



U.S. Public Pension Plan Mortality Assumptions

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June 2018

Mortality assumptions in use by public pension plans in the United States vary widely. This study compares the mortality assumptions used for funding purposes by state-based and large-city public pension plans in terms of the annuity factors they produce. Because mortality changes at older ages generally affect pension plan liabilities more than mortality changes at younger ages, this analysis focuses on post-retirement mortality assumptions.

In general, this analysis studies mortality assumptions used in completing the 2016 actuarial valuations for funding purposes that were prepared for these plans. To provide a common frame of reference, the analysis includes annuity factors for various RP-2014 mortality tables with generational projection of Scale MP-2017, currently the most up-to-date point of reference. All annuity factors shown are for immediate single life annuities at 7% interest with 2% annual benefit increases. These assumptions are for comparison purposes only and not intended as endorsement of their appropriateness for funding these plans or for any other purpose.

The Retirement Plans Experience Committee (RPEC) and the SOA are working on a mortality study specifically for public pension plans in the United States. RPEC expects to release an exposure draft report in late summer or early fall 2018. In the August 2017 edition of *Pension Section Update*, the SOA preliminarily indicated that across all data collected and across all job categories, results were generally closer to RP-2014 white-collar mortality rates than to aggregate RP-2014 rates. Upon deeper analysis, RPEC has found clear differences in mortality experience among the following three job categories: general employees, safety employees and teachers.¹ Consequently, this analysis is split by the same job categories.

The Scatter Graphs section of this report (Figure 1–Figure 3) shows that mortality assumptions varied widely among plans and by job category. In addition to job category, the choice of mortality assumptions can be influenced by geography, socio-economic conditions and plan-specific mortality experience.

Here is a summary of key findings:

- For all job categories combined, the unweighted average age-65 annuity factor for mortality assumptions in use is 99.3% for males and 99.1% for females of the annuity factor for aggregate RP-2014 rates.² Compared to RP-2014 white-collar tables, percentages are 94.8% for males and 96.4% for females. Based on RPEC's preliminary findings, these percentages suggest that mortality assumptions for many plans may be lagging behind current aggregate mortality experience among public plans.
- Roughly one-third of the plans had adopted RP-2014 mortality base rates or a variation of them. However, some of the adjustments to the RP-2014 base tables and/or projections scales result in considerably

¹ Safety employees are primarily police, firefighters and correctional officers.

² Throughout this report, all references to RP-2014 tables include generational projection with Scale MP-2017 unless explicitly stated otherwise.

different annuity factors. Valuation reports typically state that such adjustments were made to reflect plan-specific experience studies.

- Mortality projection is an important part of mortality assumptions, and it also varies significantly among plans. While 58% of plans use generational projection, about 37% of plans use static projection and 5% of plans do not project mortality. Of the plans using generational projection, at least 55% are using scales that were published prior to Scale MP-2014.
- Mortality assumptions for teachers tend to reflect longer life expectancies than for other job categories. For females, mortality assumptions for safety employees tend to reflect shorter life expectancies than for general employees. However, for males, assumptions for safety employees tend to reflect longer life expectancies than for general employees.

Data Used

This analysis uses mortality assumptions from the actuarial reports for state-based and large-city public pension plans that were publicly available on the Public Plans Data website in February 2018. The Public Plans Data includes annual data on 114 state-based and 56 large local public pension plans in the United States, “which account for 95 percent of state/local pension assets and members in the US.”³ Funding valuation reports for 2016 were used whenever possible. Otherwise, 2015 funding valuation reports or recent Comprehensive Annual Financial Reports (CAFRs) were used.

Actuarial valuation reports of the plans studied typically noted that mortality assumptions were based on plan-specific experience studies. The Government Finance Officers Association recommends as a best practice that plans have an experience study performed at least once every five years and update actuarial assumptions as needed.⁴ In some jurisdictions, governing statutes require using the same mortality assumptions for plan administration and valuation purposes. The author’s advisory team has indicated that such requirements may be viewed as a barrier to the adoption of fully-generational mortality projection.

