



**Cavanaugh Macdonald**  
CONSULTING, LLC

*The experience and dedication you deserve*



# **Experience Study 2013-2015**

## **Review of Demographic Assumptions**

**November 18, 2016**



- Review demographic assumptions
- Key findings and any recommendations
- Review recommendations for economic assumptions and actuarial methods
- Cost impact analysis – all assumption changes

- Assumptions are just that – assumptions.
  - Valuations project liabilities and provide a funding plan allocating those costs over time. They do not change the ultimate, actual cost of benefits.
  - To the extent actual experience differs over time from the actuarial assumptions, actual costs will also differ from projected costs.
  - Goal is for contribution rates to be stable, which happens to the extent assumptions match actual experience.
  - If assumptions are set too high or too low compared to actual experience, funding of the Plan's costs is shifted to earlier or later years than planned.

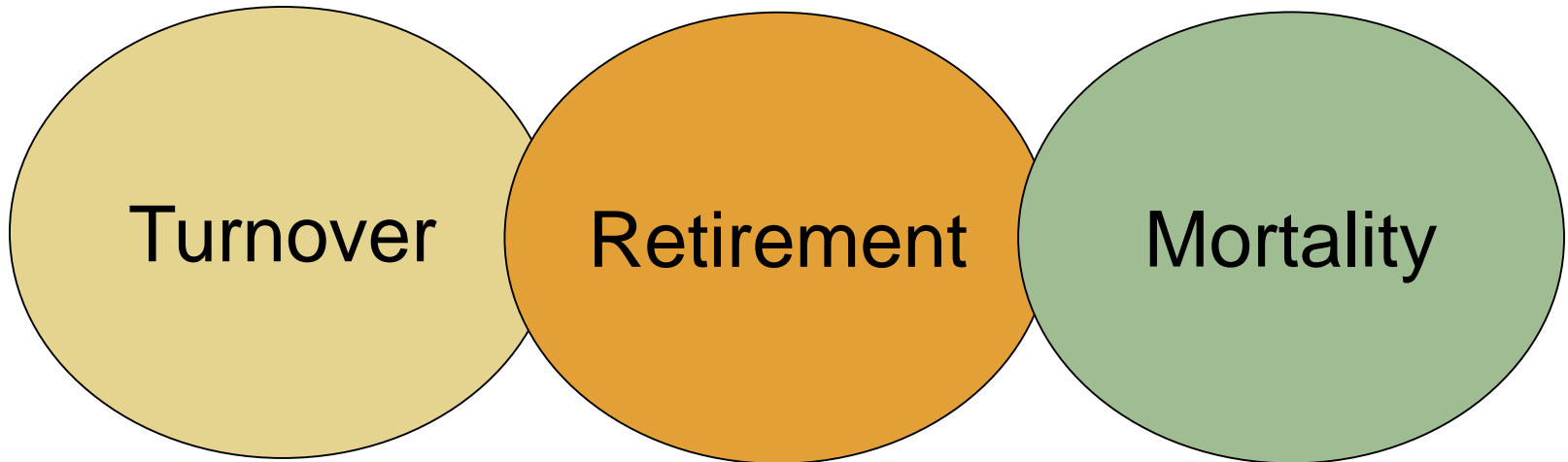
# Actuarial Assumptions

- No “correct” assumptions
  - Blend of art and science
  - Range of acceptable assumptions – choose “best estimate” based on current information
- Assumptions are long term estimates
  - Experience emerges short term
  - Year to year fluctuations expected
- Range of reasonableness
- Actuary makes recommendation, but final decision resides with Board

- Assign credibility to the observed results
  
- Guiding Philosophy
  - Don't overreact
  - Anticipate trends
  - Simplify when possible

- Studies what happened to individual members
  - Mortality
  - Retirement
  - Partial Lump Sum Option election and assumptions
  - Disability
  - Termination of employment
  - Probability of electing deferred vested benefit
  - Merit salary scale
  - Load for final average salary for pre-July 1, 1993 hires

# Demographic Actuarial Assumptions



Will a member work long enough to vest and what monthly benefit will be owed?

When will the member retire and start collecting benefits?

How long will monthly benefits be paid?

# Measuring Demographic Experience



- 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
  - Consider experience in prior study
  
- Key evaluation tool is actual decrements/expected decrements (called Actual/Expected ratio)
  - Decrement is a change in a member's status during the study period (e.g., retirement, termination)



# Measuring Demographic Experience

- Step 1: Determine number of members changing membership status (decrements) during study period, tabulated by age, duration and gender
- 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 Actual to Expected Ratio (expressed as %)

## Example:

- 100 people eligible to retire at age 62
- Actuarial assumption is 10% retire at age 62
- Expected retirements:  $100 * 10\% = 10$
- Actual retirements were 15
- Actual/Expected =  $15/10=150\%$

