TWO

DEVELOPMENT OF DEMOGRAPHIC ASSUMPTIONS

Office of the State Actuary

"Supporting financial security for generations."

Actuarial Certification Letter
Experience Study Report
As of June 30, 2018

June 2020

This report documents the results of an experience study of the retirement plans defined under Chapters 41.26, 41.32, 41.35, 41.37, 41.40, and 43.43 of the Revised Code of Washington (RCW). The primary purpose of this experience study is to determine if any adjustments are required to ensure our assumptions remain a reasonable estimate of future plan experience. This report should not be used for other purposes.

This analysis will become outdated with the release of our next experience study report. Please replace this report with our next report when available.

The experience study results summarized in this report involve methods for analyzing past demographic experience and setting new demographic assumptions for the plans. We believe that the methods used and assumptions developed in this study are reasonable and are in conformity with generally accepted actuarial principles and standards of practice as of the date of this publication.

The Pension Funding Council hired an outside actuarial firm, Milliman, to audit the actuarial analysis we performed in this study including the new assumptions. They found our work to be reasonable. Milliman's full audit report is available on our website.

The Department of Retirement Systems provided member and beneficiary data to us. We also received data from the Office of the Superintendent of Public Instruction.

We checked the data for reasonableness as appropriate based on the purpose of this study. An audit of the data was not performed. We relied on all the information provided as complete and accurate. In our opinion, this information is adequate and substantially complete for the purposes of this study.

The undersigned, with actuarial credentials, meet the Qualification Standards of the American Academy of Actuaries to render the actuarial opinions contained herein. While this report is intended to be complete, we are available to offer additional advice and explanations as needed.

Sincerely,

Matthew M. Smith, FCA, EA, MAAA
State Actuary

Luke Masselink, ASA, EA, MAAA
Senior Actuary

PO Box 40914 | Olympia, Washington 98504-0914 | state.actuary@leg.wa.gov | leg.wa.gov/osa
Phone: 360.786.6140 | Fax: 360.586.8135 | TDD: 711

TWO: DEVELOPMENT OF DEMOGRAPHIC ASSUMPTIONS

DISABILITY RATES

What is the Disability Rates Assumption and How Do We Use it?

The Disability Rates assumption represents the probability that an eligible active service individual will experience a disabling incident and select a disability pension benefit immediately. Members that experience a disabling incident may not immediately leave employment, or when they leave, may not immediately retire. This assumption focuses only on members that select a disability pension benefit, the goal of which is to project when members will leave employment and move into disabled retirement. We then use the assumed disablement behavior, along with other assumptions, to estimate how much and for how long members will collect their disabled retirement benefits for purposes of plan funding.

This assumption generally varies by plan and age. However, where appropriate, we set an assumption by combining the experience of similar plans. We also set an assumption that varies by years of service credit where appropriate.

High-Level Takeaways

In general, disabled retirement data available since the Great Recession (2008-2017) showed consistently lower rates of disabled retirement than prior to the recession (1995 2007). In the prior experience study, we had removed 2008-2012 data for PERS, TRS, and SERS Plans 2 and 3 because of impacts from the recession. We removed the recession data because we did not think there was sufficient experience after the recession in which to observe an economic recovery. Economic cycles can impact the selection aspect of disabled retirements because the benefit may be less affordable during poor economic times. We included 2008-2017 data in this study due to the continued trend of lower disabled retirement. As a result, observed rates of disability in the study period were lower than old disability rates, and in general, we lowered our assumed rates.

The following list demonstrates some of the economic and demographic changes that may have impacted disabled retirement behavior – specifically the selection or choice aspect of the benefit – over the last decade:

- **Life Expectancy** – Washington State employees are living longer than in the past. Members could be deferring disabled retirement to save money and build a larger retirement benefit instead of retiring earlier with a reduced benefit.
- **Plan 3 Retirement Accounts** – The Great Recession heavily affected Plan 3 Defined Contribution (DC) retirement account balances. When a member experiences a disability, the size of their Plan 3 DC account may impact their decision to choose a disabled retirement benefit. If their DC account is large enough to provide sufficient financial support, members may choose to terminate employment and defer service retirement, rather than choose a disabled retirement benefit. Over the last decade, Plan 3 DC accounts have recovered since the 2008 09 market downturn.
- **Cost of Health Insurance** – Some members may continue working prior to Medicare eligibility in order to retain employer provided health insurance that is typically cheaper than other options.

Due to data credibility concerns, we made several changes to the disability rates assumption. For all retirement systems, we now use gender-neutral rates. Further, we combined rates for PERS, TRS, and SERS Plan 2, and similarly for Plan 3. Experience shows that Plan 3 members select disabled retirement at lower rates than Plan 2 members, in general. We believe that occurs because Plan 3 members can elect to retire from the defined contribution portion of the plan and defer commencement of their defined benefit. However, we don't have sufficient data to set experienced-based rates in Plan 3. To set separate Plan 3 rates, we applied our professional judgment to reflect lower rates of selection of the immediate disability retirement benefit than Plan 2.

While we also observed few disabled retirements in LEOFF Plan 2, PSERS Plan 2, and WSPRS, we did not combine these public safety plans with the other, larger systems because public safety occupations, and many of the systems' disability benefits, are fundamentally different. Likewise, we set rates for LEOFF 2, PSERS Plan 2, and WSPRS separate from each other due to population and benefit structure differences. For example, in PSERS Plan 2, many of its members transferred from PERS so we expect its experience will be similar to that of PERS. However, we expect a different rate of selection between PERS and PSERS due to the more generous disability benefit in PSERS.

DISABILITY RATES *continued*

Data and Assumptions

We looked at 23 years of experience study records, from 1995-2017. No special data was added for this assumption, but some data was removed as noted below.

Consistent with prior studies, we removed valuation years 2001 and 2007 because the valuation date changed in those years. Including data for 2001 and 2007 would lead to valuation periods of unequal length. We also removed 2000 data for SERS Plans 2/3 because the plan was created in 2000. SERS experienced relatively few disabled retirements in 2000 compared to subsequent years. We do not believe the year 2000 disability experience is representative of expected long-term experience.

