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Montana Public Employees Retirement Association

Experience Study Results Five-year Period Ending June 30, 2021

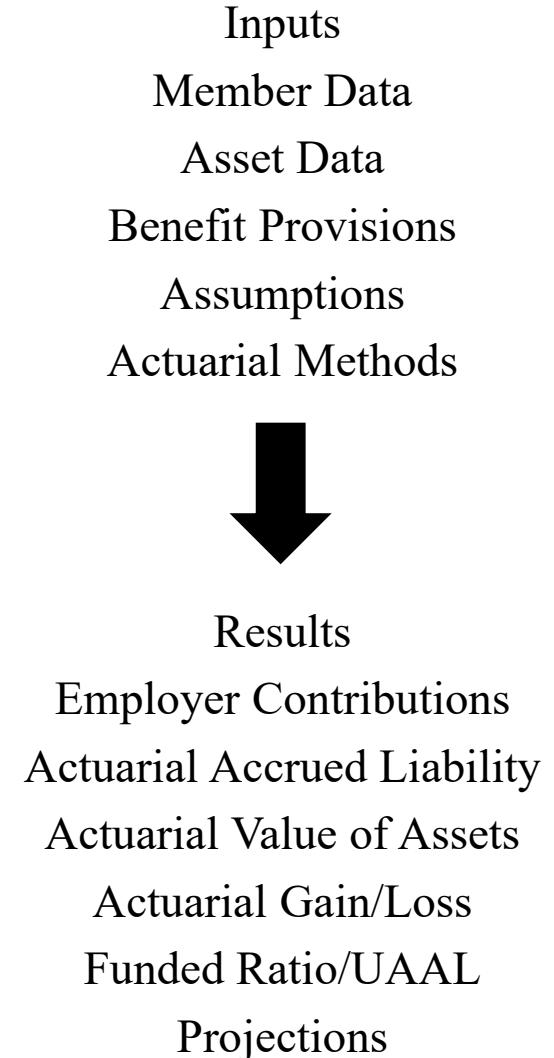
Presented May 12, 2022

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Actuarial Valuations

- The Actuarial Valuation process uses various inputs to develop various results
- Over the short term, contributions determined by the actuarial valuation are based upon estimated investment returns, benefits and expenses, which utilize assumptions and the Actuarial Methods (Funding Policy) recommended by the actuary and adopted by the Board
- Over the long term, contributions are adjusted to reflect actual investment returns, benefits and expenses



- Best estimate of ultimate costs
- Requires use of assumptions to estimate benefit payouts
 - When?
 - How much?
 - How long?
- Assumptions should represent the best estimate of future experience
- Each assumption should be individually reasonable

Actuarial Assumptions

- No “correct” assumptions
 - Blend of art and science
 - Range of acceptable assumptions
- More aggressive assumptions are more likely to generate actuarial losses in future years; more conservative assumptions are likely to generate actuarial gains
- Assumptions are long term estimates
 - Experience emerges short term
 - Year-to-year fluctuations expected
- Most powerful assumption is the investment return assumption
- Ultimate responsibility for selection of assumptions lies with the Board of Trustees

Selection of Assumptions

Economic

- Investment Return
- Payroll Growth Rate
- Inflation
- Wage Inflation

Demographic

- Retirement Rates
- Merit Pay Increases
- Disability
- Turnover
- Mortality

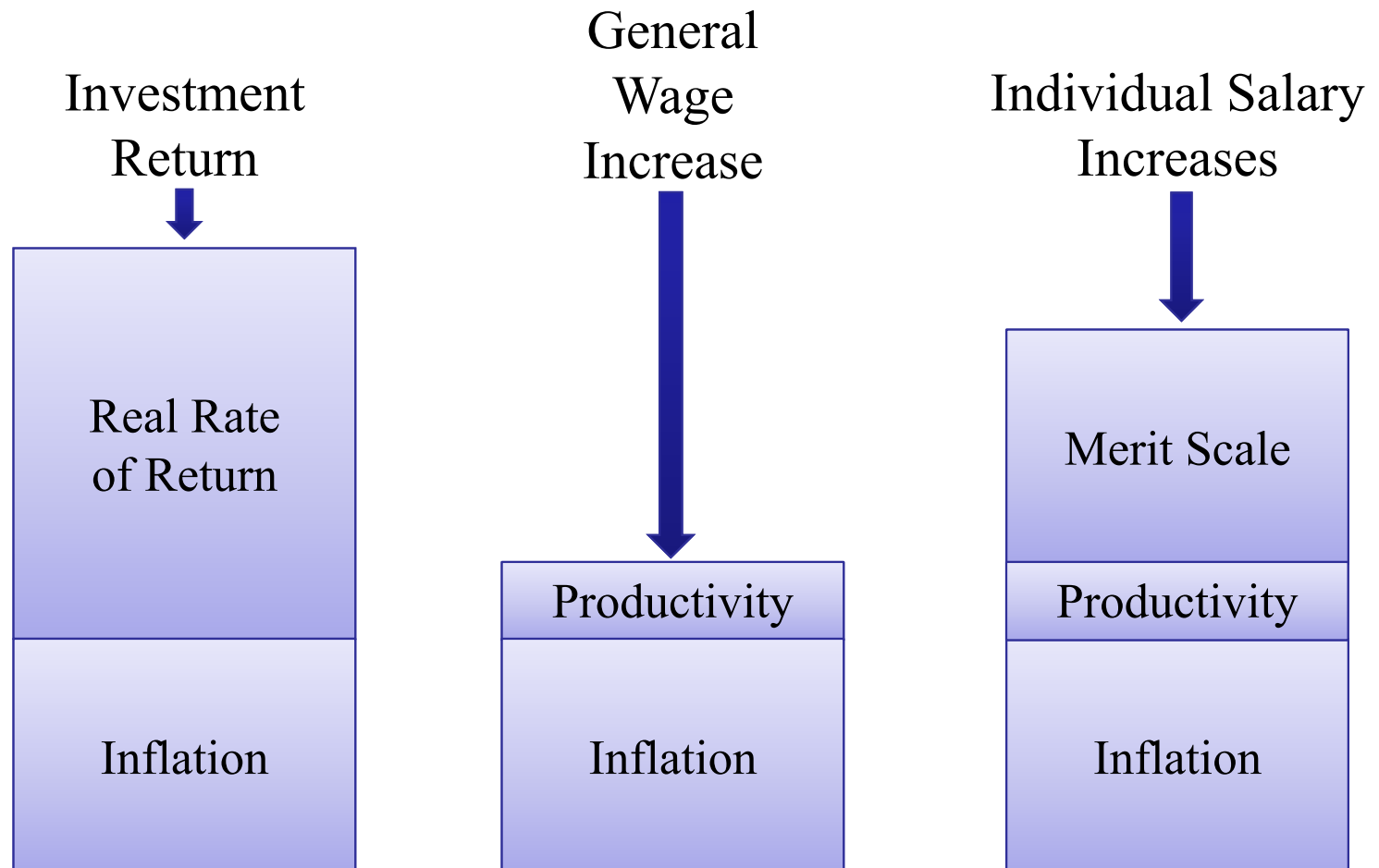
Our Philosophy

- Do Not Overreact
 - Typically, we do not make significant changes in actuarial assumptions unless a major event causes changes in expectations.
- Anticipate Trends
 - If an identified trend is expected to continue, like improved retiree mortality experience, then our assumptions should reflect these anticipated trends.
- Simplify
 - We identify which factors are significant and eliminate the ones that will not have a material impact on results.

Economic Assumptions

- Assumptions reviewed
 - Price inflation
 - Investment return
 - Wage inflation
- Actuarial Standard of Practice (ASOP) No. 27, “*Selection of Economic Assumptions for Measuring Pension Obligations*” provides guidance to actuaries in selecting economic assumptions for measuring obligations under defined benefit plans.

