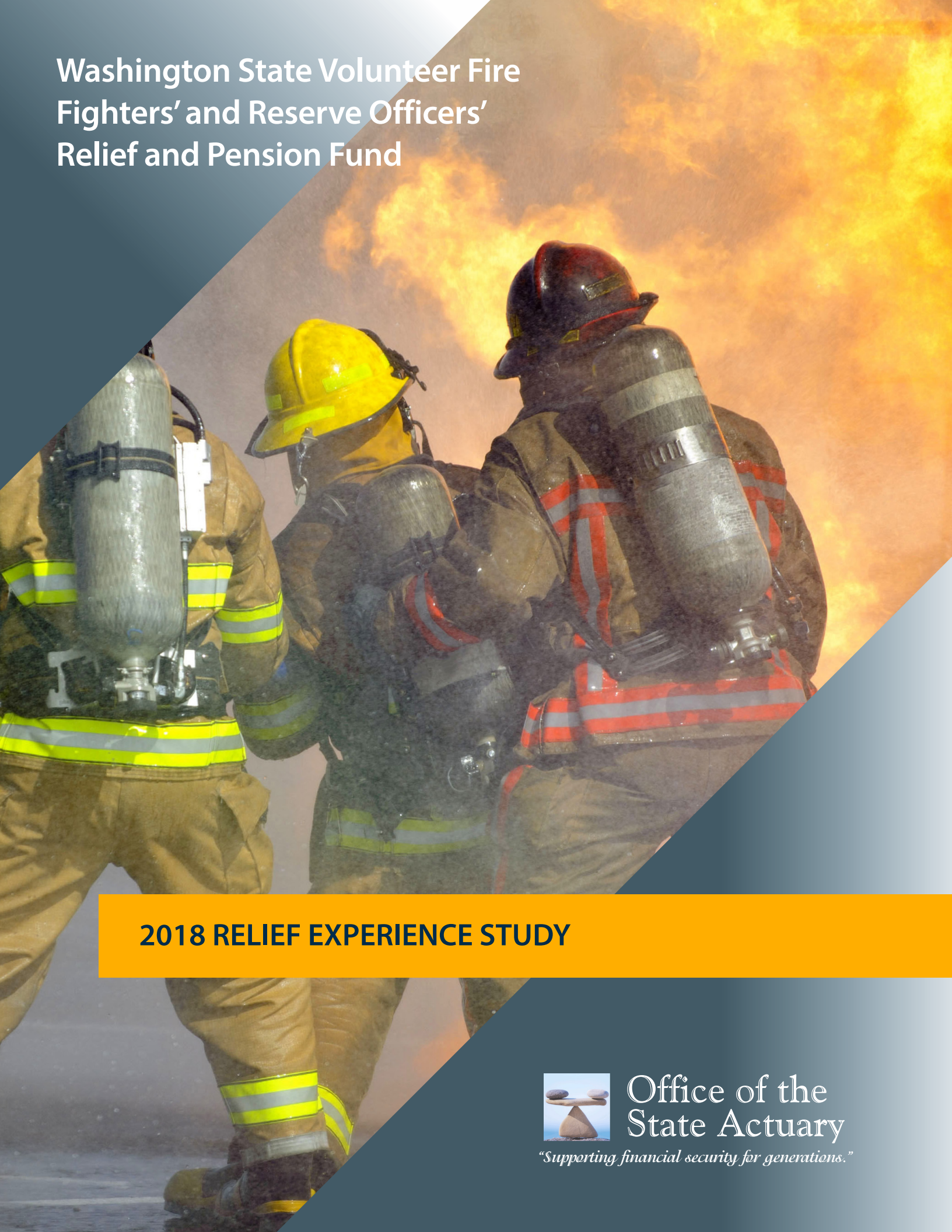
Washington State Volunteer Fire Fighters' and Reserve Officers' Relief and Pension Fund



2018 RELIEF EXPERIENCE STUDY

Office of the State Actuary

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2018 Relief Experience Study

Acknowledgment Page

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Contents

Executive Summary

This report documents the results of an actuarial experience study on the assumptions related to relief benefits for the Volunteer Fire Fighters' and Reserve Officers' (VFF) Relief and Pension Fund. The primary purpose of this experience study is to compare the current demographic assumptions, related to relief benefits, to the actual experience of the plan and apply our professional judgment regarding future expectations to determine if any adjustments are required to ensure our assumptions remain reasonable. Readers should not use this study for other purposes. We also advise readers of this study to seek professional guidance as to its content and interpretation and not to rely upon this communication without such guidance. Distribution of or reliance on only parts of this study could result in its misuse and may mislead others.

