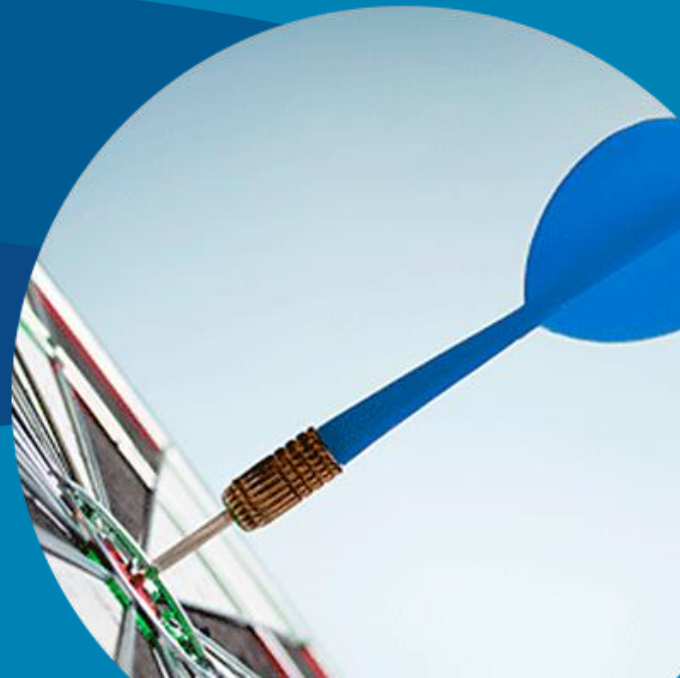


Wisconsin Retirement System

35th Annual Actuarial Valuation of
Retired Lives
December 31, 2017



Operation of the System

	Core Annuities	Variable Annuities
Investment Return Hurdle to Trigger Annuity Adjustment	Returns over/under 5%	Returns over/under 5%
Ratio of Assets to Liabilities	If > 0.5%, dividend may be granted If <-0.5%, prior dividends reduced	If > 2%, variable annuity increased If <-2%, variable annuity decreased
Increase/Decrease Rounding Conventions	Rounded to nearest 0.1%	Truncated, carried to next year
Adjustment Effective Date	April following 12/31 valuation	April following 12/31 valuation

Smoothing Mechanisms - Core

- Undesirable for retirees to experience wide swings in monthly benefits from year to year (especially downward swings)
- Mitigated in Core division by asset smoothing process and portfolio mix
- Asset smoothing has worked well historically, but could not prevent negative dividends in 2009-2013

Smoothing Mechanisms - Variable

- Variable fund is marked to market each year and subject to wide swings
- Dropping fractions from the percent is a form of smoothing
- Usually has very little effect due to the magnitude of the gains and losses

Summary of Results – December 31, 2017

\$ Millions

	Core	Variable
Number of Annuitants	203,202	40,877
Annual Amount	\$ 4,747.0	\$ 369.9
Fund Balance	54,900.0	4,324.9
Actuarial Reserve	53,590.0	3,682.1
Ratio	1.024	1.175

Core published effective earnings rate (MRA) = 8.5%, dividend = 2.4%.
Variable published effective earnings rate (Market Value) = 24.0%, and the
variable adjustment = 17.0%.

(Report- Cover Letter & Pages 6 and 16)

Summary of Results

- Due to smoothing via Market Recognition account, as of December 31, 2017 there are approximately \$3 billion in unrecognized **gains** in the Core fund
 - Last year was \$3 billion in unrecognized losses
 - Will be recognized over the next 4 years
 - Roughly ½ of gain applies to the annuitant reserve, the other half shared by active members and employers
 - Will put upward pressure on dividends in the coming years (primarily in December 31, 2020 and December 31, 2021 actuarial valuations)

Operation of Market Recognition Account (MRA) - \$ Millions **2016 Valuation**

	<u>2016</u>	<u>2017</u>	<u>2018</u>	<u>2019</u>	<u>2020</u>
Actual Investment Earnings	\$ 6,876				
Assumed Investment Earnings	6,279				
Gain/(Loss) to be phased-in	597				
Phased-in recognition					
• Current year	\$ 119	?	?	?	?
• First prior year	(1,344)	\$ 119	?	?	?
• Second prior year	(243)	(1,344)	\$ 119	?	?
• Third prior year	953	(243)	(1,344)	\$ 119	?
• Fourth prior year	<u>793</u>	<u>953</u>	<u>(243)</u>	<u>(1,344)</u>	<u>\$ 119</u>
Total recognized gain (loss)	\$ 278	\$ (515)	\$ (1,468)	\$ (1,225)	\$ 119

2017-2020: Expect \$3 billion in deferred asset LOSSES

Operation of Market Recognition Account (MRA) - \$ Millions **2017 Valuation**

	<u>2017</u>	<u>2018</u>	<u>2019</u>	<u>2020</u>	<u>2021</u>
Actual Investment Earnings	\$ 13,842				
Assumed Investment Earnings	6,533				
Gain/(Loss) to be phased-in	7,309				
Phased-in recognition					
• Current year	\$ 1,462	?	?	?	?
• First prior year	119	\$ 1,462	?	?	?
• Second prior year	(1,344)	119	\$ 1,462	?	?
• Third prior year	(243)	(1,344)	119	\$ 1,462	?
• Fourth prior year	953	(243)	(1,344)	119	\$ 1,462
Total recognized gain (loss)	\$ 947	\$ (6)	\$ 237	\$ 1,581	\$ 1,462