Building Block Method is Used to Develop Economic Assumptions

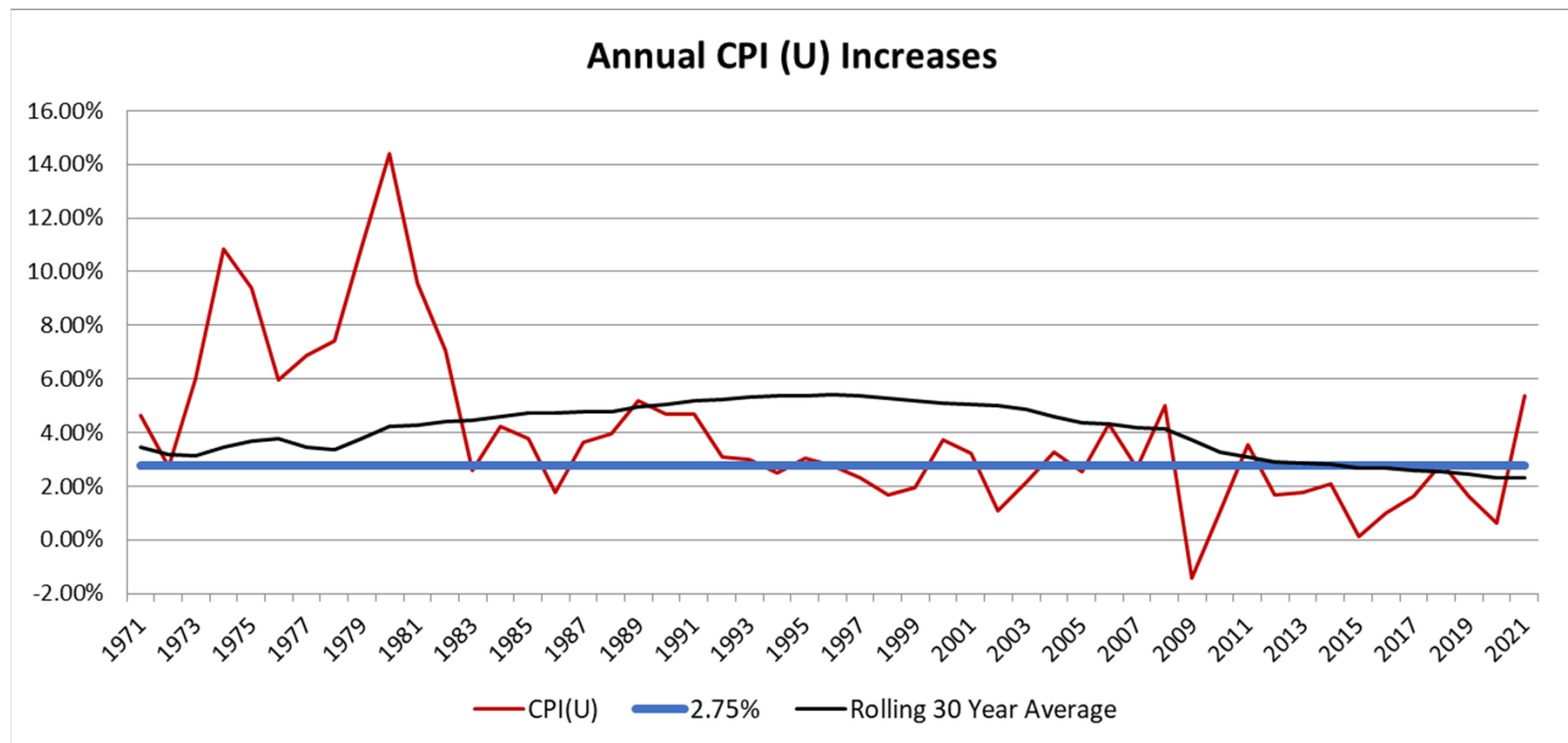


Note: inflation assumption and productivity must be consistent in all assumptions.

Economic Assumptions

Price Inflation

- Current assumption: 2.75%
- Historical data: Annual CPI (U) Increases



Economic Assumptions

Price Inflation

➤ Recommendation:

- Median inflation published in the “First Quarter 2022 Survey of Professional Forecasters” published by the Philadelphia Federal Reserve Bank is 2.50%
- Current breakeven rates of inflation (as of 3/31/2022)
 - 10-year = 2.84%; 20-year = 2.79%; 30-year = 2.47%
- Based on this data and current inflationary trends we recommend retaining the current inflation assumption

Price Inflation Assumption	
Current	2.75%
Recommended	2.75%

Economic Assumptions

Investment Return

➤ Recent Experience

Year Ending 6/30	Market Value Rate of Return							
	PERS	JRS	SRS	GWPORS	HPORS	MPORS	FURS	VFCA
2012	2.27%	2.20%	2.32%	2.31%	2.24%	2.40%	2.42%	1.67%
2013	12.99%	12.72%	12.88%	12.69%	12.88%	12.42%	12.43%	12.01%
2014	17.12%	17.03%	17.08%	16.97%	17.10%	16.53%	16.53%	16.23%
2015	4.60%	4.59%	4.60%	4.58%	4.60%	4.52%	4.52%	4.49%
2016	2.02%	2.06%	2.06%	2.11%	2.04%	2.13%	2.15%	1.84%
2017	11.93%	11.91%	11.95%	11.92%	11.87%	11.56%	11.56%	11.51%
2018	8.90%	8.88%	8.83%	8.81%	8.86%	8.65%	8.63%	8.68%
2019	5.65%	5.64%	5.70%	5.72%	5.63%	5.42%	5.44%	5.41%
2020	2.73%	2.72%	2.71%	2.70%	2.66%	2.65%	2.64%	2.66%
2021	27.80%	27.69%	27.82%	27.66%	27.80%	27.07%	27.04%	26.93%
Average	9.34%	9.28%	9.33%	9.29%	9.30%	9.09%	9.09%	8.89%

Economic Assumptions

Investment Return

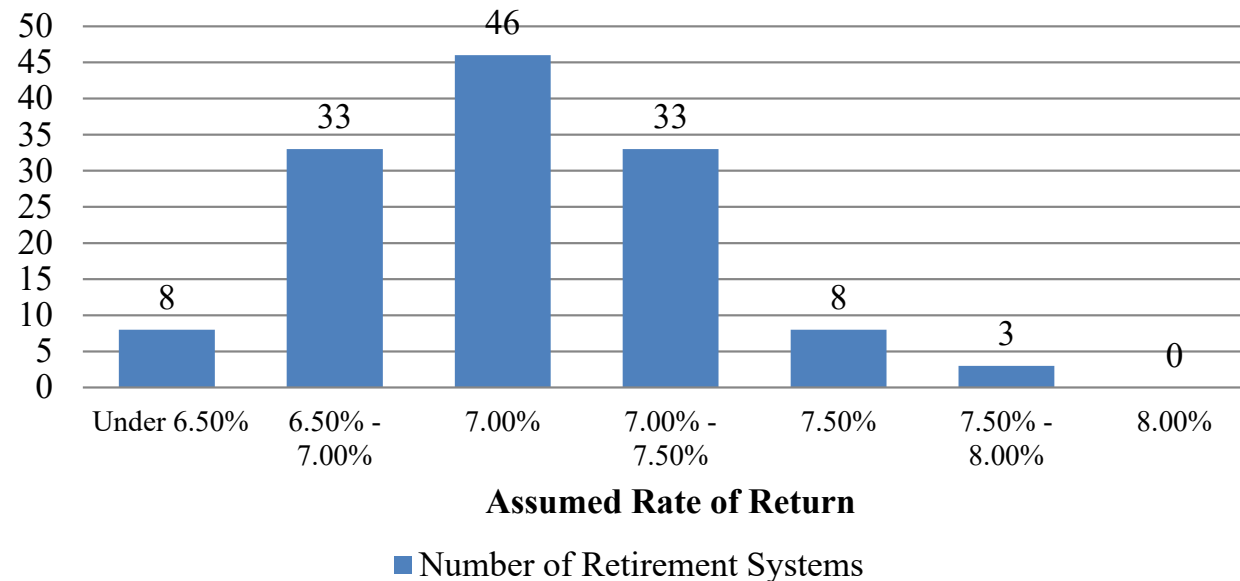
➤ Recent Experience

Actuarial Value Rate of Return								
Year Ending 6/30	PERS	JRS	SRS	GWPORS	HPORS	MPORS	FURS	VFCA
2012	3.28%	3.63%	3.82%	4.43%	3.32%	3.71%	3.87%	2.97%
2013	11.91%	11.60%	11.57%	11.13%	11.86%	11.08%	11.05%	11.11%
2014	13.21%	12.92%	12.96%	12.62%	13.13%	12.46%	12.44%	12.34%
2015	9.63%	9.53%	9.60%	9.47%	9.61%	9.32%	9.32%	8.95%
2016	9.27%	8.64%	8.66%	8.42%	8.76%	8.37%	8.33%	8.30%
2017	8.08%	8.22%	8.23%	8.15%	8.25%	8.01%	8.00%	7.89%
2018	6.69%	6.89%	6.92%	7.01%	6.84%	6.81%	6.84%	6.59%
2019	7.06%	7.22%	7.24%	7.28%	7.18%	7.05%	7.07%	6.93%
2020	7.11%	7.08%	7.04%	6.99%	7.06%	6.81%	6.79%	6.87%
2021	10.76%	10.77%	10.81%	10.80%	10.72%	10.50%	10.52%	10.44%
Average	8.67%	8.62%	8.66%	8.61%	8.64%	8.39%	8.40%	8.21%

Economic Assumptions

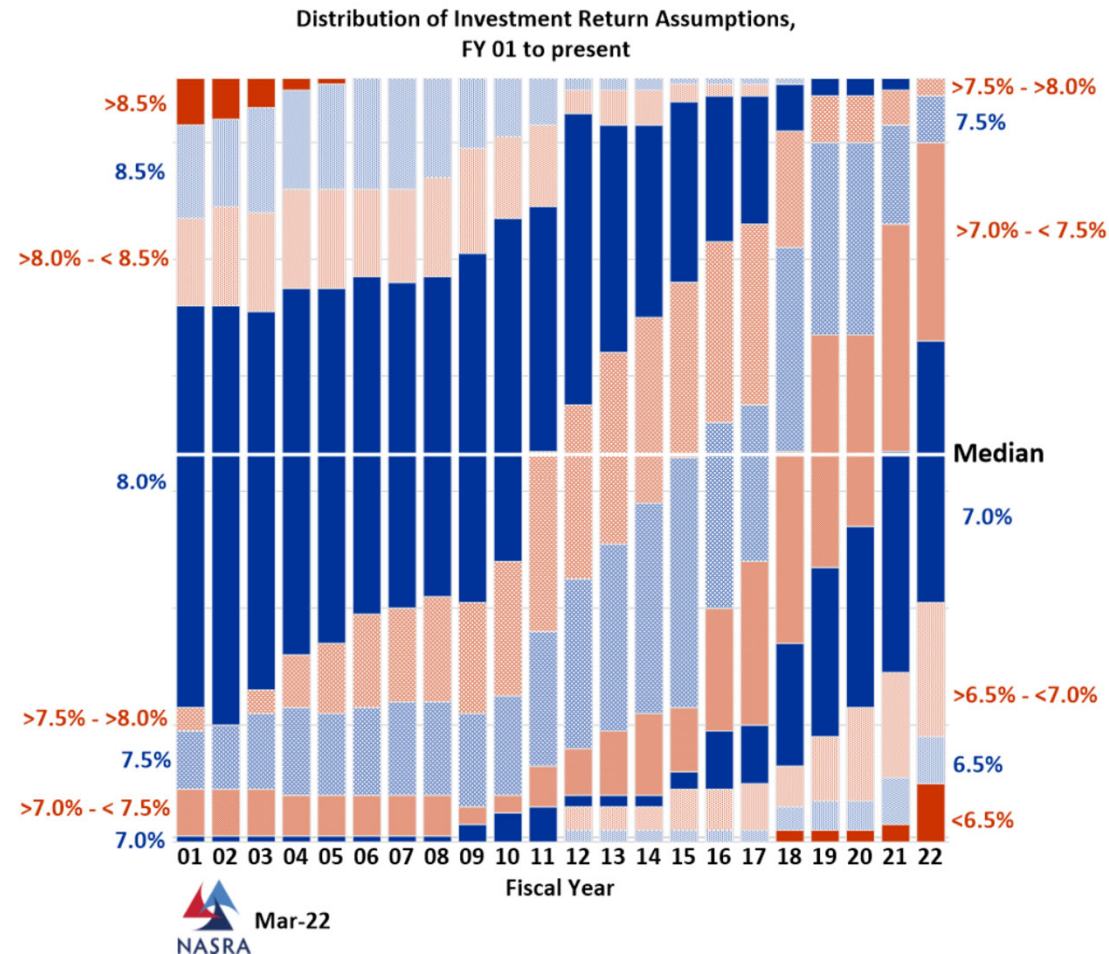
Investment Return

**NASRA Issue Brief: Public Pension Plan Investment
Return Assumption**



The median assumed rate of return among Public Retirement Systems is 7.00% according to the February 2021 NASRA Issue Brief: “Public Pension Plan Investment Return Assumptions”

