



U.S. Public Pension Plan Mortality Assumptions Compared to Pub-2010 Mortality Tables

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Introduction

In June 2018, the Society of Actuaries (SOA) published a comparison of post-retirement mortality assumptions used by state-based and large-city public pension plans in the United States in terms of the annuity factors they produce.¹ Recently, the Retirement Plans Experience Committee (RPEC) and the SOA released an exposure draft of the Pub-2010 Public Retirement Plans Mortality Tables, which are based on a mortality study of public pension plan participants in the United States. This study updates the June 2018 study to incorporate the Pub-2010 Mortality Tables and also changes the basis for comparison from the RP-2014 to the RP-2006 Mortality Tables. In addition, the June paper compared 2016 annuity factors while this analysis compares 2018 annuity factors.

Readers might note that the RPEC updated nomenclature for mortality tables. The year in the table name reflects the central year of the data, without projection. The RP-2014 Mortality Tables were released in 2014 and reflected mortality rates that had been projected from the central year of 2006—now known as the RP-2006 Mortality Tables—to 2014 using mortality improvement scale MP-2014.²

In the study of public plan mortality experience, the RPEC found clear differences among three job categories that were studied individually, and published mortality tables accordingly: general employees, safety employees and teachers.³ The RP-2006 Mortality Tables were published in aggregate for all employees as well as for white-collar and blue-collar employees.

In general, this analysis studies mortality assumptions used in completing the studied plans' 2016 actuarial valuations for funding purposes. In addition to the amount-weighted Pub-2010 Tables, the comparison includes annuity factors for various amount-weighted RP-2006 Mortality Tables. Both Pub-2010 and RP-2006 Mortality Tables are projected generationally with Scale MP-2017, currently the most up-to-date mortality improvement scale published by the RPEC and the SOA. All annuity factors shown are for monthly, immediate single life annuities beginning in 2018, computed at 7% interest with 2% annual benefit increases.⁴ These assumptions are used for comparative purposes only and not intended as endorsement of their appropriateness for funding these plans or for any other purpose.

¹ Society of Actuaries, "U.S. Public Pension Plan Mortality Assumptions," June 2018, <https://www.soa.org/research-reports/2018/public-pension-mortality/>.

² The June paper used RP-2014 rates, which were developed by projecting the RP-2006 from 2006 to 2014 with Scale MP-2014, and then subsequently projected with Scale MP-2017. This paper uses RP-2006 projected from 2006 with Scale MP-2017.

³ Safety employees are primarily police, firefighters and correctional officers.

⁴ These assumptions differ slightly from those used in the Pub-2010 Mortality Tables report, hence the annuity factors differ.

Mortality assumptions in use by large public pension plans varied widely among plans and generally reflected the same three job categories as Pub-2010 Mortality Tables. In addition to job category, the choice of mortality assumptions can be influenced by geography, socioeconomic conditions and plan-specific mortality experience.

Key Findings

Here is a summary of key findings:

- For all job categories and ages, Pub-2010 annuity factors exceed the comparable average annuity factor under current assumptions.⁵ Pub-2010 factors range from 0.9% greater for age 75 female safety employees to 6.3% greater for age 75 male teachers.⁶
- Mortality assumptions for teachers tend to result in larger annuity factors than for other job categories, as is consistent with the Pub-2010 Mortality Tables.
- Mortality assumptions for male safety employees tend to result in larger annuity factors than assumptions used for general employees, while assumptions for female safety employees tend to result in lower annuity factors than those in use for general employees. However, the Pub-2010 Mortality Tables produce lower annuity factors for safety employees than for general employees across gender and age combinations, except for males age 55.
- Roughly one-third of the plans had adopted the RP-2006 or RP-2014 mortality rates or a variation of them. However, some of the adjustments to the RP-2006 or RP-2014 base tables and/or projections scales result in considerably 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 setting a mortality assumption, 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 improvements beyond measurement dates. Of the plans using generational projection, at least 55% are using scales that were published prior to Scale MP-2014.

Data Used

This analysis uses mortality assumptions from the actuarial reports for state-based and large-city public pension plans that were available from Public Plans Data in February 2018. 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.”⁷ Funding valuation reports for 2016 were used whenever possible. Otherwise, 2015 funding valuation reports or recent Comprehensive Annual Financial Reports 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.⁸ In some jurisdictions, governing statutes require using the same mortality assumptions for plan administration and

⁵ Average annuity factors for current assumptions are weighted one per plan.

⁶ Throughout this report, all references to Pub-2010 and RP-2006 Mortality Tables are for amount-weighted base tables generationally projected with Scale MP-2017, unless explicitly stated otherwise.

⁷ Public Plans Data, 2018, <http://publicplansdata.org/public-plans-database/>.

⁸ 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>.

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 Pub-20210 and RP-2006 Mortality Tables projected generationally with MP-2017 as well as the average annuity factors for each job category.

