and readers should be cautioned against drawing conclusions on underlying trends from these results.

1. INTRODUCTION

Five reports have been published to date covering the sickness experience for group PHI policies.

The first report, published in *C.M.I.R.* **5**, 51 (1981) described the experience of 1973–76 and compared actual weeks of sickness with those expected on the basis of the Manchester Unity A.H.J. table. Inception rates for quinquennial age groups were also tabulated.

The second report, *C.M.I.R.* **8**, 89 (1986) described the experience of 1975–78. The main basis of comparison was again the Manchester Unity A.H.J. table of sickness rates. Some comparisons were carried out against both

sickness rates and inception rates derived from the 1975–78 individual Standard experience as set out in *C.M.I.R.* **7**, 99 (1984).
A third report, *C.M.I.R.* **15**, 209 covered the experience of 1979–82 and 1983–86 and compared Manchester Unity-type sickness rates and inception rates with those expected on the basis of the 1975–78 individual Standard experience. The report also contained some commentary on the variation of experience between the eight offices whose experience was analysed.

The above reports all relied on the traditional Manchester Unity approach to analysing PHI data. Most practical PHI pricing has for many years been based around an inception/disability annuity approach. Although some analysis of inception rates had been carried out in these reports, they contained no analysis of termination rates. *C.M.I.R.* **12** introduced a multiple state model for PHI which reconciled the two approaches. The individual male Standard data for 1975–78 was used to develop graduated transition intensities between healthy and sick, sick and healthy and sick and dead. *C.M.I.R.* **12** described how inception rates, disability annuities and other functions could be derived from these basic building blocks.

Two subsequent reports used the model to compare the experience of subsequent data sets with the graduated rates based on individual Standard data for 1975–78.

One report *C.M.I.R.* **15**, 1 compared actual and expected inceptions for, *inter alia*, the quadrennia 1975–78, 1979–82 and 1983–86 in respect of group PHI business. The report described the methodology that has been used to analyse inceptions in this report.
A second report *C.M.I.R.* **15**, 51 compared actual and expected recoveries and deaths of those sick and claiming under PHI policies for, *inter alia*, group PHI business in 1975–78, 1979–82 and 1983–86. The report described the methodology that has been used to analyse claim terminations in this report.

Group PHI business can be sub-divided into two basic types, individually costed and unit costed. Individually costed business involves a premium being calculated separately for each person in the scheme. Full records of the in force by age and sex are available and can be passed to the C.M.I. Bureau each year for analysis. This permits a detailed analysis of claim inceptions and claim terminations as well as Manchester Unity-type sickness rates. Unit costed business has premiums calculated on the basis of a single rate for all and records of in force by age and sex are not generally available on an annual basis. Claim records have, however, been collected by the C.M.I. Bureau which permits an analysis of claim terminations but not of claim inceptions or Manchester

Unity-type sickness rates. The trend in recent years has been for volumes of unit costed business to rise at the expense of individually costed business. Both types of business are analysed separately in this report.

2. THE DATA

2.1 *Description of the data*

The data received by the C.M.I. Bureau is detailed and consists of a record for each in force policy in respect of each year end. Each claim which is in force during an investigation year will also generate one or more records for that year, thus one claim which spans several years will generate at least one separate record in each investigation year. All records contain fields describing the attributes of each policy and claims records contain additional fields relating to the duration and other features of the claim. A full description of the format of the data was given in *C.M.I.R.* **5**, 82–90 although a few amendments have been made subsequently.

The total data is described in this and other reports as the Aggregate data. It has been the practice in recent reports to concentrate the analysis of claims experience on a more homogeneous subset of the Aggregate data known as the Standard data. The Standard data has the following criteria:

policies issued in the UK (the most significant exclusion being policies issued in the Republic of Ireland).
policies without an occupational rating.
policies without a known health impairment.
policies with regular benefit payments (lump sums and waiver of premium benefits being excluded).

A detailed breakdown by attribute of the data analysed is given in Tables A1 and A2 of the Appendix.

Table A1 covers group PHI policies where the lives covered are individually costed. It shows, for both Aggregate and Standard data, the number of policies in force at the beginning and end of each investigation year summed across all four years in the period. It also shows the number of claims records similarly summed across the four year period.

Table A2 covers group PHI policies where the lives covered are unit costed. No in force data is collected for such business and the table shows, for both Aggregate and Standard data, the number of claims records summed over the four year period.

The following features emerge from these tables and an examination of similar tables in respect of 1983–86 published in *C.M.I.R.* **15**, 225–230.

2.2 *Individually costed group business*

Figure 1 below shows the comparison of the volume of Aggregate in force and claims records submitted for individually costed group business for 1987–90 and that submitted for the previous two quadrennia. The in force volumes are calculated as the average of the in force number of policies at the beginning and end of each year and therefore represents a broad measure of exposure by "policy years in force". The claims volumes are measured by the total number of claims records received.

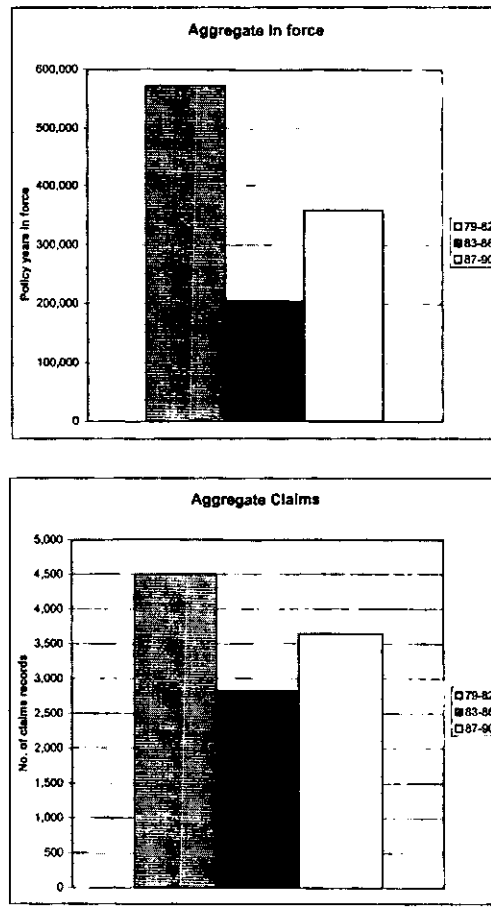


Figure 1. Comparison of volumes of Aggregate data for individually costed group PHI business in 1979–82, 1983–86 and 1987–90.

The low volumes submitted in respect of 1983–86 were primarily the result of irrecoverable data errors incurred by some offices in the period. While these have not affected the 1987–90 quadrennium, volumes are still considerably down on 1979–82. This reflects two main influences. The first is that certain offices have been unable to contribute any data for some years in the 1987–90 quadrennium. The second is that some offices have submitted lower volumes of individually costed data since 1979–82. This may reflect a trend in the industry away from individually costed business towards unit-costed business.

The Standard in force data represents about 80% of the Aggregate data. The Standard claims data accounts for some 78% of the Aggregate data.

The breakdown of the Aggregate data by deferred period is shown in Table 1 below.

Table 1. Individually costed group PHI 1987–90. In force and claims. Aggregate data by deferred period.

Deferred period	Policy years in force	%	No. of claims records	%
1 week	275	–	44	1
4 weeks	2,724	1	112	3
13 weeks	86,230	24	887	25
26 weeks	242,300	68	2,410	66
52 weeks	27,044	7	188	5
Total	358,573	100	3,641	100

As in previous quadrennia, there is very little data for DP1 and DP4, with most of the data being concentrated in DP13 and DP26. The proportions are virtually identical for the Standard data.

Some 21% of the Aggregate in force data relates to females. This compares to some 17% in 1983–86 and some 11% in 1975. The proportion of Standard in force data relating to females is slightly higher at 22%. Some 13% of the Aggregate claims records relate to females, the same as 1983–86. The proportion of Standard claims data relating to females is slightly higher at 14%.

An analysis of the Aggregate data by location shows that some 9% of the in force data and some 14% of the claims data relate to the Republic of Ireland. The remainder is virtually all mainland UK data.

A second, perhaps more informative, way of looking at the volumes of data is by the number of significant 'events' – claim inceptions and claim terminations

by recovery and death in the data. A breakdown of the Aggregate data is shown in Table 2 below.

Table 2. Individually costed group PHI 1987–90. Volume of data by number of analysed events. Aggregate data by deferred period.

Deferred period	No. of inceptions	%	No. of recoveries	%	No. of deaths	%
1 week	23	3	16	5	1	1
4 weeks	42	5	25	7	4	3
13 weeks	278	33	166	49	29	21
26 weeks	474	56	132	39	95	71
52 weeks	23	3	1	–	5	4
Total	840	100	340	100	134	100

The number of recoveries and deaths combined (474) is much less than the number of inceptions (840). There are a number of reasons for this. Firstly, the terminations do not directly correspond to the inceptions e.g. some terminations relate to the inceptions prior to the investigation and some inceptions are continuing claims at the end of the period. Secondly, some claims terminate due to expiry of benefit at a terminal age. Thirdly, the number of terminations by recovery and death excludes suspected duplicate policies whereas the number of inceptions does not. The reader will also notice that the number of both claims terminations and claims inceptions is much less than the total number of claims records in Table 1. This reflects the fact that the great majority of claims records relate to claims which continued into the next investigation year.

2.3 *Unit costed group business*

Figure 2 below shows the comparison of the volume of unit costed claims records for 1987–90 with the two previous quadrennia.