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

➤ General cost impact of each change alone

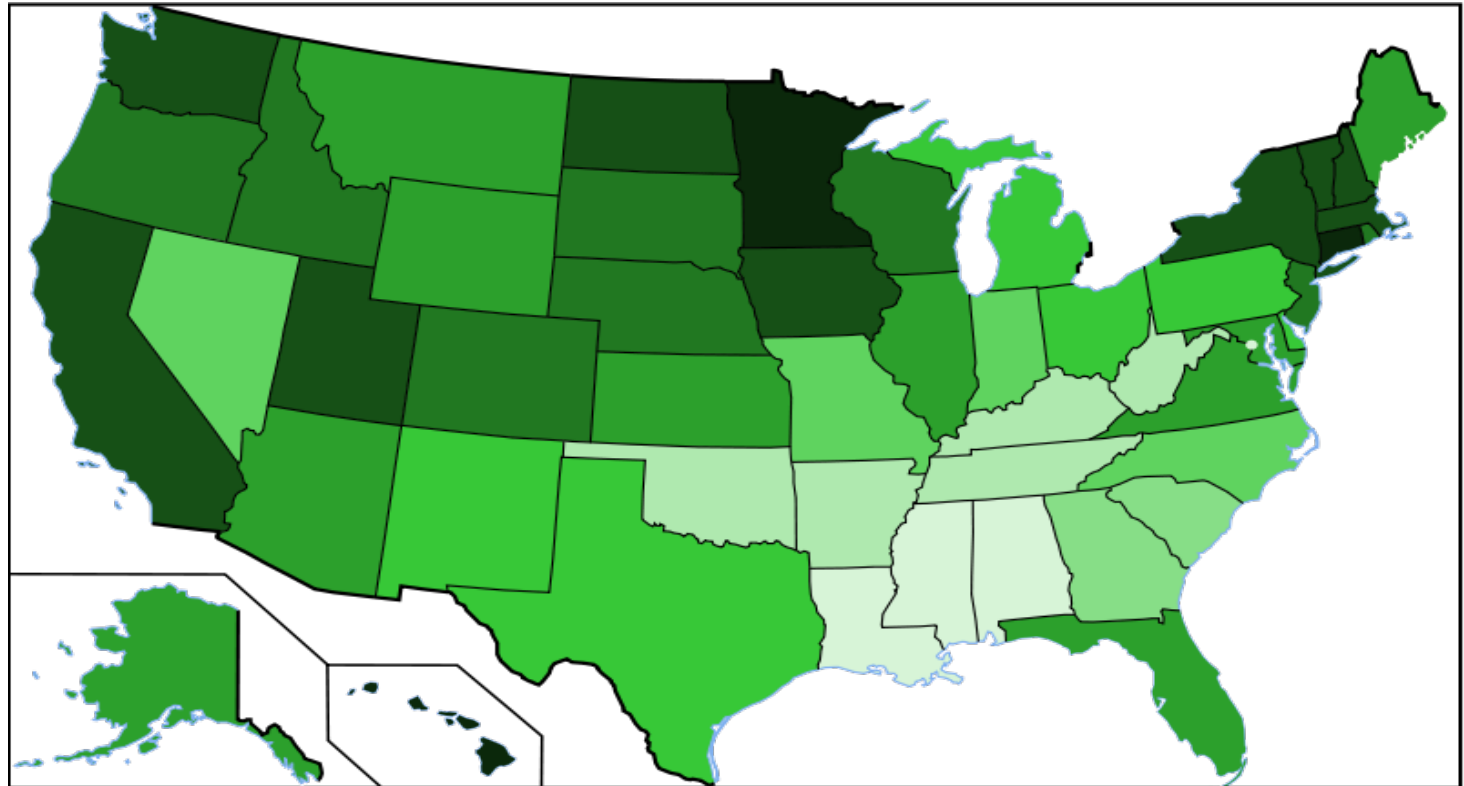
<b>Assumption</b>	<b>Change in Assumption</b>	<b>Typical Effect On Liabilities/Costs</b>
Mortality	Decrease (longer life expectancy)	Increase
Retirement	Retire Later	Decrease
Disability	Lower Disability	Increase for KPERS Decrease for KPF
Termination	Increase	Decrease

# Mortality Assumption

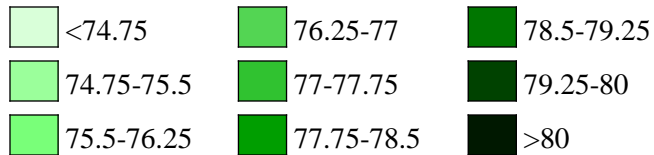
- Critical assumption from a cost perspective because it drives the duration of benefit payments
  - If people live longer (mortality rates decrease), it increases the liabilities and costs of the plan
  - Future mortality improvements must be addressed per Actuarial Standards of Practice
  
- Adjust standard mortality tables to create a better fit to the actual experience
  - Age setback or set forward
  - Collar adjustments (White or Blue)
  - Scaling factors

- Mortality varies by:
  - Region/geography
  - Race
  - Marital Status
  - Gender (male/female)
  - Education
  - Income/Wealth
  
- Study mortality by group and gender

# Variations in Life Expectancy at Birth



**Legend:**



Source: American Human Development Report

# Future Mortality Improvements

- Differences of opinion exist
- Some believe mortality improvements will continue at current rate or even accelerate
  - Assumes medical advancements will occur to help slow or even reverse the aging process.
- Others believe rate of mortality improvement cannot continue
  - Obesity and related health issues
  - Biomechanical limits on human lifespan
- We believe it is prudent to reflect some improvement in mortality in the future

# Retiree Mortality

- Mortality rates have declined in past and are generally expected to continue. Some disagreement about how long and how much they will decline.
- Current assumption uses RP-2000 Table, Generational, with adjustments to better fit actual experience
  - “Generational” approach projects mortality improvements each year in the future
  - Actual/Expected Ratios should be around 100%
- Combined current and prior study results to enhance credibility
  - Recommended assumption based on 2010-2015 data
  - Credibility limited for KPF and Judges due to membership size



	Actual/Expected Ratio (2010 -2015)	
	<u>Count Basis</u>	<u>Benefit-Weighted Basis</u>
School		
Male	112%	96%
Female	98%	<b>91%*</b>
State		
Male	93%	<b>82%*</b>
Female	103%	99%
Local		
Male	102%	94%
Female	106%	100%
KP&F	108%	101%

\* Data indicates change needed for School-Females and State-Males.

