

Society of Actuaries

RPEC Response to Comments on Mortality Improvement Scale MP-2014 Exposure Draft

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Section 1. Overview

In February 2014, the Society of Actuaries' (SOA's) Retirement Plans Experience Committee (RPEC or "the Committee") released the RP-2014 Mortality Tables report and the Mortality Improvement Scale MP-2014 report, both in exposure draft form. The SOA solicited comments on the exposure drafts through the end of May 2014. This report summarizes the comments received on the Scale MP-2014 exposure draft, presents the Committee's formal responses to those comments,¹ and identifies any resulting changes reflected in the final report. Concurrent with the release of this report, RPEC has issued a separate report with responses to comments on the RP-2014 Mortality Tables exposure draft.

The SOA received a total of 25 comments from individuals and organizations on the Scale MP-2014 and RP-2014 exposure drafts. Some of the comments were in the form of email messages that focused on one specific topic and some replies contained comments on multiple topics in formal letter format.

Due to the number of comments received on Scale MP-2014 report, the SOA formed an independent Scale MP-2014 Process Review Team² (Process Review Team) to review (1) the process used by RPEC to construct the Scale MP-2014 mortality improvement model and (2) RPEC's responses to the most critical comments received.

The Process Review Team:

- Concluded that RPEC followed appropriate actuarial procedures in the development of (1) the underlying mortality improvement model and (2) the committee-selected assumption set underpinning Scale MP-2014 as RPEC's current best estimate of future mortality improvement.
- Agreed with RPEC that a range of alternate assumption sets³ could be used within the framework of the Scale MP-2014 model, producing a range of reasonable mortality improvement scales.
- Agreed with RPEC that two-dimensional mortality improvement models represent a significant technological improvement over one-dimensional models.
- Believes that RPEC's responses to the comments received (including related changes to the final Scale MP-2014 report) adequately address the concerns of those commenters.

RPEC would like to thank those individuals and organizations that commented. The Committee would also like to express its gratitude to the members of the Scale MP-2014 Process Review

¹ A number of the more narrowly-focused comments (each of which was raised by an individual commenter) were addressed directly through phone calls or e-mail responses with these commenters.

² The Scale MP-2014 Process Review Team was one of two independent teams assembled at the request of the SOA Leadership Team to evaluate certain processes used by RPEC in the development of the RP-2014 mortality tables and the Scale MP-2014 mortality improvement model. The members of the Scale MP-2014 Process Review Team were Tonya Manning (SOA Leadership Team Liaison), Noel Abkemeier, David Flagg, Zachary Granovetter, and Marianne Purushotham.

³ The assumptions that a user could modify include the ultimate long-term rates of mortality improvement, the length of the convergence periods, and the blending percentages of future cohort and age/period effects.

Team for their thorough examination of the processes used by RPEC in the development of the new mortality improvement model. The Committee believes that the changes that were prompted by the comments received during the exposure period, along with the very helpful suggestions made by the Process Review Team, resulted in an improved final report.

The remainder of this document is organized into the following sections:

- Section 2: Prescriptiveness of exposure draft recommendations
- Section 3: Two-dimensional mortality improvement rates
- Section 4: Approximation by one-dimensional mortality improvement rates
- Section 5: Generational mortality projection
- Section 6: Assumed long-term mortality improvement rates
- Section 7: Convergence periods
- Section 8: Implications on RP-2014 base mortality rates
- Section 9: Other comments

Each section (other than the last) is organized into four subsections:

1. A short background paragraph
2. A summary of the comments received
3. RPEC's response to those comments
4. Changes, if any, made to the final RP-2014 Mortality Tables report

Section 2. Prescriptiveness of Exposure Draft Recommendations

2.1 Background

The exposure draft describes a new mortality improvement model patterned after the model developed by the Continuous Mortality Investigation⁴ (CMI). Scale MP-2014 was based on this new methodology reflecting a single “committee-selected” set of assumptions. The exposure draft included directions on how the model could accommodate alternate assumption sets,⁵ but the discussion of how those alternate assumption sets might be used in practice was limited. The Committee recommended that:

... subject to standard materiality criteria (including Actuarial Standard of Practice No. 35) and the user’s specific knowledge of the covered group, Scale MP-2014 be used to project mortality rates beyond 2014 for all retirement programs in the United States. Furthermore, RPEC recommends that Scale MP-2014 be used to project all of the tables presented in the RP-2014 report, including those for disabled lives.

2.2 Summary of Comments Received

Five commenters replied that the recommendations in the Scale MP-2014 exposure draft were too prescriptive. Three of these five commenters suggested that the wording in the final report should allow for actuaries to exercise professional judgment in their selection of mortality improvement assumptions. Another subset of three commenters stressed that the language should be flexible enough to accommodate other assumptions for the long-term improvement rate and convergence periods (for the smooth transition from near-term rates to the assumed long-term rates).