The volume of unit costed data submitted to the C.M.I. has increased dramatically in the period 1987–90 compared to previous quadrennia. The claim termination experience for the period 1975–86 was reported in *C.M.I.R.* **15**, 5. For the purposes of analysis, the individually costed and unit costed data were combined for the years covered by that report. There were two reasons for this, namely the low volumes of data and the broad similarity of the experience for the two groups. For the purposes of this report, the two termination experiences have been analysed separately. This reflects the large increase in

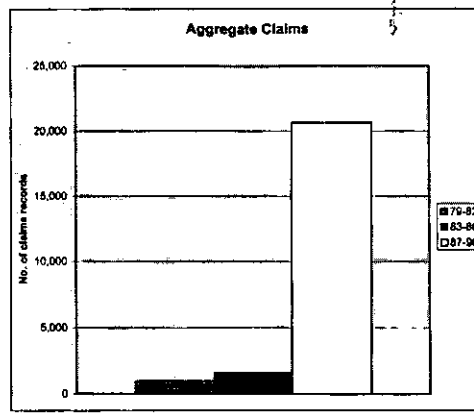


Figure 2. Comparison of volumes of Aggregate data for unit costed group PHI business in 1979–82, 1983–86 and 1987–90.

unit costed data volumes and differences in the two experiences as observed in 1987–90. The Standard data is some 95% of the Aggregate data.

Table 3 shows an analysis of the Aggregate data by deferred period. The proportions shown falling within each deferred period are very similar for the Standard data.

The bulk of the data relates to DP26. There is negligible data for DP1 and DP4. Females account for about 19% of both the Aggregate and Standard data. The Republic of Ireland accounts for about 5% of the data which explains virtually all the difference between the Standard and Aggregate data.

Table 3: Unit costed group PHI 1987–90.
Aggregate claims data by deferred period.

Deferred period	No. of claims records	%
1 week	2	–
4 weeks	4	–
13 weeks	1,579	8
26 weeks	15,782	76
52 weeks	3,243	16
Total	20,610	100

Again, it is informative to look at the data in terms of the number of analysed events. A breakdown of the Aggregate data is shown in Table 4 below.

Table 4. Unit costed group PHI 1987–90. Volume of data by number of analysed events. Aggregate data by deferred period.

Deferred period	No. of recoveries	%	No. of deaths	%
1 week	–	–	–	–
4 weeks	–	–	–	–
13 weeks	271	14	50	8
26 weeks	1,338	72	475	77
52 weeks	256	14	92	15
Total	1,865	100	617	100

3. INDIVIDUALLY COSTED EXPERIENCE - INCEPTIONS

The methodology for analysing the claim inception experience of PHI business was set out in *C.M.I.R.* **15**, 1. The same methodology and table layout is used in this report. The basic approach is to compare actual inceptions with those expected on the basis of the *C.M.I.R.* **12** model parameterised using the males, individual policies, Standard experience for 1975–78.

The results are set out in Tables A3.1 and A3.2 in the Appendix to this report covering the male and female experiences respectively. Analyses of the Aggregate experience can be supplied to interested parties on request to the C.M.I. Bureau.

The report in *C.M.I.R.* **15** featured tables giving brief summaries of the analyses of claim inceptions on group policies for each quadrennium in the period 1975–86. Tables A4.1 and A4.2 in the Appendix are updates of those tables with the addition of the experience for 1987–90. The tables show values of $100 \times A/E$ for each deferred period and a confidence interval of ± 2 standard deviations. The tables also show a statistical analysis of actuals against a modified value of expected, labelled EINC*, where σ_x has been multiplied by a factor required to make the total number of expected claim inceptions equal to the total actual number (this is the factor shown as a percentage at the foot of the $100 \times A/E$ column). A more detailed description of the methodology is given in the earlier report. Figures A1.1 and A1.2 show the same information graphically. Confidence intervals are not shown where the number of expected claims is very small.

The following features are apparent:

The experience, in terms of claim inceptions, is generally lighter than previous quadrennia and much lighter than 1983–86.

Readers must exercise caution when attempting to draw conclusions about trends from these results. There is considerable variation of experience between offices and the combined results can be influenced significantly by changes in the mix of offices contributing from year to year. The experience of 1983–86 is a particular case in point. Other factors may also mask any trends in underlying morbidity, for example:

- changes to underwriting practices.
- changes to claims control procedures.
- moving some schemes to a unit costing approach.

The overall female inception experience is very similar to the male. Volumes of data are, however, low as illustrated by the wide confidence intervals.

4. INDIVIDUALLY COSTED EXPERIENCE - TERMINATIONS

4.1 *Analysis of the data*

The methodology for analysing the claim termination experience of PHI business was set out in *C.M.I.R.* **15**, 51. The same methodology and table layout is used in this report. Actual deaths and recoveries are compared with those expected on the basis of the *C.M.I.R.* **12** model parameterised using the males, individual policies, Standard experience for 1975–78.

The results and statistical analysis of the results are summarised in Tables A5.1–A5.4 of the Appendix for male recoveries, female recoveries, male deaths and female deaths respectively. Readers are referred to the report in *C.M.I.R.* **15** for a full description of the tables and the statistical analysis used. Table A6 of the Appendix contains a comparison of the values of 100A/E, for all ages and durations combined, with those applying to the previous three quadrennia. Values based on fewer than 100 events are shown in *italic*; values where the value of either p(+/−) or p(B) is less than 0.025 are shown in **bold**.

The results in Table A6 are illustrated graphically in Figures A2.1–A2.4. In addition to the 100A/E results shown in the tables, the figures also illustrate a confidence interval, the lower limit being $100(A - 2\sqrt{E})/E$ and the upper limit being $100(A + 2\sqrt{E})/E$.

When comparing the results between quadrennia it should be borne in mind that the experiences for the quadrennia up to 1983–86 related to the combined

experience of individually costed and unit costed business. For the purposes of this report the two types of business have been analysed separately. The wider confidence intervals in Figures A2.1–A2.4 for 1987–90 compared with previous quadrennia arise from the lower volumes of data available. One reason for this is the separate analysis of unit costed data in 1987–90 whereas the earlier analyses combine the unit costed data with the individually costed data. There is very little data for DP1, DP4 and DP52 and the wide confidence intervals reflect this.

4.2 *Recoveries – males*

Overall recovery rates for all deferred periods combined are some 49% of those expected on the basis of SM1975–78. The two previous quadrennia also produced rates significantly less than expected. Overall rates are slightly higher than 1983–86 but there is some overlap of confidence intervals. There is no readily discernible pattern for the 100A/E rates to vary by claim duration or by age.

Recovery rates are somewhat higher for DP13 business compared to DP26, a pattern repeated from previous quadrennia.

4.3 *Recoveries – females*

Data is sparse with only 52 recoveries for all DP combined. The confidence intervals are correspondingly large. Overall recovery rates for all DP combined are some 57% of those expected on the basis of SM1975–78, a little higher than the males but not significantly so. As with the males the rates are higher than in the 1983–86 quadrennium but there is substantial overlap of confidence intervals. There is no evidence of any significant patterns in 100A/E by age or claim duration. As with the males, recovery rates are higher for DP13 business compared to DP26 and again this is repeated from previous quadrennia.

4.4 *Deaths – males*

There were 93 deaths in total, about two-thirds of which related to DP26 business. Overall death rates for all DP combined were some 97% of those expected on the basis of SM1975–78, slightly lower than 1983–86 and similar to 1979–82. There is no discernible pattern by age or duration of claim. 100A/E is lower for DP13 business than DP26 but there is considerable overlap of confidence intervals and previous quadrennia do not show significant differences.

4.5 *Deaths – females*

Data is vary sparse, there being only 13 deaths. Overall values of 100A/E are some 96% of those expected on the basis of SM1975–78, which is almost the

same as for males. In view of the lack of data no further comment is worth making.

5. UNIT COSTED BUSINESS – TERMINATIONS

5.1 *Analysis of the data*

This business has been analysed using the same methodology and comparison basis as was used for the individually costed business. The results and statistical analysis of the results are summarised in Tables A7.1–A7.4 for male recoveries, female recoveries, male deaths and female deaths respectively.

The overall values of 100A/E for all ages and durations combined are compared with the values for the individually costed group business for the same quadrennium in Table A6. This table also shows the equivalent figures for the previous three quadrennia where the individually costed and unit costed experiences were combined for analysis. These results are illustrated graphically in Figures A2.1–A2.4 which also illustrates confidence intervals as described in Section 4.1 of this report.

There is negligible data for DP1 and DP4. The confidence intervals applying to the results for other deferred periods are narrower than for the individually costed data reflecting the relative volumes.

5.2 *Recoveries – males*

Overall recovery rates for all deferred periods combined are some 74% of those expected on the basis of SM1975–78. This is significantly higher than the equivalent figure for individually costed business (49%) for the same quadrennium. The difference arises mainly for the experience of DP26 business. Readers are cautioned from drawing the conclusion that unit costed business has an inherently more favourable recovery experience than individually costed business as other factors, such as the mix of offices in each experience, may account for the explanation.

The recovery rates are also significantly higher than those observed for the combined individually and unit costed experience of the previous two quadrennia.

There is some evidence of 100A/E rates tending to increase with claim duration, particularly for DP26 business. There is no obvious pattern of variation with age.

5.3 *Recoveries – females*

Overall recovery rates for all deferred periods combined are some 68% of those expected on the basis of SM1975–78, a little lower than the male

figure. Like the male experience, the female unit costed experience is higher than the equivalent figure for individually costed business (57%) but the difference is lower.