For PERS, TRS, and LEOFF Plans 1, we considered a 1995-2017 study period for setting rates in these closed plans. However, we believe recent rates of disablement are more indicative of future rates of disablement for the relatively small group of remaining actives in these closed plans. Therefore, we relied on data after the end of the last experience study, 2013-2017, to set new assumptions. For LEOFF Plan 2, we excluded data prior to 2005 due to significant changes in benefits during and beyond that year.

Because PSERS is a relatively new system, we do not have sufficient data to set a credible disability rates assumption for PSERS from plan experience. Instead, we relied on the PERS-TRS-SERS Plan 2 disability rates assumption to inform the PSERS Plan 2 assumption and then made subsequent adjustments based on differences in disability benefit provisions between these plans and PSERS.

Additionally, SERS is another relatively new system. However, we were able to gather SERS data prior to the creation of the plan by selectively pulling data for PERS members employed at school districts that would have been eligible for SERS had it been in place at that time.

We set no assumption for disability recovery. In the context of disabled retirement benefits, a recovery represents a member recovering from the incurred disability and returning to work, resulting in a suspension of the benefit. Over the entire study period (1984-2017), we observed very few instances of recovery. We believe an assumption based on this experience would be immaterial to any retirement system.

Law Changes

There were two law changes since the last study that could impact member disability behavior:

- **HB 2592 (2016)** – Allows disability coverage for LEOFF 2 members that become totally incapacitated as a result of certain federal emergency management service.
- **SSB 6214 (2018)** – Adds Post-Traumatic Stress Disorder (PTSD) to the list of occupational diseases and creates a rebuttable presumption for LEOFF members that PTSD is an occupational disease.

We have not yet accumulated sufficient experience under HB 2592 or SSB 6214 to update our assumptions. We will continue to monitor the situation and make adjustments as necessary.

General Methodology

For most retirement plans, we calculated the actual disability rate by dividing the number of members that experience a disabling incident and selected a disabled retirement benefit by the total number of members who were ineligible to retire. We assume retirement-eligible members in most plans, if offered the choice would select a service retirement over a disabled retirement. For LEOFF and WSPRS, we included all members regardless of retirement eligibility. In some instances, their tax-free disability benefits may exceed their after-tax service retirement benefits, thus we assume members of these systems may select a disabled retirement benefit over a retirement benefit if presented the option.

We compared the number of actual disablements (observations) to our expected number of disablements based on our old assumed rates. To determine the expected number, we applied the old assumption to the eligible population over the study period, by age. We considered this actual-to-expected measurement on an annual basis and as a whole over the entire study period. This helped us identify trends in the data where the assumption was over or underestimating disabled retirement behavior. In general, to set the new assumed rates, we divided observed disabled retirements by retirement-ineligible active members over five-year age bands. We then considered historical trend experience and applied professional judgment about future expectations to determine our final assumed rates.

DISABILITY RATES *continued*

It is important to note that not all eligible members who experience a disabling incident will choose to receive a disability benefit. Some will choose to keep working, while others will choose a traditional service retirement or choose a new career and withdraw their contributions. As noted above, Plan 3 members may elect to retire from their defined contribution portion of their benefit and defer the commencement of their defined benefit. This selection aspect of the disability assumption produces a disconnect between the disabling incident and the decision to retire based on that incident. Many individual factors unrelated to the actual incident may drive a member's decision, such as overall health, job satisfaction, financial security, and the general state of the economy.

We considered an alternate approach of studying disability rates weighted by salary instead of headcount. We created salary-weighted rates by dividing the salary that left the system through disabled retirement by the total salary ineligible for retirement. This approach attempts to set rates that better model the salary leaving the system. We studied PERS using salary-weighted rates because of the large dispersion in member salaries in the system. Overall, we did not see a large enough difference in rates to justify a method change. We decided to maintain our prior approach of using headcount weighted rates and did not pursue the salary-weighted approach in PERS or with other systems.

Results

For most plans, we reduced the disability rates assumption to reflect experience and behavior. In PERS, TRS, and LEOFF Plans 1, we removed disability rates. Nearly all members in these systems are at or near service retirement eligibility and we believe they would select a retirement benefit if they experience a disability in the future. Recent experience also shows very few disabled retirements in PERS, TRS, and LEOFF Plans 1.

We calculated an Actual-to-Expected (A/E) ratio to better understand how our assumptions compare to plan experience in our study period. The "actual" represents the number of disabled retirements we observed during the study period and the "expected" represents the number of disabled retirements our assumption produced based on the number of eligible members. In general, an A/E ratio less than 1.00 indicates lower actual rates of disability relative to our assumption. We see a ratio above 1.00 when members disable at higher rates than we assume.

In the following table, note that the A/E ratio under the old assumptions for PERS, TRS, and LEOFF Plans 1 represents a study period of 2013-2017. The ratio under the new assumptions shows Not Applicable (N/A) because we removed disability rates for these plans. Please see the **Disability Rates Appendix** for additional information on how we set this assumption.

Summary of A/E Ratios

	Under Current Assumptions	Under New Assumptions
PERS 1	0.63	N/A
PERS 2	0.72	0.86
PERS 3	0.35	0.65
TRS 1	0.78	N/A
TRS 2	1.08	0.86
TRS 3	0.44	0.65
SERS 2	0.73	0.86
SERS 3	0.31	0.65
PSERS 2	0.49	0.48
LEOFF 1	0.00	N/A
LEOFF 2	0.73	0.87
WSPRS 1/2	0.81	0.93

TWO: DEVELOPMENT OF DEMOGRAPHIC ASSUMPTIONS

MORTALITY RATES

What is the Mortality Rates Assumption and How Do We Use it?

The Mortality Rates assumption is primarily used to estimate how long pension benefits will be paid after retirement. We also use these assumptions to determine the probability that a member will survive until retirement. This assumption is generally gender and age based.

The goal of this assumption is to estimate the probability of death in a given year for both the member and any eligible survivors. We also set assumptions for how we expect mortality rates to improve over time.

High-Level Takeaways

In general, we are still observing improvements in mortality (i.e., members living longer). To project future improvements in mortality, we use a mortality improvement scale. Based on the results of our study, we believe the long-term MP-2017 rates provide a better fit and predictor of long-term mortality improvement. The long-term MP-2017 rates predict an approximate 1 percent per year improvement for both males and females over most ages. By comparison, our current assumption of Scale BB estimates mortality improvement for certain age groups in excess of 1 percent.