# Recommendation for Retiree Mortality

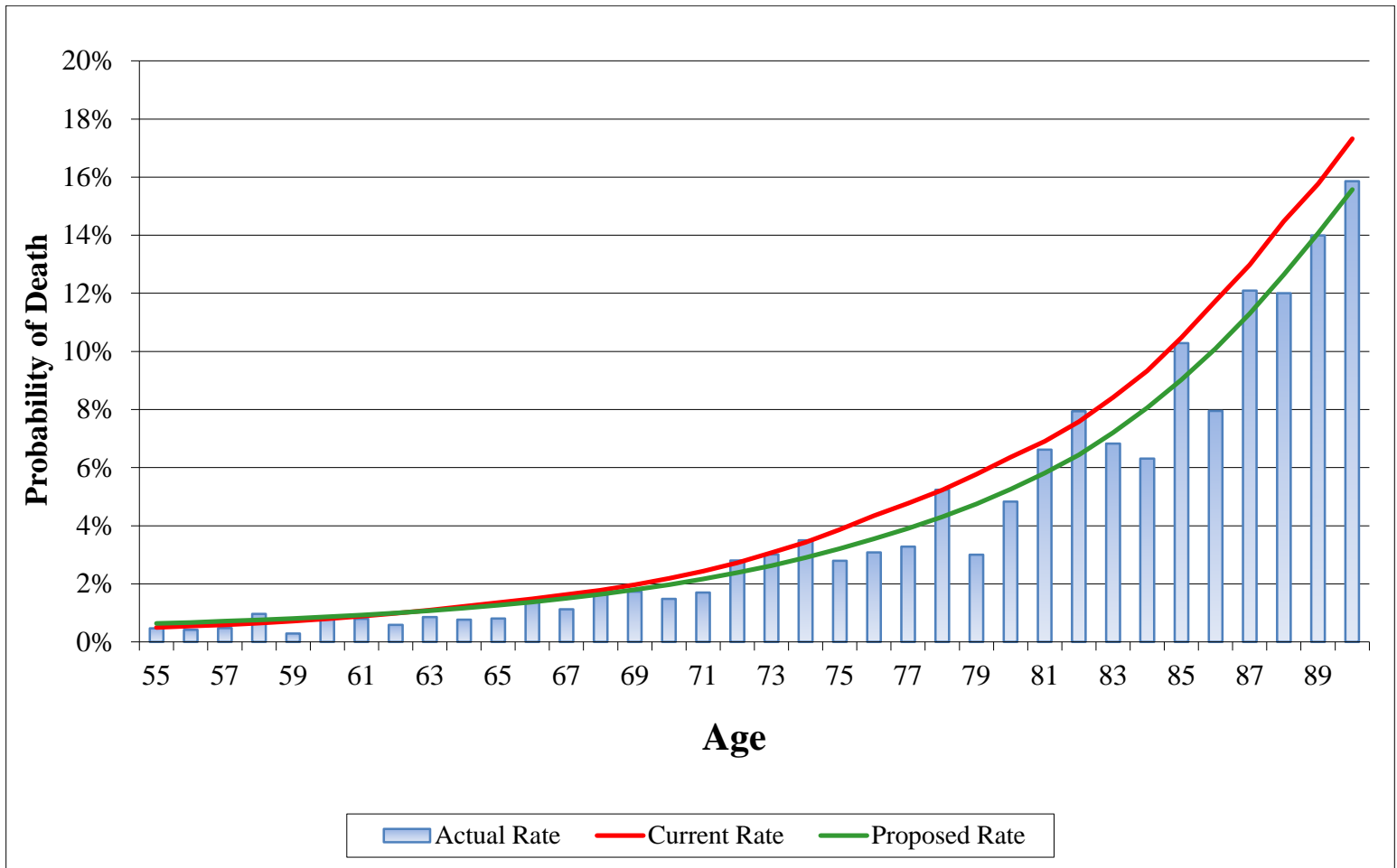


- A new mortality table was issued in October, 2014 with new mortality improvement scale (MP-2016)
- Recommend moving to RP-2014 Mortality Tables with adjustments (age adjustments and scaling factors) for all groups to match actual experience (same as current practice)
  - Minor adjustments other than State-Males and School-Females

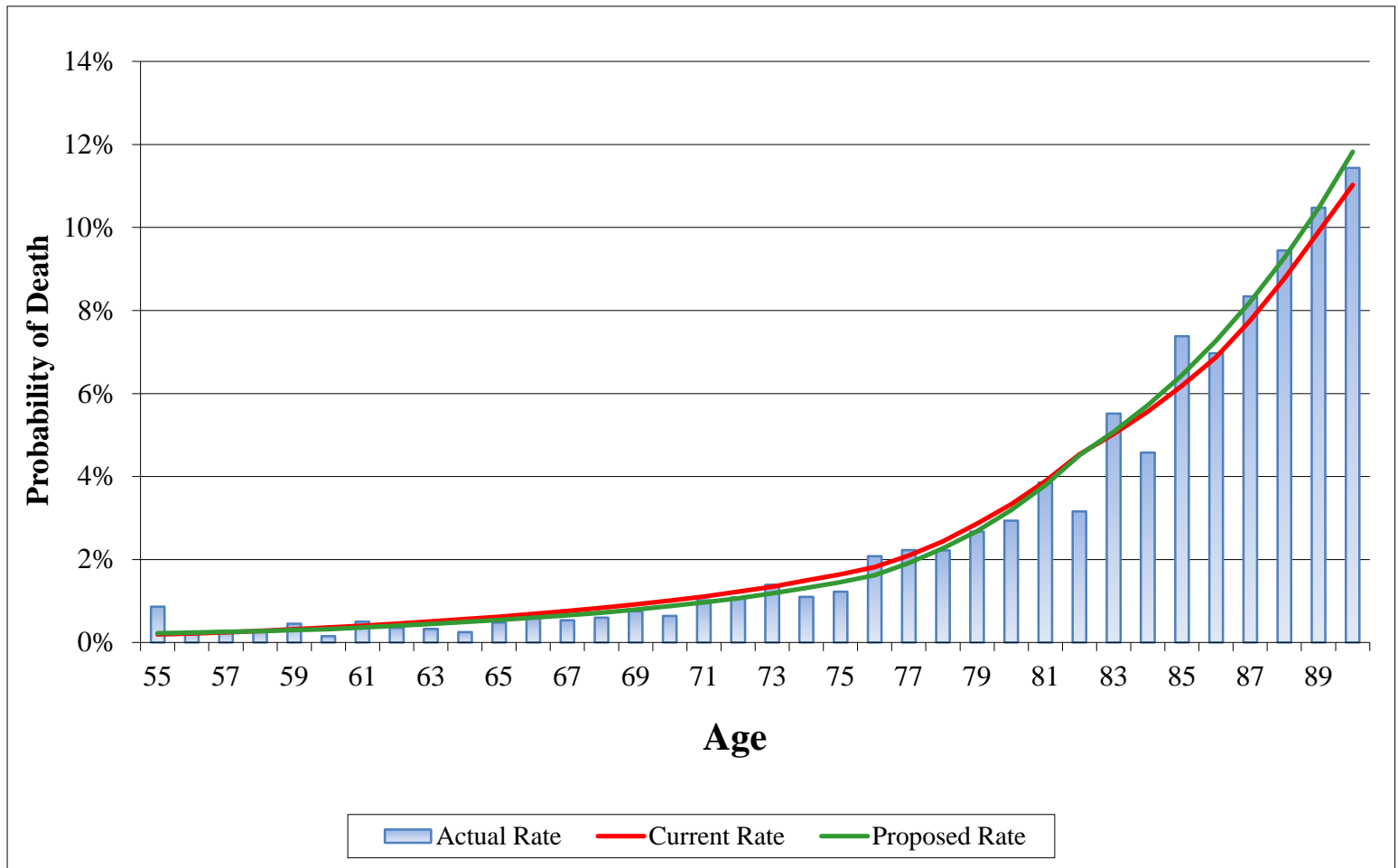
	Actual/Expected Ratio (Benefit-Weighted)	
	<u>Current</u>	<u>Proposed</u>
School		
Male	96%	96%
Female	91%	96%
State		
Male	82%	94%
Female	99%	97%
Local		
Male	94%	98%
Female	100%	95%
KP&F	101%	101%

Note: Based on 2010 – 2015 data to provide more credibility.

