Actuarial Standards Board
Conseil des normes actuarielles

Memorandum

To: All Fellows, Affiliates, Associates and Correspondents of the Canadian Institute of Actuaries and Other Interested Parties

From: A. David Pelletier, Chair
Actuarial Standards Board

Date: July 12, 2011

Subject: **Final Communication of a Promulgation of Prescribed Mortality Improvement Rates Referenced in the Standards of Practice for the Valuation of Insurance Contract Liabilities: Life and Health (Accident and Sickness) Insurance (Subsection 2350)**

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INTRODUCTION

Subsection 2350 of the final Standards of Practice released concurrently with this memorandum provides, with respect to insurance mortality:

> 2350.06 If the inclusion of mortality improvement reduces the insurance contract liabilities, then the resulting reduction would be no greater than that developed using prescribed mortality improvement rates as promulgated from time to time by the Actuarial Standards Board. If, at an appropriate level of aggregation, the inclusion of mortality improvement increases the insurance contract liabilities, then the actuary's assumption would include such improvement. The resulting increase in insurance contract liabilities would be at least as great as that developed using prescribed mortality improvement rates as promulgated from time to time by the Actuarial Standards Board.

With respect to annuity mortality, subsection 2350 provides:

> 2350.11 The mortality improvement assumption would include a best estimate assumption and an associated margin. The margin for adverse deviations related to the mortality improvement assumption is not restricted to the range of 5% to 20% noted in paragraph 2350.01. The actuary's assumption would include mortality improvement, the effect of which is to increase insurance contract liabilities, such that the resulting increase would be at least as great as that developed using prescribed mortality improvement rates as promulgated from time to time by the Actuarial Standards Board.

The Actuarial Standards Board (ASB) is promulgating the use of the mortality improvement rates described in the appendix, effective October 15, 2011. Early implementation is permitted.

The process being used to implement this is described in section D of the ASB's Policy on Due Process for the Adoption of Standards of Practice ("Due Process") and this promulgation has followed that Due Process.

RATIONALE

The concurrently released final Standards of Practice outline a minimum insurance contract liability basis with respect to the mortality improvement assumption for both insurance and annuity business, and reference prescribed mortality improvement rates.

The change to the promulgated rates is being proposed for the following reasons:

1. The changes to paragraph 2350.06 of the Standards of Practice include a new reference to promulgated mortality improvement rates with respect to the valuation of life insurance business, thus creating the need for a set of promulgated rates, and
2. The annuity mortality improvement rates are being updated to be consistent with the new insurance promulgated mortality improvement rates that will be used for insurance mortality.

A research paper released on September 23, 2010 by the Canadian Institute of Actuaries (CIA) Committee on Life Insurance Financial Reporting (CLIFR) provides a rationale for this proposed promulgation for insurance and annuity mortality secular trends. The appendix outlines the process for determining the prescribed mortality improvement rates under various circumstances.

ISSUES RAISED

The ASB published on September 23, 2010 an initial communication regarding this promulgation of mortality improvement rates, in accordance with the Policy on Due Process. A total of seven submissions were received, relating to the exposure draft, the initial communication of promulgated mortality improvement rates, and the research paper. Comments were received from six members of the CIA and one insurer. A summary of the comments and the designated group's responses are included in the Discussion of Issues Raised section of the ASB cover letter for the changes to the final Standards of Practice released concurrently with this final communication.

CRITERIA FOR THE ADOPTION OF STANDARDS OF PRACTICE

The mortality improvement rate promulgation meets the criteria set out in section B of the ASB's Policy on Due Process for the Adoption of Standards of Practice.

1. It advances the public interest through the use of a consistent basis for establishing mortality improvement rates for all business, along with an appropriate margin for adverse deviations.
2. It provides for the appropriate application of professional judgement within a reasonable range. The prescribed mortality improvement rates are not the only rates available for use, but rather establish a minimum valuation basis for the business under consideration.