To determine appropriate mortality rates for our plans, we start with a published mortality table as a base and adjust it to reflect our experience. Our latest experience supports updating to the newer Pub.H-2010 tables.[1] The Pub.H-2010 tables we select by system may vary depending on the type of jobs that comprise the system. From there, we apply appropriate age adjustments, if necessary, to better tailor the mortality rates to the demographics of each system. For most systems, we found age adjustments are no longer necessary with our updated tables with the exception of some public safety plans. In other words, our experience generally indicated that the mortality rates for the populations of the Washington State retirements systems are similar to aggregated nationwide public retirement systems experience studied by SOA when establishing these tables. The following table summarizes the new base mortality tables and age offsets used by system.

New Healthy Mortality Assumptions by System

System	Base Table	Offsets Males	Offsets Females
PERS	PubG.H-2010 (General)	0	0
TRS	PubT.H-2011 (Teachers)	0	0
SERS	PubG.H-2012 (General)	0	0
PSERS	PubS.H-2013 (Safety)	0	0
LEOFF	PubS.H-2014 (Safety)	(1)	0
WSPRS	PubS.H-2015 (Safety)	(1)	0

Consistent with our prior methodology, we chose to apply age offsets directly to the Pub.H-2010 tables and use the long-term MP-2017 generational improvement scale to project mortality rates every year thereafter. Another approach would be to apply age offsets after the projected mortality improvements.

[1]Released in January of 2019, these tables are the most recent publication from SOA on the mortality rates of public retirement system plan participants at the time of this study.

MORTALITY RATES *continued*

Our new mortality assumption – incorporating the updated base tables, age offsets, and mortality improvement scale – predicts both lower and higher rates of mortality than the old assumption dependent on the system, gender, and age examined. Illustrated below is an example of how assumed life expectancy, as of 2018, changes under two different ages in the PERS Plan 2.

Difference in Life Expectancy Under Select Ages				
	Age 45		Age 65	
	Male	Female	Male	Female
New Assumptions	85.9	89.4	85.8	88.8
Old Assumptions	86.9	89.2	86.8	89.0
Difference	**(1.0)**	**0.1**	**(1.0)**	**(0.2)**

Note: Age 45 Life Expectancies under the New Assumptions rely on PERS 2 retirement rates. Differences may not agree due to rounding.

Data and Assumptions

We looked at 34 years of data, from 1984-2017. No special data was added for this assumption, but some data was removed. Consistent with prior studies, we removed valuation years 2001 and 2007 because the valuation date changed in those years. Including data for 2001 and 2007 would lead to valuation periods of unequal length.

Law Changes

No law changes impacted our analysis of this assumption.

General Methodology

Actual mortality rates are calculated as follows. For each year and retirement plan, we counted the number of deaths during the year and divided it by the number of members alive at the beginning of the year. This underlying data serves as the basis for setting our mortality assumptions.

We approached this analysis in three steps.

- First, we looked for a trend in the data to determine how mortality rates are improving over time. The results of this analysis, outside expert opinions, and our own professional judgment were used in selecting a mortality improvement scale.
- Next, we reviewed published base mortality tables to determine which tables would be the best fit for our retirement systems.
- Finally, we compared our actual mortality rates during the 2006-2017 period to our new base tables (projected to the mid-point of the period) for purposes of establishing age offset assumptions for each retirement system.

At each step of the process we gave consideration to our amount of data. Data is considered more credible the larger the available sample size. When very precise assumptions are set, such as a mortality rate at a specific age, full credibility in the data becomes harder to obtain. With insufficient credibility, analysis of the data can be a misleading or an inaccurate representation of the population as a whole. To increase the reliability of our results, we used a published mortality table as a basis for our mortality tables, grouped our data when appropriate, and withheld making individualized assumptions for certain plans.

MORTALITY RATES *continued*

Results

Healthy Mortality

Mortality Improvement Scale

We considered our expectations for the future and how those expectations may impact the observed trends. Then, we compared our conclusions with the available mortality scales and picked the scale that, in our opinion, best reflects long-term mortality trends for the Washington State retirement systems. For this study we elected to replace our current assumption of Scale BB with RPEC's MP-2017 long-term rates applied using a generational approach.

We agree with RPEC that underlying mortality rates can vary by year of birth in addition to gender. We also agree that anticipated rates of mortality improvement can change with the addition of new experience data. However, our analysis indicated that the greater precision of the two-dimensional scale will not always provide additional value. For example, from 2008 to 2017 we found the long-term rates were better a predictor of mortality improvement than the variable rates in the full MP-2017 table that varies by year. In addition, the high level of complexity of the two-dimensional scale could pose problems. The precision of the scale can create a false sense of accuracy, and it hinders an actuary's ability to summarize the effects of mortality. It also has the potential to introduce volatility in actuarial measurements when the scale is updated annually. Furthermore, the reasons behind these periodic changes can be unclear and difficult for the actuary to explain.

MP-2017 Long-Term Rates

Age	Male & Female	Age	Male & Female	Age	Male & Female
<86	0.0100	**95**	0.0085	**105**	0.0043
86	0.0099	**96**	0.0081	**106**	0.0038
87	0.0097	**97**	0.0077	**107**	0.0034
88	0.0096	**98**	0.0072	**108**	0.0030
89	0.0094	**99**	0.0068	**109**	0.0026
90	0.0093	**100**	0.0064	**110**	0.0021
91	0.0091	**101**	0.0060	**111**	0.0017
92	0.0090	**102**	0.0055	**112**	0.0013
93	0.0088	**103**	0.0051	**113**	0.0009
94	0.0087	**104**	0.0047	**114**	0.0004
				>114	0.0000

Base Table

Based on our analysis, we selected the headcount-weighted public plan mortality tables with separate rates for employees, retirees, and contingent survivors differing by the primary job categories in each system for our healthy populations. The Pub-2010 tables were developed using more recent data than our current base table of RP-2000 and focus on public plan data. Within the Pub-2010 tables, we considered the use of liability weighted tables but found the headcount weighted tables provided a better fit to our plan experience, even when measuring liability experience. For more information on our considerations, please see the **Mortality Rates Appendix**.