Economic Assumptions Investment Return



The median assumed rate of return among Public Retirement Systems has been trending down for the past decade.

Economic Assumptions

Investment Return

- Stochastic projection expected range of real rates of return, net of expenses:

Time Span In Years	Mean Return	Standard Deviation	Real Returns by Percentile				
			5 th	25 th	50 th	75 th	95 th
1	5.40%	12.58%	-13.94%	-3.41%	4.66%	13.40%	27.27%
5	4.81	5.58	-4.11	0.97	4.66	8.48	14.23
10	4.73	3.94	-1.62	2.04	4.66	7.35	11.34
20	4.69	2.79	0.18	2.80	4.66	6.55	9.34
30	4.68	2.27	0.99	3.14	4.66	6.20	8.46
50	4.67	1.76	1.80	3.48	4.66	5.85	7.59

- Based on current capital market assumptions and policy target asset allocation

Economic Assumptions

Administrative Expenses

- Current: Explicit assumption – Investment return is net of investment expenses ONLY

FY Ending June 30	Administrative Expenses	Market Value of Assets	Expense Ratio
2017	\$6,638,528	\$7,032,659,279	0.09
2018	6,463,555	7,475,224,879	0.09
2019	5,160,673	7,685,372,436	0.07
2020	5,794,401	7,669,708,009	0.08
2021	6,892,166	9,516,857,085	0.07%

- Recommendation: Implicit assumption – Investment return net of investment AND administrative expenses
 - Investment assumption reduced by 0.08%

Economic Assumptions

Investment Return

- Stochastic Projection Approach
 - Projection results – 50 years:

Item	25 th Percentile	50 th Percentile	75 th Percentile
Real Rate of Return	3.48%	4.66%	5.85%
Inflation	2.75%	2.75%	2.75%
Investment Expenses	0.00%	0.00%	0.00%
Administrative Expenses	<u>(0.08)%</u>	<u>(0.08)%</u>	<u>(0.08)%</u>
Net Investment Return	6.15%	7.33%	8.52%

Economic Assumptions

Investment Return

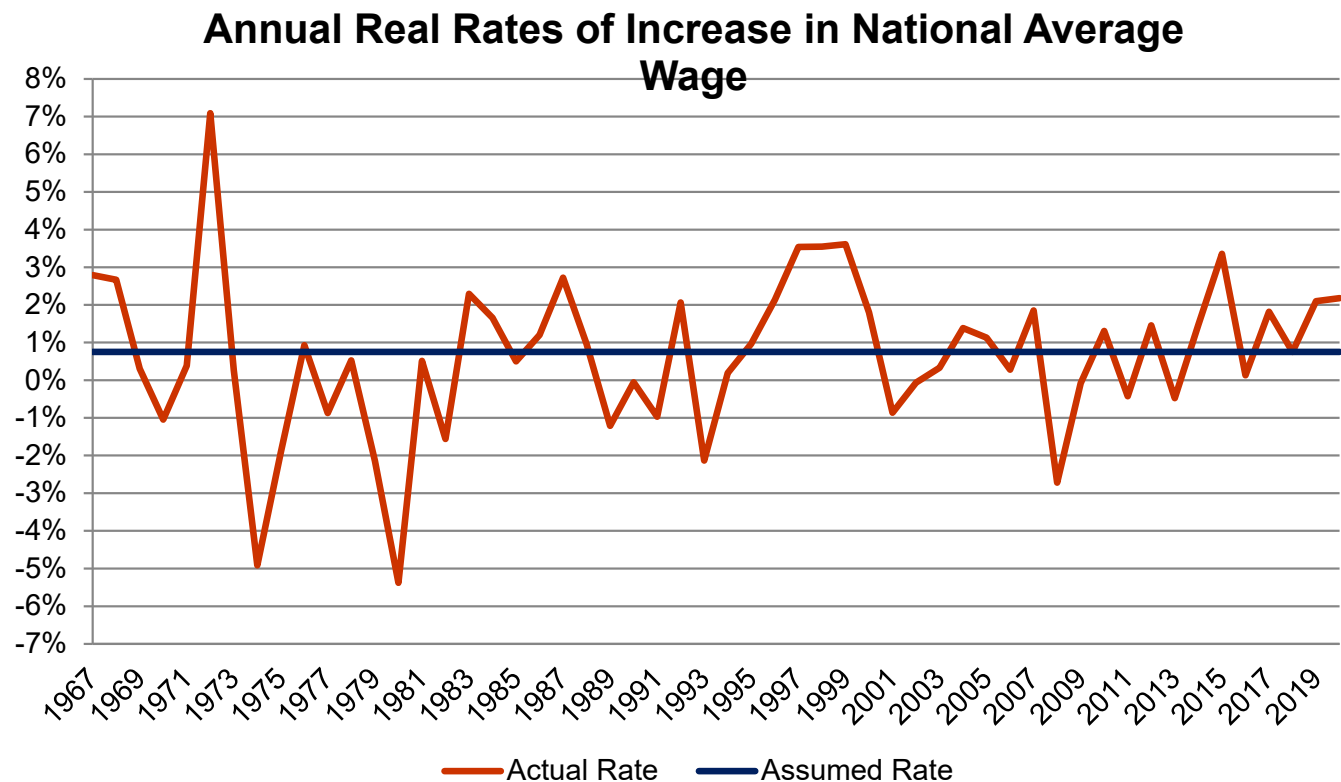
- Recommend reducing the assumed rate of return from 7.65% to 7.30%, close to the 50th percentile
- The average assumed rate of return of large public retirement systems has been declining
- Economic assumptions are volatile, recommend reviewing the assumed rate of return assumption more frequently

Investment Return Assumption	
Current	7.65%
Recommended	7.30%

Economic Assumptions

Wage Inflation

- Current assumption: 3.50%, which is 0.75% above the price inflation assumption of 2.75%
- Social Security Administration data



Economic Assumptions

Wage Inflation

➤ Historical Experience:

Period	Wage Inflation	Price Inflation	Real Wage Growth
2011-2020	2.9%	1.5%	1.4%
2001-2020	2.8%	2.0%	0.8%
1991-2020	3.3%	2.2%	1.1%
1981-2020	3.6%	2.7%	0.9%
1971-2020	4.5%	3.8%	0.7%
1961-2020	4.5%	3.7%	0.8%

- ### ➤ This shows real wage growth across all sectors
- In general, public employees tend to receive compensation more in the form of benefits than wage, so these may be on the high end

Economic Assumptions

Wage Inflation

- Recommend no change to assumption

Wage Inflation Assumption	
Current	3.50%
Recommended	
Real Wage Growth	0.75%
Price Inflation	<u>2.75%</u>
Total	3.50%

Demographic Assumptions

- Assumptions Reviewed
 - Post-Retirement Mortality
 - Pre-Retirement Mortality
 - Rates of Service Retirement
 - Rates of Disability Retirement
 - Rates of Withdrawal
 - Rates of Salary Increase for Merit and Promotions
- Actuarial Standard of Practice (ASOP) No. 35, “*Selection of Demographic and Other Noneconomic Assumptions for Measuring Pension Obligations*” provides guidance to actuaries in selecting demographic assumptions for measuring obligations under defined benefit plans.