3. Use of the prescribed table is practical for actuaries with relevant training.
4. The specified table is considered to be unambiguous.

EFFECTIVE DATE

The new mortality improvement tables should be used for valuations on or after October 15, 2011. Early implementation is permitted.

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APPENDIX: PRESCRIBED MORTALITY IMPROVEMENT RATES

This appendix describes the prescribed mortality improvement rates, for use in determining minimum valuation assumptions for future mortality improvement. As a support to this updated promulgation, the actuary is referred to the research paper on mortality improvement, published in September 2010).

The actuary would use appropriate judgment in the determination of a best estimate assumption and associated margin for future mortality improvement. As noted in paragraphs 2350.06 and 2350.11, the resulting insurance contract liabilities would be at least as high as that developed using the prescribed mortality improvement rates outlined in this appendix.

The provision for adverse deviations for mortality improvement risk would then be measured as the excess of the reported insurance contract liability over the insurance contract liability, inclusive of the reflection of the k/e_x (insurance) or percentage of mortality rate (annuities) margin, resulting from the application of the actuary's best estimate assumption for mortality improvement.

Prescribed Mortality Improvement Rates

The prescribed rates are developed from a set of base mortality improvement rates and two mortality improvement scenarios as described below.

Annual Base Mortality Improvement Rates

The annual base mortality improvement rates should apply for both life insurance and annuities and should vary by attained age as follows: 2% from age 0 to 40, decreasing linearly from 2% to 1% from age 40 to 60, 1% from age 60 to 90, and decreasing linearly from 1% to 0% from age 90 to 100 as illustrated in table 1. The annual base mortality improvement rates are the same for both females and males, and for both smokers and non-smokers.

Development of Prescribed Mortality Improvement Rates (Minimum Valuation Assumption)

In order to determine the minimum valuation assumption the actuary should perform two valuations using the following mortality improvement scenarios. The first scenario would be expected to apply in situations where the reflection of mortality improvement decreases liabilities and the second scenario where the effect is to increase liabilities.

1. Mortality improvement would be projected for 25 years only from the valuation date using 50% of the base mortality improvement rates as described above. After 25 years no further mortality improvement would be reflected.
2. Mortality improvement would be projected for all future years using 150% of the base mortality improvement rates as described above for 25 years, and 100% of the base mortality improvement rates as described above thereafter.

The prescribed mortality improvement rates should be the rates from the mortality improvement scenario producing the higher liability, determined at an appropriate level of aggregation. It would be inappropriate to aggregate annuities with life insurance business.

Calculation Example: Life Insurance, First Mortality Improvement Scenario

The following illustrates the calculation of the total mortality rate, including margins, for business in which the first mortality improvement scenario produces the higher liability at an appropriate level of aggregation.

For life insurance, the margin for adverse deviation for the mortality rate per 1,000 is k/e_x.

The total mortality rates are calculated as follows:

$q_x(pr) = q_x + k/e_x$

$q_{x+1}(pr) = q_{x+1} * (1\text{-}MImp_{x+1} * 0.5)^{1} + k/e_{x+1}$

$q_{x+2}(pr) = q_{x+2} * (1\text{-}MImp_{x+2} * 0.5)^{2} + k/e_{x+2}$

…

$q_{x+25}(pr) = q_{x+25} * (1\text{-}MImp_{x+25} * 0.5)^{25} + k/e_{x+25}$

…

$q_{x+n}(pr) = q_{x+n} * (1\text{-}MImp_{x+n} * 0.5)^{25} + k/e_{x+n}$

where:

$q_{x+t}(pr)$ is the mortality rate, which includes prescribed mortality improvement and margins, at age x+t,

q_{x+t} is the best estimate mortality rate, before mortality improvement, at age x+t,

e_{x+t} is the curtate expectation of life at age x+t,

$MImp_{x+t}$ is the base mortality improvement rate at age x+t, and

n is greater than 25.

