

**Continuous Mortality Investigation**

**Mortality sub-committee**

**Working Paper 2**

**Responses to the draft report entitled *A proposed interim basis for adjusting the “92” Series mortality projections for cohort effects* and further commentary thereon**

December 2002

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# **Continuous Mortality Investigation**

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### **Working Paper 2**

#### **Responses to the draft report entitled *A proposed interim basis for adjusting the “92” Series mortality projections for cohort effects and comments thereon***

##### **Introduction**

1. This document records the responses received to a draft report entitled *A proposed interim basis for adjusting the “92” Series mortality projections for cohort effects*. In addition, this paper comments on those responses to the extent that the Mortality sub-committee is able to do so.
2. The draft report was circulated by the CMI in late October 2002 so that it could be presented to a session at the Birmingham Life Convention on 4 November 2002. Responses were requested by 14 November. That report has now been finalised in the light of those responses and issued as Working Paper 1 and entitled *An interim basis for adjusting the “92” Series mortality projections for cohort effects*. The purpose and status of CMI working papers is described in para 34 below.
3. Besides the comments at Birmingham written responses were received from

Gary Crofts  
John Ellam  
Gerry Gallagher  
Ian Gibson  
Craig Gilbert

Peter Joshi  
Mark McCarthy  
Harold Snow  
Mike Urmston  
Watson Wyatt

The Mortality sub-committee is grateful for all the comments. In what follows the identities of respondents in respect of the various issues have not been disclosed. This has been done because we have not reproduced responses in full and authors may feel the quotes we include are taken out of context, nor did we warn them that we would publish their words.

## **Why are mortality rates improving?**

4. A common area of comment was the reasons for the improvements seen. Suggestions were made and these are detailed in later paragraphs. The point was made several times that the draft report was silent on the reasons for the improvements seen and that credibility of the projections was damaged by this omission. One respondent said:

*“Without any real understanding of cause, it is difficult to have confidence in the subsequent projections.”*

5. It is not possible from the data collected by the CMI to ascertain the causes of the mortality improvements seen in the experiences investigated. Indeed it is doubtful that offices would have been in a position to provide the necessary information even if it had been known what to look for. The CMI is also unaware of any other investigations that have directly investigated this matter for the insured or pensioner populations.
6. The only information available is ‘indirect’. These types of investigation have been the subject of much work by many medical and demographic experts. For the CMI to collate, comment and draw conclusions from this large body of work would be a change in the way it operates and will have cost and resource implications. Previously, it has confined itself to commenting on the results of its own analysis of insurance data. However, the CMI does plan to undertake some of this additional work even though it is a significant change in its role.
7. At this time the Mortality sub-committee is not aware of the existence of any better approach that could have been used in the production of the adjusted projections, which it was charged with producing before the end of 2002. Even after the completion of the work the CMI has planned, it is likely that judgment will play a significant part in the production of the next set of mortality projections. Whilst there may, by then, be more information on which to base those judgements it may not be possible to predict future mortality improvements with any greater certainty than is now the case. The sub-committee notes that a similar cohort approach has already been used for the UK national population projections and was subject to detailed analysis in the Review of Methodologies for Projecting Mortality under National Statistics.
8. The draft report makes it very clear what the Mortality sub-committee did. In providing three possible projections (now called the Short, Medium and Long cohort projections) the sub-committee was seeking to indicate the possible range of results that might reasonably be produced. They agree with the respondent who commented:

*“The projections could simply be regarded as three of a possible wide spectrum of future projections on alternative assumptions.”*

As is the case with all the CMI tables, these projections were produced as an aid to actuaries who can adjust (or ignore) the results as they judge appropriate. The Mortality sub-committee felt that to provide no such information would have been unhelpful.

### **Possible reason for improvements**

9. Many respondents gave their ideas of why the rapid improvements in mortality have happened. These included:
  - (a) the reduction in smoking,
  - (b) NHS and welfare reform,
  - (c) improvements in medical treatment (particularly for Stroke and Heart Diseases), and
  - (d) the effect of World War II on the lives that survived.

Most respondents argued that, for the 1926 cohort, these effects are coming to an end and therefore the rate of mortality improvements will slow in the future. Some respondents also took the view that there is a natural limit to life, which limits room for further improvements.