Measuring Demographic Experience (Count vs Liability Basis)

Count Basis

- **Step 1:** Determine number of members changing membership status (decrements) during study period, tabulated by groupings that may include age, duration, gender and plan
- **Step 2:** Determine number of members expected to change status by multiplying membership statistics (called exposures) by the expected rates of decrement
- **Step 3:** Compare number of actual decrements to number of expected decrements, called the Actual to Expected Ratio (expressed as %)

Liability Basis

- Same steps as Count Basis, but results are based on the estimated liability of members instead of the count of members

Demographic Assumptions

- Compare what actually happened to individual members with what was expected to happen based on the actuarial assumptions
- Assess credibility – amount of weight assigned to the recent experience
 - Length of study period
 - Unusual events during study period
 - Size of the group
- Key evaluation tool is actual decrements/expected decrements (called *Actual/Expected* or *A/E ratio*)
 - “Decrement” is a change in the member’s status (e.g., retirement, termination, death)

Measuring Demographic Experience (Example)

- 10 members eligible to retire at age 62
- Actuarial assumption is 10% retire at age 62

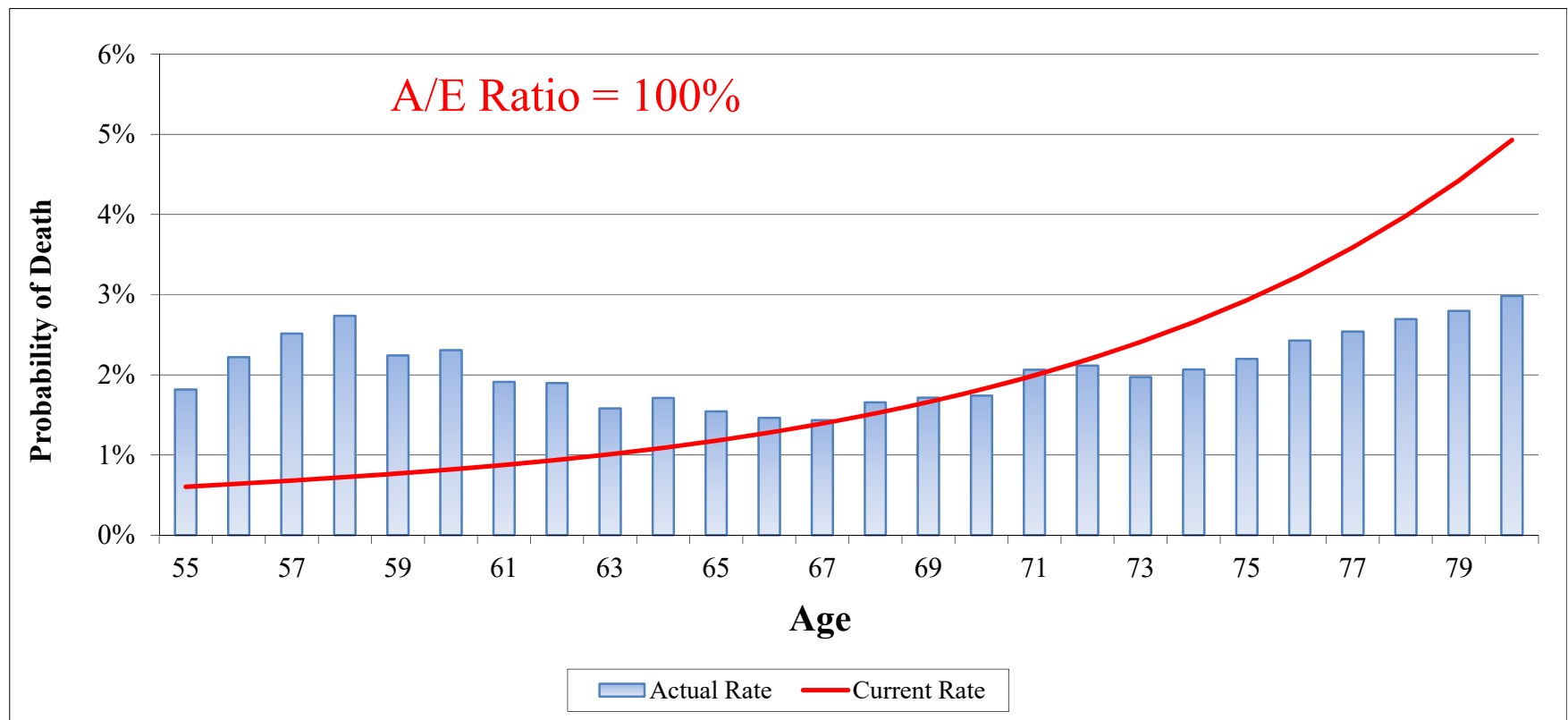
<u>Count</u>	<u>Salary</u>	<u>Service</u>	<u>Liability Weighted</u>
8	\$ 20,000	5	\$ 800,000
<u>2</u>	80,000	20	<u>3,200,000</u>
10			4,000,000

- Actual Experience: 1 member with \$80,000 and 20 years retires

	<u>Count Basis</u>	<u>Liability Weighted</u>
Exposure	10	\$4,000,000
Expected Decrement	1	400,000
Actual Decrement	1	1,600,000
Actual/Expected Ratio	100%	400%

Evaluating the Results of Demographic Experience

- Generally, the closer the Actual/Expected ratio is to 100%, the better the current assumption anticipated the overall experience. However, the pattern of the actual experience may vary significantly from the assumption indicating a need for change.



Demographic Assumptions

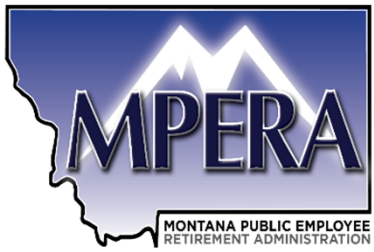
- Funds reviewed
 - PERS
 - JRS
 - SRS
 - GWPORS
 - HPORS
 - MPORS
 - FURS
 - VFCA
- Results compare actual and expected decrements and present recommended changes, if any.

Demographic Assumptions (Healthy Mortality)

- Rates of Pre- and Post-Retirement Mortality
 - Benefits are paid over a retiree's life; therefore, it is important to accurately reflect the typical life expectancy
 - The mortality assumption is used to determine the number of deaths that will occur during the year
 - Studied based on gender and age
 - Liability weighted analysis performed using the retirees and beneficiary's retirement benefit as a proxy for liability
 - The Society of Actuaries recently released a set of mortality tables based solely on public plan data. The family of tables is called the Pub-2010 tables

Demographic Assumptions (Mortality)

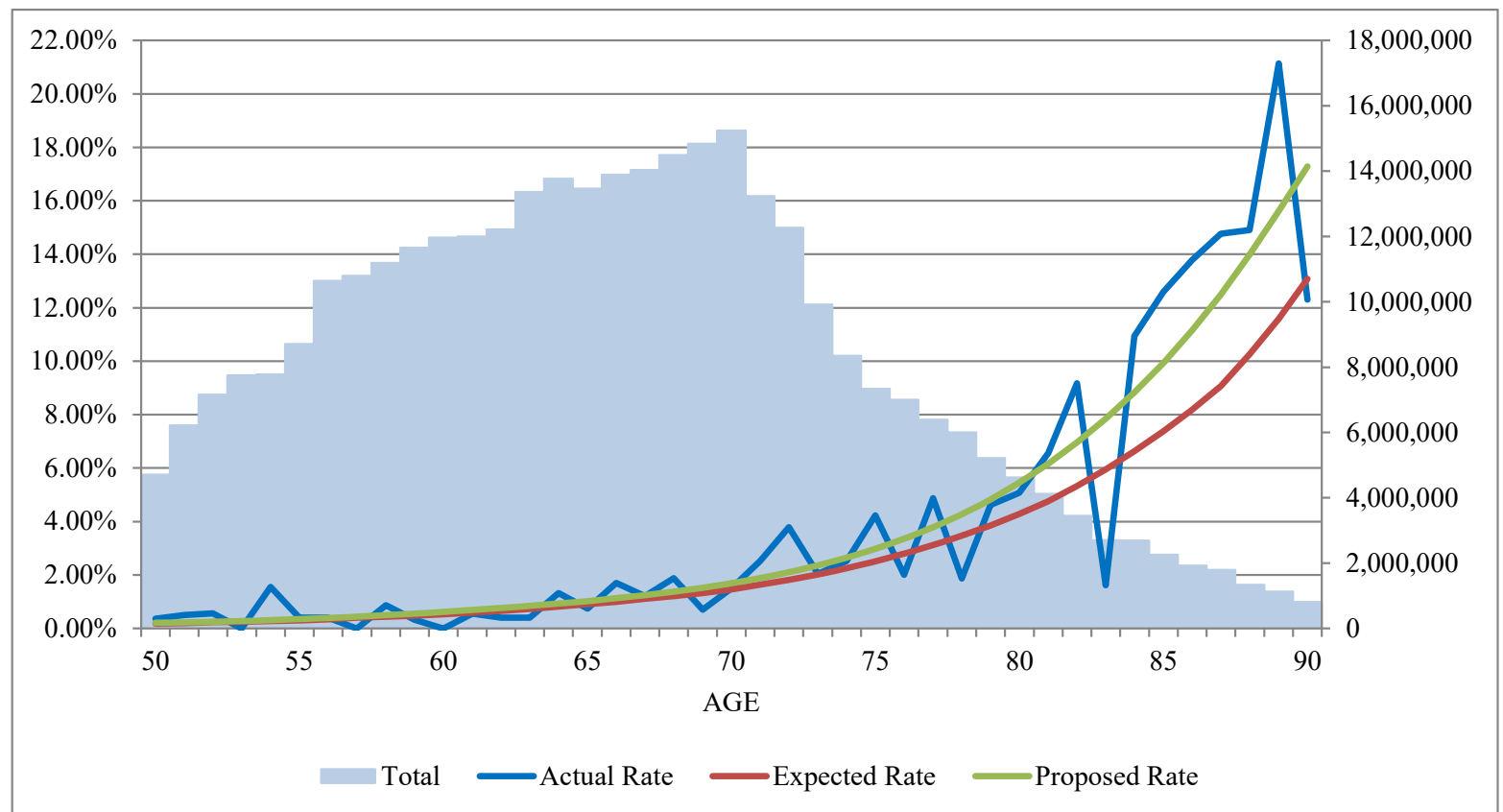
- Under Actuarial Standards of Practice, actuary must consider mortality improvements
- Mortality table assumption generally accounts for future improvements by either maintaining a margin for mortality improvement or by generationally projecting future improvements