2018-2021: Expect \$3 billion in deferred asset GAINS

Asset Rate of Return Calculation

- Rate of Return = Investment Earnings / Asset Value
- Rate of Return will vary based on calculation inputs:
 - Asset value could be smoothed or unsmoothed
 - Asset value could be beginning, middle or end of year
 - Timing of Contributions and Benefit Payments will vary
- Result is different Rate of return calculated by:
 - SWIB (investment manager)
 - ETF (calculations governed by statute)
 - GRS (actuaries)

Translating Asset Rate of Return to Core Dividend

- Actual 2017 SWIB net of fee return = **15.8%**
- Hurdle 1: 7.2% Investment Return Assumption
 - Return > assumption smoothed over 5 years
 - **Leads to \$3 billion in unrecognized Core Fund gains**
 - Core fund return available for dividend = **8.11%**
- Hurdle 2: Investment Return 5% Threshold
 - Core fund return > threshold provides **dividend before adjustments**: $1.0811/1.05-1 = 2.96\%$
- Adjustments result in **2.4%** dividend on next page

Primary Sources of Core Dividend

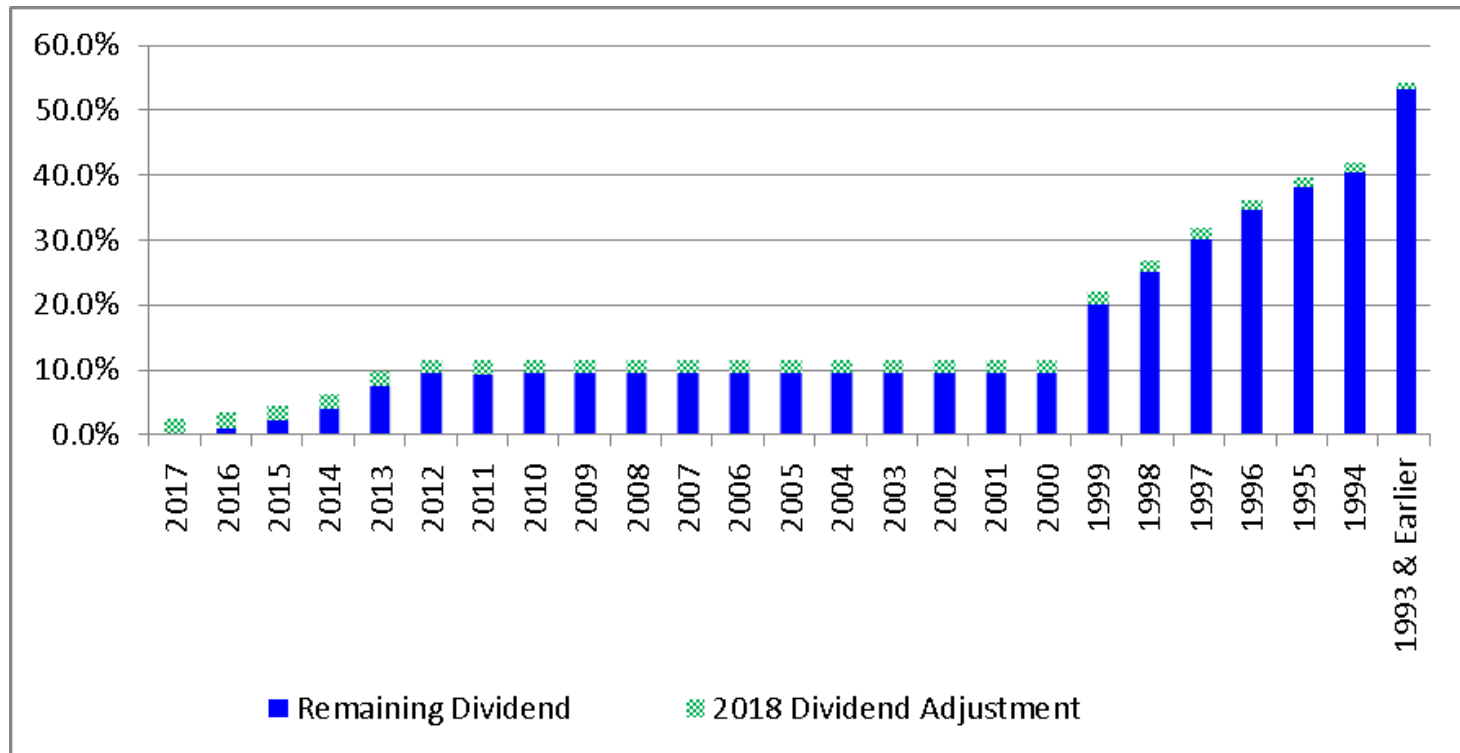
	<u>% of APV</u>
1. SWIB net of fee investment return	15.82%
2. MRA adjustment	<u>(7.32)%</u>
3. Published effective earnings rate	8.50%
4. Adjustment to relate earnings to average core annuity fund balance	<u>(0.39)%</u>
5. Earnings rate based on average balance	8.11%
6. Expected dividend before adjustments: 1.0811/1.05-1	2.96%
7. Adjustment to relate average asset to ending liability	0.03%
8. Carryover from last year due to timing of dividend accounting adjustments and rounding	0.12%
9. Experience study/mortality reserve adjustment	(0.56)%
10. Experience and other effects	(0.11)%
11. Statutory adjustment to round to nearest one-tenth percent	<u>(0.04)%</u>
12. Computed average dividend rate: (6)+(7)+(8)+(9)+(10)+(11)	2.4%
13. Adjustment for members at or near the statutory floor	0.0%
14. Final maximum computed dividend rate: (12)+(13), if greater than 0.5% of core annuities, otherwise 0%	2.4%