# Retiree Mortality (State-Males)



# Retiree Mortality (School-Females)



# Recommendation for Retiree Mortality

All assumptions are based on the RP-2014 Basic Table except School, which uses RP-2014 White Collar Mortality Table

	Age Adjustment	Pre-Age 80 Scaling Factor	Post-Age 80 Scaling Factor
School-Male	None	1.12	1.26
School-Female	None	0.83	1.18
State-Male	+2	0.98	0.93
State-Female	+1	1.03	1.13
Local-Male	+2	1.13	1.10
Local-Female	+1	0.95	1.05
KPF	+1	None	None
Judges	-2	None	None

Recommend projected mortality improvements using MP-2016 until next experience study.

# Recommendation for Active Member Mortality

- Volatility is expected given the small number of expected and actual deaths
- Minor assumption from cost impact
- Use same family of tables, so move to RP-2014 Employee Table with adjustments

School Males                      80% RP-2014 Employee White Collar Male

School Females                    80% RP-2014 Employee White Collar Female

State Males                        90% RP-2014 Employee Male +2

State Females                      90% RP-2014 Employee Female +1

Local Males                        90% RP-2014 Employee Male +2

Local Females                      90% RP-2014 Employee Female +1

- KPF and Judges: same age adjustments for actives as apply to post-retirement mortality plus 90% scaling factor for KPF and 80% for Judges.

# Active Member Mortality



	Actual/Expected Ratio	
	<u>Current</u>	<u>Proposed</u>
School		
Male	114%	104%
Female	82%	92%
State		
Male	127%	90%
Female	132%	123%
Local		
Male	131%	123%
Female	92%	109%
KP&F	94%	94%

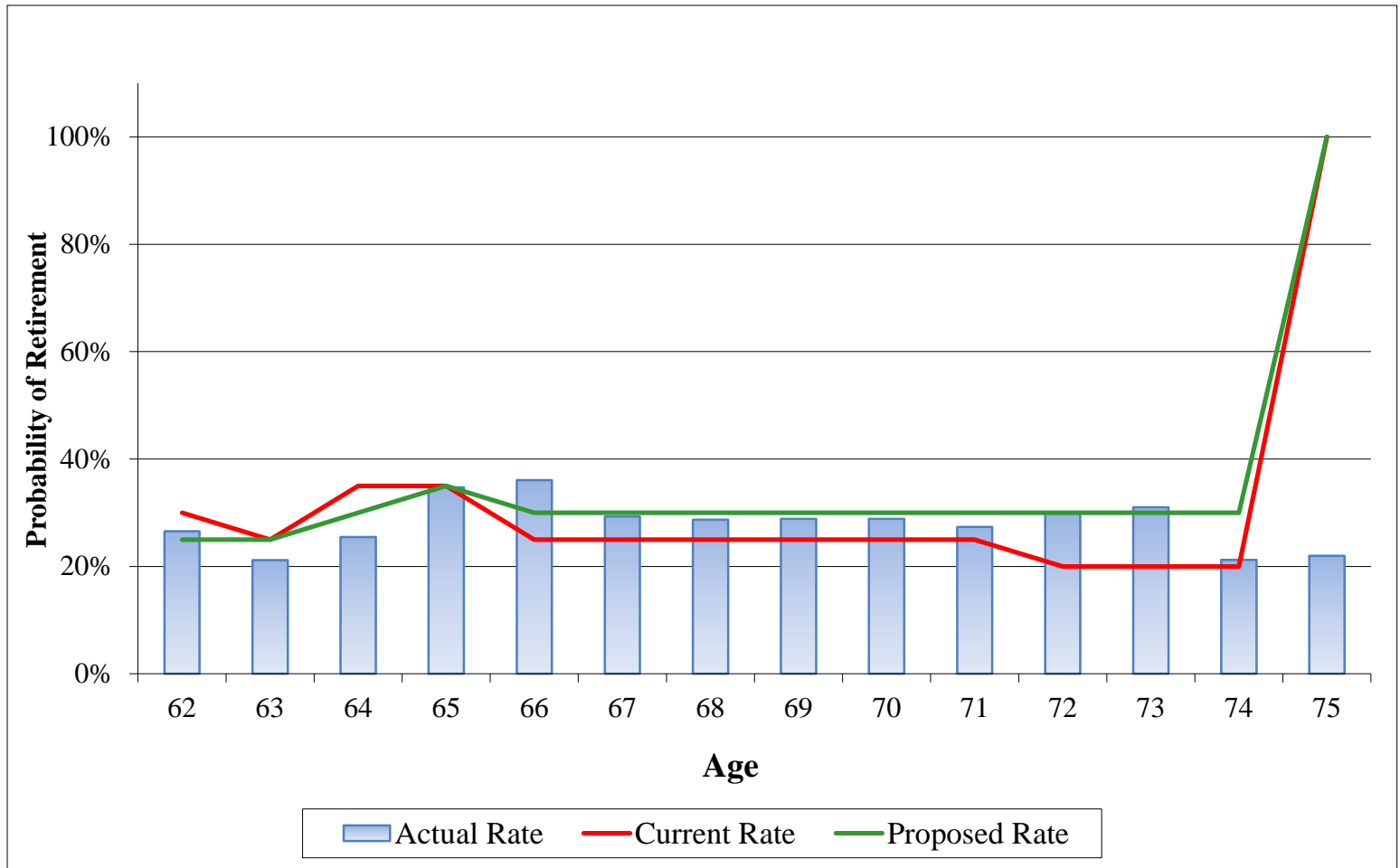


- Anticipates retirement from active status
- Analyzed separately for KPERS
  - Early (Reduced Benefit)
  - Normal (65, 62 and 10 or Rule of 85)
    - Select (First Eligible)
    - Ultimate
- KPF: analyze Tier I and II separately due to different eligibility requirements