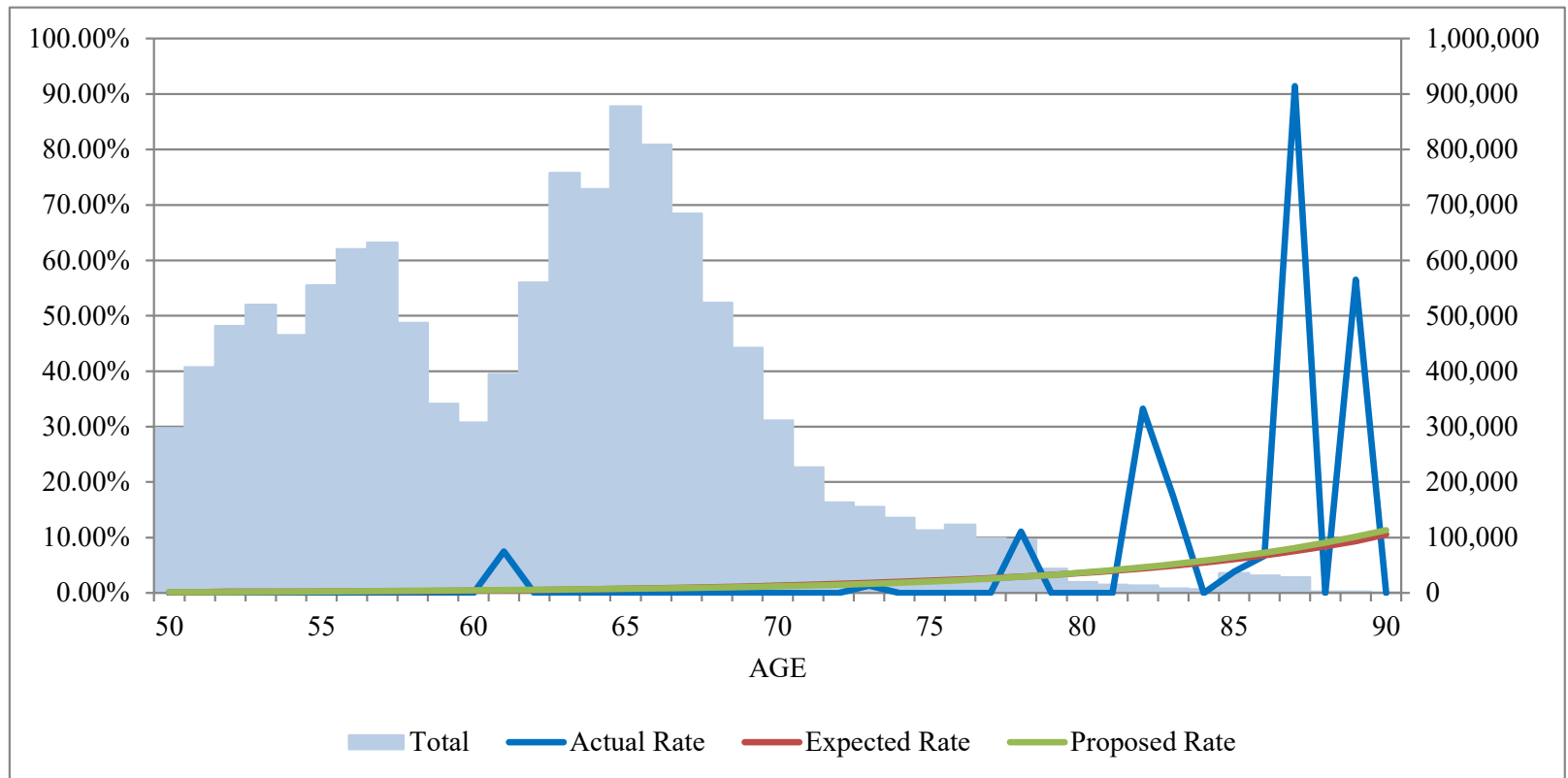
Demographic Assumptions (Public Safety Retiree Mortality)

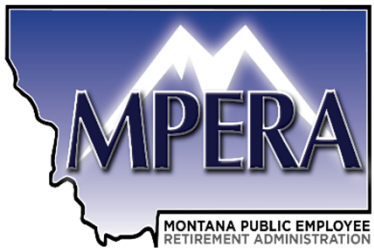
- Mortality experience was analyzed for the Public Safety Systems and General Employee Systems separately.
- Public Safety Systems include FURS, GWPORS, HPORS, MPORS, SRS, and VFCA.
- For the Public Safety Systems, experience yielded actual/expected ratios of 130% and 90% respectively for male and female retiree mortality experience.
- Mortality table should include future improvement either by including a margin or directly by projecting generationally.
- Recommend change in healthy mortality to the PubS-2010 Amount Weighted Healthy Retiree Mortality Table projected to 2021, set forward 1 year and adjusted 105% for males, with no adjustment for females. Future improvement in mortality rates is reflected by applying the MP-2021 projection scale generationally.
- Actual expected ratio under proposed assumption is 106% and 92% for males and females respectively.

Demographic Assumptions (Public Safety Male Retiree Mortality)



Demographic Assumptions (Public Safety Female Retiree Mortality)



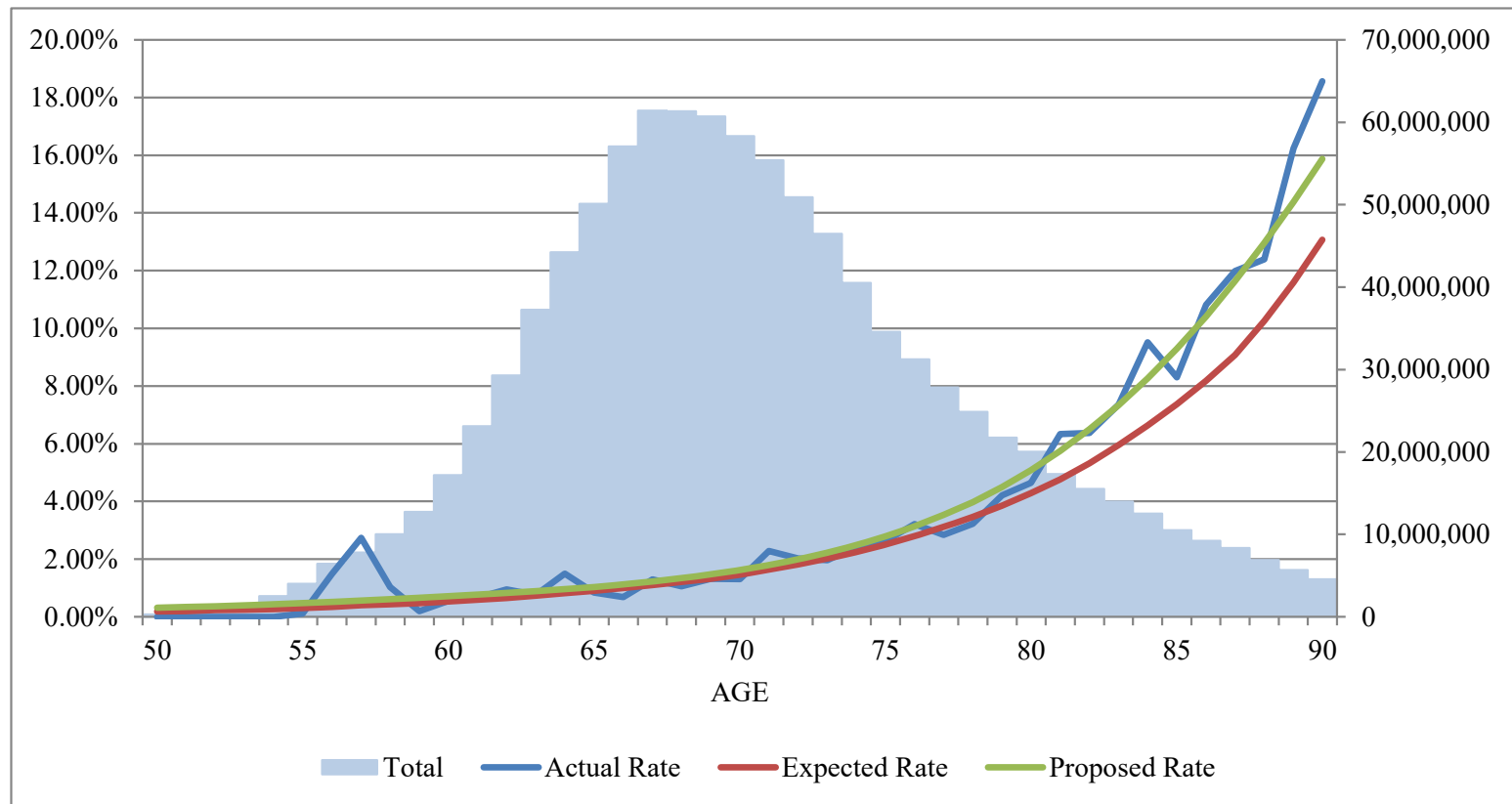


Demographic Assumptions (General Employee Retiree Mortality)