Liability Attributable to Dividends

Valuation	Liability for Dividend Remaining (billions)	Liability for Dividend Adjustment (billions)
12/31/2011	\$6.4	\$(1.7)
12/31/2012	4.5	(1.3)
12/31/2013	3.0	2.0
12/31/2014	4.6	1.3
12/31/2015	5.5	0.2
12/31/2016	5.4	1.0
12/31/2017	6.1	1.3
12/31/2018 (est)	7.1	

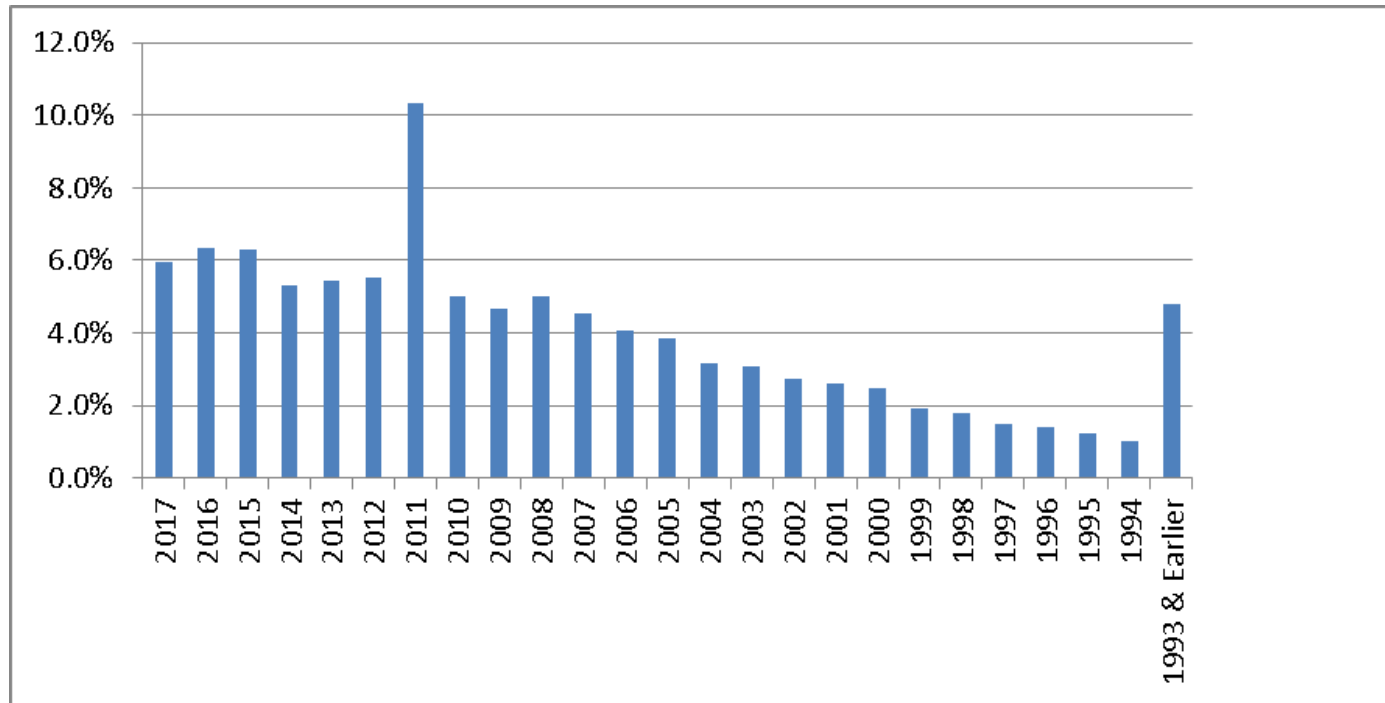
- Liability for dividend remaining represents the value of all previously granted dividends (=\$9.2B at 12/31/2008)
- If a market event similar to 2008 were to occur, the complete depletion of the dividend could occur
- Statutes do not define what would happen in such a case

Dividend Remaining (as a Percentage of Total Benefit) by Year of Retirement



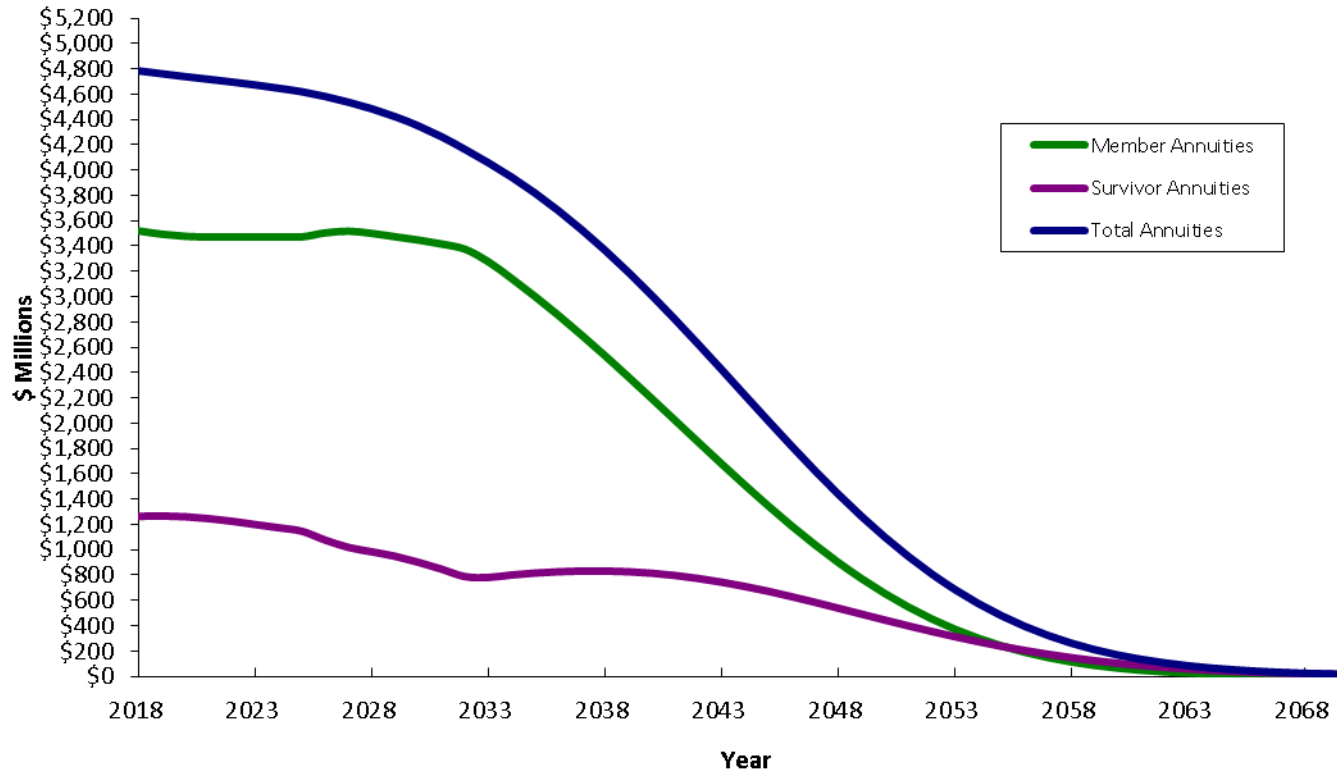
(Report-7)