For PERS and SERS, we selected the general headcount-weighted public plans mortality tables, PubG.H-2010. As expected, the general mortality tables provided the best fit for our experience in PERS. For SERS, we selected the PubG.H-2010 tables for two primary reasons: (1) the general public plan mortality table provided a better fit to SERS experience, and (2) the PubT.H-2010 tables were developed using experience from instructors only, not general school employees. We will continue to monitor this assumption and may make a change in the future.

For TRS, we selected the teachers headcount-weighted public plans mortality tables, PubT.H-2010. Teachers tend to live longer than other occupations and the PubT.H-2010 tables reflect longer assumed lifespans.

MORTALITY RATES *continued*

Lastly, for the public safety systems, PSERS, LEOFF, and WSPRS, we selected the public safety headcount-weighted public plans mortality tables, PubS.H-2010. Since our data is limited for PSERS and WSPRS, we relied on LEOFF experience and the list of occupations that make up the various Pub-2010 tables. A large portion of PSERS is correctional officers. We concluded the PubS.H-2010 would be a better predictor for PSERS, compared to the general population table, because correctional officers were included in the experience data SOA used to establish this table. We will continue to monitor this assumption and may make a change in the future.

The following table illustrates the new assumed life expectancies, by system, of a 65-year-old retiree using the Pub.H-2010 tables.

New Assumed Retiree Life Expectancy as of 2018		
	Age 65	
	Male	Female
PERS & SERS (PubG.H-2010)	85.7	88.7
TRS (PubT.H-2010)	87.8	90.3
PSERS (PubS.H-2010)	85.4	87.9
LEOFF & WSPRS (PubS.H-2010)*	86.3	87.9

**Includes a (1) age offset for males.*

The base mortality tables we selected for beneficiaries across all retirement systems blend the Pub.H-2010 single contingent survivor table and the retiree mortality rates corresponding to the member's retirement system. We believe mortality is generally higher for widow(er)s, which is consistent with the contingent survivor table developed by RPEC that was based on survivor data after the death of the primary annuitant. However, since our valuation system requires a single table to model beneficiary mortality both before and after a member's death, we created blended tables for beneficiary mortality. More weight is given to the Pub.H-2010 contingent survivor table at older ages, whereas, more weight is given to the system specific retiree mortality rates at younger ages. This approach is used to approximate a method of applying different rates of mortality before and after a member's death (that is currently unavailable due to software restraints).

TWO: DEVELOPMENT OF DEMOGRAPHIC ASSUMPTIONS

MORTALITY RATES *continued*

Age Offsets

Generally, we observed the Washington State retirement systems' mortality experience as similar to nationwide public plans mortality experience. For some of the public safety plans, we observed the mortality experience was similar to those in the new base table (projected to 2011) who are a year younger ([1] age offset). Some plans had relatively little experience in terms of total deaths over the period. As a result, we relied on their general relationship to the larger plans where appropriate when setting these assumptions for males and females.

The following table summarizes the new age offset assumptions. For active members, we assume the gender of the beneficiaries is of the opposite sex as the member. Please note that a comparison to the prior age offset assumptions is less relevant because we changed the underlying base mortality tables.

Offset Assumptions						
Analysis of Mortality Table Offsets	PERS All Plans		TRS All Plans		SERS Plan 2/3	
	Male	Female	Male	Female	Male	Female
Old Assumption	(1)	(1)	(3)	(2)	(1)	(1)
New Assumption	0	0	0	0	0	0
Analysis of Mortality Table Offsets	PSERS Plan 2		LEOFF All Plans		WSPRS Plan 1/2	
	Male	Female	Male	Female	Male	Female
Old Assumption	(1)	(1)	(1)	1	(1)	1
New Assumption	0	0	(1)	0	(1)	0

When selecting our assumptions, we gave careful consideration to the credibility of our data. The results of our analysis for larger systems, such as PERS and TRS, are more reliable than the smaller systems with less experience. As such, we believe we have insufficient data to set experience-based mortality tables for all systems.

For PERS, the largest system, we selected our age offsets based on our analysis which indicated no age offset for both males and females would provide the best fit. Likewise, our analysis for TRS, the second largest system, indicated the use of no age offset for males and females provides the best fit as well. Although the age offset selection is the same for PERS and TRS, the general employee base mortality rates are higher than the teachers' base mortality rates. In other words, we still expect members of TRS to live longer than members of PERS. For example, a 65-year-old female retiree in TRS is expected to live 1.5 years longer than a 65-year-old female retiree of PERS.

For SERS, we believe the current assumption (i.e., applying the same age offsets as PERS) remains reasonable and our limited experience supports this conclusion. However, we will continue to monitor this assumption and may make a change in the future when we have sufficient data for SERS.

For LEOFF, we selected a (1) age offset for males and no age offset for females. Our experience indicated that male members of LEOFF live longer than suggested by the PubS.H-2010 tables. Contrary to males, the observed mortality rates for LEOFF females over our study period is slightly higher than expected under the PubS.H-2010 table. However, this difference decreases when excluding survivor experience. With this in mind, and given the limited amount of LEOFF female member data, we decided to apply no age offsets for LEOFF females.

We believe we have insufficient data to set experience-based mortality tables for WSPRS. However, we expect members in this system to have similar rates of mortality to law enforcement members of LEOFF given the occupational similarities. This notion is supported by the limited amount of data we do have for WSPRS and law enforcement officers in LEOFF. Therefore, we selected a (1) age offset for males of WPSRS and no age offsets to females.

MORTALITY RATES *continued*

Similar to WSPRS, PSERS lacked sufficient experience to set experience-based mortality rates. However, we see less similarity in the job duties between PSERS and LEOFF members than between WSPRS and law enforcement officers in LEOFF. We have little reason to believe PSERS mortality rates will differ from those predicted by the general public safety PubS.H-2010 base table and selected no age offsets. Similar to SERS, we will continue to monitor this assumption and may make a change in the future when we have sufficient data.

Examples

The following examples will help illustrate how we combine the mortality improvement scale with the base mortality rates adjusted for age offsets. Let's calculate the mortality rate as of the year 2011 for a male LEOFF employee aged 25 and a male LEOFF retiree aged 70, reflecting the selected age offsets for that system. Note that this concept can be extrapolated for each year in the future.