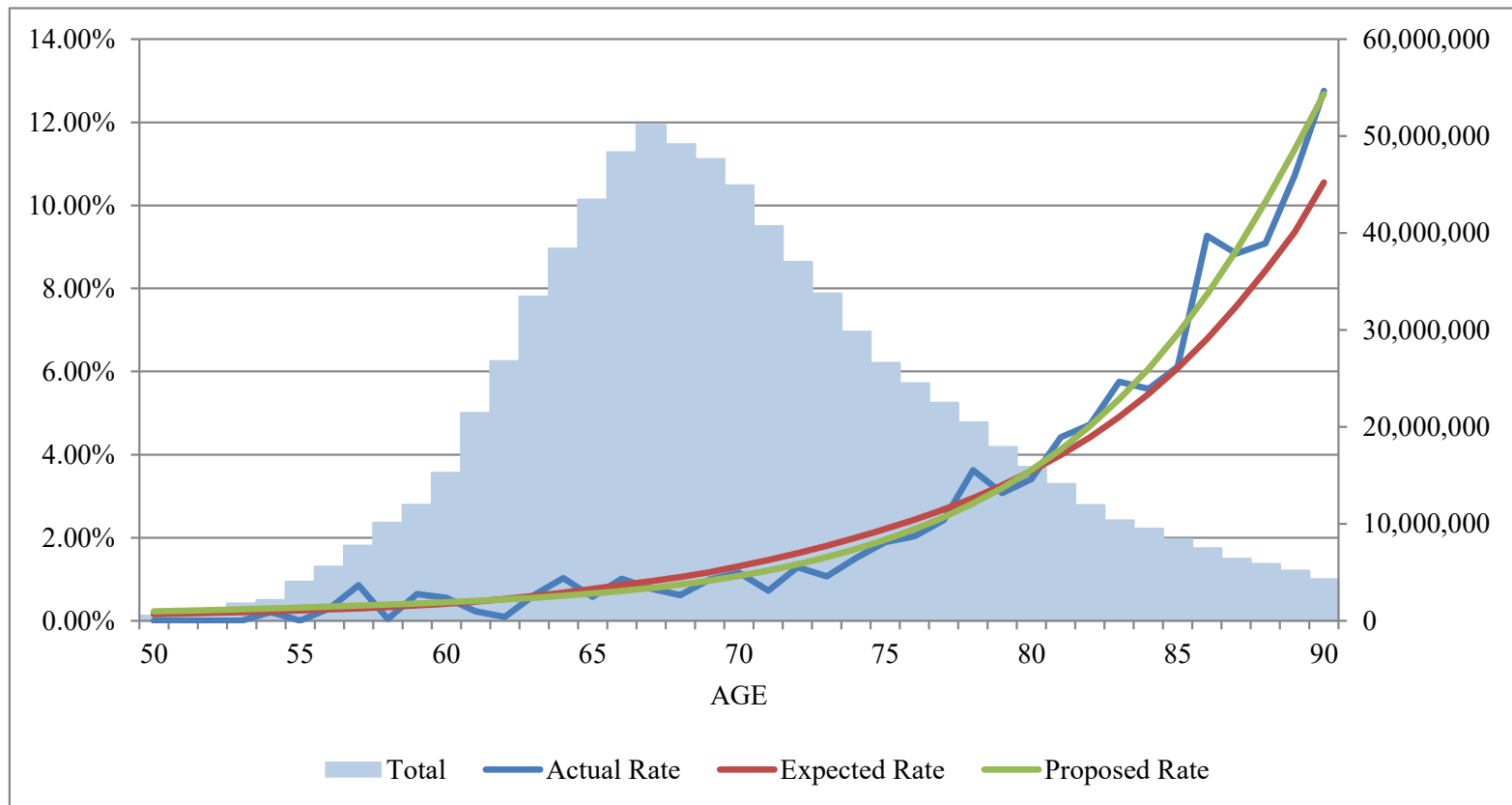


- General Employee Systems include PERS and JRS.
- For the General Employee Systems, experience yielded actual/expected ratios of 118% and 102% respectively for healthy male and female mortality experience.
- Mortality table should include future improvement either by including a margin or directly by projecting generationally.
- Recommend change in retiree mortality to the PubG-2010 Amount Weighted Healthy Retiree Mortality Table projected to 2021, with ages set forward 1 year and adjusted 104% for males and 103% for females. Future improvement in mortality rates is reflected by applying the MP-2021 projection scale generationally.
- Actual expected ratio under proposed assumption is 100% and 101% for males and females respectively.

Demographic Assumptions (Male Retiree Mortality)

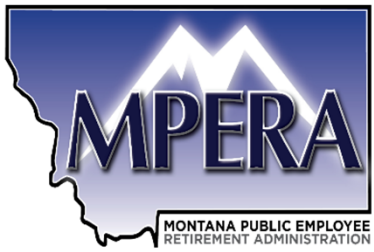


Demographic Assumptions (Female Retiree Mortality)



Recommended Mortality Assumptions

- Our recommendation is to use the same PUB2010 family of mortality tables for Actives, Disabled and Beneficiaries
- **Recommendation for Active (pre-retirement) Tables:**
 - Public Safety Systems: PubS-2010 Safety Amount Weighted Employee Mortality Table
 - General Employee Systems: PubG-2010 Amount Weighted Employee Mortality Table
- **Recommendation for Disabled Tables:**
 - Public Safety Systems: PubS-2010 Amount Weighted Disabled Retiree Mortality Table Projected to 2021, with ages set forward 1 year for males
 - General Employee Systems: PubG-2010 Amount Weighted Disabled Retiree Mortality Table projected to 2021, with ages set forward 1 year for males and females
- **Recommendation for Beneficiary Tables:**
 - Public Safety Systems: PubS-2010 Amount Weighted Contingent Survivor Mortality Table, with ages set forward 1 year for males
 - General Employee Systems: PubG-2010 Amount Weighted Contingent Survivor Mortality Table projected to 2021, with ages set forward 1 year for males and females



Recommended Mortality Assumptions

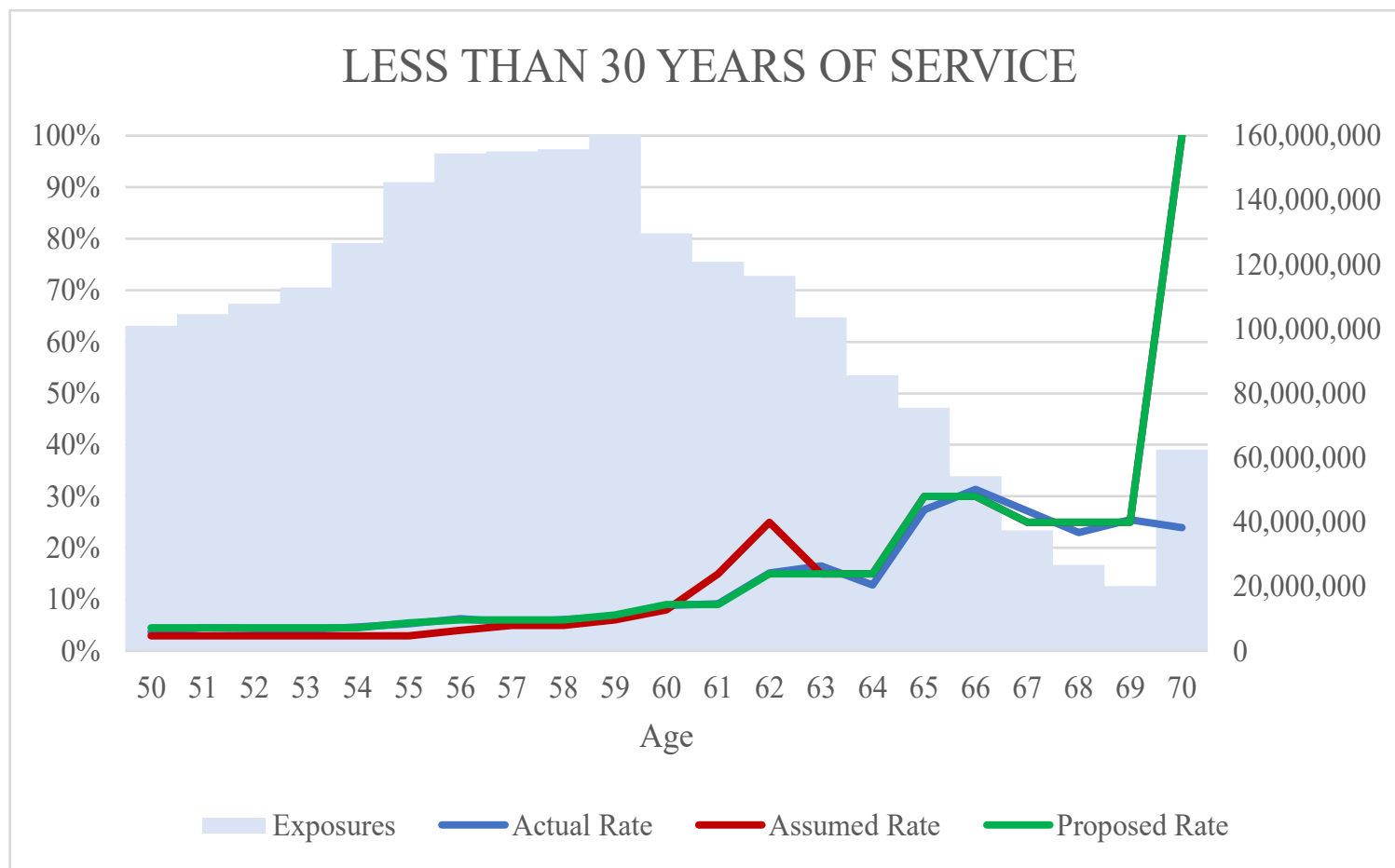


- Future improvement for pre-retirement and beneficiary tables are projected generationally using Scale MP-2021