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Public Plan Mortality Assumption Comparison

Figure 1
2018 AGE 55 ANNUITY FACTORS WITH PUB-2010 AND RP-2006

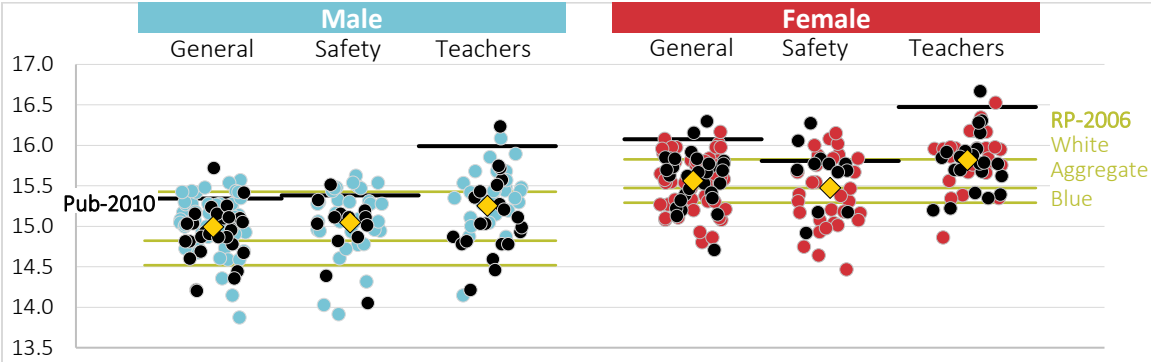


Figure 2
2018 AGE 65 ANNUITY FACTORS WITH PUB-2010 AND RP-2006

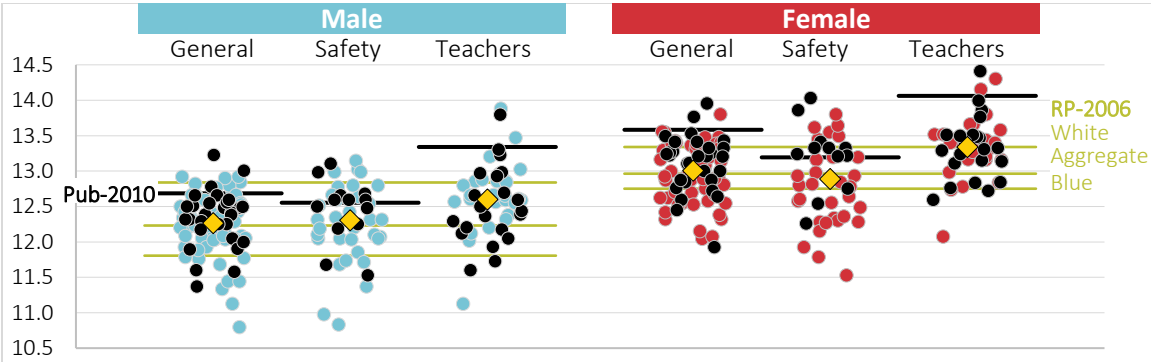
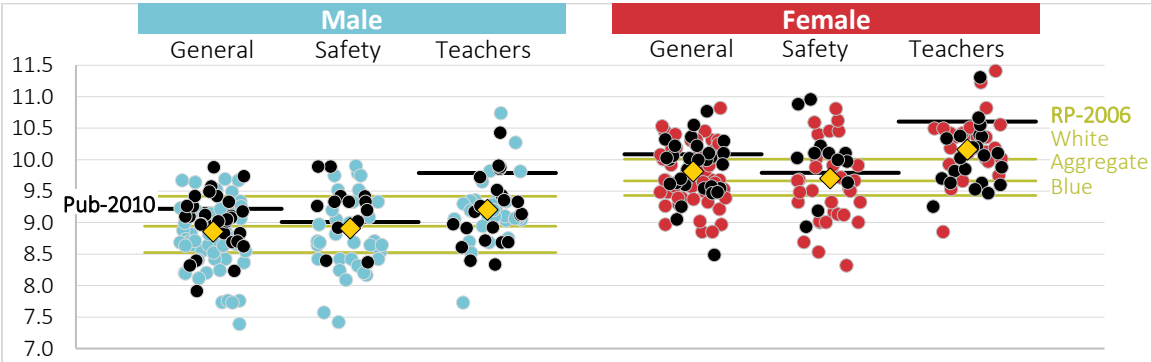


Figure 3
2018 AGE 75 ANNUITY FACTORS WITH PUB-2010 AND RP-2006



Legend

- Black dots Plans that use RP-2006 or RP-2014 mortality rates (possibly adjusted) in the base table
- Blue/red dots Plans that use neither RP-2006 nor RP-2014 mortality rates (adjusted or otherwise) in the base table
- Yellow diamonds Average of all plans in the job category, weighted one per plan
- Black lines Pub-2010 Mortality Tables (amount-weighted) generationally projected with Scale MP-2017
- Green lines RP-2006 Mortality Tables (amount-weighted) generationally projected with Scale MP-2017: white collar (top), aggregate (middle) and blue collar (bottom)
- Assumptions Monthly single life annuities beginning in 2018, computed at 7% interest with 2% annual benefit increases

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.⁹ 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 ¹⁰	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-2006 or 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 ¹¹	Job Category			Projection Type		
	General	Safety	Teachers	Generational	Static	None
AA	34	19	16	33	36	0
BB ¹²	28	11	19	28	30	0
MP ¹³	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

⁹ Projections scales as summarized are the same for each gender.