A (1) age offset means an age 25 male LEOFF employee is assumed to have mortality experience consistent with a 24-year-old male public safety employee; similarly, the age 70 male LEOFF retiree with that of a 69-year-old male public safety retiree. As of the year 2010, the age 24 (= 25 - 1) male employee and age 69 (= 70 - 1) male retiree mortality rates are 0.0430 percent and 1.5440 percent, respectively. This means that we expect there is a 0.0430 percent chance that a LEOFF male employee age 25 would die by the end of the year, while the LEOFF male retiree age 70 is assumed to have 1.5440 percent chance of dying before the end of the year.

The MP-2017 long-term mortality improvements for both of these example members is 1 percent per year. In other words, the mortality rate at these same ages is expected to decrease by 1 percent each year in the future. The following shows one year of this calculation. Projected to 2011, an age 25 male LEOFF employee and an age 70 male LEOFF retiree will have corresponding mortality rates of: 0.0426% [= 0.0430% x (1 - 1%)] and 1.5286% [= 1.5440% x (1 - 1%)].

Disabled Mortality

Similar to the healthy mortality base tables, in order to reflect more recent experience in mortality, we updated our disabled mortality assumption to the Pub.H-2010 disabled tables. We selected two sets of assumptions dependent on whether the system is public safety or not. Giving consideration to the amount of data available on disabled mortality, we opted to use no age offsets in these assumptions.

Fit of Pub.H-2010 Disabled Tables (2006-2017)			
System/Table	**LEOFF 1**	**LEOFF 2, WSPRS**	**PERS, SERS, TRS**
General PUB.H Disabled	0.56	0.48	1.17
Safety PUB.H Disabled	0.94	1.11	1.88
Number of Deaths (2006 - 2017)	**1,059**	**42**	**2,204**

For PERS, TRS, and SERS, we selected the PubG.H-2010 disabled table with no age offsets as the new disabled mortality assumption. For our public safety plans, LEOFF, PSERS, and WSPRS, we selected the PubS.H-2010 disabled table with no age offsets.

Since we chose to use MP-2017 long-term rates with the healthy mortality tables, and in light of our limited actual disabled mortality experience, we decided to apply the same mortality improvement rates for all disabled mortality. Persons with disabilities are subject to the same factors that drive mortality improvement in a healthy population such as new medical technology and innovation, new treatments of diseases, changes in nutrition, etc. Put another way, we expect they will experience higher rates of mortality than the non-disabled population, but we still expect their rates of mortality to improve in the future consistent with our long-term improvement assumption.

Please see the **Mortality Rates Appendix** for additional information on how we set this assumption.

TWO: DEVELOPMENT OF DEMOGRAPHIC ASSUMPTIONS

RETIREMENT RATES

What is the Retirement Rates Assumption and How Do We Use it?

The Retirement Rates assumption represents the probability that a retirement-eligible individual will stop working and start collecting their pension benefit immediately. The goal of this assumption is to project when members will leave employment and move into retirement. We then use the assumed retirement behavior, along with other assumptions, to estimate how long members will collect their retirement benefits for purposes of plan funding.

This assumption generally varies by amount of service and age. However, where appropriate, we also varied the assumption by plan selection.

High-Level Takeaways

In general, retirement data available since the Great Recession (2008-2017) showed consistently lower rates of retirement than prior to the recession (1995-2007). When members work longer, we see fewer actual retirements annually and lower rates of retirement. In the prior experience study, we had removed 2008-2012 data for PERS, TRS, and SERS systems because of impacts from the recession. We removed the recession data because we did not think there was sufficient experience after the recession in which to observe an economic recovery. We included 2008-2017 data in this study due to the continued trend of later retirements. As a result, we lowered the old retirement rate assumption toward the level of retirements observed in the study period.

The following list demonstrates some of the economic and demographic changes that possibly changed retirement behavior over the last decade:

- **Life Expectancy** – Washington State employees are living longer than in the past. Members could be deferring retirement to save money and build a larger retirement benefit instead of retiring earlier with a reduced benefit.
- **Plan 3 Retirement Accounts** – The Great Recession heavily affected Plan 3 Defined Contribution (DC) retirement account balances. The size of their Plan 3 DC account may impact their decision to retire. If a Plan 3 member's DC account is large enough, they may choose to retire earlier. Plan 3 members could still be recovering from the market downturn.
- **Cost of Health Insurance** – Some members may continue working prior to Medicare eligibility in order to retain employer provided health insurance that is typically cheaper than other options.

Two significant changes were made to PERS, TRS, and SERS retirement rates assumptions: gender-neutral rates and plan-specific rates. Overall, we observed male and female members to have similar retirement behavior. We expect the similar retirement behavior to continue in future years. We believe Plan 2 and Plan 3 members of PERS, TRS, and SERS systems will have different retirement behavior and we confirmed this with the data from this experience study. The additional data available in this study provided us enough evidence to move from combined Plan 2/3 rates to plan-specific rates.

RETIREMENT RATES *continued*

Data and Assumptions

We looked at 23 years of experience study records, from 1995-2017. No special data was added for this assumption, but some data was removed as noted below.

Consistent with prior studies, we removed valuation years 2001 and 2007 because of a shortened valuation year. Including data for 2001 and 2007 would lead to valuation periods of unequal length. We also removed 2000 data for SERS Plans 2/3 because the plan was created in 2000. SERS experienced a low number of retirements in 2000 compared to subsequent years. We do not believe the 2000 retirement experience is representative of expected longer-term experience.

For PERS, TRS, and LEOFF Plans 1, we considered a 1995-2017 study period for setting rates in these closed plans. However, we believe recent rates of retirement are more indicative of future rates of retirement for the relatively small group of remaining actives in these closed plans. Therefore, we relied on data after the end of the last experience study, 2013-2017, to set new assumptions.

Because PSERS is a relatively new system, we do not have sufficient data to set a credible retirement rates assumption for PSERS from plan experience. Instead, we relied on the PERS Plan 2 retirement rates assumption to inform the PSERS Plan 2 assumption and then made subsequent adjustments based on differences in plan provisions between PERS and PSERS. PSERS was created for PERS members meeting certain job specifications and has similar retirement provisions as PERS.