Female recovery rates, like the males, are also significantly higher than the combined individually and unit costed experience of the previous two quadrennia.

5.4 *Deaths – males*

Death rates for all deferred periods combined are some 81% of those expected on the basis of SM1975–78. This compares with 97% for the individually costed business but there is considerable overlap of confidence intervals. Rates are also lower than those observed for the previous two quadrennia for the combined experience and significantly lower than 1983–86.

There are no obvious patterns to variation by age or duration.

5.5 *Deaths – females*

Female death rates for all deferred periods combined are some 66% of those expected on the basis of SM1975–78, lower than the male rates. The rates are also lower than observed for individually costed business but there was little data for the latter.

Table A1. Group (individually costed) PHI policies, 1987–90. Aggregate and Standard data. Number of policies in force at the beginning and end of each investigation year and number of claims records summed across the four year period.

		Aggregate data			Standard data		
	Attribute	In force at start of year	In force at end of year	Claim records	In force at start of year	In force at end of year	Claim records
Sex	Male	299,243	270,072	3,169	243,761	205,801	2,444
	Female	77,158	70,670	472	66,879	57,168	399
Country	UK	342,319	306,790	3,126	310,640	262,969	2,843
	Republic of Ireland	33,593	33,458	511	0	0	0
	Isle of Man	30	28	0	0	0	0
	Channel Islands	459	466	4	0	0	0
Occupational Rating	Not rated	336,970	293,644	3,294	310,640	262,969	2,843
	Rated	39,431	47,098	347	0	0	0
Benefit Type	Level	79,788	64,970	1,430	47,415	29,420	973
	Increasing	296,596	275,641	2,211	263,208	233,469	1,870
	Decreasing	17	130	0	17	80	0
	Other	0	1	0	0	0	0
Medical Evidence	Medical	16,079	14,569	340	8,471	7,201	182
	Non-medical	17,730	16,912	364	5,714	5,169	136
	Non-selection	157,592	80,315	1,259	143,524	59,666	1,024
	Unknown	185,000	228,946	1,678	152,931	190,933	1,501
Premium Type	Level annual	60,624	58,503	960	26,468	22,303	481
	Recurrent single	307,162	273,887	2,652	278,735	235,757	2,347
	Increasing annual	0	1	9	0	0	0
	Other	8,615	8,351	20	5,437	4,909	15

Table A1. (Continued).

		Aggregate data			Standard data		
	Attribute	In force at start of year	In force at end of year	Claim records	In force at start of year	In force at end of year	Claim records
Underwriting Impairment	No extra risk	289,171	328,476	3,437	226,571	260,810	2,712
	Hypertension	37	31	4	0	0	0
	Neurosis	34	31	4	0	0	0
	Exclusion possible	84,610	2,544	150	84,069	2,159	131
	Unknown impairment	1	0	3	0	0	0
	Other	2,548	9,660	43	0	0	0
	Total records	376,401	340,742	3,641	310,640	262,969	2,843

Table A2. Group (unit costed) PHI policies, 1987–90. Aggregate and Standard data. Number of claims records for each investigation year summed across the four year period.

		Aggregate	Standard
	Attribute	Claims records	Claims records
Sex	Male	16,729	15,951
	Female	3,881	3,702
Country	UK	19,653	19,653
	Republic of Ireland	953	0
	Isle of Man	1	0
	Channel Islands	3	0
Occupational Rating	Not rated	20,610	19,653
	Rated	0	0
Benefit Type	Level	5,510	5,374
	Increasing	15,099	14,278
	Decreasing	1	1
	Other	0	0
Medical Evidence	Medical	0	0
	Non-medical	1	1
	Non-selection	515	160
	Unknown	20,094	19,492
Premium Type	Level annual	0	0
	Recurrent single	20,610	19,653
	Increasing annual	0	0
	Other	0	0
Underwriting Impairment	No extra risk	20,605	19,653
	Hypertension	0	0
	Neurosis	0	0
	Exclusion possible	0	0
	Unknown impairment	0	0
	Other	5	0
	Total records	20,610	19,653

Table A3.1. Males, group (individually costed) policies, Standard experience for the quadrennium 1987–90. Deferred periods 1, 4, 13, 26 and 52 weeks. Comparison of actual claim inceptions by quinquennial age group to those expected using the *C.M.I.R.* **12** model parameterised using the males, individual policies, Standard experience for 1975–78.

Table A3.1a: Deferred Period 1 Week

Age group	AINC	EINC	100 × A/E	Z	EINC*	100 × A/E*	Z*
18–24	0.0	0.0	↓	↓	0.0	↓	↓
25–29	0.0	0.1	↓	↓	0.0	↓	↓
30–34	0.0	0.0	↓	↓	0.0	↓	↓
35–39	0.0	0.3	↓	↓	0.2	↓	↓
40–44	0.0	2.9	↓	↓	1.5	↓	↓
45–49	7.0	2.8	115	0.24	1.4	↓	↓
50–54	0.0	6.5	0	−1.69	3.3	111	0.19
55–59	1.0	5.7	18	−1.30	2.8	↓	↓
60–64	5.0	7.8	64	−0.66	3.9	90	−0.18
18–64	13.0	26.1	50		13.0	100	
Total chi-squared				5.0			0.1
Degrees of freedom				4			1
Probability value				0.28			0.80

Table A3.1b: Deferred Period 4 Weeks

Age group	AINC	EINC	100 × A/E	Z	EINC*	100 × A/E*	Z*
18–24	0.0	0.1	↓	↓	0.0	↓	↓
25–29	0.0	0.3	↓	↓	0.1	↓	↓
30–34	0.0	0.8	↓	↓	0.4	↓	↓
35–39	0.0	2.4	↓	↓	1.1	↓	↓
40–44	2.0	4.0	26	−1.57	1.9	↓	↓
45–49	4.0	4.3	↓	↓	2.0	109	0.15
50–54	2.0	5.5	61	−0.93	2.6	↓	↓
55–59	4.0	8.7	46	−1.23	4.1	95	−0.12
60–64	3.0	6.1	49	−0.98	2.9	↑	↑
18–64	15.0	32.2	47		15.0	100	
Total chi-squared				5.8			0.0
Degrees of freedom				4			1
Probability value				0.22			0.85

Table A3.1c: Deferred Period 13 Weeks

Age group	AINC	EINC	100 × A/E	Z	EINC*	100 × A/E*	Z*
18–24	4.0	2.6	↓	↓	1.9	↓	↓
25–29	8.0	8.3	110	0.31	6.2	148	1.27
30–34	10.0	14.4	70	−1.07	10.7	94	−0.19
35–39	16.0	21.9	73	−1.16	16.2	98	−0.06
40–44	15.0	34.2	44	−3.04	25.4	59	−1.91
45–49	30.0	32.3	93	−0.37	24.0	125	1.14
50–54	34.0	36.1	94	−0.32	26.8	127	1.28
55–59	30.0	39.0	77	−1.34	29.0	104	0.18
60–64	22.0	38.8	57	−2.49	28.8	76	−1.17
18–64	169.0	227.6	74		169.0	100	
Total chi-squared				20.1			9.7
Degrees of freedom				8			7
Probability value				0.10			0.21

Table A3.1d: Deferred Period 26 Weeks

Age group	AINC	EINC	100 × A/E	Z	EINC*	100 × A/E*	Z*
18–24	5.0	1.2	↓	↓	↓	↓	↓
25–29	10.0	4.7	258	3.39	4.2	289	3.83
30–34	6.0	9.7	62	−1.06	8.6	69	−0.80
35–39	13.0	17.3	75	−0.91	15.4	84	−0.54
40–44	23.0	31.8	72	−1.40	28.4	81	−0.90
45–49	35.0	39.7	88	−0.67	35.4	99	−0.06
50–54	61.0	60.4	101	0.07	53.8	113	0.87
55–59	83.0	91.1	91	−0.76	81.3	102	0.17
60–64	92.0	112.0	82	−1.69	99.9	92	−0.70
18–64	328.0	367.9	89		328.0	100	
Total chi-squared				19.2			17.7
Degrees of freedom				*8*			7
Probability value				0.0136			0.0132

Table A3.1e: Deferred Period 52 Weeks

Age group	AINC	EINC	100 × A/E	Z	EINC*	100 × A/E*	Z*
18–24	0.0	0.0	↓	↓	0.0	↓	↓
25–29	0.0	0.0	↓	↓	0.0	↓	↓
30–34	1.0	0.2	↓	↓	0.2	↓	↓
35–39	0.0	0.6	↓	↓	0.6	↓	↓
40–44	2.0	1.5	↓	↓	1.5	↓	↓
45–49	1.0	2.2	↓	↓	2.2	↓	↓
50–54	7.0	3.7	133	0.85	3.7	135	0.90
55–59	8.0	5.5	144	0.93	5.5	146	0.97
60–64	1.0	6.5	15	−1.92	6.4	16	−1.90
18–64	20.0	20.3	99		20.0	100	
Total chi-squared				5.3			5.4
Degrees of freedom				3			2
Probability value				0.15			0.0689

Table A3.2. Females, group (individually costed) policies, Standard experience for the quadrennium 1987–90. Deferred periods 1, 4, 13, 26 and 52 weeks. Comparison of actual claim inceptions by quinquennial age group to those expected using the *C.M.I.R.* **12** model parameterised using the males, individual policies, Standard experience for 1975–78.