#### *Smoking*

10. Most comments under this heading were that the switch to non-smoking for the cohort of lives aged over 60 in 2000 has come to an end, which means that mortality improvements for this group of lives will quickly diminish. This is assumed to be especially true for males where there has been a greater switch than for females.
11. The CMI has no direct evidence to support these views. Whilst it may be that the change in smoking habits has improved the mortality of males born in the 1920s during the 1980s and 1990s it is not clear that this can explain more than part of what has been observed. It seems likely that there will be two timing issues that impact on the mortality improvements resulting from the reduction in smoking. The first is the speed at which the change happens. Looking at smoker prevalence rates in the UK population<sup>1</sup> for this cohort, it has taken 30 years for these rates to reduce, linearly, to about 16% in 2000. (Many respondents seem to think that the switch was completed earlier than this.) It may be that this trend is now tailing off. The second is the period, after smoking ceases, over which any resulting mortality improvements occur. It can be seen from Appendix B1.1 of the report that the cohort effect starts in the 1970s. However, if the improvement period were very short then the appearance of the cohort should have been more marked earlier. This seems to imply that the reduction period could be 10 to 15 years. If this is so then there may be some way to go before this effect works its way to a conclusion. Given this, it seems reasonable to

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<sup>1</sup> ONS General Household survey 2000.

assume that the resulting mortality improvements will not fall away too rapidly and that the duration of the projected cohort effect should be chosen with this in mind.

12. All of the foregoing is conjecture. It seems likely that the observed cohort effects are a result of a number of factors. This may be particularly so if this change is part of a general increased awareness of the factors that affect health. These factors include diet, exercise, lifestyle and a better understanding of medical issues.
13. When considering the assured lives experience it must also be remembered that in the 1990s offices may have changed their underwriting standards as a result of the introduction of smoker products. Thus, as well as the falling away of endowment products for lives over age 60, the experience could have fewer smokers amongst the lives taking out new policies after 1990. Both these factors could lead to a reduction in mortality improvements observed in the assured lives experience just at the point when the cohort passes into the pensioner population. However, neither of these factors would affect the experience of the pensioner population. This may explain the apparent difference in the two experiences at ages over 60 in the later years of the investigation. Again, this is conjecture but the point is that it is dangerous to champion any particular idea without evidence to back it up.

#### *Other reasons*

14. At this stage the Mortality sub-committee has little to add to the respondents' comments on the other "why" reasons they have given. Clearly they could all have affected mortality but the CMI is not aware of any usable information about their effect on mortality or how these effects may change in the future.
15. There are many arguments that can be put forward for further mortality improvements. Some experts dispute the idea of a natural limit to lifespan and there is some evidence to support their views. What impact future medical advances might have is unclear but it seems reasonable to assume that such advances will happen and that they will benefit the mortality of lives then living. The CMI notes that the UK government has published targets for the further reduction in the number of deaths from various causes and that the resulting commitment of money and other resources is likely to produce some success in this venture. Even if there is a limit to lifespan, there is still much room for the rectangularisation of the mortality curve, which could lead to significant improvements at older ages.

#### **The "shape" of the cohort projection**

16. Several comments were received about the shape of the cohort projection as illustrated in the annual improvement rates underlying the various contour maps in the appendices of Working Paper 1. Amongst these were:

*“ ... could the improvements at the young ages continue at a greater rate than 4.2% for some time into the future?”*

*“ [the cohort approach means] ... improvements at key ages over about age 75 are greater than have ever occurred in the past.”*

*“The projections rely to some extent on recent experience in the last two or three years being representative of the general mortality trend.”*

*“It also appears to be the case that the graduation adopted for the pensioners has smoothed over some of the more recent decline.”*

17. To help others see and understand the data and the projections the Mortality sub-committee has agreed to provide, in a spreadsheet, the crude and graduated  $q_{x,s}$ , in addition to the information previously supplied.
18. Paragraph 33 of Working Paper 1 gives brief details of what was done with regard to the projected “shape” of the cohort effect. Exact details can be seen in the spreadsheet of improvement factors that accompanied the draft report. The rates were based on the pensioner experience. The Loyal Office graduation was used to guide the assumption about the range of ages to which the cohort effect applies. However, given some instability in the maximum improvement rates derived from that graduation, the assumption about the quantum of annual improvement rates in the period 1992 to 1999 was derived from the All Office graduation. These rates were lower than for the Loyal Office graduation. For both these experiences, the maximum annual improvement rates (as seen on the cohort ridge derived from the graduated  $q_{x,s}$ ) increase in all years up to 1999. In 1999, the annual improvement rate seen on both ridges is a maximum of about 6.5%. None of the three projections continued that trend. Each assumes that, after 1999, the cohort ridge declines in years during the cohort period. Therefore, like most respondents, the Mortality sub-committee has formed the view that the cohort effect is likely to decline in the future. Not all those who commented were comfortable with this assumption.
19. The assured lives graduation was used to provide support to the assumptions described above. In particular it shows that the 1926 cohort effect has existed for over 20 years. However, there are differences between the assured lives and pensioner investigations and it is felt that some respondents did not give enough weight to these difference. In particular the sub-committee did not think that the change in the assured lives cohort seen in years after 1995 was a feature that had been carried through into the pensioner experience. The reasons for this view are given in para 13 above.
20. A further contribution noted that the current (i.e. 2002) annuitant mortality experience of their office was heavier than that anticipated by the new cohort projections but continued:

*“However, looking forward from 2002, [the author’s emphasis] the Main Cohort [now Medium Cohort] improvement rates seem reasonable estimates of future mortality rates.”*

## **Males and Females**

21. Many respondents asked about females. The draft report gave little information about this matter because of the limited amount of work done. The result of applying the improvement factors derived from the male cohort investigation to the females experience is shown in Appendix A4.1. The sub-committee’s view is that the improvement rates derived from the males experience do not satisfactorily fit the female experience. The draft report noted that the original “92” Series projections had worked better for females than for males. This is certainly true when looking at the “all age” 100A/Es. (See the same appendix.) However, this is not the case when looking at 100A/Es for different age groups, as can be seen from the annual returns supplied to CMI member offices. Those returns show that the mortality experience for ages below 80 is well below the “92” Series projected mortality rates. Whilst the committee suggests it would be reasonable to continue to use the “92” Series projection factors for females it also warns that some adjustment may be required at younger ages. It also seems likely that, when this matter is fully considered, different projection factors may be produced for females.

## **Lives and Amounts**

22. Several respondents questioned the draft report’s comments about amounts and, in particular, the comment about prudence. One respondent noted:

*“In consequence the [draft] report might be interpreted as recommending that for reserving purposes the ‘High Impact’ [now the Long Cohort] projection should be used ... In our view this interpretation is neither warranted nor intended by the CMI.”*

This respondent is correct and the sentence concerned has been removed from Working Paper 1, which the draft report has now become. The preceding sentence in the draft report (now para 47 of Working Paper 1) states the sub-committee’s opinion that, at this stage, all three cohort projections can be used for both lives and amounts.

23. As the report makes clear, the decision about the basis to use in any particular circumstance rests with the actuary concerned. The CMI’s intention is to help actuaries make those decisions in the light of the best information available.

## Data

24. The draft report noted data problems. Several respondents commented on this. The use of the Loyal Office experience to try and isolate some of these problems was welcomed. Some comments were received that indicated more work should be done on this problem:

*“We also have some concerns that the data issues may still be potentially distorting the results.”*

*“ ... to what extent have the CMI Bureau satisfied themselves over the quality of the Loyal Office data. In particular, how has the data been adjusted for late notified deaths?”*

25. The report makes clear that data issues may still be affecting the experience. However, it is unlikely that the CMIB can do more without substantial help from the offices concerned, including the resubmission of data over a period of many years. Offices have indicated that they are in no position to do this. The secretariat has spent much time dealing with this problem and has come to the end of what they can reasonably do with the current data. This has mainly involved excluding suspect data. The Mortality sub-committee now feels that the results are not being materially distorted by the remaining data problems. However, they acknowledge that the experience analysed is not as representative of the insured pensioner population as it would be if all the data could be included.
26. On the question of late notification of deaths, the CMI asks data contributors to wait six months before supplying data in order to capture such information. Deaths that are notified after that period should be included in the next data return so that they are not missed. It must be remembered that we are measuring the financial effects of paying pensions rather than looking at actual mortality rates. This is because the resulting annuity rates are applied to amounts of pension. Thus the key data for the CMI to measure is the date an office stops paying pension rather than any earlier date of death.

## The process by which the CMI releases information and the status of that information

27. There were several comments about the process used by the CMI to release the draft report and collect feedback on it. Some respondents felt that the timescale for consultation was too short and that, once finalised, the draft report, which is based on work in progress, would impose a standard that had not had full professional scrutiny.

*“ ... there is a danger that the CMI will in effect be imposing a valuation standard which has not been subject to the level of attention appropriate to the scale of the liabilities at issue.”*

*“ ... [the report] should be subject to full professional challenge, perhaps through a sessional meeting, before being adopted by the profession.”*

*“I’m very concerned that this work is being rushed through for the 2002 year end.”*