Additionally, SERS is another relatively new system. However, we were able to gather SERS data prior to the creation of the plan by selectively pulling data for PERS members employed at school districts that would have been eligible for SERS had it been in place at that time.

Law Changes

There were four law changes since the last study that could impact member retirement behavior:

- **SB 5046 (2013)** – Modifies mandatory retirement provision for judges of PERS.
- **E2SSB 6455 (2016)** – Opens a window for TRS 2/3 retirees selecting a lower early retirement benefit reduction to return to work as a substitute teacher.
- **E2SHB 2872 (2016)** – Provides WSPRS members a recruitment and retention bonus.
- **SB 5274 (2017)** – Allows voluntary overtime to be included in salaries for calculating retirement benefits of WSPRS members.

We did not see a significant impact to retirement behavior resulting from SB 5046 or E2SSB 6455. E2SHB 2872 and SB 5274 do not directly impact WSPRS retirement provisions, but the additional benefits provided in the bills potentially changed retirement behavior at later ages. In general, we saw some older members of WSPRS defer retirement to presumably take advantage of the new provisions.

TWO: DEVELOPMENT OF DEMOGRAPHIC ASSUMPTIONS

RETIREMENT RATES *continued*

General Methodology

For each retirement plan, we calculated the actual retirement rate by dividing the number of members that retired by the total number of members eligible to retire. We then compared the actual rate of retirement to our expected rate of retirement based on our last experience study. We considered this actual to expected measurement over the full time period and on an annual basis. This helped us identify trends in the data where the assumption was over or underestimating retirement behavior.

We then developed new retirement rates, based on historical experience as well as professional judgment on future retirement behavior.

We considered an alternate approach of studying retirement rates weighted by salary instead of headcount. We created salary-weighted rates by dividing the salary that left the system through retirement by the total salary eligible for retirement. This approach attempts to adjust the rates to better model the salary leaving the system. We studied PERS using salary-weighted rates because of the large dispersion in member salaries in the system. Overall, we did not see a large enough difference in rates to justify a method change. We decided to maintain our prior approach of using headcount weighted rates and did not pursue the salary-weighted approach with other systems.

Results

For most plans, we reduced the retirement rates assumption to reflect longer working careers and older retirement ages. The notable exception is WSPRS Plans 1/2, where younger members generally elect retirement upon reaching 25 years of service. However, we reduced rates for older WSPRS members because of delayed retirements similar to the other retirement systems.

We calculated an Actual-to-Expected (A/E) ratio to better understand how our assumptions compare to plan experience in our study period. The "actual" represents the number of retirements we observed during the study period, and the "expected" represents the number of retirements our assumption produced based on the number of eligible members. In general, an A/E ratio less than 1.00 indicates lower actual rates of retirement relative to our assumption. We see a ratio above 1.00 when members retire at higher rates than we assume. Please see the **Retirement Rates Appendix** for additional information on how we set this assumption.

Summary of A/E Ratios

	Under Old Assumptions	Under New Assumptions
PERS 1	0.81	0.99
PERS 2/3	0.80	0.93
TRS 1	0.90	0.98
TRS 2/3	0.52	0.89
SERS 2/3	0.67	0.83
PSERS 2*	N/A	N/A
LEOFF 1	1.00	1.00
LEOFF 2	0.88	0.92
WSPRS 1/2	1.14	1.03

**PSERS lacks sufficient retirement experience to compare with assumptions.*

TWO: DEVELOPMENT OF DEMOGRAPHIC ASSUMPTIONS

SERVICE-BASED SALARY INCREASE

What is Service-Based Salary Increase and How Do We Use it?

Assumptions about salary growth help us project salaries to determine the size of the members' future benefits and calculate contribution rates, which are collected as a percentage of payroll.

The salary increases a member will receive over their career depend on both economic and demographic factors. Likewise, our total salary growth assumption consists of two parts.

- **Service-Based Salary Increase** – We assume active members in each system will receive Service-Based Salary (SBS) increases in the future, as long as they remain active in their plan. This assumption includes increases in salary due to step (or merit increases), promotion, overtime, or extra contracts. This assumption captures the increases to salary applicable to the plan demographics. We would expect this portion of members' salary increases to remain relatively consistent during economic swings.
- **General Salary Growth** – The General Salary Growth (GSG) assumption is a combination of inflation and real wage growth (or productivity). It is the portion of salary increases due to economic factors. We would expect this portion of members' salary increases to fluctuate during economic swings.

For this demographic study, we focused on the SBS increases. For more information on our GSG assumption, please see the 2019 Economic Experience Study.

Please note that the salary increases due to the National Board Certification bonuses for teachers is addressed separately in the **TRS Salary Bonus Assumption** section.

High-Level Takeaways

In general, we have seen a rebound in total salary increases from the Great Recession since our prior study. Across most systems, we observed higher-than-expected SBS increases for members over most service levels. The exception is LEOFF, which experienced SBS increases at a similar rate to our prior assumptions.

Generally, we increased our assumed rates of SBS increases at most service levels. For PERS and PSERS, we slightly extended the service levels at which members receive SBS increases from 17 years of service to 20 years of service.

There have also been recent substantial changes to salary allocations for Washington teachers, school workers, and state patrol officers that impacted our new assumptions. Please see the **Law Changes** section for more information.

Data and Assumptions

We looked at 23 years of experience study records, from 1995-2017, for active members who worked full time for at least two consecutive years. No special data was added for this assumption. We included two years of data, 2001 and 2007, with shortened valuation years because, unlike other assumptions, we aggregate the data over the entire study period.

In the prior experience study, we removed 2008-2012 data for the Great Recession. We included all Great Recession years in this study due to the experienced economic recovery and the expected relatively minor impact that economic swings have on our demographic projections.

We considered a longer study period (1984-2017) for setting rates. However, we believe more recent SBS increases are more indicative of future SBS increases. This is a change from our prior study in which we used historical data from 1984-2009.

Because PSERS is a relatively new system, we do not have sufficient data to set a credible SBS increase assumption for PSERS from plan experience. Instead, we relied on the PERS SBS increase assumption to inform the PSERS assumption.