Table A3.2a: Deferred Period 1 Week

Age group	AINC	EINC	100 × A/E	Z	EINC*	100 × A/E*	Z*
18–24	0.0	0.0	↓	↓	0.0	↓	↓
25–29	0.0	0.0	↓	↓	0.0	↓	↓
30–34	0.0	0.0	↓	↓	0.0	↓	↓
35–39	0.0	0.0	↓	↓	0.0	↓	↓
40–44	0.0	0.7	↓	↓	0.0	↓	↓
45–49	0.0	0.0	↓	↓	0.0	↓	↓
50–54	0.0	0.0	↓	↓	0.0	↓	↓
55–59	0.0	1.2	↓	↓	0.0	↓	↓
60–64	0.0	0.0	0	−0.93	0.0	0	0.00
18–64	0.0	2.0	0		0.0	0	
Total chi-squared				0.9			0.0
Degrees of freedom				1			0
Probability value				0.35			0.0000

Table A3.2b: Deferred Period 4 Weeks

Age group	AINC	EINC	100 × A/E	Z	EINC*	100 × A/E*	Z*
18–24	0.0	0.0	↓	↓	0.0	↓	↓
25–29	1.0	0.1	↓	↓	0.1	↓	↓
30–34	0.0	0.1	↓	↓	0.1	↓	↓
35–39	0.0	0.2	↓	↓	0.2	↓	↓
40–44	0.0	0.6	↓	↓	0.6	↓	↓
45–49	1.0	0.6	↓	↓	0.6	↓	↓
50–54	1.0	0.8	↓	↓	0.8	↓	↓
55–59	0.0	0.5	↓	↓	0.5	↓	↓
60–64	0.0	0.0	103	0.04	0.0	100	0.00
18–64	3.0	2.9	103		3.0	100	
Total chi-squared				0.0			0.0
Degrees of freedom				1			0
Probability value				0.97			0.0000

Table A3.2c: Deferred Period 13 Weeks

Age group	AINC	EINC	100 × A/E	Z	EINC*	100 × A/E*	Z*
18–24	4.0	2.6	↓	↓	1.9	↓	↓
25–29	2.0	4.7	82	−0.44	3.5	112	0.25
30–34	3.0	4.5	↓	↓	3.5	↓	↓
35–39	7.0	5.0	105	0.16	3.6	143	1.05
40–44	7.0	7.2	97	−0.06	5.3	132	0.68
45–49	7.0	7.7	91	−0.24	5.7	123	0.51
50–54	3.0	7.8	38	−1.59	5.8	52	−1.06
55–59	4.0	7.8	37	−1.90	5.8	51	−1.28
60–64	0.0	2.9	↑	↑	2.1	↑	↑
18–64	37.0	50.2	74		37.0	100	
Total chi-squared				6.4			4.7
Degrees of freedom				6			5
Probability value				0.38			0.46

Table A3.2d: Deferred Period 26 Weeks

Age group	AINC	EINC	100 × A/E	Z	EINC*	100 × A/E*	Z*
18–24	0.0	1.3	↓	↓	1.2	↓	↓
25–29	4.0	3.1	↓	↓	2.8	↓	↓
30–34	6.0	3.5	126	0.65	3.1	140	0.95
35–39	5.0	4.0	↓	↓	3.6	↓	↓
40–44	5.0	6.1	99	−0.02	5.5	110	0.28
45–49	7.0	8.2	85	−0.38	7.4	94	−0.14
50–54	13.0	12.1	108	0.24	10.8	120	0.58
55–59	16.0	16.2	99	−0.04	14.5	110	0.34
60–64	0.0	7.8	0	−2.48	7.0	0	−2.36
18–64	56.0	62.2	90		56.0	100	
Total chi-squared				6.8			7.0
Degrees of freedom				6			5
Probability value				0.34			0.22

Table A3.2e: Deferred Period 52 Weeks

Age group	AINC	EINC	100 × A/E	Z	EINC*	100 × A/E*	Z*
18–24	0.0	0.0	↓	↓	0.0	↓	↓
25–29	0.0	0.0	↓	↓	0.0	↓	↓
30–34	0.0	0.1	↓	↓	0.0	↓	↓
35–39	0.0	0.1	↓	↓	0.0	↓	↓
40–44	0.0	0.1	↓	↓	0.0	↓	↓
45–49	0.0	0.2	↓	↓	0.0	↓	↓
50–54	0.0	0.2	↓	↓	0.0	↓	↓
55–59	0.0	0.3	↓	↓	0.0	↓	↓
60–64	0.0	0.2	0	−0.95	0.0	0	0.00
18–64	0.0	1.1	0		0.0	0	
Total chi-squared				0.9			0.0
Degrees of freedom				1			0
Probability value				0.34			0.0000

Table A4.1. Males, group (individually costed) policies, Standard experience for the quadrennia 1975–78, 1979–82, 1983–86 and 1987–90. Deferred periods 1, 4, 13, 26 and 52 weeks. Ratios of actual claim inceptions to those expected using the *C.M.I.R.* **12** model parameterised using the males, individual policies, Standard experience for 1975–78. Also shown are 100 × A/E plus/minus two standard deviations.

Deferred period	Quadrennium	100 × A/E − 2 × SD	100 × A/E	100 × A/E + 2 × SD
1	1975–78	–	38.0	77.8
	1979–82	14.5	48.7	82.9
	1983–86	–	42.9	94.1
	1987–90	–	49.8	109.0
4	1975–78	71.2	104.0	136.8
	1979–82	31.2	64.5	97.8
	1983–86	29.3	66.0	102.7
	1987–90	0.9	46.6	92.3
13	1975–78	89.3	108.5	127.7
	1979–82	76.6	89.6	102.6
	1983–86	67.7	86.9	106.1
	1987–90	60.0	74.3	88.6
26	1975–78	90.9	104.8	118.7
	1979–82	102.0	111.1	120.2
	1983–86	130.3	148.2	166.1
	1987–90	77.5	89.2	100.9
52	1975–78	109.8	152.0	194.2
	1979–82	99.6	133.3	167.0
	1983–86	111.3	171.3	231.3
	1987–90	48.7	98.5	148.3

Table A4.2. Females, group (individually costed) policies, Standard experience for the quadrennia 1975–78, 1979–82, 1983–86 and 1987–90. Deferred periods 1, 4, 13, 26 and 52 weeks. Ratios of actual claim inceptions to those expected using the *C.M.I.R.* **12** model parameterised using the males, individual policies, Standard experience for 1975–78. Also shown are 100 × A/E plus/minus two standard deviations.

Deferred period	Quadrennium	100 × A/E − 2 × SD	100 × A/E	100 × A/E + 2 × SD
1	1975–78	–	81.0	–
	1979–82	–	22.9	125.5
	1983–86	–	128.4	–
	1987–90	–	0.0	–
4	1975–78	241.9	344.4	446.9
	1979–82	17.4	116.1	214.8
	1983–86	–	95.4	209.1
	1987–90	–	103.4	–
13	1975–78	100.8	160.6	220.4
	1979–82	92.2	123.5	154.8
	1983–86	103.5	155.4	207.3
	1987–90	43.2	73.7	104.2
26	1975–78	85.1	124.1	163.1
	1979–82	89.9	112.4	134.9
	1983–86	150.5	195.9	241.3
	1987–90	61.5	90.0	118.5
52	1975–78	–	62.6	–
	1979–82	–	163.3	–
	1983–86	–	292.5	–
	1987–90	–	0.0	–

Table A5.1. Males, individually costed group policies, 1987–90, Standard experience, recoveries.

	DP 1	DP 4	DP 13	DP 26	DP 52	All DP
A	11	6	94	84	1	196
E	17.2	20.8	165.1	189.9	9.1	401.9
$100A/E$						
Durations:						
1–13 weeks	↓	↓	–	–	–	*48*
13–17 weeks	↓	↓	*49*	–	–	*43*
17–26 weeks	↓	↓	*43*	–	–	*45*
26–30 weeks	↓	↓	*53*	*32*	–	*41*
30–39 weeks	↓	↓	↓	*22*	–	*35*
39 weeks–1 year	↓	↓	*56*	*45*	–	*47*
1–2 years	↓	↓	↓	*46*	↓	58
2–11 years	*64*	*29*	*96*	*71*	*11*	68
Ages:						
19–29	–	–	↓	*44*	–	*61*
30–34	–	–	*73*	↓	↓	*40*
35–39	–	–	*62*	*28*	↓	*51*
40–44	–	↓	*86*	*49*	↓	*60*
45–49	↓	↓	*52*	*57*	↓	54
50–54	↓	↓	*48*	*56*	↓	51
55–59	↓	↓	↓	*41*	↓	*36*
60–65	*64*	*29*	*42*	*20*	*11*	*36*
All cells	*64*	*29*	57	44	*11*	49
Using E						
$\sum z^2$	1.87	9.80	37.39	59.60	6.33	108.63
df	1	1	14	15	1	32
$p(\chi^2)$	0.17	**0.0017**	**0.0006**	**0.0000**	**0.0119**	**0.0000**
#(+/−)	0/1	0/1	1/13	0/15	0/1	0/32
$p(+/-)$	1.0	1.0	**0.0018**	**0.0001**	1.0	**0.0000**
$p(B)$	1.0	1.0	0.574	1.0	1.0	1.0
Using adjusted E						
$\sum z^2$	–	–	9.14	12.39	–	12.89
df	–	–	5	5	–	15
$p(\chi^2)$	–	–	0.10	**0.0298**	–	0.61
#(+/−)	–	–	1/5	3/3	–	6/10
$p(+/-)$	–	–	0.22	1.0	–	0.45
$p(B)$	–	–	0.197	0.524	–	0.666

Note: $100A/E$ is shown as *italic* if the actual number of recoveries is less than 30. $p(\chi^2)$ and $p(+/-)$ are shown to 4 decimal places if less than 0.10 and as **bold** if less than 0.05. $p(B)$ is shown as **bold** if less than 0.050.