28. The Mortality sub-committee is sensitive to this matter, which is not new. The issue is how to expose commercially sensitive information for comment and consideration by the profession without a disruptive period of uncertainty resulting. This is a matter for the profession rather than for the CMI alone.
29. In the draft report (now Working Paper 1) the Mortality sub-committee was seeking to do three things. Firstly, to expose the new analysis that highlights the cohort features seen in the past; secondly, to warn that the “92” Series projection factors are no longer appropriate without adjustment; and thirdly, to provide some help to actuaries who must use mortality projections in the interim period up to new mortality tables becoming available. The Mortality sub-committee was acutely aware of the commercial sensitivity of this work and because of this felt that early exposure of the information was essential even though they did not consider their work complete.
30. Without exception respondents have welcomed the draft report’s analysis of past experience and agree that it clearly demonstrated the existence and extent of the cohort related features in past mortality improvements. All seem to agree that the publication of those results is helpful.
31. The background to the release of the draft report is that during early 2002 it became apparent that the work on identifying the cohort effect was likely to produce important new information, which would allow better estimates of future mortality improvements to be made. In March the CMI shared this information with the Life Board and in April disclosed this work to the profession at the CILA Seminar where a timetable for future work was also given. This included the possible issue of an adjustment to the “92” Series projection factors for discussion at the November 2002 Life Convention. Also in April the CMI wrote to all CMI contributing offices to give them details of what was said at CILA.
32. In the event the timetable was met but the report’s issue was later than anticipated due to the late discovery of data problems (see para 10 of Working Paper 1).
33. Many comments were made about the status of the new projections. Respondents felt that the production of a finalised report would place constraints upon actuaries’ freedom to choose bases they felt appropriate for the circumstances of their work. This was not the intention of the Mortality sub-committee and indeed has never been the case with any work published by the CMI. During the compilation of the draft report the sub-committee looked at the mortality bases of a number of leading life offices. No two bases were the same and a wide variation in the assumptions used was evident. Clearly actuaries do use judgement when it comes to setting the

mortality bases that they use, including the assumption about mortality improvements. The sub-committee hoped that the projections detailed in the draft report would help actuaries making those judgements.

34. Given the respondents' comments and to highlight the interim nature of the projections contained in the draft report, the final report has been issued as a CMI "Working Paper". The reader is directed to a separate note about the nature and purpose of these documents. A Working Paper will not necessarily be published in a Blue Book and any tables they contain will not necessarily become Standard Tables of the profession. However, it is intended that these papers will contain work to the same standard as required for Blue Book publication and although some conclusions may be tentative, the papers will still carry the authority of a CMI committee. Their purpose will be to report work early, to inform and allow debate and feedback to the CMI.
35. The Mortality sub-committee is planning the work it must do to take the cohort investigation forward. Part of this is to have two open meetings during 2003 to discuss this work. The first will allow further discussion of Working Paper 1. The second will be a seminar at which experts from a number of fields (medical, actuarial, statistical, demographical and others) will be invited to describe the work they are currently doing in the field of mortality projection.

### **Other matters**

36. Respondents made several suggestions for further work by the Mortality sub-committee. These suggestions should also be borne in mind by other actuaries when setting assumptions of future mortality improvements in respect of their own portfolios.
  - (a) Working Paper 1 considered the experience of normal retirements. To what extent does the presence of early retirements in a typical insured portfolio affect the assumption for future mortality improvements?
  - (b) What is the variation in experience of different offices?
  - (c) What has been the experience in other countries?
  - (d) What has been the experience of non-insured UK pensioners?
  - (e) What assumption for future mortality improvements should be used for new business?

The reader's attention is drawn to the first quote in para 16. The methodology used in all three projections means that generations born after the 1926 cohort are assumed to experience annual mortality improvements in line with the "92"

Series projection. However, lives born after the 1926 cohort are still assumed to benefit from the rapid mortality improvements experienced by the 1926 cohort. This is so because the projection factors suggested in this paper are cumulative from 1992. Thus, the annual improvement rates applicable to later generations are applied to mortality rates that have already been reduced substantially by the 1926 cohort improvements. This effect can be seen in Appendices C1 to C3 of Working Paper 1 where annuity factors at all ages increase with year of use.

37. Several respondents said that they (or their office) had done detailed work on their office's experience and on the mortality assumptions used in their bases and, in particular, on the allowance for future mortality improvements. These respondents will be contacted to ask if they are willing to share that work with the Mortality sub-committee. The sub-committee makes a similar request of any other actuaries who have done such work.
38. In order to better inform the profession's debate about mortality assumptions, the Mortality sub-committee intends to compile a reading list and make this available on the profession's website. It is clearly important that all concerned should have access to the latest information on mortality experiences, analyses and ideas.

## **Conclusion**

39. The draft report has now been issued as a CMI Working Paper. The names given to the three projections have been changed to make it clear that the CMI does not favour any one projection and that actuaries must use their own judgements on this matter. Other minor changes to wording have also been made and any reference to prudence has been removed. A further change relates to the correction of some rounding problems in the original projection factor spreadsheet. Apart from these changes, the report and the projection factors it described remain unchanged.
40. During the period up to the production of tables based on the 1999–2002 quadrennium the CMI may issue additional Working Papers to inform the profession of further progress and to expose new information quickly.

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