2.3 RPEC Response

RPEC agrees that its language dealing with the uses and potential appropriateness of alternate assumption sets in the Scale MP-2014 exposure draft was overly restrictive. In particular, the Committee acknowledges that users might be able to justify an alternate assumption set that is reasonable and appropriate for their particular application.

2.4 Resulting Changes Reflected in Final Report

A number of structural changes were made to the final report.

- In the final report, RPEC makes a clear distinction between (1) the new mortality improvement model (now denoted the “RPEC_2014” model) and (2) the assumption sets (committee-selected or user-selected) that are inputted into that model to generate a two-

⁴ The CMI is a U.K. private company that is supported by the Institute and Faculty of Actuaries and provides authoritative and independent mortality and sickness rate tables for U.K. life insurers and pension funds.

⁵ The phrase “alternate assumption set” is used in this Response to Comments document (and the final Scale MP-2014 report) to denote any assumption set other than the committee-selected assumption set used to develop Scale MP-2014.

dimensional table of mortality improvement rates. The “Scale MP-2014” mortality improvement rates (which remain unchanged from the exposure draft) are the result of plugging the committee-selected assumption set into the RPEC_2014 model.

- The final report includes new language regarding the concept of an “assumption universe” (per Section 2.2 of Actuarial Standard of Practice No. 35 (ASOP #35)) for inputs to the RPEC_2014 model.⁶ Rather than specifically recommending the use of Scale MP-2014, the Committee recommends that future mortality improvement be based on the RPEC_2014 model with an appropriately selected assumption set within the “relevant assumption universe.”
- The final report includes an additional table of deferred-to-62 annuity values, comparing values developed using Scale MP-2014 to those developed with alternate long-term rate assumptions equal to 75 percent and 125 percent of the committee-selected rates. This table is intended for illustrative purposes only and should not be construed as a committee-approved range for reasonable long-term rate assumptions.
- The final report makes it clear that reasonable alternate assumption sets can be used by a pension⁷ actuary in situations beyond the assessment of assumption sensitivities.

This new framework notwithstanding, the final report continues to emphasize that the assumption set underpinning Scale MP-2014 represents RPEC’s current best estimate of future mortality improvement in the United States, and that users who select alternate assumption sets within the RPEC_2014 model should be prepared to justify that those assumptions are reasonable and appropriate for the particular application at hand.

⁶ With the exception of an admonition against the use of inappropriately short convergence periods discussed in Section 7 of this Response to Comments document, the final Scale MP-2014 report does **not** include an explicit range of RPEC_2014 model assumptions that the Committee believes might be considered reasonable.

⁷ The word “pension” used in the terms “pension actuary”, “pension actuaries”, or “pension-related” in this report should be understood to include both “pension” and “other postemployment benefits (OPEB).”

Section 3. Two-Dimensional Mortality Improvement Rates

3.1 Background

RPEC believes that two-dimensional mortality improvement models represent an important methodological advancement over one-dimensional, “age-only” versions. In particular, two-dimensional models are able to reflect the relatively high levels of improvement that have been experienced of late without being bound to continue them indefinitely into the future. The two-dimensional RPEC_2014 model is patterned after the CMI’s Mortality Projections model,⁸ which was developed over the past decade based on the following three key concepts:

- Recently observed experience is the best predictor of future near-term mortality improvement rates.
- Long-term rates of mortality improvement should be based on “expert opinion” and analysis of longer-term mortality patterns.
- Near-term rates should transition smoothly into the assumed long-term mortality improvement rates over appropriately selected convergence periods.

The resulting age-period-cohort (APC) models are designed to capture mortality improvement trends in three separate directions: along fixed age lines, along fixed calendar year lines, and along fixed year-of-birth cohort lines.

3.2 Summary of Comments Received

Three commenters remarked that, given the subjective nature of projecting future mortality improvement, a two-dimensional improvement scale may not be appropriate because it gives a false impression of greater precision. Two commenters suggested that little accuracy is gained from implementing a two-dimensional table and that such a structure is unnecessarily complex. Another commenter expressed skepticism about the two-dimensional structure of the tables due to the lack of understanding about the causes of year-of-birth cohort effects.

3.3 RPEC Response

By its very nature, the process of selecting any forward-looking actuarial assumption always involves some degree of subjectivity. While RPEC agrees that the projection of future mortality improvement rates might be perceived as somewhat more speculative than some other assumptions, the Committee believes that this should not be used as a justification for perpetuating inferior methodologies.

The older “age-only” models, such as Scale AA, are incapable of distinguishing between different patterns of mortality improvement over distinct periods of time or over year-of-birth cohorts. Year-of-birth cohort effects have been apparent in the U.S. population for over 30 years now and, despite

⁸ The individual gender-specific mortality improvement rates in both the RPEC_2014 and CMI models are functions of two independent variables; age and calendar year, or, equivalently, age and year of birth.

the fact that experts might disagree on their cause, there is no indication that those diagonal patterns are likely to disappear any time soon.