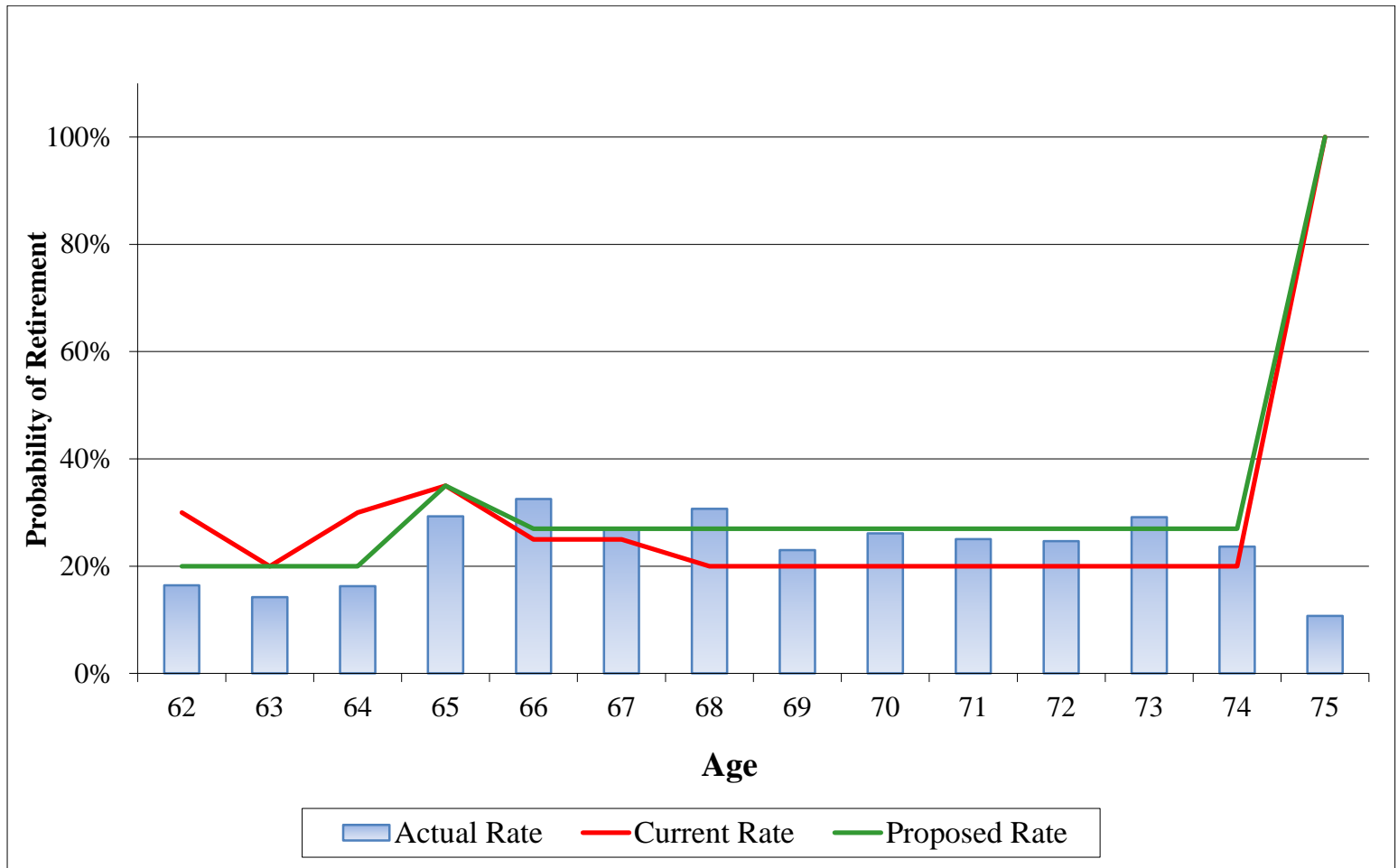
	<b>Actual/Expected Ratio</b>	
	<b><u>2013 - 2015</u></b>	<b><u>2010 - 2012</u></b>
Rule of 85: Select		
School	106%	103%
State	129%	143%
Local	126%	97%
Rule of 85: Ultimate (< age 62)		
School	81%	78%
State	74%	131%
Local	82%	70%
Normal Retirement		
School	94%	86%
State	79%	82%
Local	91%	72%
KP&F		
Tier 1	68%	62%
Tier 2	96%	65%

- Observed some consistent patterns in current and prior study for KPER so recommend some adjustments
  - Increase select rates that apply when first eligible to retire
  - Lower rates for ultimate and normal retirement to fit actual experience
  - Move part of the way and re-evaluate in the next study (avoid overreacting)

# Normal Retirement Rates Schools



# Normal Retirement Rates State



	Actual/Expected Ratio	
	<u>Current</u>	<u>Proposed</u>
Rule of 85: Select		
School	106%	102%
State	129%	116%
Local	126%	111%
Rule of 85: Ultimate (< age 62)		
School	81%	93%
State	74%	87%
Local	82%	88%
Normal Retirement		
School	94%	96%
State	79%	86%
Local	91%	91%
KP&F		
Tier 1	68%	87%
Tier 2	96%	102%

# Retirement Rates Early (Reduced) Benefits



	<b>Actual/Expected Ratio</b>	
	<b><u>2013 - 2015</u></b>	<b><u>2010 - 2012</u></b>
School	48%	42%
State	63%	77%
Local	62%	58%