Liabilities (as a Percentage of Total) by Year of Retirement



(Report-7)

Projected Future Core Annuities



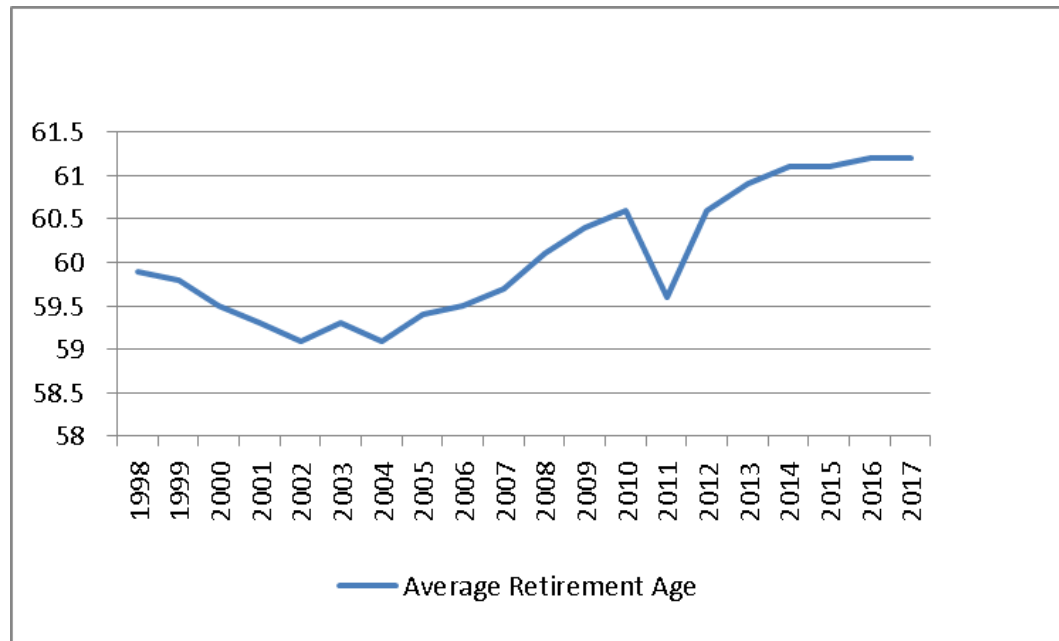
Total Future Payments	\$121.9 billion
From Present Assets	54.9
From Investment Return	67.0

(Report-13)