We will continue to review these relief benefit assumptions approximately every six years. In addition, we perform a similar study on the demographic assumptions related to pension benefits on a different review cycle.

Please see the *2017 Volunteer Fire Fighters' and Reserve Officers' Relief and Pension Fund Actuarial Valuation Report (VAVR)* for the impact on plan liabilities and contribution rates resulting from this experience study.

High Level Takeaways

We are currently in the early stages of data collection related to relief assumptions since these benefits were first valued in the *2009 Actuarial Valuation Report of the Relief Benefits*. We relied on data from the Board for Volunteer Fire Fighters and Reserve Officers (BVFF) staff when it was available. Where necessary, we also relied on outside sources of data to supplement our analysis when BVFF staff did not have data. We will continue to work with BVFF staff for collecting data on the assumptions we studied in this report.

When data was available, we used an Actual to Expected table to help determine if we are currently under-estimating or over-estimating relief costs. In general, we found the current assumptions over-estimated the relief costs.

We moved the new assumptions in the direction of historical experience; however, they will not match actual historical experience. We will continue to monitor the relief benefit assumptions and adjust the assumptions towards experience. Additional data will help to confirm trends in the experience.

The following table provides a high-level summary of the current assumptions used to value relief benefits and the new assumptions we selected as part of our *2018 Relief Experience Study*. Please see the individual sections for additional details.

Summary of Change in Assumptions		
Assumption	**Current**	**New**
Medical Claims*	$139.39 per member Costs increase with medical inflation	$115 per member Costs increase with medical inflation
Temporary Disability*	$15.27 per member Costs increase with inflation	$10 per member Costs increase with inflation
Physicals*	$11.11 per member Costs increase with inflation	$11 per member No assumed inflation
Disability Rates	1.5 permanent disabilities a year	0.5 permanent disabilities a year
Percent Married	64.2%	65.0%
Eligible Children	0.61 per member	N/A**
Duration of Child Benefit	10 years	N/A**
Duration of Spouse Benefit	Paid for life, assume no remarriage	Paid for life, assume no remarriage
Duty Death	1.0 duty related deaths a year	0.5 duty related deaths a year

**As of 2017 VFF Actuarial Valuation Report.*

***Valued as a load to other benefits.*

For this experience study, we also considered methodology changes for valuing relief benefits. We made two changes: 1) developed load assumptions related to child benefits; and 2) valued medical benefits (medical claims, temporary disability, and physicals) as an annual cost per member while actively volunteering. Please see the **Methodology** section for additional details.

We considered the impact of law changes since the last relief experience study. Since 2010, two legislative bills impacted VFF relief benefits. *House Bill 2823* (2010 Legislative Session) allowed members to retire from the pension system and return to volunteering. The bill would increase the number of members eligible for relief benefits in each year. We reflected these members in our headcounts for this analysis. *Substitute House Bill 1180* (2013 Legislative Session) increased the duty death lump sum benefit as well as increased the monthly benefit for dependent children. This bill only impacts the amount of the benefits paid in the event of a duty-related death, not the likelihood that they occur, so this bill did not impact this experience study.

Except as otherwise noted, all data, assumptions, and methods used in the development of the assumptions match those disclosed in the 2017 VAVR. Please see the 2017 VAVR for additional information on the relief benefits including the payment amounts as of the valuation date.