Refer to the Appendix for summaries of the mortality assumptions reflected in this study as well as details regarding identification of plans. The Appendix also provides annuity factor values for the RP-2014 mortality tables projected generationally with MP-2017 as well as the average annuity factors for each job category.

Acknowledgments

The author thanks the following volunteers for their advice, insights and arm’s-length review of this study prior to publication. Any opinions expressed may not reflect their opinions nor those of their employers. Any errors belong to the author alone.

David L. Driscoll, FSA, EA, FCA, MAAA

Timothy J. Geddes, FSA, EA, FCA, MAAA

David T. Kausch, FSA, EA, FCA, MAAA, MSPA

Laurence Pinzur, FSA

³ Public Plans Data, 2018, <http://publicplansdata.org/public-plans-database/>.

⁴ Government Finance Officers Association, *Sustainable Funding Practices for Defined Benefit Pension and Other Postemployment Benefits (OPEB)*, Jan. 2016, <http://www.gfoa.org/sustainable-funding-practices-defined-benefit-pensions-and-other-postemployment-benefits-opeb>.

The author also thanks the following Arcadia University students and professor for their assistance and insights while gathering the data used in this analysis. Any opinions expressed may not reflect their opinions nor those of the university.

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Lili Liu

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Scatter Graphs

Figure 1
AGE 55 ANNUITY FACTORS

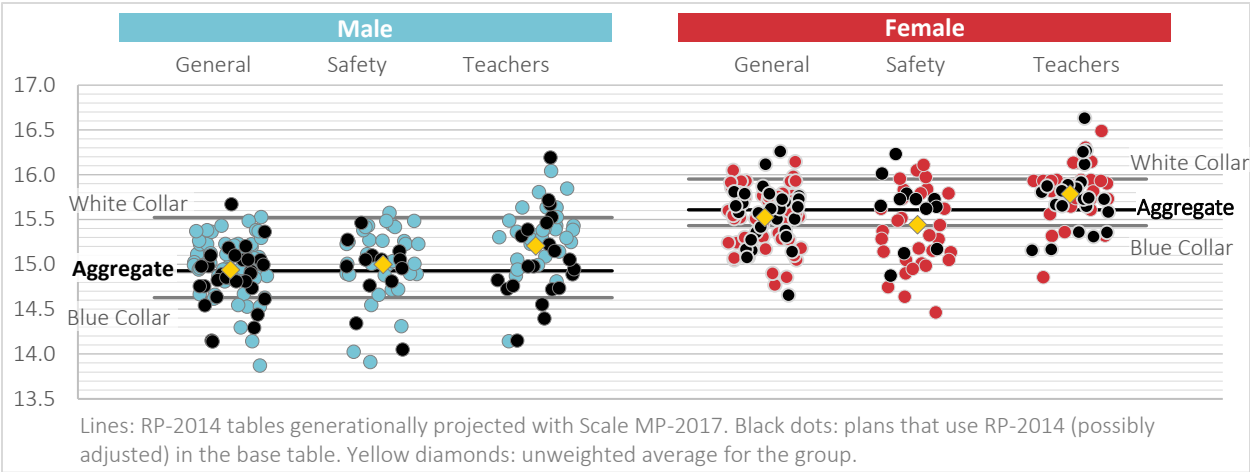


Figure 2
AGE 65 ANNUITY FACTORS

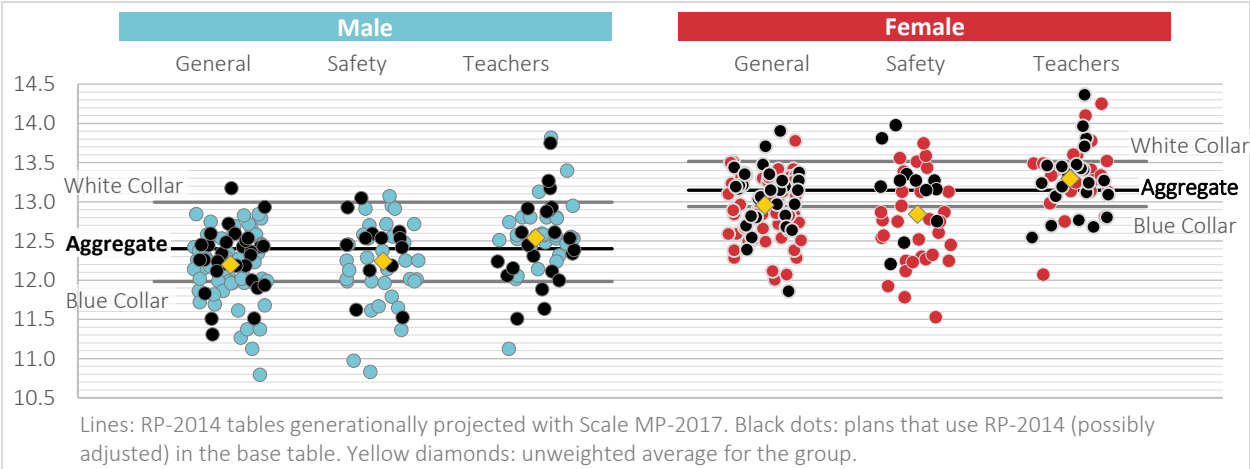
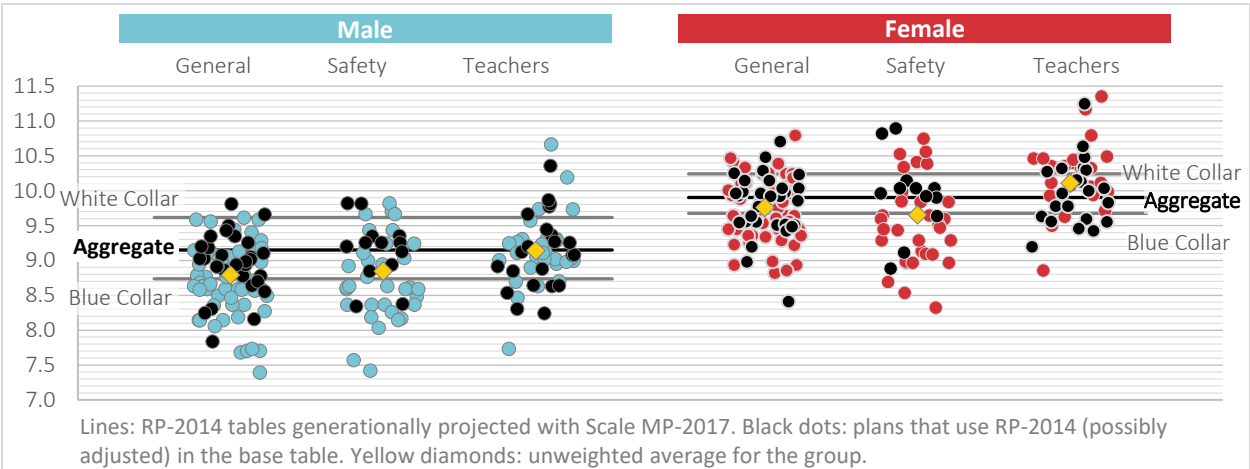


Figure 3
AGE 75 ANNUITY FACTORS



Appendix

Table 1 summarizes the base mortality tables included in the study, by gender and job category. Table 2 provides summaries of the projection scales in use by job category and by projection type.⁵ In some jurisdictions, governing statutes require using the same mortality assumptions for plan administration and valuation purposes.

Note the following details regarding plans and job categories:

- If a plan covers more than one job category and uses different mortality assumptions for different categories, it is counted as a separate plan for each mortality assumption identified.
- If a plan covers only school employees, including teachers, and the same mortality assumption is used for teachers as well as other employees, the plan is included in the teachers category.
- Plans that use mortality tables to which the author does not have access for either gender are excluded from the study. For plans that are included in the study, if the author does not have access to a mortality table, the plan is reflected in Table 1 and Table 2, but not in Table 3 averages for the applicable gender.