Calculation Example: Life Insurance, Second Mortality Improvement Scenario

The following illustrates the calculation of the total mortality rate, including margins, for business in which the second mortality improvement scenario produces the higher liability at an appropriate level of aggregation.

For life insurance, the margin for adverse deviation for the mortality rate per 1,000 is k/e_x.

The total mortality rates are calculated as follows:

$q_x(pr) = q_x - k/e_x$

$q_{x+1}(pr) = q_{x+1} * (1\text{-}MImp_{x+1} * 1.5)^{1} - k/e_{x+1}$

$q_{x+2}(pr) = q_{x+2} * (1\text{-}MImp_{x+2} * 1.5)^{2} - k/e_{x+2}$

…

$q_{x+25}(pr) = q_{x+25} * (1\text{-}MImp_{x+25} * 1.5)^{25} - k/e_{x+25}$

…

$q_{x+n}(pr) = q_{x+n} * (1\text{-}MImp_{x+n} * 1.5)^{25} * (1\text{-}MImp_{x+n} * 1.0)^{(n-25)} - k/e_{x+n}$

where:

$q_{x+t}(pr)$ is the mortality rate, which includes prescribed mortality improvement and margins, at age x+t,

q_{x+t} is the best estimate mortality rate, before mortality improvement, at age x+t,

e_{x+t} is the curtate expectation of life at age x+t,

$MImp_{x+t}$ is the base mortality improvement rate at age x+t, and

n is greater than 25.

Calculation Example: Annuities

The following illustrates the calculation of the total mortality rate, including margins, for annuity business in which the second mortality improvement scenario produces the higher liability at an appropriate level of aggregation.

For annuities, the margin for adverse deviation, Mort MFAD, is a percentage of the mortality rate.

The total mortality rates are calculated as follows:

$q_x(pr) = q_x * (1\text{-Mort MFAD})$

$q_{x+1}(pr) = q_{x+1} * (1\text{-Mort MFAD}) * (1\text{-}MImp_{x+1} * 1.5)^{1}$

$q_{x+2}(pr) = q_{x+2} * (1\text{-Mort MFAD}) * (1\text{-}MImp_{x+2} * 1.5)^{2}$

…

$q_{x+25}(pr) = q_{x+25} * (1\text{-Mort MFAD})*(1\text{-}MImp_{x+25} * 1.5)^{25}$

…

$q_{x+n}(pr) = q_{x+n} * (1\text{-Mort MFAD})*(1\text{-}MImp_{x+n} * 1.5)^{25}* (1\text{-}MImp_{x+n} * 1.0)^{(n-25)}$

where:

$q_{x+t}(pr)$ is the mortality rate, which includes prescribed mortality improvement and margins, at age x+t,

q_{x+t} is the best estimate mortality rate, before mortality improvement, at age x+t,

$MImp_{x+t}$ is the base mortality improvement rate at age x+t, and

n is greater than 25.

Mortality Improvement Rates for Out-of-Canada Business

For markets other than Canada, the actuary would select appropriate mortality improvement rates (inclusive of margin) for both life insurance and annuities. These improvement rates would produce a total liability for each of life insurance and annuities that is at least as large as what would be produced using the prescribed rates used in Canada, unless experience indicates otherwise.

Table 1: Annual Base Mortality Improvement Rates

(applies to both females and males, and to both smokers and non-smokers)

Attained Age	Base Rates	Attained Age	Base Rates	Attained Age	Base Rates
0 to 40	2.00%				
41	1.95%	51	1.45%	91	0.90%
42	1.90%	52	1.40%	92	0.80%
43	1.85%	53	1.35%	93	0.70%
44	1.80%	54	1.30%	94	0.60%
45	1.75%	55	1.25%	95	0.50%
46	1.70%	56	1.20%	96	0.40%
47	1.65%	57	1.15%	97	0.30%
48	1.60%	58	1.10%	98	0.20%
49	1.55%	59	1.05%	99	0.10%
50	1.50%	60 to 90	1.00%	100+	0.00%