SERVICE-BASED SALARY INCREASE *continued*

We adjusted the counting method for some of the TRS and SERS members in valuation years 2008-2017. We found that the full-time members in their first year of employment appeared to receive less than a full valuation year of service. This is because TRS and SERS members begin their first year at the beginning of the school year (late August or early September), but the valuation cut-off date is June 30. We adjusted our counting method to compensate.

We also gathered Consumer Price Index (CPI) data of urban wage earners and clerical workers from the Bureau of Labor Statistics (BLS) for the Seattle-Tacoma-Bremerton area to help inform historical inflation.

We assume the SBS increase for new entrants (service equal to zero) will match the SBS increase for members with one year of service.

Law Changes

TRS/SERS

Following the State Supreme Court's decision in *McCleary v. State of Washington* (2012), the Legislature has been making systemic changes to K-12 funding; much of which includes changes to salary allocations. For example, EHB 2242 (2017) and E2SSB 6362 (2018) made many changes to education funding. One of these changes was an increase to salary allocations, subject to a phase-in period and regionalization factors.

We will know the full extent of the salary increases when fully allocated and reflected in our data. Until that time arrives, it is difficult for us to predict the full impacts of these changes. This is because salary allocations are the amounts the state provides to each school for each position, but the schools can determine how those funds are actually proportioned. In other words, the increase in allocations could go toward hiring more staff, paying existing staff higher salaries, or some combination thereof. Salaries may also be affected by local collective bargaining agreements.

WSPRS

The Legislature passed a number of bills since our prior study that may influence future salary increases for members of WSPRS:

- **E2SHB 2872 (2016)** – Requires that future salaries remain competitive with other law enforcement agencies in the state.
- **SB 5274 (2017)** – Allows a certain amount of voluntary overtime to be included in salaries for purposes of calculating retirement benefits in WSPRS.
- **SHB 2692 (2018)** – Makes permanent the process used for setting competitive minimum salaries under 2016 Legislation (E2SHB 2872).

General Methodology

We began our study by examining the salaries of active members who worked full time for two consecutive years from 1995-2017. By comparing aggregated salaries at the beginning and end of each year, we were able to determine total salary increases over different time periods and service levels for each retirement system.

After determining total salary increases at each level of service, we isolated historical SBS increases from our range of estimated historical GSG. This was performed by dividing the total salary increase at each service level by our estimates for inflation and real wage growth.

Furthermore, we examined recent, or anticipated, changes in salary allocations that would cause future experience to deviate from historical trends. After considering historical experience and anticipated trends, we applied professional judgement to set new rates by system.

SERVICE-BASED SALARY INCREASE *continued*

Results

We generally increased our assumed rate of SBS increases at most service levels. The exception is LEOFF and WSPRS, where we made only minor adjustments to our prior assumption.

Based on our combined economic assumptions for GSG and SBS increases, we anticipate long-term future salaries will grow at a rate higher than experienced from 1995-2017 for all systems. In particular, we anticipate TRS and SERS to receive higher salary increases in the future due in part to the State Supreme Court's decision in *McCleary v. State of Washington* (2012).

We did not rely on historical experience when setting the PSERS and WSPRS SBS increases assumptions. PSERS is a relatively young plan and does not have enough credible experience to set assumptions. Instead, we relied on assumptions developed for PERS. Recent legislation altered WSPRS salaries to remain competitive with members of other law enforcement agencies. As a result, we believe historical experience is no longer a good indicator of future experience and instead relied on assumptions developed for LEOFF.

We calculated an Actual-to-Expected (A/E) ratio to better understand how our assumptions compare to plan experience in our study period. The "actual" is the average total salary increase a member received during a single year of service and the "expected" is the total average increase in salary we expect a member to receive during a single year of service. We include both demographic and economic salary assumptions in this comparison.

The calculated A/E ratio for total salary growth is helpful for understanding how our combined assumptions for GSG and SBS increases compare to historical experience. If we anticipated future experience to match our study period exactly, we would select new assumptions that had an A/E ratio of one. When determining total salary growth, we look at both historical experience and expectations for the future. Therefore, the following table can inform if our assumptions are reasonable, but it does not necessarily determine the best estimate projections for the future. For example, the total historical A/E for PERS worsened under our new assumptions because we anticipate future salary increases will be higher than both historical experience and our prior assumptions. Please see the **Service-Based Salary Increases Appendix** for additional information on how we set this assumption.

Total Average Annual Salary Increase (1995-2017)

System	Actual	Under Old Assumptions*	Old A/E	Under New Assumptions**	New A/E
PERS	4.4%	4.8%	0.93	4.8%	0.92
TRS	5.0%	5.3%	0.93	5.5%	0.90
SERS	4.9%	5.0%	0.97	5.2%	0.94
LEOFF	5.1%	5.5%	0.93	5.4%	0.94

**Includes the current 3.5 percent GSG assumption and SBS assumptions developed as part of the* 2007-2012 Demographic Experience Study.

***Includes the current 3.5 percent GSG assumption and the new SBS assumptions.*

TWO: DEVELOPMENT OF DEMOGRAPHIC ASSUMPTIONS

TERMINATION RATES

What is the Termination Rates Assumption and How do we Use it?

The Termination Rates assumption represents the probability that a member will leave active employment status without becoming disabled or retiring. The goal of this assumption, along with the **Probability of Withdrawing Contributions Assumption**, is to estimate the number of terminated members who defer commencement of their retirement benefit. We assume that members who do not defer the commencement of their retirement benefits will immediately withdraw their accumulated contributions.

This assumption generally varies by retirement plan and service (or age).

High-Level Takeaways

In general, we observed terminations that were higher than expected since the last experience study. The LEOFF System was the only one that showed terminations less than expected since the last experience study.

In prior studies, we developed a combined termination assumption for Plans 2/3. When looking at each plan separately, the recent experience showed Plan 2 terminations were typically less than expected and Plan 3 terminations were typically higher than expected. Looking back further, we observed Plan 3 members tend to show higher termination rates than Plan 2. This is most pronounced in PERS where we have the longest history of members having the option to choose between Plan 2 and Plan 3. We believe we have credible experience to prepare different termination assumptions for Plan 2 and Plan 3 for early career employees.