The Committee strongly believes that the RPEC_2014 model represents a significant—and necessary—improvement over the methodology used by U.S. pension actuaries prior to the release of Scale BB. In an environment where large longevity risk transactions are becoming more prevalent and more complex, RPEC believes it is critical for actuaries to have access to a more robust model that permits the projection of future mortality rates by both age and year of birth.

With respect to the model's complexity, RPEC simplified the most complicated aspects of the CMI methodology to make them more accessible to the SOA membership. In particular, the smoothing of historical mortality improvement rates was based on straightforward Whittaker-Henderson graduation, and the formulas for the transition from near-term rates to assumed long-term rates are easily implemented using the polynomial formulas presented in Appendix B of the Scale MP-2014 Report.

3.4 Resulting Changes Reflected in Final Report

There were no changes to the final Scale MP-2014 report that resulted from the comments received on this topic.

Section 4. Approximation by One-Dimensional Mortality Improvement Rates

4.1 Background

Prior to the release of Scale BB-2D in 2012, all SOA mortality projection scales were one-dimensional, with gender-specific improvement rates that varied by age only. Scale BB was constructed expressly as an interim set of one-dimensional rates⁹ that, when projected generationally, approximated the deferred-to-62 annuity values determined with the full set of Scale BB-2D rates. Such one-dimensional approximations tend to work reasonably well in the year for which they are created, but become less accurate if not updated periodically.

In the Scale BB report, RPEC clearly stated its expectation that the next generation of pension mortality improvement scales was likely going to be two-dimensional.

4.2 Summary of Comments Received

Three commenters stated that it would be preferable if a one-dimensional mortality projection scale were to be released as an alternative because this would be more practical, particularly for small and medium-sized plans.

4.3 RPEC Response

RPEC does not agree that a one-dimensional scale should be considered appropriate for some plans based solely on their size. However, RPEC understands that some actuarial software may not yet be able to accommodate a two-dimensional model and that it may be desirable to approximate the impact of a two-dimensional scale with a one-dimensional scale.

The construction of a one-dimensional approximation requires selection of (1) a base mortality table, (2) a “base year” of application, (3) an interest rate structure, and (4) the type of annuity upon which the matching process is based. Given the number of possible combinations of these inputs, the Committee believes that the most appropriate resolution to this issue is to include in the final report a description of the process by which a user who wishes to construct a one-dimensional scale can do so.

Bob Howard, a member of RPEC, has developed a spreadsheet-based program¹⁰ that (given the four inputs described in the prior paragraph) produces a set of one-dimensional mortality improvement factors that when used to project the RP-2014 base rates on a generational basis, produces near-term annuity values that closely approximate corresponding annuity values determined using the full two dimensional Scale MP-2014. The tool also provides the user with

⁹ It should be noted that the resulting Scale BB rates (and the other one-dimensional approximation techniques discussed in this Section 4) are not representative of “actual” mortality improvement in the United States. These one-dimensional approximations are merely artifacts of the recursive approach used to match the “correct” annuity values calculated using the full set of two-dimensional rates.

¹⁰ Click [here](#) to access the 2D-to-1D Conversion Program.

some indication of how quickly the annuity values developed from the one-dimensional factors diverge from those developed using the full two-dimensional Scale MP-2014.

4.4 Resulting Changes Reflected in Final Report

The final report includes a description of a methodology for constructing a one-dimensional scale that can be used to approximate Scale MP-2014 results when both are projected generationally. It also mentions the availability of a spreadsheet that develops those factors for a given set of requisite assumptions.

Section 5. Generational Projection of Mortality

5.1 Background

The concept of generational mortality projection of pension-related mortality rates goes back to the GAR-94 tables published by the SOA almost 20 years ago. At its most basic, the methodology produces a distinct set of age-specific mortality rates for each gender/year-of-birth combination. This is in contrast to the “static” projection of mortality rates, in which a single set of suitably projected¹¹ base mortality rates is used to develop approximate annuity values for all those in a selected group of covered lives.

5.2 Summary of Comments Received

Three commenters questioned the appropriateness of a generational mortality table, citing the following reasons:

- Generational mortality is not practical for small and medium-sized plans.
- The projection method is subjective, so a sophisticated projection method may misrepresent what is just an actuarial estimate.
- A generational projection might not be superior to a static approximation.

One comment letter expressed the opinion that RPEC’s stance that generational mortality tables are superior to static mortality tables was not enough to warrant the strong recommendation that generational tables should be used. Citing that a large number of sponsors currently use static tables for minimum funding purposes, this commenter pointed out that the use of generational mortality would represent a “significant industry change.” The commenter goes on to state:

“We do not believe that there is sufficient reason to recommend the sole use of fully generational tables, which implicitly reflect the critical debatable assumption that mortality improvement will continue at a significant pace permanently.”

Finally, one commenter asked whether RPEC planned to include any duration-based approximation methodology (similar to that first presented with the GAR-94 tables) in the final reports.