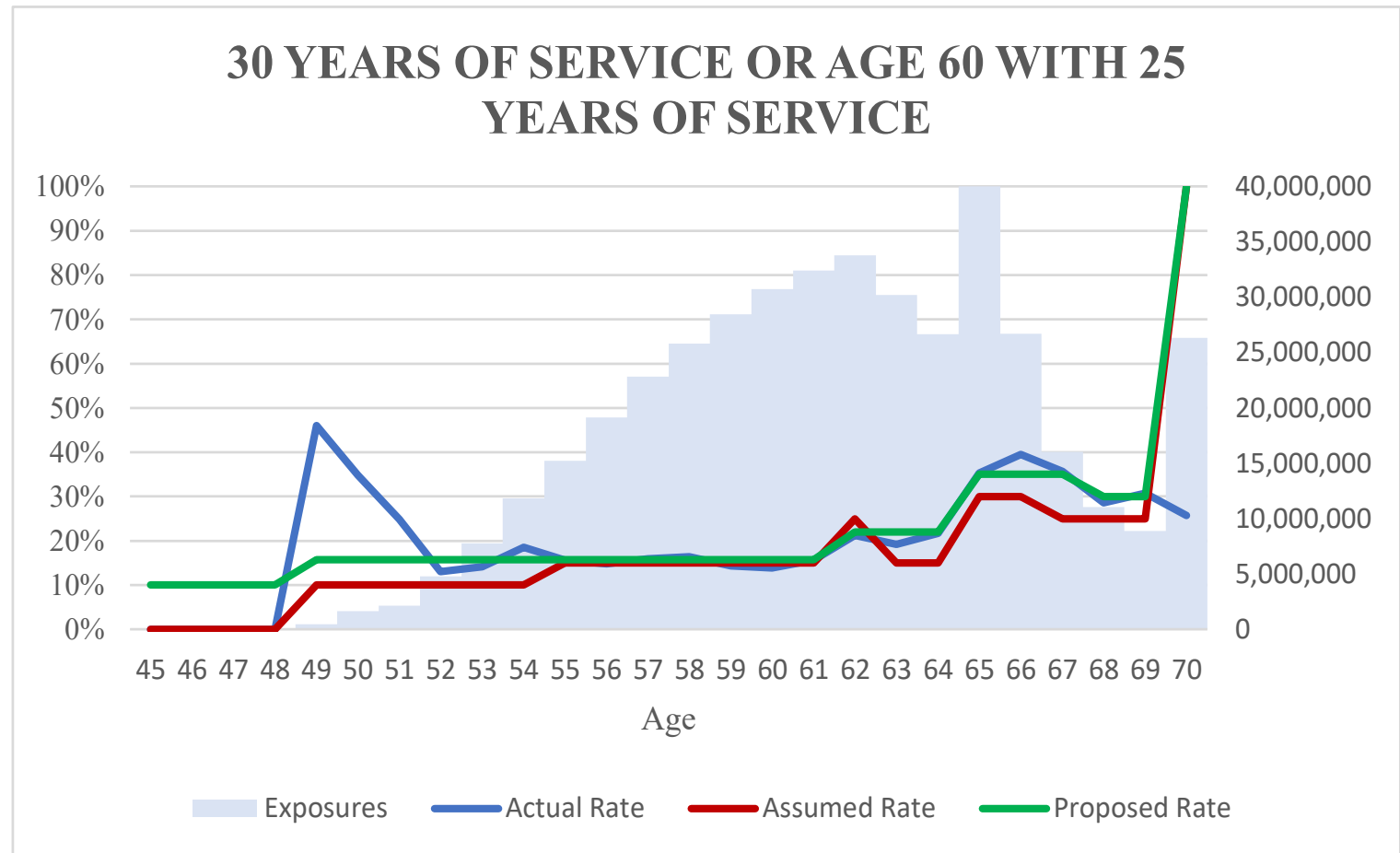
PERS Demographic Assumptions (Service Retirements)

- Reduced retirement benefit
 - Retirement experience was investigated separately for members who had less than 30 years of service and for members who had 30 or more years of service or who were at least age 60 with at least 25 years of service.
 - Experience yielded actual/expected ratios of 104%.
 - In general, retirements were more than anticipated.
 - We recommend adjusting the assumed rates to reflect recent experience.
 - Recommended assumptions produce an actual/expected ratio of 99%

PERS Demographic Assumptions (Service Retirements)

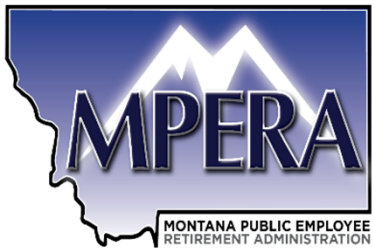


PERS Demographic Assumptions (Service Retirements)



Demographic Assumptions (Service Retirements)

	A/E Ratio (Current Assumption)	A/E Ratio (Recommended Assumption)
PERS	104.00%	98.94%
JRS	177.18%	88.72%
HPORS	169.75%	123.38%
SRS	158.98%	87.80%
GWPORS	102.60%	103.95%
MPORS	101.57%	99.02%
FURS	112.93%	82.94%
VFCA	82.93%	95.75%

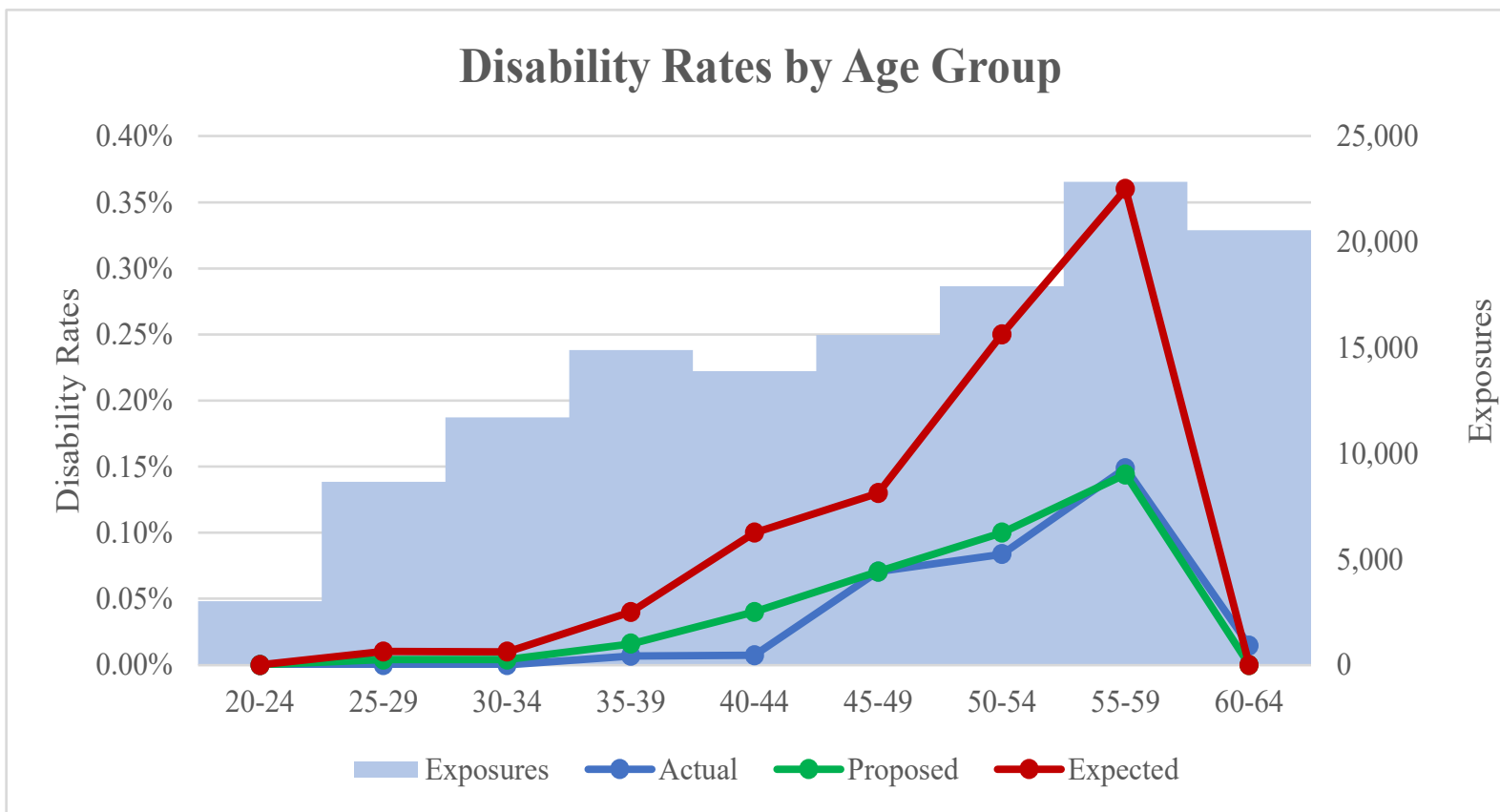


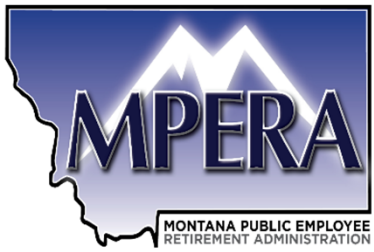
PERS Demographic Assumptions (Disability Retirements)



- Experience yielded an actual/expected ratio of 38%.
- An actual/expected ratio that is less than 100% indicates that the number of disability retirements over the experience period was less than anticipated.
- Disability retirements represent a small component of the Retirement System's obligation.
- Recommend reducing the assumed rates of disability.
 - Recommended rates produce an actual/expected ratio of 92%

PERS Demographic Assumptions (Disability Retirements)

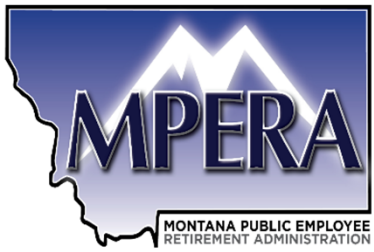




Demographic Assumptions (Disability Retirements)



	A/E Ratio (Current Assumption)	A/E Ratio (Recommended Assumption)
PERS & JRS	38.34%	92.13%
Public Safety	71.41%	84.05%