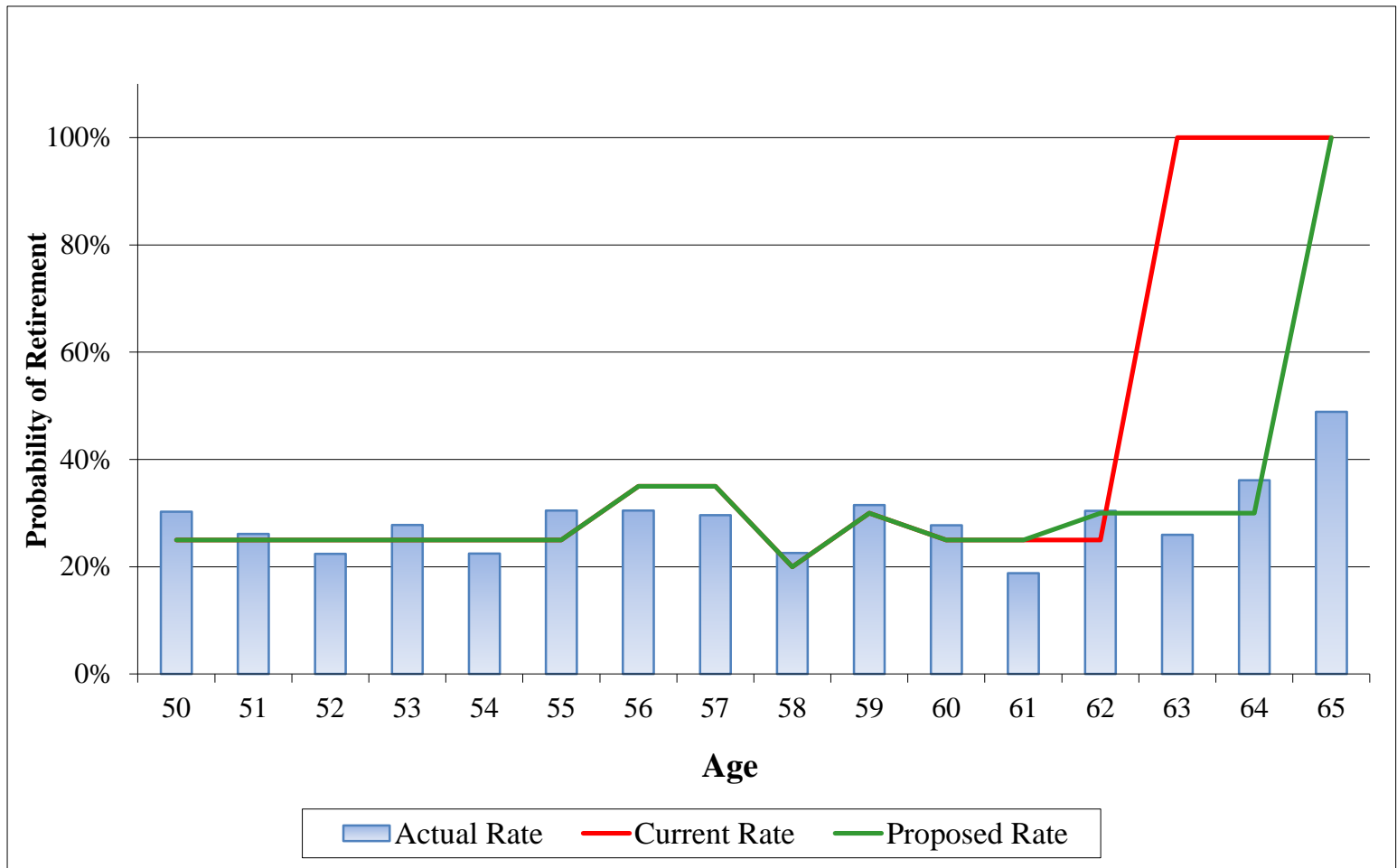
No change in last study. Much lower rates of early retirement in current and prior study, so recommend moving part of the way toward observed experience.

- Size of the corrections groups are small so actual experience has limited credibility
- Group A (C55)
  - Actual/Expected ratio in current study is 80% (75% in prior study).
  - Recommend minor adjustments to current assumption with resulting Actual/Expected ratio of 88%
- Group B (C60)
  - Actual/Expected ratio in current study is 82% (56% in prior study)
  - Small group, but adjustments appear necessary
  - Recommended changes to assumption result in same Actual/Expected ratio, but better fit across various ages



- Actual/Expected ratios for Tier I were 68% in current study and 62% in last study
- Actual/Expected ratios for Tier II were 96%, compared to 65% in last study
- Consistent pattern for Tier I so recommend lowering rates with resulting Actual/Expected ratio of 87%
- Tier II experience in current study period is relatively good fit
  - Extend age at which rate is 100% from 62 to 65
  - Resulting Actual/Expected ratio is 102%

# KPF Tier II Retirement Assumption



- Size of group is small, which limits credibility
- Actual/Expected ratio in current study was 75% while in prior study was 50%
- Recommend some modifications, both increases and decreases at various ages, for a better fit
- Resulting Actual/Expected ratio on recommended assumption is 74%, but fit across various ages improved

- Basis for Current Lump Sum Calculation:
  - Interest Rate: 8%
  - Mortality Table: 50/50 blend - 1983 Group Annuity Table
- Partial Lump Sum Option (PLSO) Experience 2010-15
  - Similar to prior studies
  - Percent electing PLSO: 35%
  - 50% most common PLSO percentage
- Intent is for PLSO election to be cost neutral, but actual experience produced a very small actuarial gain
- Recommend no change in mortality table at this time
- Interest rate will change to the investment return assumption, either 7.75% or 7.50%
- Recommend keeping current valuation assumption that 12% of future benefits will be paid as lump sums

- This assumption reflects the probability that an active member will become disabled
- Results are often volatile given the low probability of this event
- Also consider prior experience in addition to current study

# Disability Experience



	2013 – 2015 Experience		Actual/Expected Ratio	
	<u>Actual</u>	<u>Expected</u>	<u>2013 - 2015</u>	<u>2010 - 2012</u>
School	201	384	52%	63%
State	115	217	53%	56%
Local	139	278	50%	58%
KP&F	102	89	115%	93%

Note: Actual/Expected ratios greater than 100% imply more disabilities than expected

# Disability Experience

- Actual disabilities for KPERS were much lower than expected, even after the rates were lowered in last study
  - Recommend reducing disability rates to better fit experience, but move only part of the way
  - Actual/Expected ratios with proposed assumptions are:
    - School: 76%
    - State: 62%
    - Local: 69%
- KPF: recommend keeping current disability assumption based on aggregate experience over 6 years

	<b>Actual/Expected Ratio</b>	
	<u><b>2013 - 2015</b></u>	<u><b>2010 - 2012</b></u>
School		
Male	129%	101%
Female	118%	99%
State		
Male	135%	111%
Female	145%	115%
Local		
Male	128%	110%
Female	138%	110%
KP&F	124%	127%