5.3 RPEC Response

Generational projection has become the generally acknowledged professional standard for mortality projection around the world. Compared to the standard static projection methodology, generational projection (1) produces superior measurements for various subgroups within the covered population and (2) works over extended periods of time; e.g., for long-term pension cost projections. Hence, RPEC continues to strongly recommend generational projection of mortality.

¹¹ The static projection period is typically based on the modified Macaulay duration of the underlying obligation for the group under consideration. (Note that this technique is necessarily self-referential, since the determination of “duration” depends on the selection of a suitable mortality assumption.)

The Committee is fully aware that the wide-spread adoption of generational mortality projection in the U.S. would represent a significant change—one that RPEC believes is long overdue. The fact that the IRS currently permits the use of static approximations for minimum funding purposes is not, in itself, a good reason to perpetuate its use.

RPEC also believes that the commenter’s logic in the sentence quoted in the previous subsection is flawed, in that it inappropriately links the choice of mortality improvement assumptions with the selection of a mortality projection methodology. The appropriate size and duration of mortality improvement rates need to be captured as part of the assumption set. The method by which those rates get applied, either generationally or through a static approximation, should be independent from the selection of the mortality improvement assumption set. Specifically, the issue of whether or not mortality improvement “will continue at a significant pace permanently” is a separate issue from selecting an appropriate mortality projection methodology.

Other than the 2D-to-1D generational methodology described in Section 4 of this report, the Committee has not tested any approximation techniques. In particular, RPEC has not assessed the effectiveness of any duration-based approximation methodologies relative to a RPEC_2014 model projected generationally.

The Committee’s recommendation of generational projection notwithstanding, RPEC understands that actuaries are free to use any approximation technique judged acceptable, including a static projection.

5.4 Resulting Changes Reflected in Final Report

There were no changes to the final Scale MP-2014 report that resulted from the comments received on this topic.

Section 6. Assumed Long-Term Rates of Mortality Improvement

6.1 Background

Two of the key inputs to the RPEC_2014 model are (1) the assumed long-term rates of mortality improvement and (2) the assumed period of time over which those rates are ultimately attained. This section deals with the first assumption; Section 7 deals with the second assumption.

After extensive research¹² on the topic, the Committee selected the following set of (gender-neutral) long-term mortality improvement assumptions:

- Ages 0 through 85: flat 1.00 percent
- Ages 85 through 95: linear taper from 1.00 percent at age 85 to 0.85 percent at age 95
- Ages 95 through 115: linear taper from 0.85 percent at age 95 to 0.00 percent at age 115
- Ages older than 115: 0.00 percent

6.2 Summary of Comments Received

There were several comments that suggested alternatives to the set of committee-selected mortality improvement rates.

One commenter suggested an improvement rate of 1.10 percent. This commenter felt that 1.10 percent was more representative of long-run statistics and because “everyone wants to live longer – so all incentives are aligned” towards higher mortality improvement.

Another comment contrasted the 1.00 percent used in Scale MP-2014 to the estimate of 1.26 percent implied by the life expectancy study of the 2011 Technical Panel of the Social Security Advisory Board and the estimate of 1.17 percent recently developed by the Congressional Budget Office. Based on these higher assumed rates of long-term mortality improvement, this commenter felt that it would be difficult for actuaries to demonstrate that 1.00 percent is reasonable.

One of the comment letters pointed out that the exposure draft cites a study showing a slower rate of mortality improvement from 1982 to 2009 of 0.9 percent. This letter states that to justify a mortality improvement rate close to those observed in the past, “it must be reasonable to conclude that the drivers and conditions present over the last century will persist at a similar rate into the future.” The recent slowing of mortality improvement and major variations in several parts of the 20th century might, therefore, make a lower long-term improvement rate reasonable.

One commenter stated that a 0.75 percent rate of long-term mortality improvement would be more consistent with long-term Social Security expectations. Using this rate would give more credence to the conclusions reached by Social Security Administration (SSA) actuaries. The commenter

¹² RPEC’s research included the commissioning of an extensive literature review performed by Ernst & Young (EY) (available [here](#) for download from the SOA website).

also stated that RPEC's strong recommendation to use Scale MP-2014 for all private plans suggests that too little consideration was given to the research efforts of the SSA actuaries.

One commenter questioned the Committee's assumption that all cohorts, including the baby boom generation, will ultimately converge to the same long-term rate structure, in view of the fact that historical cohort effects have persisted for over three decades.

One commenter thought it would be important for the final report to include some additional discussion regarding the impact of cohort effects within the underlying model. In particular, the commenter suggested that the Committee should note "that it is also possible that accelerated improvement in mortality for a generation up to a certain age could result in decelerated improvement at higher ages, if the observed improvement was a matter of keeping more compromised lives alive in a relatively debilitated state through the observed period." The same commenter also remarked that historical data and recent research suggest using a "stronger age gradient, starting below age 85" than that reflected in the committee-selected assumption set.

Finally, one commenter requested additional sensitivity analysis of the impact of the long-term improvement rate on annuity values.