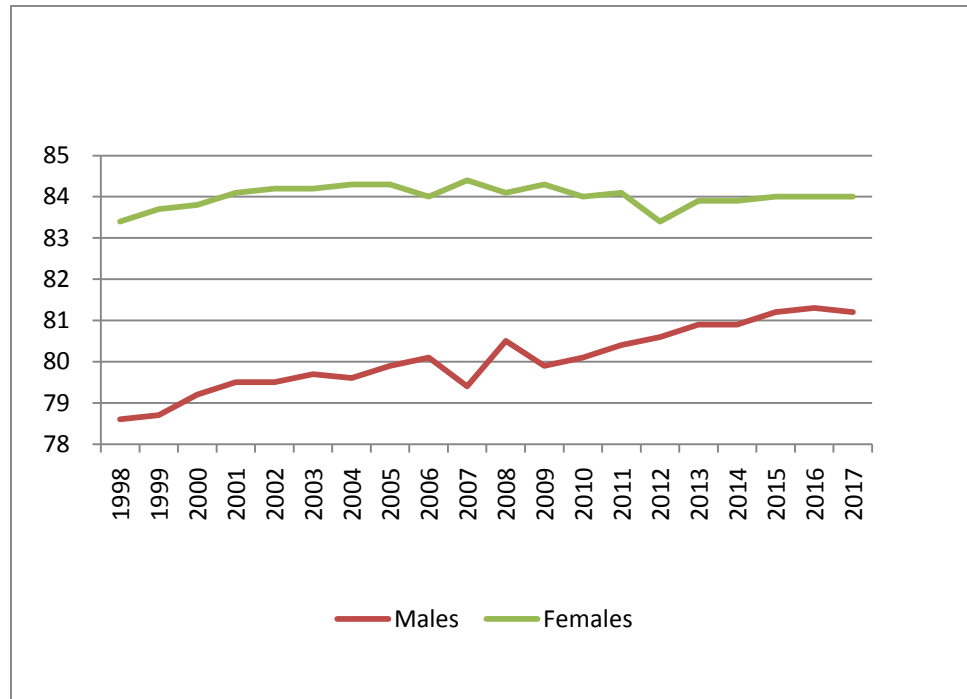
Primary Sources of Variable Adjustment

	<u>% of APV</u>
1. SWIB net of fee investment return	23.2%
2. Adjustment to published effective rate	<u>0.8%</u>
3. Published effective earnings rate	24.0%
4. Adjustment to relate earnings to average variable annuity fund balance	<u>(0.7)%</u>
5. Earnings rate based on average balance	23.3%
6. Expected change before adjustments: $1.233/1.05-1$	17.4%
7. Adjustment to relate average asset to ending liability	0.5%
8. Carryover from last year due to timing of distribution, accounting adjustments and truncation	0.1%
9. Experience study/mortality reserve adjustment	(0.5)%
10. Experience and other effects	0.0%
11. Statutory adjustment: (truncate to whole percent)	<u>(0.5)%</u>
12. Variable annuity change: (6)+(7)+(8)+(9)+(10)+(11)	17.0%

Average Retirement Age



Average Age at Death



Average age at death, while an interesting statistic, is not a proper measure of life expectancy, because it does not include people who have not yet died. The expected age at death for a 65 year old is 85.3 for males and 88.2 for females.

Comparative Statement - Core

Valuation Date	Number	\$ Millions			Ratio	Change in		
		Annual Annuities	Fund Balance	Actuarial Reserve		Annuities		CPI*
						Average	Maximum	
2008	144,033	\$ 3,399.3	\$ 35,798.1	\$ 36,551.5	0.979	(2.1)%	(2.1)%	0.1 %
2009	150,671	3,449.3	36,655.8	37,072.7	0.989	(1.1)%	(1.3)%	2.7 %
2010	155,775	3,532.4	37,798.4	38,148.5	0.991	(0.9)%	(1.2)%	1.5 %
2011	167,453	3,842.0	40,411.5	42,078.3	0.960	(4.0)%	(7.0)%	3.0 %
2012	173,655	3,806.3	40,591.6	41,852.4	0.970	(3.0)%	(9.6)%	1.7 %
2013	180,056	3,800.7	44,273.2	42,300.5	1.047	4.7 %	4.7 %	1.5 %
2014	185,605	4,102.3	47,135.7	45,790.7	1.029	2.9 %	2.9 %	0.8 %
2015	191,795	4,364.9	49,147.0	48,897.5	1.005	0.5 %	0.5 %	0.7 %
2016	197,647	4,523.1	51,972.0	50,941.4	1.020	2.0 %	2.0 %	2.1 %
2017	203,202	4,747.0	54,900.0	53,590.0	1.024	2.4 %	2.4 %	2.1 %
35-Year Average						3.9 %		2.7 %
20-Year Average						2.4 %		2.2 %
10-Year Average						0.1 %		1.6 %
5-Year Average						2.5 %		1.4 %

**Based on December CPI-U67 index.*

(Report-21)