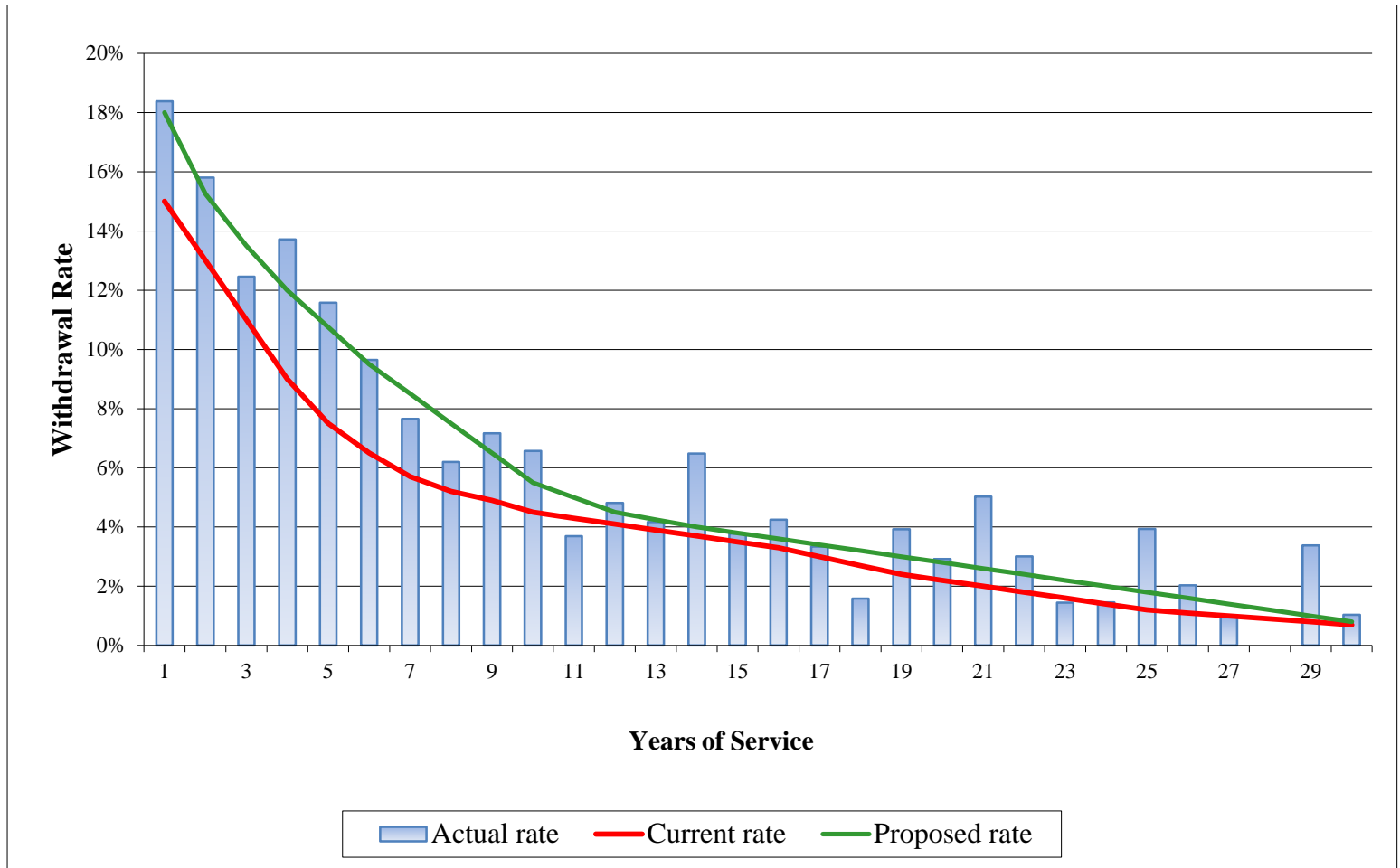
Note: Actual/Expected ratios greater than 100% imply more terminations than expected



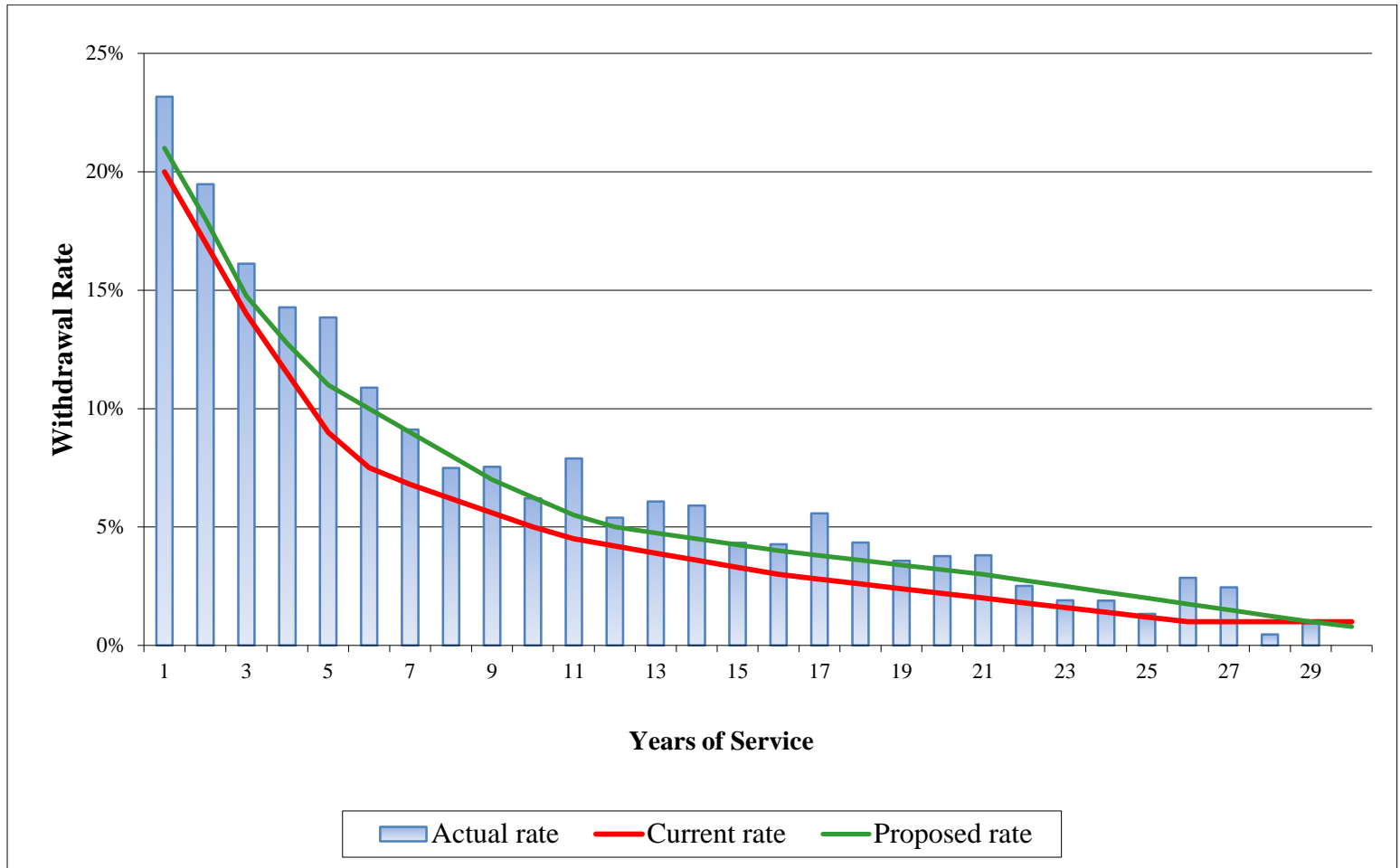
# Recommendations for Termination of Employment