6.3 RPEC Response

While acknowledging the subjective nature of this assumption, RPEC continues to regard the committee-selected set of rates (summarized in subsection 6.1 above) as its best estimate of future long-term mortality improvement rates in the United States. The fact that some commenters suggested that the committee-selected rates were too low, while other commenters suggested that the committee-selected rates were too high, provides RPEC some comfort that the set of Scale MP-2014 long-term rates represents an estimate that is neither unduly pessimistic nor overly optimistic with respect to the level of future long-term mortality improvement in the United States.

A number of Committee members initially preferred a long term rate higher or lower than the final committee-selected assumptions, just as do some of the commenters. However, RPEC eventually decided it was appropriate to construct Scale MP-2014 around a set of long-term assumptions that balanced the opinions of a variety of experts in the field, some anticipating rates lower than 1.00 percent and others projecting rates higher than 1.00 percent.

Specifically with respect to RPEC's set of long-term rates compared to those assumed by the SSA, the Committee spent a considerable amount of time carefully reviewing the relevant sections in recent Trustees' Reports and the reports by the Technical Panel¹³ of the Social Security Advisory Board. RPEC would also like to reiterate that (1) when compared on an age-grouped basis, most of the SSA's assumed long-term rates are not very different from the committee-selected assumptions¹⁴ and (2) the flat 0.75 percent rate recommended by one commenter would actually be less than the SSA-assumed long-term rates at all ages below 85.

¹³ The Technical Panel is a group of outside experts appointed by the Social Security Advisory Board. Every four years, it publishes an independent report on the assumptions and methods used by the SSA.

¹⁴ See Table 2 in the Scale MP-2014 report.

Regarding the comment questioning RPEC’s decision not to reflect historical trends (such as reduced levels of mortality improvement experienced by the baby boom generation) in the shape of the committee-selected long-term rate structure, the Committee decided not to further complicate Scale MP-2014 by incorporating a more complex long-term rate structure into the committee-selected assumption set.¹⁵ That comment notwithstanding, users who believe that it is appropriate to place greater emphasis on future cohort effects can do so within the RPEC_2014 model by shifting some portion of the horizontal blending percentage¹⁶ to the diagonal percentage, possibly in conjunction with increasing the length of the cohort convergence period.

With respect to the comments regarding the possible deceleration of cohort-related mortality improvements and a “stronger” gradient at advanced ages, RPEC believes that such a scenario is just one of many that need to be balanced against the possibility that the recent trend of relatively high levels of mortality improvement could continue for a longer period of time than otherwise anticipated.

In summary, RPEC maintains that when all sources of relevant information are taken into consideration, the committee-selected set of long-term rates represents a well-balanced assimilation of the various factors that could influence future mortality patterns in the United States.

6.4 Resulting Changes Reflected in Final Report

As described previously in Section 2, the final report includes (1) less prescriptive language regarding the use of alternate assumption sets and (2) comparisons illustrating the sensitivity of alternate long-term rate assumptions on annuity values. Those changes notwithstanding, the report also contains language that reaffirms RPEC’s continued strong support for the set of long-term rates that underpins Scale MP-2014.

To address the request for additional sensitivity analysis on the long-term improvement rate, the Committee has included in the final Scale MP-2014 report sensitivities of 0.75 and 1.25 times the full set of committee-selected values upon which Scale MP-2014 was based. It is important to note that these alternate long-term rate assumptions are included for illustration purposes only and should not be construed as a recommended range for such assumptions.

¹⁵ Given that (1) the financial impact of the RPEC_2014 model is concentrated in the first 15 years of projection and (2) Scale MP-2014 assumes a 20-year convergence period, the Committee concluded that a consistent long-term rate assumption for all cohorts was appropriate. This approach is consistent with the CMI’s “Core level” model.

¹⁶ The committee-selected blending percentages for the cubic interpolations in the horizontal (age/period) and diagonal (cohort) directions are both 50 percent; see subsection 3.4 of the final Scale MP-2014 report.

Section 7. Convergence Periods

7.1 Background

The number of years between the most recent year of actual near-term mortality improvement rates (2007 in the Scale MP-2014 report) and the year in which the set of long-term rates is attained is called the convergence period. The basic “Core level” CMI model assumes two different sets of age-specific convergence periods: one for age/period effects (starting at 10 years for ages 20 through 50, gradually increasing to 20 years for ages 60 through 80, and gradually decreasing to five years at ages 95 and above) and another for cohort effects (starting at 40 years for ages 20 through 80, and gradually decreasing to five years at ages 95 and above).

Similarly, the RPEC_2014 model requires the selection of appropriate convergence periods for age/period effects and cohort effects. The Committee selected 20-year convergence periods for both components of Scale MP-2014,¹⁷ which means that the assumed long-term rates are fully phased in by calendar year 2027.