We also observed not all active members who are retirement eligible and leave work will collect their retirement benefit immediately. Based on this data, we modified our termination assumption to now assume some members who are retirement eligible will leave work and defer commencing their retirement benefit. In the prior report, this behavior was modeled by a probability applied to retirements.

Data and Assumptions

We looked at 21 years of experience study records, from 1995-2015. No special data was added for this assumption, but some data was removed as noted in the **Valuation Data Excluded** section.

Because PSERS is a relatively new system, we do not have sufficient data to set a credible termination rates assumption for PSERS Plan 2 from plan experience. Instead, we relied on the PERS Plan 2 termination rates assumption to inform the PSERS Plan 2 assumption. PSERS was created for PERS members meeting certain job specifications and has similar retirement provisions as PERS.

Additionally, SERS is another relatively new system. However, we were able to gather SERS data prior to the creation of the plan by selectively pulling data for PERS members employed at school districts that would have been eligible for SERS had it been in place at that time.

TERMINATION RATES *continued*

Valuation Data Excluded

Consistent with the prior experience study, we excluded specific valuation year data if the year included events that would result in significantly under-estimating (or over-estimating) terminations for that year. Examples include shortened valuation years, plan creation years, and experience that we believe to be an outlier. We summarized the valuation data removed in the following table.

Plan	Valuation Year	Why Valuation Year Removed?
TRS Plan 3	1997	Plan created
TRS Plan 2 and Plan 3	1998	Plan 3 transfer incentive
SERS Plan 2 and Plan 3	2000	Plan 2 and Plan 3 created
All Plans	2001	Shortened valuation years
PERS Plan 3	2002	Plan created
PSERS Plan 2	2007	Plan created
PERS (All Plans)	2007	Transfer incentive to move to PSERS
All Plans	2007	Shortened valuation years
WSPRS (All Plans)	2014 and 2015	Outliers in data

Data Adjustments

A member is considered terminated if they leave active employment status without becoming disabled or retiring in a given valuation year. Some examples of termination include quitting the job, being fired, or transferring to another retirement system.

We look ahead and perform an adjustment to certain member records under some scenarios. One such scenario is that a member who returns to work within two years will be considered active during their period of absence. The purpose of this adjustment is to remove termination experience that is inconsistent with the purpose of our termination rates assumption. For this reason, we have not included valuation data from 2016 or 2017 in our analysis, since a member who left employment in the last two years could still reasonably return to work in the near future.

Law Changes

There were two law changes and one budget bill since the last study that could impact member termination behavior:

- **E2SHB 2872 (2016)** – Addresses WSPRS members recruitment and retention.
- **SB 5274 (2017)** – Allows voluntary overtime to be included in salaries for calculating retirement benefits of WSPRS members.
- **ESSB 6032 (2018)** – Increases state funding for basic education.

In valuation years 2014 and 2015, we observed a trend of increasing WSPRS terminations. After that period, the Legislature passed two WSPRS bills during the 2016 and 2017 Legislative Session intended to improve recruitment and retention in WSPRS. Collective bargaining during this time lead to WSPRS members receiving significant salary increases and we expect them to be more in line with market salaries for these positions. The recent legislation and salary increases could improve retention in WSPRS.

Recent increases in state funding for basic education has led to higher than expected short-term salary increases for members of TRS and SERS. The salary increases could improve retention in TRS and SERS.

TERMINATION RATES *continued*

General Methodology

For each retirement plan, we counted the number of active members at the beginning of the year, which we call exposures, and the number of terminations during the year, simply referred to as terminations. We divided the number of terminations by the number of exposures to arrive at the actual rate of termination. The actual rate of termination was calculated for both members not eligible for retirement and members eligible for retirement.

We then compared the actual number of terminations to the number of terminations we expect based on our old assumed rates. To determine how many terminations we expect to occur, we applied our old assumption to the population over the study period. We analyzed this actual-to-expected measurement both on an annual basis, and over the entire study period. This helped us identify trends in the data where the assumption was over or underestimating termination behavior.

We then developed a new termination rates assumption, based on historical actual-to-expected measurements and applied professional judgment on future termination behavior.

Results

For members not eligible for retirement, we mostly increased termination rates to reflect higher historical terminations. The most pronounced increases were for early career Plan 3 members.

We calculated an Actual-to-Expected (A/E) ratio to better understand how our assumptions compare to plan experience in our study period. The "actual" represents the number of terminations we observed during the study period, and the "expected" represents the number of terminations our assumption produced based on the number of eligible members. In general, an A/E ratio less than 1.00 indicates lower actual rates of termination relative to our assumption. We see a ratio above 1.00 when members terminate at higher rates than we assume.

The following table summarizes the A/E ratios, by plan, under our old and new assumptions. The table only includes members not eligible for retirement.

Not Eligible for Retirement
Summary of A/E Ratios

	Under Old Assumptions	Under New Assumptions
PERS 2/3	1.01	1.00
TRS 2/3	1.04	1.02
SERS 2/3	1.03	1.02
PSERS 2	0.93	0.97
LEOFF 2	0.96	0.98
WSPRS 1/2	1.04	1.02

We excluded Plans 1 from the table above because of the relatively few remaining active members in those plans. We still include a termination assumption for Plan 1 members not eligible for retirement, however we don't believe the Plans 1 A/E metric is a useful target for this study.

TERMINATION RATES *continued*

We created a new termination assumption for retirement eligible members. The following table summarizes the A/E ratios, by plan, under our old and new assumptions. The table only includes members eligible for retirement.

Eligible for Retirement* Summary of A/E Ratios		
	Under Old Assumptions*	Under New Assumptions
PERS 2	N/A	1.10
PERS 3	N/A	1.21
TRS 2	N/A	1.20
TRS 3	N/A	1.05
SERS 2	N/A	1.56
SERS 3	N/A	1.11
PSERS 2	N/A	1.82

**We did not previously assume retirement eligible members would terminate and defer commencement of their retirement benefit.*

While the A/E ratios are relatively high for this new assumption, retirement eligible terminations do not occur frequently so the historical data can be somewhat volatile. We expect these ratios to move closer to 100 percent as more data is collected in future studies. We continue to assume no terminations for members eligible for retirement in Plans 1, LEOFF 2, and WSPRS 1/2. Please see the **Termination Rates Appendix** for additional information on how we set this assumption.