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Actuarial Certification Letter
Volunteer Fire Fighters' and Reserve Officers' Relief and Pension Fund
2018 Relief Experience Study

November 2018

This report documents the results of an actuarial experience study on the assumptions related to relief benefits for the Volunteer Fire Fighters' and Reserve Officers' (VFF) Relief and Pension Fund defined under *Chapter 41.24* of the Revised Code of Washington. The primary purpose of this experience study is to compare the current demographic assumptions, related to relief benefits, to the actual experience of the plan and apply our professional judgment regarding future expectations to determine if any adjustments are required to ensure our assumptions remain reasonable. This report should not be used for other purposes.

We will continue to review these relief benefit assumptions as appropriate or approximately every six years. This analysis will become outdated with the release of the next Relief Experience Study. Please replace this report with our next report when available. These assumptions have been incorporated into our *2017 VFF Actuarial Valuation Report.*

The experience study results summarized in this report involve methods for analyzing past experience and setting new assumptions for VFF. We believe that the methods used and the assumptions developed in this study are reasonable and are in conformity with Actuarial Standards of Practice (ASOPs) as of the date of this publication.

It is our intent to hire an outside actuarial firm to audit the actuarial analysis we performed in this study, for reasonableness, including the new assumptions. In addition, we rely on a healthcare actuary to set the medical inflation assumption since we do not have healthcare expertise.

The Board for Volunteer Fire Fighters and Reserve Officers (BVFF) provided us with relief benefit data. We did not perform an audit of the BVFF data. We also relied on data from the *Bureau of Labor Statistics* and *United States Census Bureau* to perform our analysis. We relied on all the information as complete and accurate, and checked the BVFF data for reasonableness. In our opinion, this information is adequate and reasonable for purposes of this study.

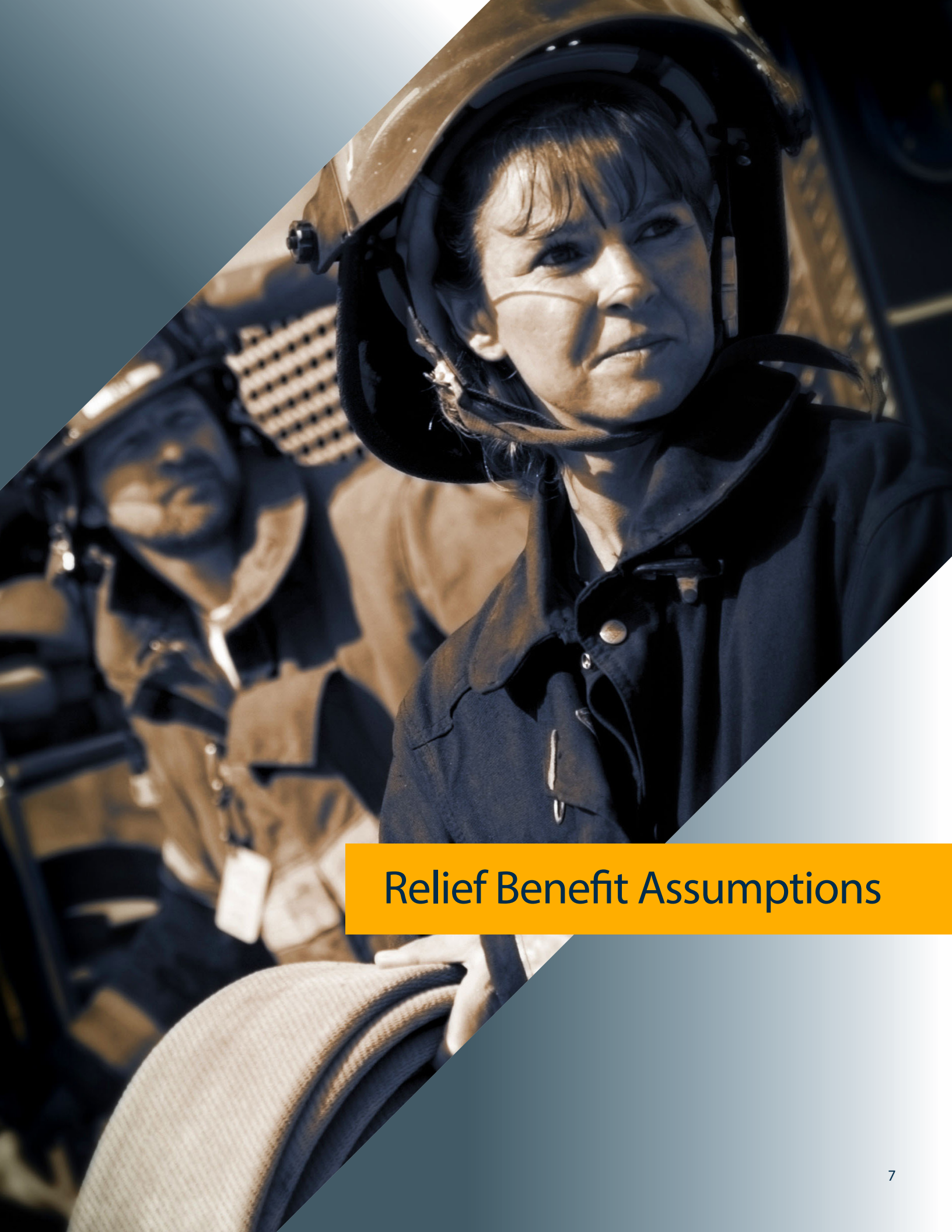
We continue to work with BVFF staff to collect data needed to set the assumptions we studied in this report. More detailed and reliable data improves our assumption setting process because we can analyze trends in the underlying data and more accurately project future liabilities.

