

**Continuous Mortality Investigation**

**Mortality Committee**

**Working Paper 11**

**Responses to Working Paper 3 entitled *Projecting future mortality: A discussion paper* and further commentary thereon**

January 2005

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#### **Introduction**

1. This document has been produced by the CMI Mortality Projections Working Party and approved by the CMI Mortality Committee. It records the responses received to Working Paper 3 entitled *Projecting future mortality: A discussion paper*. In addition, this paper comments on those responses to the extent that the Working Party is able to do so.
2. Working Paper 3 was produced by the CMI Mortality Projections Working Party and circulated in March 2004. It recognised that the projection of mortality is uncertain and sought to address the sources of uncertainty. This approach is consistent with the current trend in insurance regulation towards risk management based on stochastic models of risk.
3. Working Paper 3 was the start of a process of raising the profession's awareness of the uncertainty involved in mortality projections, and new methodologies for measuring or modelling that uncertainty. The new projections that will be produced alongside the "00" Series standard tables will only be a particular point in this process and as further research is carried out, the projection methodologies used by the CMI could change.
4. Working Paper 3 was set out as a discussion paper and included eight specific questions. This document describes in turn the responses that have been received to these questions.
5. On 4 June 2004 the CMI hosted a seminar at Staple Inn to discuss both Working Paper 3 and Working Paper 8 (produced by the Mortality Graduation Working Party on the graduation of a new set of standard mortality tables). The seminar gave members of the profession an opportunity to comment on the proposals made in Working Paper 3. Written responses were also welcomed.
6. Besides the comments at the seminar, written responses were received from

Hannover Life Re  
Prudential  
Norwich Union  
Standard Life  
GenRe LifeHealth UK

The Mortality Committee is grateful for all the comments. In what follows the identities of respondents have not been disclosed.

7. The members of the Mortality Projections Working Party are Angus Macdonald (chairman), Adrian Gallop, Keith Miller, Stephen Richards, Rajeev Shah and Richard Willets.

**Question 1: What base tables and projections do life offices use now?**

8. The few responses to this question indicated that offices chose standard tables and projections based on their own observed experiences.
9. As little feedback has been received on this question, the Working Party has set out its own observations below.
10. For the most part offices use the “92” Series standard tables. Some offices use adjusted “80” Series standard tables and a small number of offices use even older tables with adjustments.
11. The “92” Series projections or interim cohort projections are the most widely used, particularly for male mortality, though some offices have adjusted these projections to reflect their own experiences and expectations. Many offices projected different, lower, improvements for female mortality. These included the “92” Series projections and projections derived from offices’ own experiences and expectations.

**Question 2: What level of aggregation is appropriate in projecting future mortality?**

12. There was general agreement that, while cause-specific projections should be carried out if they could be made to work, the currently available methods fell far short of being adequate. However, contributors at the seminar expressed their continuing concerns that the improvements seen in the past may have been greatly influenced by changing smoking patterns and as smoking patterns stabilised, future improvements could follow a different pattern. These concerns were also supported by the written feedback received. Smoking was seen as a different issue and the impact of changing smoking patterns ought to be considered in making projections, as far as is possible.

The Working Party believes that smoking is not the single most important factor affecting mortality improvements though it is obviously one of those most easily

identifiable from the available data. Mortality improvements for almost all causes arise due to the interaction of a number of factors. Many of these factors are common to several causes and few of the interactions are fully understood. Therefore, it is not possible to model cause-specific mortality rates in a robust way. The Working Party does, however, agree that cause-specific rates might be used to check the aggregate projections for reasonableness, as suggested by one respondent, and to provide some commentary on changes to projected aggregate rates.

13. Respondents observed that past improvements have differed by sex with the different pattern of smoking patterns for males and females being one of the many reasons for this. Though separate male and female projections had not been previously produced, feedback was strongly in support of separate projections for males and females.
14. The Working Party will consider producing separate female projections. It is noted that it may be impossible to produce separate female projections based only on insured data as such data have not been collected for long enough. However, if population data were used, sufficient data would be available.