Table A5.2. Females, individually costed group policies, 1987–90, Standard experience, recoveries.

	DP 1	DP 4	DP 13	DP 26	DP 52	All DP
A	–	2	29	21	0	52
E	–	5.9	40.7	43.6	0.4	90.7
$100A/E$						
Durations:						
1–26 weeks	–	↓	*61*	–	–	↓
26–30 weeks	–	↓	↓	↓	–	*56*
30 weeks–1 year	–	↓	↓	*39*	–	*49*
1–11 years	–	*34*	*84*	*59*	–	*67*
Ages:						
19–29	–	↓	↓	↓	↓	*41*
30–39	–	↓	*68*	*42*	↓	*56*
40–49	–	↓	↓	↓	↓	*83*
50–54	–	*34*	↓	↓	–	↓
55–63	–	–	*74*	*53*	–	*41*
All cells	–	*34*	*71*	*48*	–	57
Using E						
$\sum z^2$	–	1.94	3.04	10.44	0.00	14.51
df	–	1	3	4	1	7
$p(\chi^2)$	–	0.16	0.39	**0.0336**	**0.0000**	**0.0428**
#(+/−)	–	0/1	0/3	0/4	0/1	0/7
$p(+/-)$	–	1.0	0.25	0.13	1.0	**0.0156**
$p(B)$	–	1.0	1.0	1.0	1.0	1.0
Using adjusted E						
$\sum z^2$	–	–	–	–	–	0.53
df	–	–	–	–	–	2
$p(\chi^2)$	–	–	–	–	–	0.77
#(+/−)	–	–	–	–	–	1/2
$p(+/-)$	–	–	–	–	–	1.0
$p(B)$	–	–	–	–	–	0.761

Note: $100A/E$ is shown as *italic* if the actual number of recoveries is less than 30. $p(\chi^2)$ and $p(+/-)$ are shown to 4 decimal places if less than 0.10 and as **bold** if less than 0.05. $p(B)$ is shown as **bold** if less than 0.050.

Table A5.3. Males, individually costed group policies, 1987–90, Standard experience, deaths.

	DP 1	DP 4	DP 13	DP 26	DP 52	All DP
A	1	4	16	68	4	93
E	0.8	1.5	24.1	64.0	5.3	95.8
$100A/E$						
Durations:						
1 week–1 year	↓	↓	↓	*100*	–	*91*
1–2 years	↓	↓	↓	*146*	↓	*117*
2–11 years	*119*	*265*	*66*	*89*	*75*	90
Ages:						
19–49	↓	↓	↓	*90*	↓	*90*
50–54	↓	↓	↓	↓	↓	*108*
55–59	↓	↓	↓	↓	↓	*99*
60–64	*119*	*265*	*66*	112	*75*	*92*
All cells	*119*	*265*	*66*	106	*75*	97
Using E						
$\sum z^2$	0.00	2.62	2.38	5.79	0.13	3.59
df	1	1	1	4	1	7
$p(\chi^2)$	**0.0000**	0.11	0.12	0.22	0.71	0.83
$\#(+/-)$	1/0	1/0	0/1	2/2	0/1	4/3
$p(+/-)$	1.0	1.0	1.0	1.0	1.0	1.0
$p(B)$	1.0	1.0	1.0	0.666	1.0	0.854
Using adjusted E						
$\sum z^2$	–	–	–	6.18	–	3.60
df	–	–	–	4	–	6
$p(\chi^2)$	–	–	–	0.19	–	0.73
$\#(+/-)$	–	–	–	2/3	–	4/3
$p(+/-)$	–	–	–	1.0	–	1.0
$p(B)$	–	–	–	0.671	–	0.924

Note: $100A/E$ is shown as *italic* if the actual number of deaths is less than 30. $p(\chi^2)$ and $p(+/-)$ are shown to 4 decimal places if less than 0.10 and as **bold** if less than 0.05. $p(B)$ is shown as **bold** if less than 0.050.

Table A5.4. Females, individually costed group policies, 1987–90, Standard experience, deaths.

	DP 1	DP 4	DP 13	DP 26	DP 52	All DP
A	–	0	4	9	0	13
E	–	0.3	4.1	8.8	0.2	13.5
$100A/E$						
Durations:						
1 week–11 years	–	–	*97*	*102*	–	*96*
Ages:						
19–63	–	–	*97*	*102*	–	*96*
All cells	–	–	*97*	*102*	–	*96*
Using E						
$\sum z^2$	–	0.00	0.00	0.00	0.00	0.00
df	–	1	1	1	1	1
$p(\chi^2)$	–	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**
$\#(+/-)$	–	0/1	0/1	1/0	0/1	0/1
$p(+/-)$	–	1.0	1.0	1.0	1.0	1.0
$p(B)$	–	1.0	1.0	1.0	1.0	1.0
Using adjusted E						
$\sum z^2$	–	–	–	–	–	–
df	–	–	–	–	–	–
$p(\chi^2)$	–	–	–	–	–	–
$\#(+/-)$	–	–	–	–	–	–
$p(+/-)$	–	–	–	–	–	–
$p(B)$	–	–	–	–	–	–

Note: $100A/E$ is shown as *italic* if the actual number of deaths is less than 30. $p(\chi^2)$ and $p(+/-)$ are shown to 4 decimal places if less than 0.10 and as **bold** if less than 0.05. $p(B)$ is shown as **bold** if less than 0.050.

Table A6. Summary of termination experience for group PHI claims 1975–90. Standard experience.

	DP 1	DP 4	DP 13	DP 26	DP 52	All DP
(a) Males, recoveries						
1975–78 Combined	*59*	*102*	111	59	*14*	74
1979–82 Combined	*74*	*83*	77	40	*41*	52
1983–86 Combined	*63*	*77*	60	**31**	*29*	39
1987–90 Ind. Costed	*64*	*29*	*57*	*44*	*11*	49
1987–90 Unit Costed	*0*	*0*	65	**73**	91	**74**
(b) Females, recoveries						
1975–78 Combined	*66*	*54*	*112*	*66*	*0*	*72*
1979–82 Combined	*139*	*78*	*75*	*35*	*16*	46
1983–86 Combined	*59*	*125*	*66*	33	*24*	43
1987–90 Ind. Costed	*0*	*34*	*71*	*48*	*0*	*57*
1987–90 Unit Costed	*0*	*0*	87	65	*56*	**68**
(c) Males, deaths						
1975–78 Combined	*289*	*116*	*203*	204	*167*	199
1979–82 Combined	*0*	*0*	*93*	96	*97*	94
1983–86 Combined	*0*	*159*	*121*	**116**	*96*	114
1987–90 Ind. Costed	*119*	*265*	*66*	*106*	*75*	*97*
1987–90 Unit Costed	*0*	*0*	*84*	80	*89*	81
(d) Females, deaths						
1975–78 Combined	*0*	*0*	*0*	*120*	*0*	*92*
1979–82 Combined	*0*	*0*	*90*	*91*	*168*	*91*
1983–86 Combined	*0*	*161*	*88*	*62*	*25*	*64*
1987–90 Ind. Costed	*0*	*0*	*97*	*102*	*0*	*96*
1987–90 Unit Costed	*0*	*0*	*74*	*68*	*38*	*66*

Note:

Italic if number of recoveries or deaths is less than 100.

Bold if either $(+/-)$ or $p(B) < 0.025$ for adjusted E.

Table A7.1. Males, unit costed group policies, 1987–90, Standard experience, recoveries.

	DP 1	DP 4	DP 13	DP 26	DP 52	All DP
A	0	0	145	1,004	169	1,318
E	0.1	0.5	223.0	1,378.5	185.2	1,787.3
$100A/E$						
Durations:						
1–17 weeks	↓	↓	*59*	–	–	*59*
17–26 weeks	↓	↓	64	–	–	64
26–30 weeks	↓	↓	*36*	31	–	31
30–39 weeks	↓	↓	*71*	34	–	37
39 weeks–1 year	↓	↓	*27*	47	–	45
1–2 years	↓	↓	*62*	98	78	92
2–5 years	↓	↓	↓	95	↓	94
5–11 years	–	–	113	166	111	173
Ages:						
18–24	–	–	↓	*72*	↓	*65*
25–29	–	–	*89*	81	↓	86
30–34	–	–	*90*	59	*74*	65
35–39	–	–	*53*	63	*103*	65
40–44	–	–	*89*	76	*100*	79
45–49	–	–	*54*	83	113	83
50–54	–	–	*48*	83	102	81
55–59	–	–	*48*	66	↓	65
60–64	–	–	*75*	67	72	67
All cells	–	–	65	73	91	74
Using E						
$\sum z^2$	0.00	0.00	45.21	314.35	12.24	366.60
df	1	1	19	44	11	55
$p(\chi^2)$	**0.0000**	**0.0000**	**0.0006**	**0.0000**	0.35	**0.0000**
#(+/−)	0/1	0/1	3/16	13/31	4/7	12/43
$p(+/-)$	1.0	1.0	**0.0044**	**0.0096**	0.55	**0.0000**
$p(B)$	1.0	1.0	0.073	**0.000**	0.329	**0.000**
Using adjusted E						
$\sum z^2$	–	–	15.66	296.16	11.82	337.69
df	–	–	11	42	10	50
$p(\chi^2)$	–	–	0.15	**0.0000**	0.30	**0.0000**
#(+/−)	–	–	4/8	19/24	6/5	21/30
$p(+/-)$	–	–	0.39	0.54	1.0	0.26
$p(B)$	–	–	0.392	**0.000**	0.221	**0.000**

Note: $100A/E$ is shown as *italic* if the actual number of recoveries is less than 30. $p(\chi^2)$ and $p(+/-)$ are shown to 4 decimal places if less than 0.10 and as **bold** if less than 0.05. $p(B)$ is shown as **bold** if less than 0.050.