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 extra advice and explanations as needed.

Sincerely,

Lisa Won, ASA, FCA, MAAA
Deputy State Actuary

Michael Harbour, ASA, MAAA
Actuary



Relief Benefit Assumptions

Medical Claims

What is the Medical Claims Assumption and How Do We Use it?

The Board for Volunteer Fire Fighters and Reserve Officers (BVFF) reimburses all duty-related medical charges including physician fees, hospital fees, screening physical exams, mileage for treatment, vocational rehabilitation, and prescriptions, as defined under *RCW 41.24.220* and *RCW 41.24.155*.

We apply an average annual medical claims assumption to all relief members. The purpose of the assumption is to capture the total annual medical claims cost for all active paid by the VFF trust fund members.

High-Level Takeaways

Over the last 12 years, the average annual cost per member has been volatile. Less frequent but more expensive [or more severe] claims help to explain the volatility.

One significant event occurred during the observed period of data. Significant events are unpredictable events and can lead to a sharp increase in costs for a given year. For this report, we define a significant event as an injury that results in at least $500,000 in medical claims.

On an annual basis, we observed lower medical claim amounts, per person, than expected in all years except 2009. As a result, we reduced the medical claims assumption to move in the direction of the plan experience.

Data, Assumptions, and Methodology

BVFF provided our office with 12 years of medical claims data (2005-2016), with the costs allocated to the incident year. The data included total annual costs as well as costs broken out by age cohort and by type of injury. We used this data with relief headcounts from our valuation data to determine the average annual cost per person.

The following table provides the annual data as well as summarized data, averaged over three time periods that include the most recent experience.

Annual Medical Claims Summary			
Before Inflation Adjustment			
Year	Total Claims	Number of Relief Members	Average Cost
2005	$931,485	14,185	$66
2006	568,979	15,591	36
2007	1,113,131	14,066	79
2008	1,277,148	13,393	95
2009	1,824,860	13,418	136
2010	1,225,604	13,327	92
2011	1,163,659	12,982	90
2012	1,023,475	12,631	81
2013	781,639	12,290	64
2014	987,414	12,151	81
2015	649,581	11,831	55
2016	$954,506	11,532	$83
Average			
12 year	$1,041,790	13,116	$80
6 year	$926,712	12,236	$76
3 year	$863,834	11,838	$73

Results

We began by analyzing actual plan experience against the current assumption. We compared the observed (or actual) medical claims to what we assumed (or expected) to occur. The following table shows the year-by-year Actual and Expected costs. In general, the current assumption was high from 2009 through 2016, where we observed a 77 percent Actual to Expected (Actual/Expected) ratio. The table only goes back to 2009 since this was the first year we developed the assumption for medical claims.