Table 1
BASE MORTALITY TABLES: NUMBER OF PLANS

Base Mortality Table ⁶	Male			Female		
	General	Safety	Teachers	General	Safety	Teachers
1994-GAM or UP-94	4	0	1	4	0	1
RP-2000	55	34	30	53	32	28
RP-2014	31	14	23	31	14	23
Other	0	0	0	2	2	2
Total	90	48	54	90	48	54

Table 2
MORTALITY PROJECTION: NUMBER OF PLANS

Projection Scale ⁷	Job Category			Projection Type		
	General	Safety	Teachers	Generational	Static	None
AA	34	19	16	33	36	0
BB ⁸	28	11	19	28	30	0
MP ⁹	23	12	13	44	4	0
Other	2	2	4	6	2	0
None	3	4	2	0	0	9
Total	90	48	54	111	72	9

⁵ Projections scales as summarized are the same for each gender.

⁶ Base mortality tables may be adjusted.

⁷ Projection scale may be adjusted.

⁸ Includes both one-dimensional and two-dimensional versions of Scale BB.

⁹ Includes MP-2015, MP-2016 and MP-2017.

Table 3 shows the average annuity factors for each group shown in Figure 1 through Figure 3, as well as the annuity factors for RP-2014 mortality tables generationally projected with Scale MP-2017. Table 4 provides the average annuity factor for each group relative to annuity factors for the RP-2014 mortality tables generationally projected with Scale MP-2017. All annuity factors are for immediate annuities computed at 7% interest with 2% annual benefit increases.

Table 3
ANNUITY FACTORS

	Male			Female		
	Age 55	Age 65	Age 75	Age 55	Age 65	Age 75
Average						
General Employees (G)	14.9405	12.2005	8.7900	15.5257	12.9595	9.7596
Safety Employees (S)	14.9998	12.2457	8.8457	15.4429	12.8434	9.6547
Teachers (T)	15.2087	12.5404	9.1399	15.7852	13.2963	10.1104
RP-2014 generationally projected with Scale MP-2017						
White Collar	15.5236	12.9947	9.6157	15.9522	13.5151	10.2413
Aggregate	14.9286	12.4015	9.1492	15.6089	13.1472	9.9023
Blue Collar	14.6296	11.9837	8.7364	15.4326	12.9394	9.6748

Table 4
CHANGE IN AVERAGE ANNUITY FACTORS RELATIVE TO RP-2014 ANNUITY FACTORS

	Male			Female		
	Age 55	Age 65	Age 75	Age 55	Age 65	Age 75
General Employees (G)						
White Collar	-3.8%	-6.1%	-8.6%	-2.7%	-4.1%	-4.7%
Aggregate	+0.1%	-1.6%	-3.9%	-0.5%	-1.4%	-1.4%
Blue Collar	+2.1%	+1.8%	+0.6%	+0.6%	+0.2%	+0.9%
Safety Employees (S)						
White Collar	-3.4%	-5.8%	-8.0%	-3.2%	-5.0%	-5.7%
Aggregate	+0.5%	-1.3%	-3.3%	-1.1%	-2.3%	-2.5%
Blue Collar	+2.5%	+2.2%	+1.3%	+0.1%	-0.7%	-0.2%
Teachers (T)						
White Collar	-2.0%	-3.5%	-4.9%	-1.0%	-1.6%	-1.3%
Aggregate	+1.9%	+1.1%	-0.1%	+1.1%	+1.1%	+2.1%
Blue Collar	+4.0%	+4.6%	+4.6%	+2.3%	+2.8%	+4.5%
All Job Categories ¹⁰						
White Collar	-3.2%	-5.3%	-7.4%	-2.4%	-3.6%	-4.0%
Aggregate	+0.7%	-0.8%	-2.7%	-0.2%	-0.9%	-0.7%
Blue Collar	+2.7%	+2.7%	+1.9%	+0.9%	+0.6%	+1.6%

Note: RP-2014 tables are projected generationally with Scale MP-2017.

¹⁰ These average annuity factor values are not represented in Figure 1 through Figure 3.

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