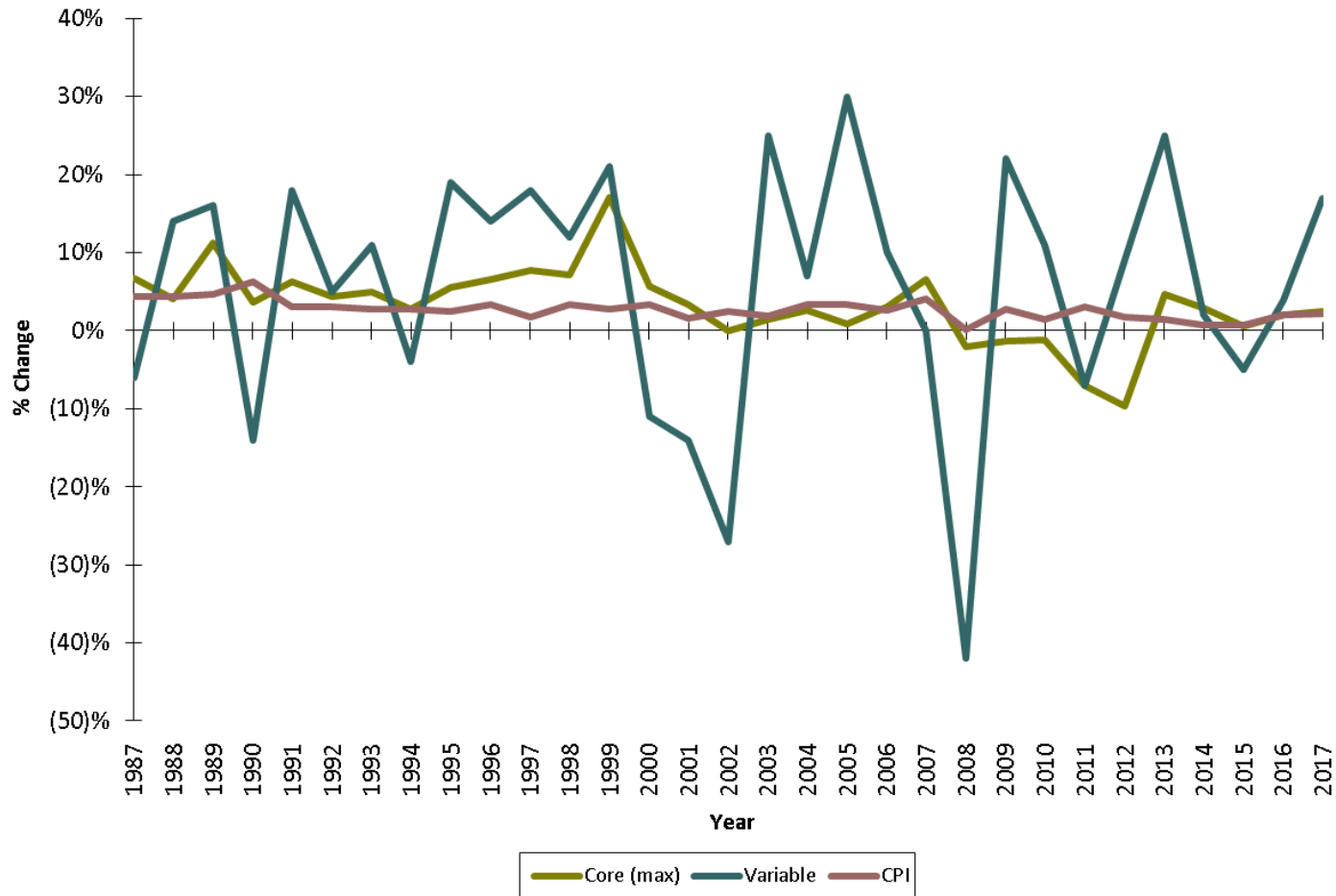
Comparative Statement - Variable

Valuation Date	Number	\$ Millions				Change in	
		Annual Annuities	Fund Balance	Actuarial Reserve	Ratio	Annuities	CPI*
2008	34,927	\$ 427.0	\$ 2,574.5	\$ 4,491.0	0.573	(42.0)%	0.1 %
2009	34,836	240.3	3,078.4	2,512.7	1.225	22.0 %	2.7 %
2010	35,866	288.4	3,340.6	3,005.4	1.111	11.0 %	1.5 %
2011	38,949	330.3	3,197.9	3,462.9	0.924	(7.0)%	3.0 %
2012	39,873	304.6	3,463.9	3,169.6	1.093	9.0 %	1.7 %
2013	40,317	324.5	4,187.3	3,347.0	1.251	25.0 %	1.5 %
2014	39,420	386.5	3,995.4	3,917.1	1.020	2.0 %	0.8 %
2015	40,152	387.8	3,704.8	3,910.1	0.947	(5.0)%	0.7 %
2016	40,647	363.6	3,792.0	3,645.1	1.040	4.0 %	2.1 %
2017	40,877	369.9	4,324.9	3,682.1	1.175	17.0 %	2.1 %
35-Year Average						4.6 %	2.7 %
20-Year Average						1.5 %	2.2 %
10-Year Average						1.6 %	1.6 %
5-Year Average						8.1 %	1.4 %

**Based on December CPI-U67 index.*

(Report-22)

History of % Changes



(Report-23)

Looking Ahead

- As of the December 31, 2017 valuation, there are about \$3 billion in unrecognized asset gains in the Core fund
 - Recognized over the next four years, about half of which will be applied to the annuitant reserve
- A few more years of positive dividends for all annuitants is needed to decrease the probability of leveraged negative dividends that occurred between 2008 and 2012

CURRENT EVENTS

Mortality Assumptions

- Actuarial Standards of Practice
- Actuary must state provisions made for future mortality improvements
- Most demographers expect future mortality rates to continue to decrease
- Most recent WRS Experience study anticipated future improvement using:
 - Fully generational mortality rates – via a set of rates for every year of birth



Mortality Impact on WRS Dividends

- In WRS, it is important not to let anticipated future mortality improvements have an undue effect on dividends payable to current retirees
- Historical experience studies used static projection, meaning:
 - Phasing into the current mortality over 3 years for retirees and
 - Immediate recognition for actives
- In the 2012-2014 study, we proposed a similar retiree phase-in approach, but based on fully generational tables
 - Change first reflected in 2015 Retired Lives valuation
 - Led to ~0.56% annual adjustments to retiree dividends paid in 2016-2018

Mortality Impact: WRS Core Dividends

Year	Decrease
2006-8	0.5%
2009-10	0.3%
2011	0.4%
2012-13	0.3%
2014	0.4%
2015	0.5%
2016-18	0.6%

With fully generational mortality tables, mortality improvement is now already accounted for. However, there may still be adjustments due to changes in underlying mortality table and projections scale, but they should be smaller adjustments.

Society of Actuaries Research



Age Wise is a series of infographics to help individuals understand how life expectancy and the decisions they make impact their plans for a happy, healthy and well-funded retirement.



You may live much longer than you think.

Many people base their planning on what their grandparents or parents experienced, but **individual life expectancies have improved dramatically over the past century**. Current trends suggest that...



1 out of 3 males



1 out of 2 females

who are in their mid-50s today **will live to be 90**

Will your **retirement income plan** be enough?

It's not just luck or genes.

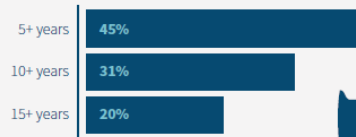
Some **factors** that influence how long you live may be **beyond your control**. Others depend upon the **choices you make** every day. A successful retirement plan will address both.