### **Question 3: Should the CMI continue to project cohorts?**

15. All respondents supported the projection of cohort mortality improvements, giving as their reasons the significant evidence of the presence of cohorts in past mortality improvements. Some respondents also noted that these cohort improvements could continue to high ages as highlighted by the Japanese experience.
16. It was noted that projecting on a cohort basis would be consistent with draft guidance from the FSA and the Actuarial Profession, namely that possible future trends should be taken into account where reliable data are available. It was also suggested that an appropriate cohort basis should be applied to different classes of business. The Working Party is encouraged to hear that the self-administered pension schemes, with a large volume of data, have a better fit with the cohort projections.
17. The Working Party found that there was no disagreement on projecting cohorts. However, more research is needed on developing statistical methods for projecting cohorts.
18. The Working Party agrees that, ideally, there should be cohort analyses by class of business. However the only CMI experience old enough to support analysis of cohorts is the assured lives. Neither this nor population data are suitable for sub-classes of business like annuitants or life office pensioners. The Working Party would be interested to hear from anyone who has suggestions as to where to obtain appropriate data.

**Question 4: Are quantitative measures of uncertainty associated with projections needed, and if so, what form should they take?**

19. While the feedback was unanimous on the need for a measure of uncertainty, views differed on how this should be provided. Scenarios similar to the long, medium and short interim cohort projections were seen as very useful in presenting the mortality risks to non-actuaries, particularly boards of life offices.
20. It was suggested that model uncertainty was likely to be more relevant than parameter uncertainty, although testing different models would involve a lot of work. Concern was also raised that presenting results from a number of models may result in the wrong model being chosen by an office.
21. Another respondent remarked that care needed to be taken in extrapolating trends from past data and there may be different drivers in the future acting on different ages, which would affect the model. An explanation of changes to drivers was requested. However, it was noted that in the short term the projections were likely to be reasonable in the absence of, for example, new diseases or socio-economical changes.
22. Some respondents indicated that they would like stress scenarios to be provided.
23. In an informal show of hands, attendees at the seminar voted overwhelmingly in favour of measures of uncertainty being provided with the next set of projections. No one voted against the proposal.
24. The Working Party believes cohort projections with measures of uncertainty could readily be created from the output of a stochastic projection by choosing a suitable confidence interval.
25. The Working Party recognises that model risk exists and intends to compare different models, such as time series and regression models. This is unlikely to lead to any robust quantification of model risk, however, which by itself would be a major research programme with no certainty of reaching a useful conclusion.
26. The Working Party has decided not to provide stress scenarios as it feels that it is the role of the directors, with advice from the Actuarial Function Holder, and the regulator, perhaps with input from the profession, to agree stress tests. Further, such scenarios cannot be provided using the output of a single stochastic projection model.

**Question 5: Are distributions or percentiles of future rates of mortality, derived from statistical models of past rates of mortality, sufficiently meaningful to be used in practice?**

27. There was general agreement on the need for quantitative measures.

28. Concern was raised that percentiles might emphasise unduly the projections, without due regard for the uncertain parameterisation and validity of the model. However, it was suggested this risk should not hold back publication, but that suitable caveats should be included. The profession should be fully informed about the projection methodology but then it should be up to the individual users of the projections to take account of their own office experience or other variations as they see fit.
29. There were also concerns that the projections may inadvertently become a standard and that the FSA may use any published confidence intervals to set reserving standards. The Working Party anticipates that it will present confidence intervals to illustrate the methodology it develops but also stresses that any confidence intervals that may be presented are not central to its aims, of highlighting the uncertainty inherent in any mortality projection, and of improving projection methodology.
30. One respondent mentioned that the distributions would be helpful in calculating risk-based capital requirements and for valuing reinsurance arrangements. Another respondent thought the distributions would be particularly helpful in giving small offices an idea of the uncertainty surrounding future mortality projections. The Working Party notes that the latter is an aspect of stochastic risk, which is present even if future rates of mortality were known with certainty; model risk and parameter risk are more of an issue.
31. It was suggested that the analysis of experience from other developed countries would be useful for benchmarking the level of future mortality. Creating a panel of experts, from fields such as social science, epidemiology and demography, to advise on possible levels of future mortality improvements should assist in targeting and indicating the level of uncertainty.
32. The Working Party recognises that provision of confidence intervals is integral to stochastic projections and so cannot be avoided. For presentational purposes, individual actuaries could still use scenarios generated using stochastic projections. The Working Party has no further comment on the other responses.