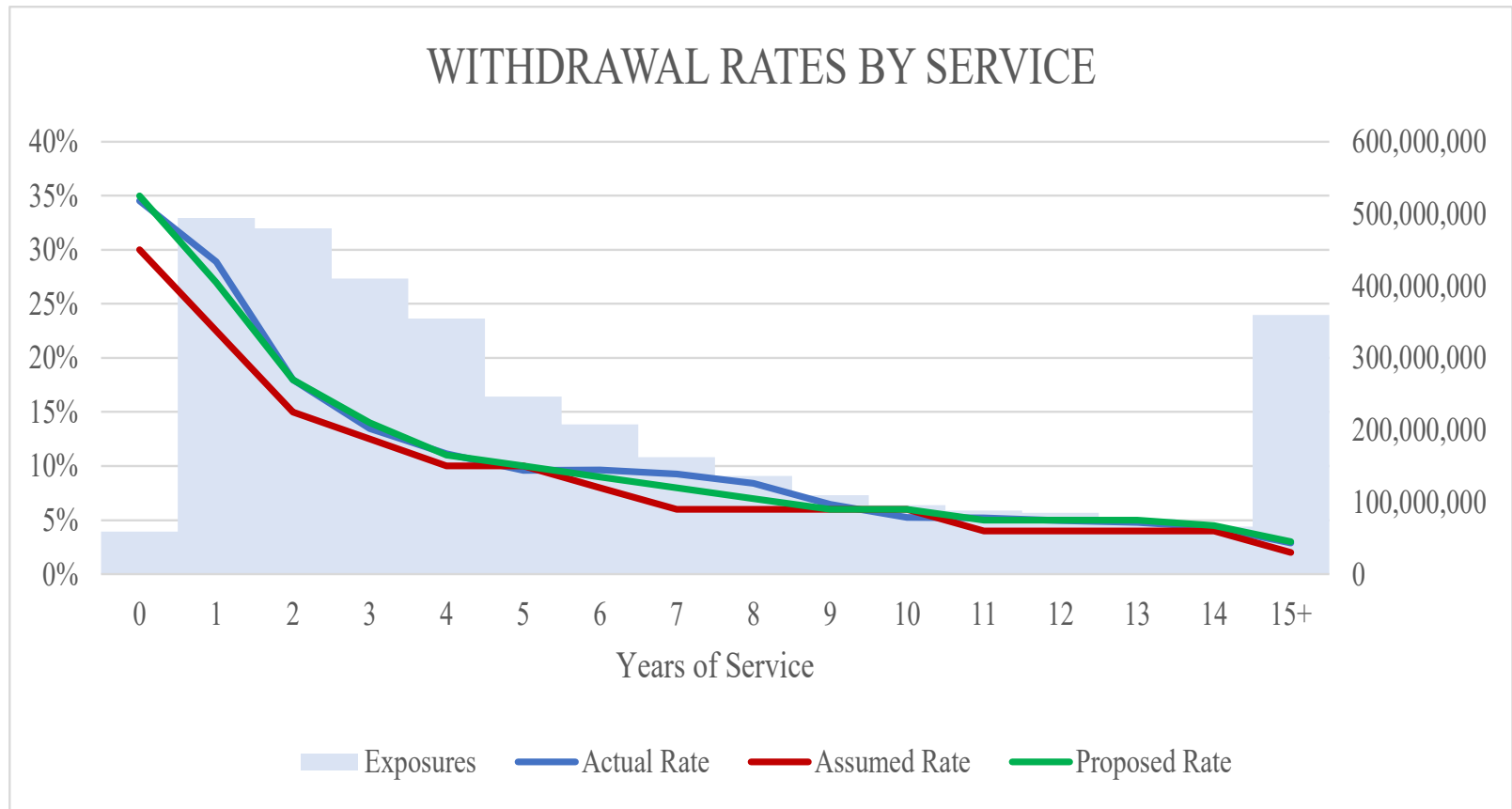


PERS Demographic Assumptions (Withdrawal Rates)



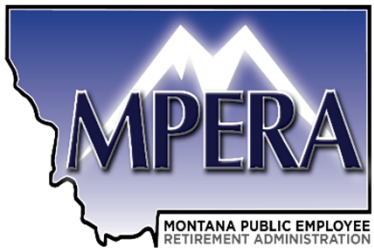
- Experience yielded actual/expected ratio of 119%.
- A ratio greater than 100% indicates that there were more withdrawals than expected.
- Overall, the assumed rates of withdrawal underestimated the number withdrawals during the experience period.
- Recommend revising assumption to better match experience
 - Recommended assumption produces an actual/expected ratio of 102%

PERS Demographic Assumptions (Withdrawal Rates)



Demographic Assumptions (Withdrawal Rates)

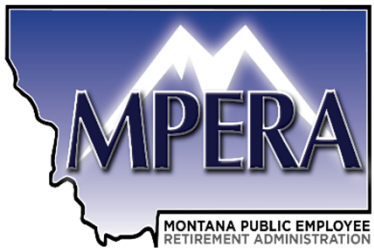
	A/E Ratio (Current Assumption)	A/E Ratio (Recommended Assumption)
PERS	119.31%	102.44%
JRS	N/A	N/A
HPORS	103.30%	103.30%
SRS	133.49%	105.72%
GWPORS	110.98%	106.05%
MPORS	117.30%	112.77%
FURS	130.00%	120.55%
VFCA	93.91%	93.91%



PERs Demographic Assumptions (Salary Increase Experience)



- Experience yields an actual/expected ratio equal to 99.9%.
- In general, salary increases were as anticipated for the investigation period.
- We have recommended no change in wage inflation, which is a component of salary scale.
- In addition, we recommend no change to the merit component of the salary scales at this time.



Public Safety Demographic Assumptions (Salary Increase Experience)



- Experience yields an actual/expected ratio equal to 100.7%.
- In general, salary increases were as anticipated for the investigation period for 0 to 6 years of service and higher than anticipated for years of service greater than 7 seven years of service.
- We have recommended no change in wage inflation, which is a component of salary scale.
- We recommend increasing the merit scale slightly for years of service for 7 + years of service.
- The actual/expected ration under the proposed assumption is 100.1%.

Demographic Assumptions Other Systems

Retirement Plan	Assumption Changes
Public Employees' Retirement System Long-Term Disability Plan	Mortality, Retirement, Disability, Withdrawal
Judges' Retirement System	Mortality, Retirement, Disability
Sheriffs' Retirement System	Mortality, Retirement, Disability, Withdrawal, Merit Scale
Game Wardens' and Peace Officers' Retirement System	Mortality, Retirement, Disability, Withdrawal, Merit Scale
Highway Patrol Officers' Retirement System	Mortality, Retirement, Disability, Merit Scale
Municipal Police Officers' Retirement System	Mortality, Retirement, Disability, Withdrawal, Merit Scale
Firefighters' United Retirement System	Mortality, Retirement, Disability, Withdrawal, Merit Scale
Volunteer Firefighters' Compensation Act	Mortality, Retirement

Other Assumptions

- Interest on Member Contributions – Member contributions grow with interest each year. We recommend reducing the assumed interest on members contributions from 2.75% to the rate adopted by the Board each year.

Actuarial Methods

- Actuarial Cost Method
 - Recommend no change in the Entry Age Normal Cost Method for all plans
- Actuarial Smoothing of Assets
 - Recommend no change in 4-year smoothing of market value gains and losses
- Amortization of Unfunded Accrued Liability (UAL)
 - Recommend no change in Level Percent of Payroll Amortization Payment Method
 - **Recommend reducing payroll growth assumption from 3.50% to 3.25%**
 - UAL is amortized as one single amount each valuation.
 - Amortization period is “open” and is solved for each valuation.
 - Result depends on UAL and fixed contribution rate.

Impact of Recommendations

Impact of Changes on the Unfunded Accrued Liability

Retirement Plan	Before Changes	After Changes	Change
Public Employees' Retirement System	\$2,019,652,381	\$2,324,638,368	\$304,985,987
Public Employees' Retirement System Long-Term Disability Plan	(2,013,863)	(6,185,621)	(4,171,758)
Judges' Retirement System	(52,404,231)	(50,326,572)	2,077,659
Sheriffs' Retirement System	87,203,044	122,806,554	35,603,510
Game Wardens' and Peace Officers' Retirement System	43,463,824	64,372,802	20,908,978
Highway Patrol Officers' Retirement System	84,025,161	100,005,124	15,979,963
Municipal Police Officers' Retirement System	178,467,014	228,679,756	50,212,742
Firefighters' United Retirement System	90,655,985	152,361,319	61,705,334
Volunteer Firefighters' Compensation Act	7,156	1,797	(5,359)

Impact of Recommendations

Impact of Changes on the Funding Ratio

Retirement Plan	Before Changes	After Changes	Change
Public Employees' Retirement System	76.34%	73.70%	(2.64)%
Public Employees' Retirement System Long-Term Disability Plan	134.85%	484.89%	350.04%
Judges' Retirement System	176.55%	171.35%	(5.20)%
Sheriffs' Retirement System	83.40%	78.10%	(5.30)%
Game Wardens' and Peace Officers' Retirement System	85.06%	79.35%	(5.71)%
Highway Patrol Officers' Retirement System	66.67%	62.69%	(3.98)%
Municipal Police Officers' Retirement System	74.31%	69.30%	(5.01)%
Firefighters' United Retirement System	85.97%	78.48%	(7.49)%
Volunteer Firefighters' Compensation Act	99.98%	100.00%	0.02%

Impact of Recommendations

Impact of Changes on the Amortization Period

Retirement Plan	Before Changes	After Changes	Change
Public Employees' Retirement System	28	37	9
Public Employees' Retirement System Long-Term Disability Plan	0	0	No Change
Judges' Retirement System	0	0	No Change
Sheriffs' Retirement System	18	41	23
Game Wardens' and Peace Officers' Retirement System	35	Infinite	N/A
Highway Patrol Officers' Retirement System	26	62	36
Municipal Police Officers' Retirement System	15	26	11
Firefighters' United Retirement System	6	14	8
Volunteer Firefighters' Compensation Act	1	1	No Change

Actuarial Certification and Disclosures

- Todd B. Green, is a member of the American Academy of Actuaries, Associate of the Society of Actuaries, and meets the Qualification Standards of the American Academy of Actuaries to render the actuarial opinions contained herein.
- Bryan Hoge, is a member of the American Academy of Actuaries, Fellow of the Society of Actuaries, and meets the Qualification Standards of the American Academy of Actuaries to render the actuarial opinions contained herein.