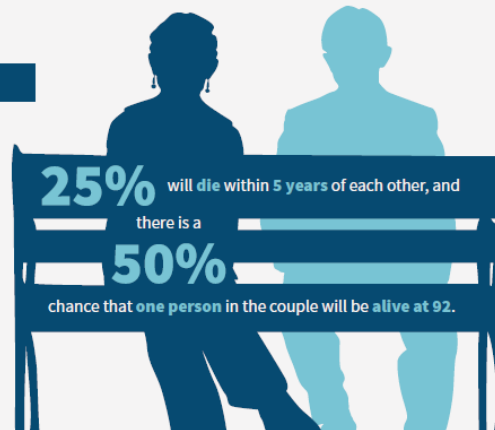
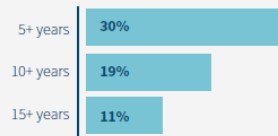
Couples should consider their combined planning timeline.

For a couple who are 65 today...

Odds a wife outlives her husband by...



Odds a husband outlives his wife by ...



- Personal Health & Safety Habits
- Medical Knowledge & Access to It
- Social Connections
- Genes / Gender
- Compliance with Medical Advice
- Prenatal & Childhood Conditions
- Education
- Health & Safety of Your Neighborhood

Society of Actuaries Research

It's Time to "Check Out" Inflation

A 2015 survey by the Society of Actuaries found

Most of us have always expected that inflation will have some impact on how far our dollars stretch for retirement. Hopefully, you have included some assumptions about inflation in your plan for retirement income. **But will that be enough?**



**69% of
pre-retirees**



**52% of
retirees**

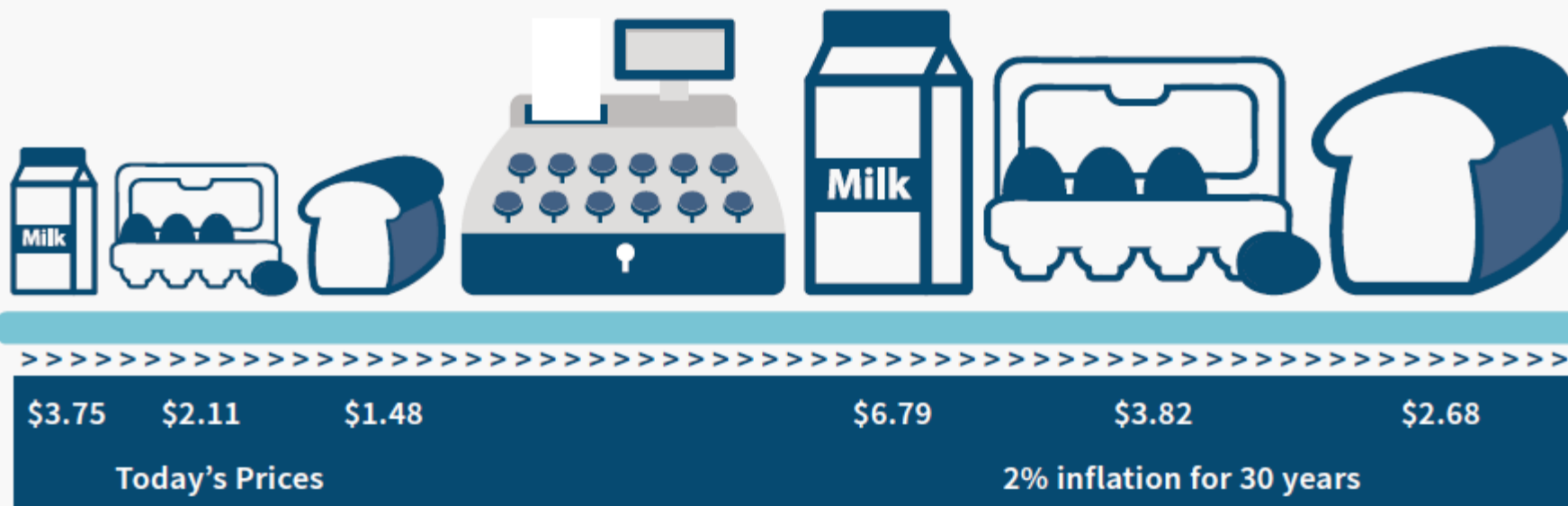
were either **somewhat or very concerned** that the **value of their savings and investments might not keep up with inflation.**

Society of Actuaries Research

How far will your dollars stretch?

Retirees are living longer than ever before, and that impacts how far your dollars will stretch.

Here is how your expenses would look if inflation were a flat 2% a year for the next 30 years:



Society of Actuaries Research

But that doesn't tell the whole story...

For example, the **rate of medical inflation** over the **past 20 years** has been **nearly double the rate of overall inflation**. As you age, you are likely to spend more for health care.



If inflation were to inch up to 3% instead of 2%, that same gallon of milk would cost over **\$9.00** in 30 years.



Medical could have the biggest impact of all. Are you planning for inflation in your retirement?

Society of Actuaries Research

Take the Long View: Expect the Unexpected in Retirement

No matter how well we plan, no one can predict all the expenses that could occur during a retirement lasting 30 years or more.

In a study conducted in 2015, the Society of Actuaries identified common expenses, which they labeled “shocks” because of their sudden, disruptive nature.

According to the research

7 out of 10 retirees have experienced at least one “shock” during retirement.



2 of those 7 have experienced three or more shocks.

Society of Actuaries Research

Many of these expenses aren't so unexpected after all.

Here are three most common “shocks” and what you can do to plan for them:

28%

of retirees reported unexpected expenses for major home repairs/upgrades.



Tip:

Consider having a home inspection prior to your retirement date, and periodically after that, to **identify and budget** for major repairs and accommodations.

24%

reported unexpected large dental expenses.



Tip:

Visit your dentist to determine **what work needs to be done now** and **what you might expect in the future**.

20%

reported unexpected out-of-pocket medical and prescription drug expenses.



Tip:

Talk to your doctor about **alternative treatments** and look into retailers', manufacturers', and other group **discount programs**.

Society of Actuaries Research

Where Will You Live?

As you age, your choice of where to live may change...