**Question 6: Should projections and any measures of uncertainty be based on the largest available appropriate populations?**

33. The feedback agreed that the largest appropriate population should be used and that this choice was greatly affected by what was practical.
34. It was pointed out that changes in the mix of offices, and other changes affecting CMI data could cause distortions. Care must also be taken in applying the results from a wider population to a very specific subset of insured lives. However if the results of two data sets are compared, e.g. general population data and insured lives data, the differences should be explainable.

35. The GAD data had also shown the existence of cohort effects. One respondent was concerned that there were differences between the cohorts on the GAD and CMI data and that these should be better understood.
36. The Working Party believes that the only choice is between population data and male assured lives data. No other current CMI experience is old enough to be credibly used for producing projections.

**Question 7: Is there, at this stage, any clearly preferred methodology?**

37. The majority of the respondents had no preference for any particular methodology, although a desire for simplicity was expressed. Concerns were aired about the complexity of stochastic mortality models and the difficulties that would arise in explaining them to non-actuaries.
38. A number of respondents expressed a desire to see the research undertaken in selecting a methodology. One respondent expressed a preference for consistency with the methodology used by the GAD for projecting population mortality. This is to form a view on the mortality level that will ultimately be reached and then to decide on the speed at which the population reaches it.
39. The Working Party does not expect the mortality model to be too sophisticated or complicated, compared to stochastic asset models for instance, and so such difficulties should not be overplayed. The Working Party considers that a method feeding into Monte Carlo type simulations would be useful in practice.

**Question 8: What may be the financial consequences of allowing for uncertainty in projecting future mortality?**

40. There was concern about how mortality research could be misunderstood, especially outside the profession. In particular attention was drawn to an investment analyst's interpretation that offices were going to strengthen reserves with an impact on earnings. There were also concerns that regulators may draw inappropriate conclusions from the results of research.
41. Some respondents expressed views that the financial consequences would be significant. For that reason the results of any research needs to be adequately scrutinized and debated by the profession.
42. The need for care with communications and the use of appropriate caveats was highlighted.
43. The Working Party has no further comments to the responses to this question.

### **Future work of the Working Party**

44. Following its subsequent discussions of the points raised at the seminar and in the written responses to Working paper 3, the Working Party concluded that it would be impossible for it to produce any final answers to the problems raised by mortality projections, and that any methodology that it might suggest for use in practice would inevitably be subject to criticism and to change in the light of ongoing research. It believes it to be absolutely essential that users of the projections are fully aware of this. In particular, it considers the following questions to be beyond the scope of its current research:

- (a) Model uncertainty.
- (b) Correlation between mortality and investment risk.
- (c) Moving projection methodology towards cause-specific projections.

The Working Party also noted in its deliberations that any financial uncertainty arising from uncertainty regarding the level of aggregate future mortality rates can be easily swamped by the heterogeneity of the amounts of pensions within an office's portfolio, given the very large difference between the mortality of pensioners with the smallest and largest pensions.

45. The Working Party intends to produce aggregate projections of cohorts, if possible with separate projections for females. The projections will include a measure of uncertainty, although more work is needed on choosing a methodology and developing a model. The projections will be based on either population data or the CMI's males assured lives data.