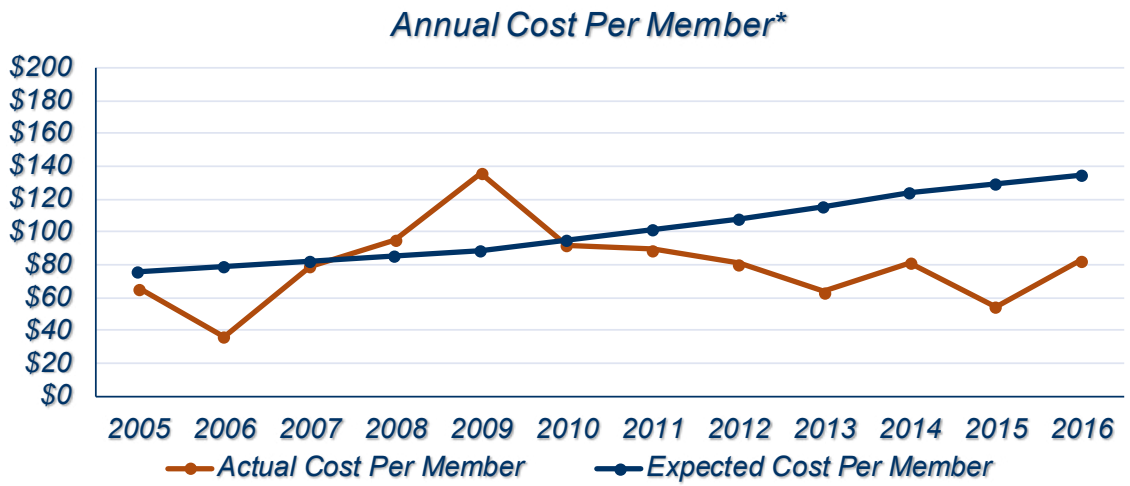
Medical Claims Cost Compared to Current Assumption								
	2009	2010	2011	2012	2013	2014	2015	2016
Actual	$1,824,860	$1,225,604	$1,163,659	$1,023,475	$781,639	$987,414	$649,581	$954,506
Expected	$1,194,477	$1,269,423	$1,323,125	$1,368,443	$1,424,657	$1,507,210	$1,533,534	$1,550,131
Actual/Expected	153%	97%	88%	75%	55%	66%	42%	62%
						Total Actual/Expected Ratio		77%

Based on our Actual/Expected analysis, the current assumption has been high over the observed time period. We looked at historical costs to determine why our current assumption was high.

The number of relief members can influence the total annual cost. We observed a decrease in the number of relief members, which helps to explain a decrease in total cost. We wanted our medical claims assumption to be independent of the number of relief members, so our analysis

focuses on the cost per member.

We observed that the medical claim cost, per person, has been volatile on an annual basis. The following graph summarizes both the actual cost and expected cost, per relief member, during the observed time period.



**Before Inflation adjustment.*

Note: Relief assumptions for medical claims were first developed in 2009. For display purposes only, the 2009 medical claim assumption was reduced by 4% annually to estimate costs in years 2005 through 2008.

We looked at the expenses for each type of claim to help explain the volatility in average cost. Sprains and strains are high frequency, low severity claims that account for approximately 45 percent of medical claims. We observed the claims from sprains and strains were reasonably predictable annually. Fractures, chest pain, motor vehicle accidents, and "other" are low frequency, high severity claims that account for approximately 35 percent of medical claims. We also define a low frequency, high severity claim as a "significant event" if the injury results in at least $500,000 in medical claims. In 2009, we observed a significant event, which helps to explain the high cost per member for that year. Without the significant event, the cost per member would have been approximately $60.

We also considered the impact of inflation on historical experience since we expect a medical service performed in 2010 to be less expensive than the same medical service performed in a year following 2010. For our analysis, we adjusted the observed medical claims for historical medical inflation.[1] We calculated the observed medical claims in "2017 dollars". As an example, the medical claims in 2010 would have seven years of medical inflation added. We believe adjusting historical medical claims for inflation provides a reasonable comparison of year-to-year costs.

[1] *Historical medical inflation relies on the Bureau of Labor Statistics Medical Care Services trend (U.S. city average). The average inflation over the observed time period was approximately 4 percent.*

The following table summarizes the estimated annual medical claims costs in 2017 dollars that we used to develop our assumption.