Table A7.2. Females, unit costed group policies, 1987–90, Standard experience, recoveries.

	DP 1	DP 4	DP 13	DP 26	DP 52	All DP
A	–	–	*100*	*274*	*26*	*400*
E	–	–	115.0	424.2	46.6	585.8
$100A/E$						
Durations:						
1–17 weeks	–	–	*110*	–	–	*110*
17–26 weeks	–	–	↓	–	–	*50*
26–30 weeks	–	–	65	*21*	–	*47*
30–39 weeks	–	–	↓	*28*	–	39
39 weeks–1 year	–	–	*90*	67	–	68
1–2 years	–	–	↓	55	*42*	53
2–5 years	–	–	↓	84	↓	88
5–11 years	–	–	*116*	203	*78*	202
Ages:						
18–24	–	–	↓	*49*	↓	*57*
25–29	–	–	*72*	*42*	↓	49
30–34	–	–	*72*	*60*	↓	62
35–39	–	–	↓	60	↓	66
40–44	–	–	117	74	*57*	83
45–49	–	–	↓	75	↓	75
50–54	–	–	↓	79	↓	83
55–59	–	–	↓	↓	*55*	↓
60–64	–	–	84	*60*	–	56
All cells	–	–	87	65	*56*	68
Using E						
$\sum z^2$	–	–	9.38	132.35	9.32	140.90
df	–	–	9	31	3	42
$p(\chi^2)$	–	–	0.40	**0.0000**	**0.0253**	**0.0000**
#(+/−)	–	–	4/5	5/26	0/3	9/33
$p(+/-)$	–	–	1.0	**0.0002**	0.25	**0.0003**
$p(B)$	–	–	0.064	0.076	1.0	**0.014**
Using adjusted E						
$\sum z^2$	–	–	7.56	123.72	–	125.23
df	–	–	8	21	–	29
$p(\chi^2)$	–	–	0.48	**0.0000**	–	**0.0000**
#(+/−)	–	–	6/3	7/15	–	9/21
$p(+/-)$	–	–	0.51	0.13	–	**0.0428**
$p(B)$	–	–	0.368	0.141	–	**0.002**

Note: $100A/E$ is shown as *italic* if the actual number of recoveries is less than 30. $p(\chi^2)$ and $p(+/-)$ are shown to 4 decimal places if less than 0.10 and as **bold** if less than 0.05. $p(B)$ is shown as **bold** if less than 0.050.

Table A7.3. Males, unit costed group policies, 1987–90, Standard experience, deaths.

	DP 1	DP 4	DP 13	DP 26	DP 52	All DP
A	0	0	38	384	77	499
E	0.0	0.2	45.0	481.9	86.8	613.9
$100A/E$						
Durations:						
1–30 weeks	↓	↓	↓	*78*	–	*90*
30–39 weeks	↓	↓	↓	81	–	84
39 weeks–1 year	↓	↓	↓	85	–	90
1–2 years	↓	↓	*96*	67	*74*	67
2–5 years	↓	↓	↓	84	95	85
5–11 years	–	–	*71*	86	*102*	87
Ages:						
18–34	–	–	↓	*60*	↓	*61*
35–39	–	–	↓	*78*	↓	*86*
40–44	–	–	↓	*64*	↓	73
45–49	–	–	*101*	77	*73*	76
50–54	–	–	↓	85	*70*	84
55–59	–	–	↓	86	↓	86
60–64	–	–	*75*	75	105	82
All cells	–	–	84	80	89	81
Using E						
$\sum z^2$	0.00	0.00	3.26	37.51	4.89	47.65
df	1	1	3	25	5	26
$p(\chi^2)$	**0.0000**	**0.0000**	0.35	0.0516	0.43	**0.0059**
#(+/−)	0/1	0/1	1/2	4/21	2/3	5/21
$p(+/-)$	1.0	1.0	1.0	**0.0009**	1.0	**0.0025**
$p(B)$	1.0	1.0	0.675	0.434	0.800	0.773
Using adjusted E						
$\sum z^2$	–	–	0.52	18.75	4.40	30.17
df	–	–	2	20	4	24
$p(\chi^2)$	–	–	0.77	0.54	0.35	0.18
#(+/−)	–	–	2/1	10/11	2/3	11/14
$p(+/-)$	–	–	1.0	1.0	1.0	0.69
$p(B)$	–	–	0.720	0.166	0.871	0.408

Note: $100A/E$ is shown as *italic* if the actual number of deaths is less than 30. $p(\chi^2)$ and $p(+/-)$ are shown to 4 decimal places if less than 0.10 and as **bold** if less than 0.05. $p(B)$ is shown as **bold** if less than 0.050.

Table A7.4. Females, unit costed group policies, 1987–90, Standard experience, deaths.

	DP 1	DP 4	DP 13	DP 26	DP 52	All DP
A	–	–	10	67	5	82
E	–	–	13.6	97.9	13.1	124.6
$100A/E$						
Durations:						
1 week–1 year	–	–	↓	*80*	–	*83*
1–2 years	–	–	↓	*75*	↓	*71*
2–5 years	–	–	↓	*101*	↓	*86*
5–11 years	–	–	*74*	*13*	*38*	*15*
Ages:						
18–39	–	–	↓	*75*	↓	*72*
40–44	–	–	↓	↓	↓	*18*
45–49	–	–	↓	*50*	↓	*68*
50–54	–	–	↓	*70*	↓	*73*
55–59	–	–	↓	↓	*38*	↓
60–64	–	–	*74*	*95*	–	*79*
All cells	–	–	*74*	68	*38*	66
Using E						
$\sum z^2$	–	–	0.69	19.01	4.44	23.76
df	–	–	1	7	1	8
$p(\chi^2)$	–	–	0.41	**0.0082**	**0.0352**	**0.0025**
#(+/−)	–	–	0/1	1/6	0/1	0/8
$p(+/-)$	–	–	1.0	0.13	1.0	**0.0078**
$p(B)$	–	–	1.0	0.284	1.0	1.0
Using adjusted E						
$\sum z^2$	–	–	–	14.30	–	12.96
df	–	–	–	3	–	6
$p(\chi^2)$	–	–	–	**0.0025**	–	**0.0436**
#(+/−)	–	–	–	3/1	–	6/1
$p(+/-)$	–	–	–	0.63	–	0.13
$p(B)$	–	–	–	0.467	–	**0.040**

Note: $100A/E$ is shown as *italic* if the actual number of deaths is less than 30. $p(\chi^2)$ and $p(+/-)$ are shown to 4 decimal places if less than 0.10 and as **bold** if less than 0.05. $p(B)$ is shown as **bold** if less than 0.050.

Figure A1.1. Males, individually costed group policies. Standard inception experience for the quadrennia 1975–78, 1979–82, 1983–86 and 1987–90. Graphical presentation of Table A4.1.

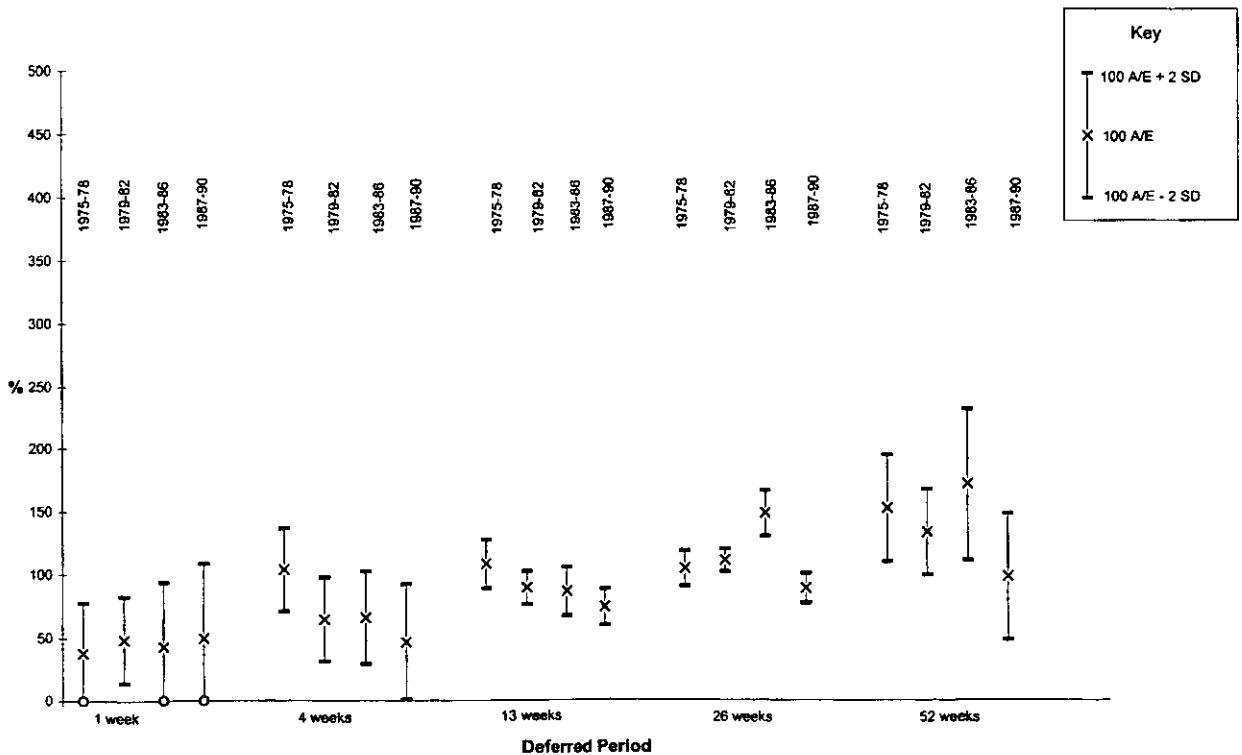


Figure A1.2. Females, individually costed group policies. Standard inception experience for the quadrennia 1975–78, 1979–82, 1983–86 and 1987–90. Graphical presentation of Table A4.2.