7.2 Summary of Comments Received

There were four comments pertaining to the 20-year convergence period over which near-term mortality improvement rates transition to the long-term rates:

- One commenter suggested a longer blending period of approximately 25 to 30 years.
- One commenter stated that although the 20-year phase-in period may be reasonable, other phase-in durations may also be reasonable, and the language in the Scale MP-2014 report should be flexible enough to accommodate alternative convergence periods.
- Another commenter felt that 20 years was too long and that a shorter convergence period of 10 years would be more appropriate. This commenter cited the swifter transition period used by RPEC in the 2012 Scale BB study and that historically, changes in improvement rates have been quicker than that implied by a 20-year convergence period.
- One commenter questioned the use of 2027 as the ultimate convergence year at all ages, when this year is likely beyond the life expectancy of some older participants.

7.3 RPEC Response

RPEC acknowledges that the potential impact of alternate convergence period assumptions—and, in particular, of very short assumed convergence periods—can be quite significant.

The Committee spent a great deal of time analyzing the convergence period issue. A key consideration throughout those analyses was the appropriate degree to which the model should project historically observed age/period and year-of-birth cohort effects beyond 2007. Given that well-defined cohort effects have been observed (most notably for the two male cohorts born around

¹⁷ The flat 20-year convergence period applies through age 95. The RPEC_2014 model develops the mortality improvement rates at ages over 95 by straight-line interpolation between the age-95 rate in that calendar year and zero at age 115.

1935 and around 1950), RPEC was reluctant to assume that those effects—many of which have persisted for well over 30 years now—are going to dissipate any time soon. For example, a cohort convergence period of only 10 years, as suggested by one commenter, would result in no assumed year-of-birth cohort effects beyond 2016.

RPEC also considered convergence periods longer than 20 years. Recognizing that most of the impact of mortality improvement rates is concentrated in the first 15 years, the Committee concluded that assuming a full phase-in of the long-term rates over a 20-year period starting in 2007 was its best estimate.

The Committee concluded that the CMI's assumption of two different sets of convergence periods, each with its own pattern of age-specific rates, is unnecessarily complicated.¹⁸ RPEC discussed the possibility of assuming different convergence periods for the age/period and cohort components of the model, but concluded that the additional complexity that would have been introduced into the Scale MP-2014 methodology was not warranted. RPEC ultimately concluded that assuming the same flat 20-year convergence periods for both the age/period and cohort convergence periods (through age 95) was an appropriate way to simplify the construction of Scale MP-2014, without undermining the key precepts underlying the CMI model.

7.4 Resulting Changes Reflected in Final Report

As described previously in Section 2, the final report now includes less restrictive language regarding the use of alternate assumption sets. In particular, the general RPEC_2014 model can be modified to accommodate distinct age/period and cohort convergence period assumptions, and shortened convergence periods at the oldest ages.

Those edits notwithstanding, the report also contains language that expresses RPEC's continued strong support for the 20-year convergence periods that underpin Scale MP-2014, along with an admonition against the use of excessively short convergence periods that could inappropriately dilute the anticipated impact of near-term mortality improvement trends.¹⁹

¹⁸ The CMI, in its Working Paper # 39, acknowledged that their "Core level" convergence period patterns were "somewhat subjective."

¹⁹ For example, the selection of an assumed convergence period of only 15 years starting in 2007 would result in the attainment of the long-term rate structure in 2022.

Section 8. Implications on RP-2014 Base Mortality Rates²⁰

8.1 Background

The central year of the dataset that formed the basis for the RP-2014 base mortality rates is 2006. Before they were graduated, these raw mortality rates were first projected to 2014 using the Scale MP-2014 mortality improvement rates for years 2007 through 2014.

As a result, all of the RP-2014 base tables implicitly reflect the committee-selected assumption set for mortality improvement between years 2007 through 2014. It is possible that an actuary who believes that an alternate set of assumptions for the RPEC_2014 model is more appropriate than the committee-selected set might consider adjusting the RP-2014 mortality tables to reflect the resulting differences in the two sets of projected mortality improvement rates after 2006.

8.2 Summary of Comments Received

One commenter remarked that a table with a 2006 base year should be published either instead of, or in addition to, the table with the 2014 base year. The rationale is that using 2014 as a base year implies that the underlying table reflects data through 2014 and that the mortality improvement rates in the scale are certain through that year. This approach could cause confusion, and “since the application of mortality improvements has become standard practice, it is just as easy to apply an appropriate projection to a 2006 table as it is to a 2014 table.”

8.3 RPEC Response

It is common practice for pension mortality tables to be projected from the central year of the observation period to the release date of the final set of tables. The only difference now is that the RP-2014 tables have been projected using Scale MP-2014 mortality improvement rates that reflect certain committee-selected assumptions that the user might want to modify.