As you age, the cost of housing will continue to impact your financial choices. Some choices will depend on your lifestyle and needs. Others will depend on your family and/or health status.



Live at Home

Did you know?

Roughly three-quarters of people age 80 or older still live in their own homes.

Did you know?

Multi-generational households are becoming more common as 9 out of 10 retirement-age Americans say they want to stay in their homes, leaving fewer starter homes available for millennials.



Modify home to meet your needs



Stay in Home

With varying degrees of outside services



Share a Private Home

- With Family
- With Others

Society of Actuaries Research

Occupy Needs-Appropriate Housing

With varying degrees of help for day-to-day living needs and social engagement



Did you know?

People age 85 or over represent a fast growing segment of the U.S. population. 13% of those individuals live in nursing homes today, and there will be 3 times as many by 2050.

Move to a Residential Facility Offering Skilled Help

- Medical
- Memory Care

Did you know?

Average expenses for an older adult in a skilled nursing facility can be 4 times greater than the average expenses of community-provided paid care.

Did you know?

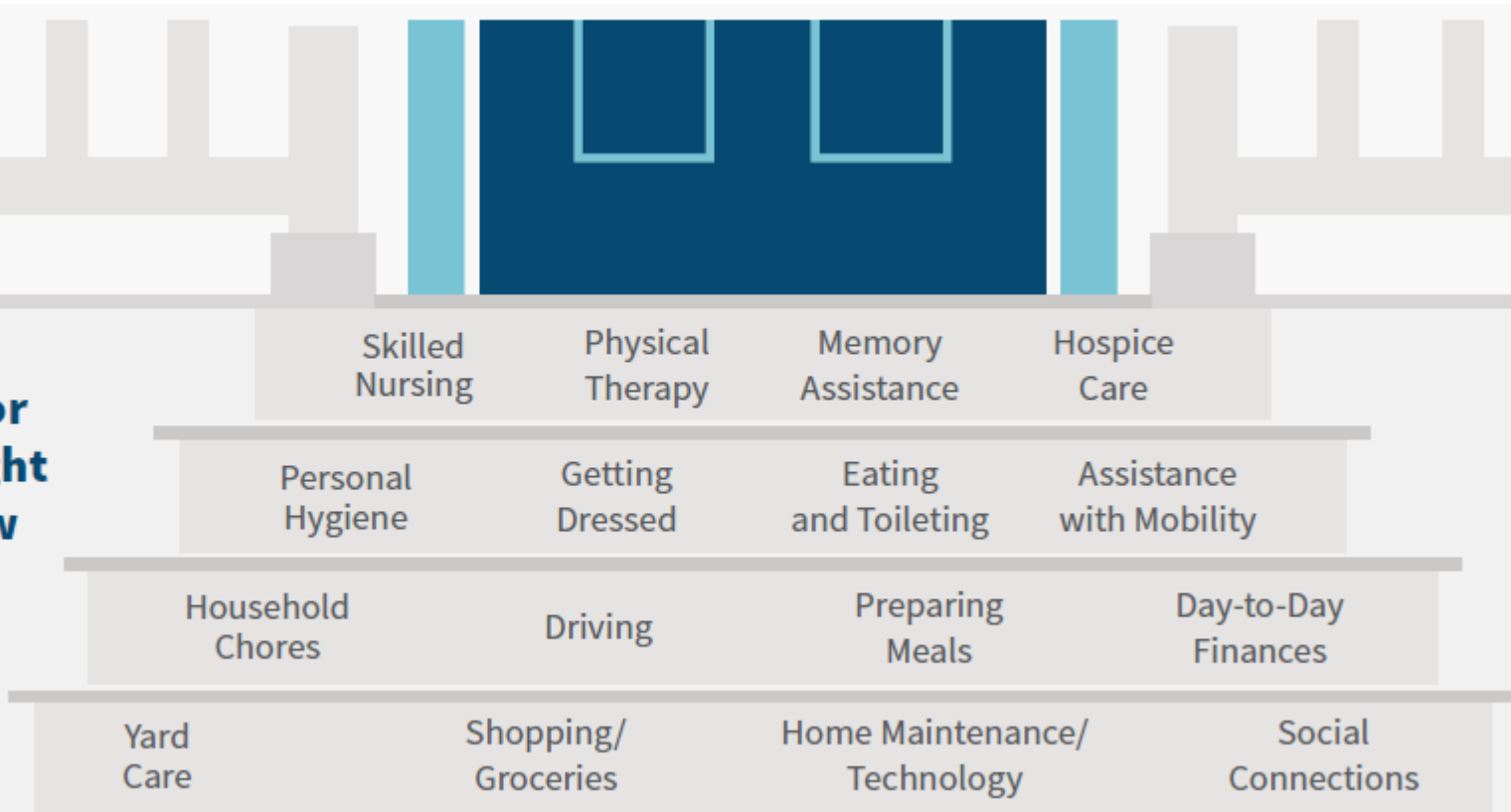
The lifetime probability of needing assistance in at least 2 activities of daily living or being cognitively impaired is 68% for people age 65 or older.



Society of Actuaries Research

**Over time,
your need for
support might
change/grow
as well...**

Greater help
could include
these steps:



Disclaimers

- This presentation shall not be construed to provide tax advice, legal advice or investment advice.
- This presentation is intended to be used in conjunction with the actuarial valuation report for retired lives issued on March 7, 2018. This presentation should not be relied on for any purpose other than the purpose described in the valuation report.
- Readers are cautioned to examine original source materials and to consult with subject matter experts before making decisions related to the subject matter of this presentation.
- This presentation expresses the views of the author and does not necessarily express the views of Gabriel, Roeder, Smith & Company.