¹⁰ Base mortality tables may be adjusted.

¹¹ Projection scale may be adjusted.

¹² Includes both one-dimensional and two-dimensional versions of Scale BB.

¹³ 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 annuity factors for the amount-weighted Pub-2010 and RP-2006 Mortality Tables generationally projected with Scale MP-2017. Table 4 and Table 5 provide the change in the average annuity factor for each group relative to annuity factors for the amount-weighted Pub-2010 and RP-2006 Mortality Tables generationally projected with Scale MP-2017. All annuity factors are for immediate annuities starting in 2018, computed at 7% interest with 2% annual benefit increases.¹⁴ These assumptions are for comparison purposes only and not intended as endorsement of their appropriateness for funding these plans or for any other purpose.

Table 3
2018 ANNUITY FACTORS

	Male			Female		
	Age 55	Age 65	Age 75	Age 55	Age 65	Age 75
Average						
General Employees (G)	14.9897	12.2639	8.8581	15.5593	13.0056	9.8142
Safety Employees (S)	15.0453	12.3040	8.9085	15.4744	12.8865	9.7057
Teachers (T)	15.2535	12.5993	9.2052	15.8162	13.3387	10.1616
Pub-2010¹⁵						
General Employees (G)	15.3432	12.6856	9.2192	16.0754	13.5827	10.1464
Safety Employees (S)	15.3817	12.5531	9.0095	15.8072	13.1934	9.7910
Teachers (T)	15.9903	13.3402	9.7885	16.4734	14.0616	10.6047
RP-2006¹⁵						
White Collar	15.4269	12.8385	9.4184	15.8268	13.3398	10.0081
Aggregate	14.8220	12.2309	8.9431	15.4727	12.9630	9.6628
Blue Collar	14.5190	11.8057	8.5247	15.2915	12.7509	9.4314

Table 4
CHANGE FROM AVERAGE ANNUITY FACTORS TO PUB-2010 ANNUITY FACTORS

	Male			Female		
	Age 55	Age 65	Age 75	Age 55	Age 65	Age 75
General Employees (G)	+2.4%	+3.4%	+4.1%	+3.3%	+4.4%	+3.4%
Safety Employees (S)	+2.2%	+2.0%	+1.1%	+2.2%	+2.4%	+0.9%
Teachers (T)	+4.8%	+5.9%	+6.3%	+4.2%	+5.4%	+4.4%

Table 5
CHANGE FROM AVERAGE ANNUITY FACTORS TO RP-2006 ANNUITY FACTORS

	Male			Female		
	Age 55	Age 65	Age 75	Age 55	Age 65	Age 75
General Employees (G)						
White Collar	+2.9%	+4.7%	+6.3%	+1.7%	+2.6%	+2.0%
Aggregate	-1.1%	-0.3%	+1.0%	-0.6%	-0.3%	-1.5%
Blue Collar	-3.1%	-3.7%	-3.8%	-1.7%	-2.0%	-3.9%
Safety Employees (S)						
White Collar	+2.5%	+4.3%	+5.7%	+2.3%	+3.5%	+3.1%
Aggregate	-1.5%	-0.6%	+0.4%	0.0%	+0.6%	-0.4%
Blue Collar	-3.5%	-4.0%	-4.3%	-1.2%	-1.1%	-2.8%
Teachers (T)						
White Collar	+1.1%	+1.9%	+2.3%	+0.1%	+0.0%	-1.5%
Aggregate	-2.8%	-2.9%	-2.8%	-2.2%	-2.8%	-4.9%
Blue Collar	-4.8%	-6.3%	-7.4%	-3.3%	-4.4%	-7.2%

¹⁴ These assumptions differ slightly from those used in the Pub-2010 Mortality Tables report, hence the annuity factors differ.

¹⁵ Amount-weighted tables generationally projected with Scale MP-2017.

About the Society of Actuaries

The Society of Actuaries (SOA), formed in 1949, is one of the largest actuarial professional organizations in the world, dedicated to serving 30,000 actuarial members and the public in the United States, Canada and worldwide. In line with the SOA Vision Statement, actuaries act as business leaders who develop and use mathematical models to measure and manage risk in support of financial security for individuals, organizations and the public.

The SOA supports actuaries and advances knowledge through research and education. As part of its work, the SOA seeks to inform public policy development and public understanding through research. The SOA aspires to be a trusted source of objective, data-driven research and analysis with an actuarial perspective for its members, industry, policymakers and the public. This distinct perspective comes from the SOA as an association of actuaries, who have a rigorous formal education and direct experience as practitioners as they perform applied research. The SOA also welcomes the opportunity to partner with other organizations in our work where appropriate.

The SOA has a history of working with public policymakers and regulators in developing historical experience studies and projection techniques as well as individual reports on health care, retirement and other topics. The SOA's research is intended to aid the work of policymakers and regulators and follow certain core principles:

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