Annual Medical Claims Summary			
After Inflation Adjustment			
Year	Total Claims*	Number of Relief Members	Average Cost
2005	$1,421,107	14,185	$100
2006	833,936	15,591	53
2007	1,547,682	14,066	110
2008	1,701,236	13,393	127
2009	2,352,580	13,418	175
2010	1,522,407	13,327	114
2011	1,400,571	12,982	108
2012	1,183,095	12,631	94
2013	875,299	12,290	71
2014	1,080,783	12,151	89
2015	694,281	11,831	59
2016	$978,759	11,532	$85
Average			
12 year	$1,299,311	13,116	$99
6 year	$1,035,465	12,236	$84
3 year	$917,941	11,838	$78

**Adjusted for historic medical inflation.*

The average cost per member was $99 during the observed time period. However, to account for the frequency of significant events and volatility of annual costs, we set the new medical claims assumption at $115. The reduction in this assumption from the current level moves closer towards historical experience. Additionally, we will continue to assume medical claims increase annually by a forward-looking medical inflation assumption.[2] Following the 2017 VAVR, the medical claim assumption will grow annually with assumed medical inflation.

The following table summarizes the change in the medical claims assumption.

Medical Claims		
	Current	New
Per Member*	$139.39	$115.00
Inflation**	Increase with Medical Inflation	Increase with Medical Inflation

**As of 2017 VAVR. Applies to all ages.*

***Consistent with the medical inflation assumption used in the 2017 Other Post-Employment Benefits (OPEB) Actuarial Valuation Report.*

[2] *Uniform Medical Plan (UMP) Non-Medicare rates without excise tax.*

The following table summarizes the expected medical claim costs as well as the change in Actual/ Expected ratios under the new assumption. For the displayed table, we projected the new cost per person ($115) backward from 2017 using the observed historical medical inflation during our 2005-2016 study period of 4 percent.

Medical Claims Cost Compared to New Assumption								
	2009	2010	2011	2012	2013	2014	2015	2016
Actual	$1,824,860	$1,225,604	$1,163,659	$1,023,475	$781,639	$987,414	$649,581	$954,506
Expected	$1,127,506	$1,164,654	$1,179,884	$1,193,903	$1,208,138	$1,242,252	$1,257,919	$1,275,173
Actual/Expected	162%	105%	99%	86%	65%	79%	52%	75%
						Total Actual/Expected Ratio		**89%**

Additional Considerations

Since medical claims constitute the largest percent of relief liabilities, we considered the impact of using additional analysis and other methodologies.

Additional Analysis

1. **Load on Recent Data:** BVFF allocates medical claims data to incident year so we believe the more recent years are still incurring claims. We considered the impact of increasing the total medical claims for 2015 and 2016 by 25 percent. The inflation-adjusted average cost per member would increase from $99 to $102. We don't believe this is a material change in average cost per member so a load on more recent data was not applied. We would also consider a load if a significant event was incurred but not yet paid; however, we are not aware of any such qualifying significant events.
2. **Longer Study Period:** We considered including data back to 1997, which increases the average inflation-adjusted cost per member from $99 to $104. We do not believe the additional years of data materially influences the assumption we selected. Additionally, the actuarial audit of our prior experience study recommended we use a shorter time period to set this assumption.
3. **Impact of Additional Significant Events**: From 1997-2016 we observed three events that we would consider significant events. These events occurred in 1999 (approximately $900,000 fracture claim), 2000 (approximately $800,000 chest pain claim), and 2009 (approximately $1,000,000 "other" category claim). Based on a 20-year history, we observed one significant event every seven years but only one significant event was included in our 12-year study period. For this reason, we considered the increase in cost per person if two significant events occurred between 2005 and 2016. If an additional significant event occurred then we would have observed the inflation-adjusted cost per member increase from $99 to $108. This analysis confirms that the new medical claims assumption provides enough margin for adverse deviation if another significant event occurs in the near-term.