The RP-2014 report contains a total of 22 separate tables. Instead of publishing 22 new “2006” versions of those tables (which would increase the chances of wrong tables inadvertently getting picked up), RPEC believes it is more efficient for those who wish to start their projections as of 2006 to “factor out” the Scale MP-2014 rates for years 2007 through 2014. This factoring out process is accomplished by dividing all of the rates in the selected RP-2014 table by the product of eight factors of the form $(1 - f(x,y))$ [for $y = 2007, 2008, \dots, 2014$], where $f(x,y)$ is the gender-specific Scale MP-2014 factor at age x and calendar year y . RPEC has confirmed that this methodology produces base mortality rates that are extremely close to those that would have been produced by graduating the raw 2006 mortality rates.²¹

Based on these considerations, RPEC will not be producing separate sets of “2006” tables.

²⁰ Given the relevance of this comment to both the RP-2014 and Scale MP-2014 reports, this response has been included in both Response Documents.

²¹ The extremely small differences are the result of switching between the “first project from 2006 to 2014, then graduate the resulting rates” methodology of Scale MP-2014 and the “first graduate 2006 raw rates, then project to 2014” methodology implicit in the “factoring out” approach described above.

8.4 Resulting Changes Reflected in Final Report

The final Scale MP-2014 report contains a description of the “factoring out” methodology described above. Otherwise, there are no other changes in the final RP-2014 or Scale MP-2014 reports that resulted from the comments received on this topic.

Section 9. Other Comments

9.1 Negative Mortality Improvement Rates

One commenter mentioned that the negative mortality improvement rates in Figure 2 on page 13 of the Scale MP-2014 exposure draft are not adequately addressed by the analysis in the report.

9.1.1 RPEC Response

There are two year-of-birth cohorts that exhibited negative (or very low) periods of mortality improvement in the calendar year 2007 snapshot in Figure 2 of the Scale MP-2014 exposure draft. One is the cohort born around 1980, and the other is the “baby boom” cohort (born around 1950 for males and 1955 for females).

RPEC has noticed a relatively high degree of period volatility in historic U.S. mortality improvement rates at ages younger than 45. The Committee is not aware of any research performed on the subject, and readers should keep in mind the rates at these young ages result from taking ratios of extremely small annual mortality rates.

The paragraph under Figure 2 alludes to the relatively low mortality improvement rates for the second (baby boom) cohort. A commonly mentioned reason for this observation, which has been evident since at least the early 1980s, is the HIV/AIDS epidemic that disproportionately affects this cohort of the U.S. population.

9.1.2 Resulting Changes Reflected in Final Report

RPEC has slightly expanded its comments under Figure 2 to address these patterns of especially low mortality improvement.

9.2 Pre-1950 Mortality Improvement Rates

One commenter requested that the improvement rates prior to 1950 be added to the final version of the Scale MP-2014 report to minimize the difference between the published scales and those used in practice.

9.2.1 RPEC Response

The starting year for the historical SSA mortality improvement data underpinning the RPEC_2014 model was 1951. Subsection 8.3 of the final Scale MP-2014 report describes approximate mortality improvement assumptions that RPEC believes would “not be unreasonable” to use in situations that require those rates for years prior to 1951.

The Committee believes that codifying those rates in the final “official” version of Scale MP-2014 would ascribe more credibility to them than the broad approximations they are

meant to represent. Therefore, the Committee still prefers not to incorporate these broad pre-1951 estimates into Scale MP-2014.

9.2.2 Resulting Changes to Final Report

There were no changes to the final Scale MP-2014 report that resulted from this comment.

9.3 Adjustment for Socioeconomic Factors

One commenter mentioned the following regarding use of a margin in long-term improvement rates due to socioeconomic factors:

“We believe potential users of the MP-2014 scale will benefit if the exposure draft discloses the different margins adopted in the U.K. (i.e., 0.4 percent) and other comparable countries to aid plan actuaries in determining a reasonable margin in their long-term improvement rate assumption.”

9.3.1 RPEC Response

The Committee stated in subsection 4.1 of the Scale MP-2014 exposure draft that “while there has been some growing evidence that recent mortality improvement trends in the United States have differed based on various socioeconomic factors, RPEC is of the opinion that there is not yet enough definitive research on the extent and potential duration of these trends to warrant the use of different mortality improvement rates for different segments of the U.S. population.”

A number of studies have identified variations in recent U.S. mortality improvement trends linked to one or more proxies for socioeconomic status. For example, a 2008 study²² found rather significant differences in mortality improvement by education levels among various U.S. subpopulations between 1993 and 2001. Although RPEC considers these studies very interesting, the Committee is of the opinion that there are two significant shortcomings that have limited the utility of this research for near-term pension-related purposes.

The first is that the proxies for socioeconomic status (such as education level) are not ones that could be readily implemented for pension-related purposes. The second is that the Committee is not aware of any research that has considered the future “shape” of differences in mortality improvement by any proxy for socioeconomic status. For example, it is not known how long the recently observed variations by education level are expected to persist or whether they could eventually reverse.