- Higher actual termination rates than expected for KPER
- Modify rates to improve fit with experience in last two studies
  - Actual/Expected ratios under proposed assumptions
    - School (Males): 106%
    - School (Females): 113%
    - State (Males): 107%
    - State (Females): 105%
    - Local (Males): 107%
    - Local (Females): 112%
- Increase KPF rates at certain ages to better fit actual experience
- No change for Judges (no termination assumption)

# KPERS State-Males Termination Rates



# KPERS Local-Females Termination Rates



## Election of Vested Benefit

- Vested member who terminates has two options:
  - Take refund of employee account balance
  - Wait and get monthly income when eligible
- This assumption reflects the probability that a KPERS 1 vested member will elect to take a deferred benefit
  - Actual experience slightly higher than expected (Actual/Expected ratios around 104-108%)
  - Higher contribution rates in effect may have an impact on this assumption in future (if more people elect a refund)
  - Recommend no change at this time
- KPERS 2 and 3 members are valued assuming the higher benefit value is elected at termination

- Two components: wage inflation (applies to all groups) + merit scale (varies by group)
- Recommendation for wage inflation was a decrease from 4.0% to 3.5%
- Therefore, total salary increase assumption will be lower unless merit scale is adjusted
- Actual total salary increases shown below:

Group	Actual Salary Increase				Expected
	2013	2014	2015	Average	
State	3.36%	4.82%	3.84%	4.00%	5.34%
School	4.30%	5.23%	5.03%	4.85%	5.94%
Local	4.64%	6.13%	7.71%	6.16%	5.89%
KPF	5.80%	3.57%	7.39%	5.58%	5.74%

- Actual price and wage inflation were lower during study period than assumption so actual increases would typically be less than assumed
- Expected trend observed for State and School, but not Local and KPF
- Actual salary increase for 2015 appears very high for Local and KPF
  - Possibly some “catch up” from prior low salaries
  - Likely not indicative of long term trend
- Recommend no change to merit scales at this time

# Final Average Salary Load

- KPERS Pre-1993 hires receive the greater of high 4 year average including add-ons or high 3 year average without add-ons
  - “Add-ons” include accrued vacation and sick leave payouts
- A “load” factor is used to estimate the impact on KPERS benefit amounts (and liabilities) as a result of application of the high 4 year average including add-ons
- KPF Pre-1993 hire final average salary: the average of the highest 3 years of the last 5, including add-ons
- Any resulting benefit increase above 15% is paid by the employer (therefore, analysis caps increase at 15%)
- Currently, separate loads for C55 and C60, but we recommend the State load be used for these small groups

- Legislation impacting use of add-ons was introduced repeatedly during study period and may have resulted in members with higher value add-ons electing to retire
- Limits full credibility, but general patterns are consistent with prior study period

Group	Current Load	Actual Experience	Recommended Load
State	2.0%	2.7%	2.2%
School	0.5%	0.6%	0.5%
Local	1.8%	2.2%	2.0%
KPF	0.0%	8.0%	7.0%



- Update mortality assumption for all groups to the RP-2014 Mortality Tables with adjustments.
  - Most significant change for State-Males and School-Female groups
  - Projected mortality improvements based on MP-2016 Scale
- Modify retirement rates for all groups
- Change interest assumption for lump sum calculation to the investment return assumption
- Increase termination of employment rates for all KPERS groups and KPF
- Lower disability rates for KPERS
- Modify load for final average salary for pre-1993 hires in KPERS (except School) and KPF

# Summary of Recommended Economic Assumptions

Assumption	Current	Recommended	Cost Impact
Price inflation	3.00%	2.75%	None
Investment return	8.00%	7.50%/7.75%	Increase
KPERS 3 Interest crediting rate	6.50%	6.25%	Decrease
General wage inflation (part of individual salary increase)	4.00%	3.50%	Decrease
Payroll growth	4.00%	3.00%	Increase
Administrative expenses	Reduce investment return	Component of contribution rate	Added to contribution rate

Cost impact is shown for each assumption change on its own.

## ➤ Basic Alternatives

- Option 1: Continue the current amortization policy and reevaluate during next experience study (2019)
- Option 2: Use the “layered” amortization base approach to avoid single, closed period, with a 20 year amortization period for each new piece (recommended)
- Option 3: Extend the current amortization period to a longer period

# All Assumption Changes (7.75%)

## Cost Impact of All Assumption Changes

	State/School		Local		KP&F		Judges	
	<u>Before</u>	<u>After</u>	<u>Before</u>	<u>After</u>	<u>Before</u>	<u>After</u>	<u>Before</u>	<u>After</u>
Actuarial Liability (millions)	\$18,010	\$18,390	\$4,806	\$4,898	\$2,966	\$3,049	\$166	\$176
Normal Cost Rate	8.31%	8.22%	7.93%	7.76%	15.07%	14.86%	19.39%	20.09%
UAL Amortization Rate	10.92%	12.40%	6.46%	7.31%	12.17%	14.31%	0.91%	4.77%
Employer Contribution Rate	13.23%	14.62%	8.39%	9.07%	20.09%	22.02%	14.68%	19.24%

Comparison made on the 12/31/15 valuation results. Actual results, based on the 12/31/16 valuation, will vary.

# All Assumption Changes (7.50%)



## Cost Impact of All Assumption Changes

	State/School		Local		KP&F		Judges	
	<u>Before</u>	<u>After</u>	<u>Before</u>	<u>After</u>	<u>Before</u>	<u>After</u>	<u>Before</u>	<u>After</u>
Actuarial Liability (millions)	\$18,010	\$18,901	\$4,806	\$5,041	\$2,966	\$3,135	\$166	\$179
Normal Cost Rate	8.31%	8.68%	7.93%	8.14%	15.07%	15.67%	19.39%	20.98%
UAL Amortization Rate	10.92%	13.07%	6.46%	7.81%	12.17%	15.43%	0.91%	6.05%
Employer Contribution Rate	13.23%	15.75%	8.39%	9.95%	20.09%	23.95%	14.68%	21.41%

Comparison made on the 12/31/15 valuation results. Actual results, based on the 12/31/16 valuation, will vary.