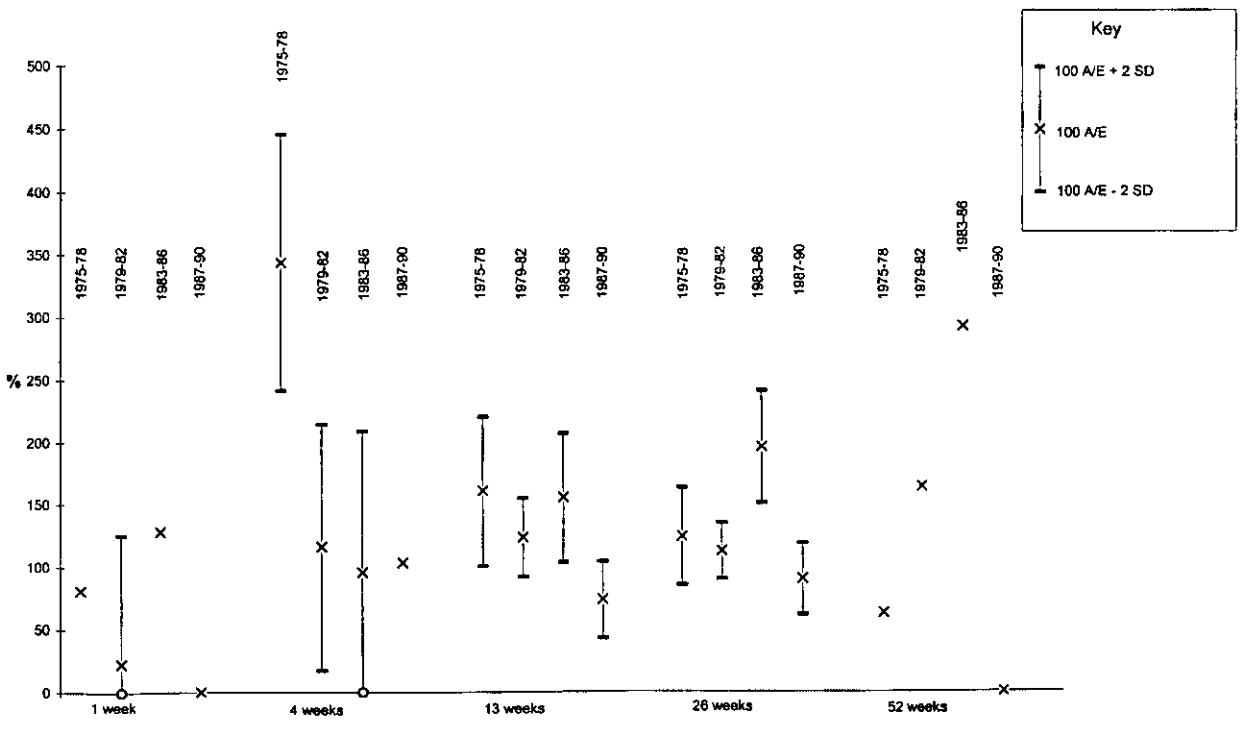


Figure A2.1. Males, recoveries, individually costed and unit costed group policies. Standard experience for the quadrennia 1975–78, 1979–82, 1983–86 and 1987–90. 100 A/E and confidence intervals. Compare with Table A6.(a).

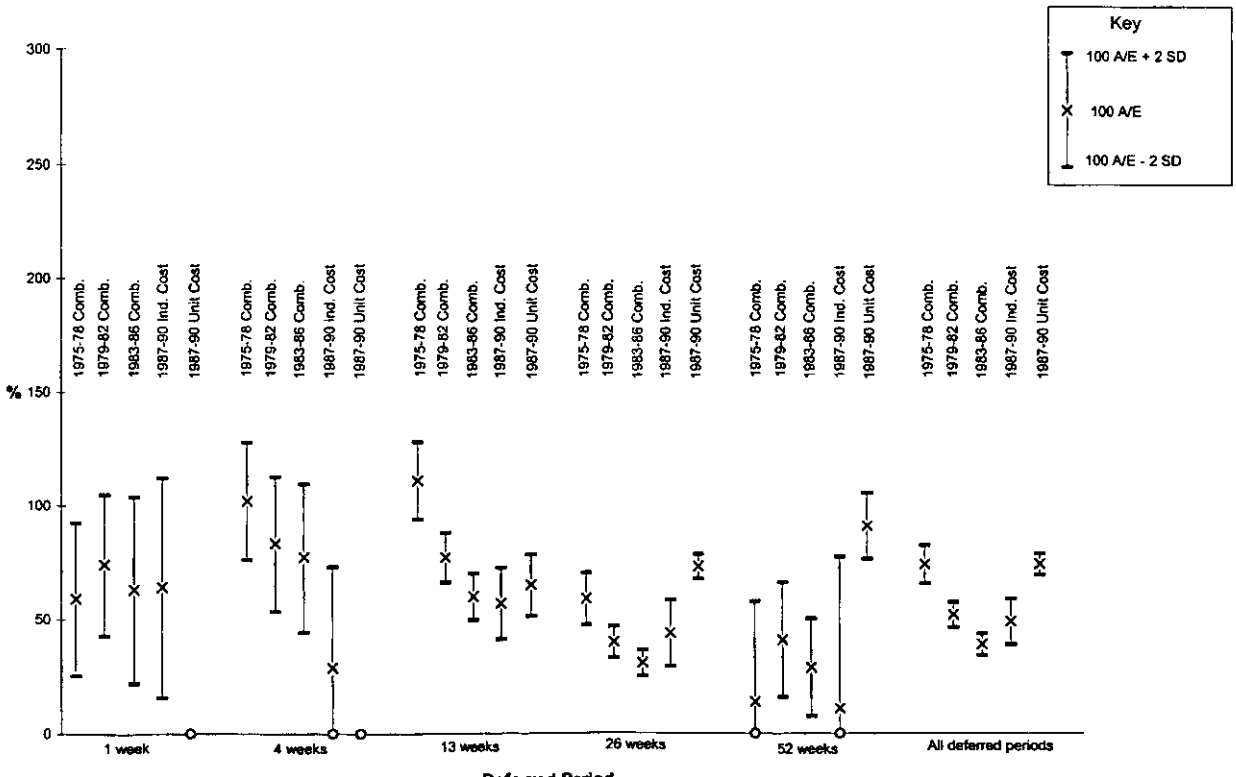


Figure A2.2. Females, recoveries, individually costed and unit costed group policies. Standard experience for the quadrennia 1975–78, 1979–82, 1983–86 and 1987–90. 100 A/E and confidence intervals. Compare with Table A6.(b).