In contrast to socioeconomic variations in mortality improvement rates, differences in base mortality rates have been well-documented in the United States for decades. So, while the Committee continues to strongly recommend that users select the most appropriate RP-2014 tables based on their specific knowledge of the covered population, RPEC is of the

²² Widening of Socioeconomic Inequalities in U.S. Death Rates, 1993-2001, Jemal, A., et al., *PLoS ONE*, Volume 3, Issue 5, May 2008.

opinion that the science of mortality improvement is not yet sufficiently developed for it to encourage the application of different mortality improvement trend rates for different pension plan populations.

9.3.2 Resulting Changes Reflected in Final Report

RPEC has expanded its comments on its rationale for not currently encouraging the use of variations in mortality improvement rates based on socioeconomic factors.

9.4 Backtesting

One commenter stated that it would be helpful to produce “backtested” heat map extrapolations based on data through various points in history, claiming that comparing the projections from these tests against the actual historical data would help to illustrate the effectiveness of the Scale MP-2014 methodology.

9.4.1 RPEC Response

RPEC agrees that some informal backtesting of the model would be of interest.

9.4.2 Resulting Changes Reflected in Final Report

Anticipating triennial updates to the model, Appendix C of the Scale MP-2014 report includes supplementary sets of heat maps developed using the RPEC_2014 methodology, but assuming that RPEC had only SSA data through calendar years 2000, 2003, and 2006 (in addition to the Scale MP-2014 heat maps, which reflect SSA data through 2009).

9.5 Heat Maps Based on 100 Percent Horizontal and 100 Percent Diagonal Projections

One commenter suggested that RPEC include supplementary heat maps that reflect 100 percent horizontal (age/period) and 100 percent diagonal (cohort) interpolations.

9.5.1 RPEC Response

RPEC agrees that these additional heat maps would be informative.

9.5.2 Resulting Changes Reflected in Final Report

The final Scale MP-2014 report contains these supplementary heat maps in Appendix C.

9.6 Social Security Administration Mortality Improvement Data from 2010

One commenter claimed (in a letter dated May 30, 2014) that the 2010 SSA mortality dataset was currently available at that time and suggested that the Scale MP-2014 analysis should be redone to reflect that additional year of data.

9.6.1 RPEC Response

RPEC confirmed with the SSA's Office of the Chief Actuary that the 2010 SSA mortality dataset was not publicly available until the release of the 2014 Trustees' Report on July 28, 2014.

Given the relatively small impact of one additional year of SSA data on the already exposed Scale MP-2014 rates and RPEC's expectation that the SOA will produce updated versions of the model on a much more frequent schedule,²³ the Committee concluded that it was not necessary to redo the current RPEC_2014 model to reflect the 2010 SSA dataset.

9.6.2 Resulting Changes Reflected in Final Report

There were no changes to the final Scale MP-2014 report that resulted from this comment.

9.7 Use of Public Plan Data²⁴

Four commenters mentioned an inconsistency in excluding public plan data to develop RP-2014 mortality rates while using public plan data to ascertain the suitability of using the Scale MP-2014 mortality improvement rates (which were derived from SSA data).

9.7.1 RPEC Response

RPEC finds no inconsistency in excluding public plan data in the development of RP-2014 base mortality rates while using that data to help assess the suitability of applying Scale MP-2014 mortality improvement patterns in measuring U.S. pension plan obligations.

Early in the current pension mortality project, RPEC realized that it would be worthwhile to explore whether there were significant differences in mortality improvement rates within the subset of the population covered by pension plans relative to the general U.S. population, as captured with Social Security data. As discussed in subsection 3.2 of the Scale MP-2014 exposure draft, the development of historical mortality improvement trend rates requires extremely large sets of consistent data tracked over long periods of time. The public plan datasets, being the only ones that satisfied those requirements, provided the Committee its best opportunity to compare recent historical mortality improvement trends for U.S. pension plans with that based on the SSA dataset, from which Scale MP-2014 was developed. Section 3.3 of the Scale BB report states that the mortality improvement patterns of the public plans studied at that time were generally consistent with those based

²³ RPEC recommends that the underlying model be reviewed at least every three years. This review would include an update to reflect all additional years of SSA mortality data, as well as an assessment of the continued appropriateness of the committee-selected assumption set.

²⁴ The term "public plan data" used in this subsection should be understood to include data from both public and federal pension plans.

on SSA mortality data. RPEC found that linkage to still hold true in developing Scale MP-2014.

9.7.2 Resulting Changes Reflected in Final Report

There were no changes to the final Scale MP-2014 report that resulted from this comment.

9.8 Ultimate Responsibility for the Selection of Demographic Assumptions

One commenter disagreed with RPEC's interpretation of ASOP #35 in connection with the ultimate responsibility for the selection of demographic assumptions and requested a more "nuanced" treatment of the various shared responsibilities associated with the assumption selection process.

9.8.1 RPEC Response

RPEC agrees that its discussion of ultimate responsibility of demographic assumptions in the Scale MP-2014 exposure draft was not sufficiently nuanced.

9.8.2 Resulting Changes Reflected in Final Report

The final Scale MP-2014 report references ASOP #35 in general terms and avoids any attempt to interpret professional standards of practice.