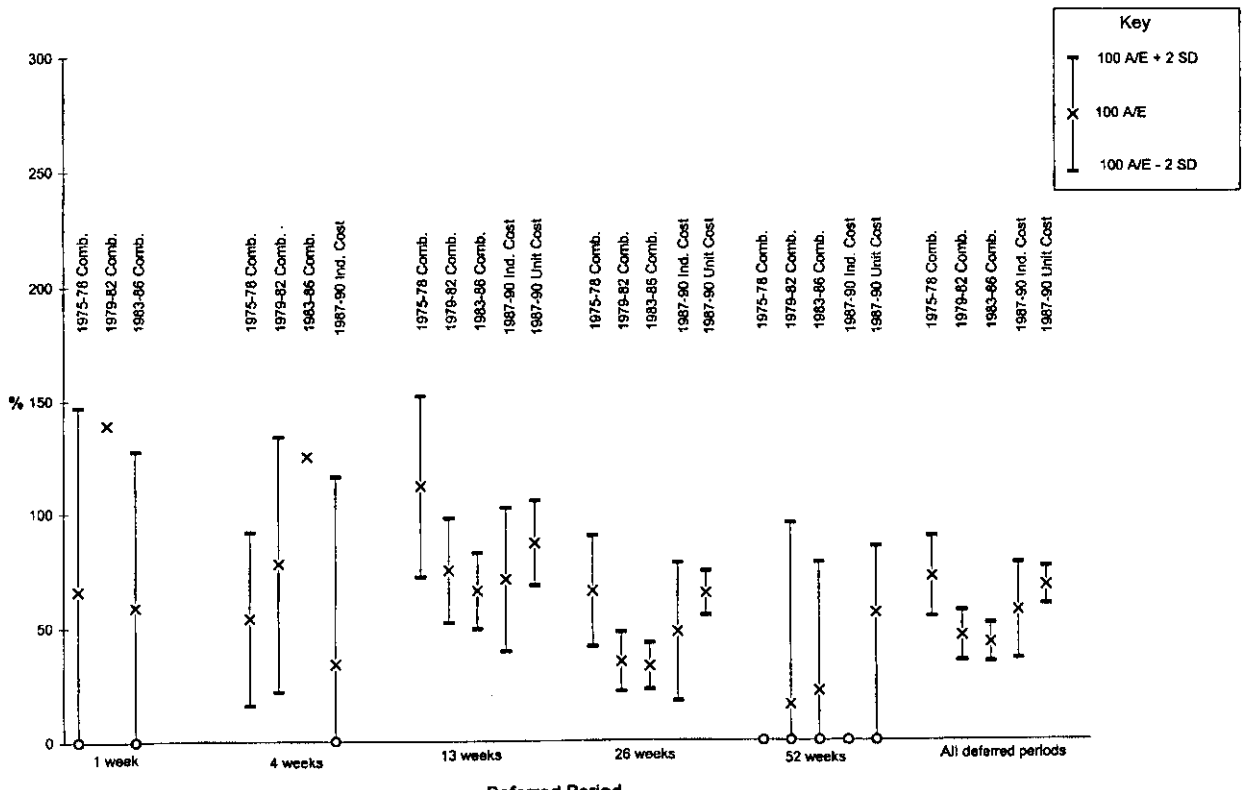


Figure A2.3. Males, deaths, individually costed and unit costed group policies. Standard experience for the quadrennia 1975–78, 1979–82, 1983–86 and 1987–90. 100 A/E and confidence intervals. Compare with Table A6.(c).

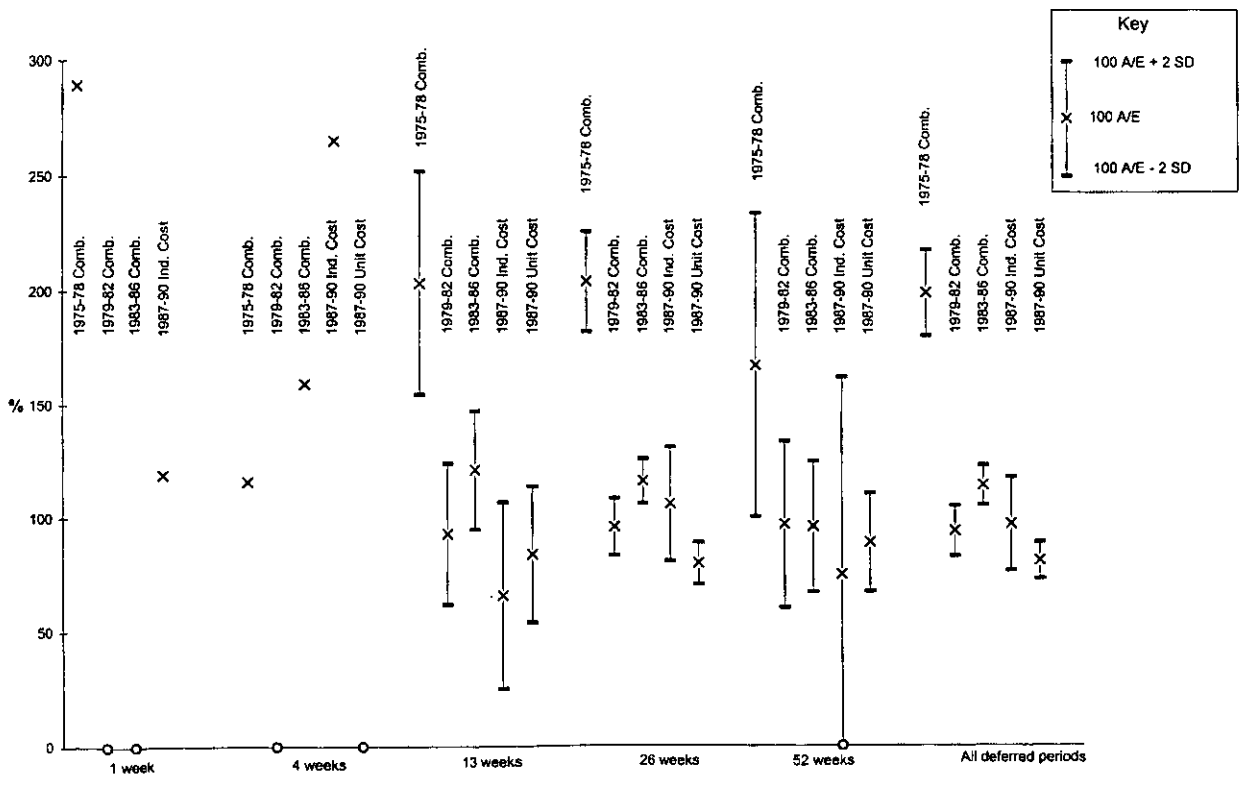
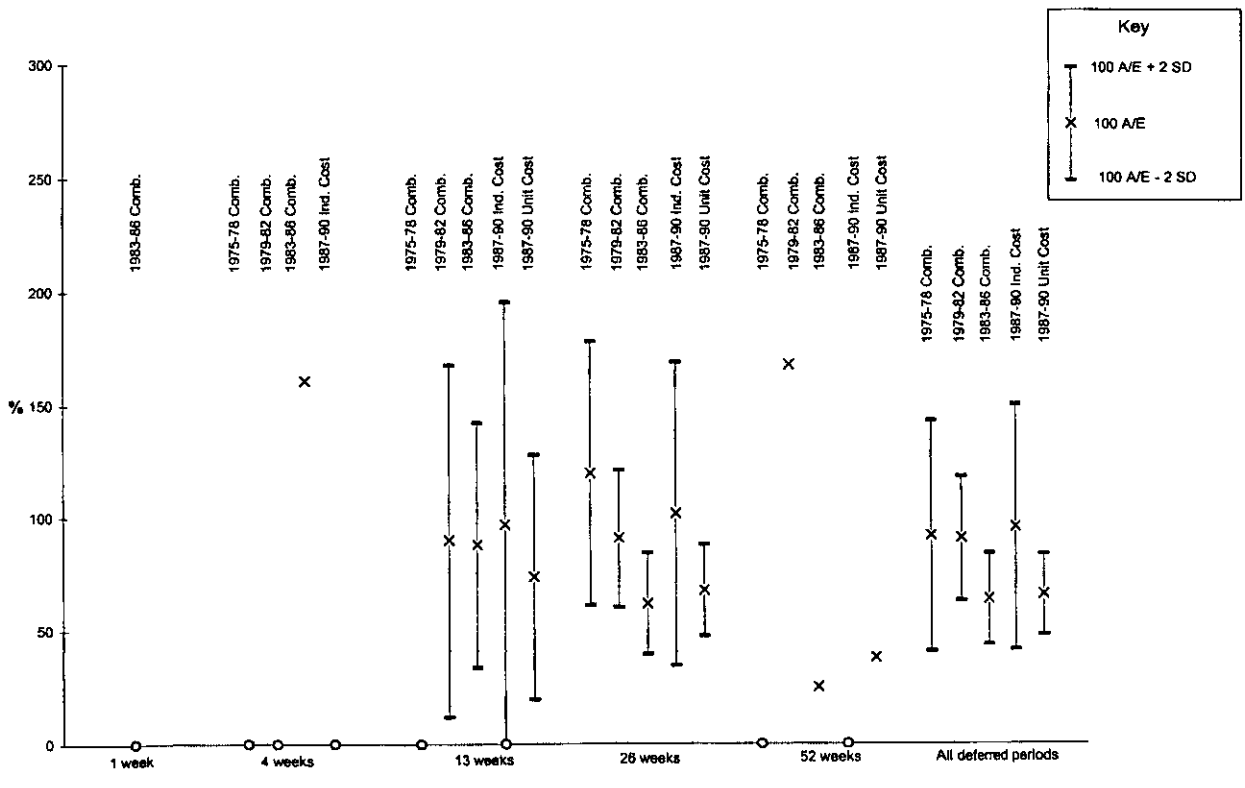


Figure A2.4. Females, deaths, individually costed and unit costed group policies. Standard experience for the quadrennia 1975–78, 1979–82, 1983–86 and 1987–90. 100 A/E and confidence intervals. Compare with Table A6.(d).



CORRIGENDA

C.M.I.R. **14,** 20 Table 1.5.1 should read:

Table 1.5.1. Minimum evidence assurances written on one male life and one female life, males, 1987–90: actual deaths and ratios of actual deaths to those expected using the AM80 table.

Age group (nearest ages)	Actual deaths 1987–90	100A/E 1987–90	100A/E 1985–86
Duration 0			
–25	22	72	61
26–30	43	103	78
31–35	57	140	91
36–40	51	96	67
41–45	56	88	61
46–50	57	109	53
51–	7	156	0
All ages	293	102	67
Duration 1			
–25	16	55	83
26–30	57	105	73
31–35	46	85	94
36–40	63	85	76
41–45	74	73	107
46–50	82	90	74
51–	9	54	39
All ages	347	82	83
Durations 2 and over			
–25	12	41	158
26–30	86	74	
31–35	124	91	65
36–40	160	87	
41–45	206	73	74
46–50	226	78	
51–	92	53	0
All ages	906	75	82

CONTINUOUS MORTALITY INVESTIGATION REPORTS

NUMBER 16

Typeset & printed in Great Britain by the Alden Group, Oxford