Other Methodologies Considered

1. **Make Assumptions for Significant Events:** We considered a methodology change in how we approach the significant events. We removed them from our annual costs and added assumed occurrences of significant events back in at the end. The reasoning is that these costs may not have the same level of inflation as other medical claims. For purposes of this analysis, we assumed no inflation on significant events.

   The purpose of testing this methodology would be to observe the cost impact of more consistent significant events. Under this approach, we assumed a significant event would occur every seven years and that each event would cost $1,000,000. Using this approach, we estimated the cost per member would increase from $99 to $110. We do not feel the increased complexity of this model added significant value or necessarily improved the accuracy of our assumption setting process. The new assumption may not provide enough margin for multiple significant events in a short period of time, however we anticipate the new assumption is reasonable over the long-term.

2. **Age-Based Table:** An age-based medical claims assumption could also be reasonable for VFF. We observed younger members had more duty-related medical claims, but the average cost of those claims was lower. Older members, on the other hand, tended to have fewer duty-related claims, but the average cost of those claims was higher. We evaluated the liability impact of implementing an age-based assumption. We determined this approach did not have a material impact, so we elected to use a flat cost assumption for simplicity.

Member Physicals

What is the Member Physicals Assumption and How Do We Use it?

A new volunteer (or a volunteer that withdrew and returned after six months) receives a reimbursement for a physical exam, up to $100, as defined under *RCW 41.24.110*.

We apply an average annual member physicals assumption to all relief members. The purpose of the assumption is to capture the total annual cost of reimbursed physicals paid by the VFF trust fund.

High-Level Takeaways

Over the last nine years, the average annual cost for each exam has increased and is approaching the maximum amount of reimbursement under current law. However, the average cost of reimbursed exams per active relief member has remained consistent. In other words, we observed an increase in the cost per reimbursed exam, but the number of exams decreased which helped to offset the rising cost per member.

The current assumption for member physicals closely matched the historical experience. As a result, the change in member physicals assumptions for this experience study is small.

Prior to this experience study, we assumed a forward-looking inflation component for our member physical assumption. We removed the forward-looking inflation component because the actual cost per exam generally exceeds the $100 maximum reimbursement from the plan. In other words, we don't anticipate actual costs will increase in the future since they are generally hitting the current limit. However, if BVFF shows a pattern of increasing the maximum reimbursement amount of the member physicals, then we will consider reinstating an inflationary component.

Data, Assumptions, and Methodology

BVFF provided our office with nine years of data (2008-2016) on the number of exams as well as annual costs of reimbursed member physicals. We used the data with relief headcounts from our valuation data to determine the average annual cost per member. The following table provides the annual data as well as summarized data, averaged over three time periods including the most recent experience.

Annual Member Physicals Summary					
Fiscal Year	Number of Exams	Cost	Average Cost per Exam	Number of Relief Members	Average Cost per Member
2008	1,466	$125,765	$86	13,393	$9
2009	1,246	114,624	92	13,418	9
2010	1,509	138,057	91	13,327	10
2011	1,218	114,732	94	12,982	9
2012	1,211	103,285	85	12,631	8
2013	1,310	124,541	95	12,290	10
2014	1,142	108,278	95	12,151	9
2015	1,030	99,714	97	11,831	8
2016	1,238	$116,583	$94	11,532	$10
Average					
9 year	1,263	$116,175	$92	12,617	$9
5 year	1,186	$110,480	$93	12,087	$9
3 year	1,137	$108,192	$95	11,838	$9

We asked BVFF to begin collecting data on the total cost per physical exam, not just the amount reimbursed. This data would put our office in a better position to set assumptions if the maximum reimbursement amount increased. The data would also allow us to begin looking at what level of inflationary trends exist in physical exam costs.

Results

We began by analyzing actual plan experience against the current assumption. We compared the observed (or actual) cost of reimbursed exams to what we assumed (or expected) to occur. The following table shows the year-by-year Actual and Expected costs. The current assumption was both below and above the actual costs from 2009 through 2016. Overall, we observed a 94 percent Actual/Expected ratio during this time period. The table only goes back to 2009 since this was the first year we developed the assumption for member physicals.

Member Physicals Cost Compared to Current Assumption								
	2009	2010	2011	2012	2013	2014	2015	2016
Actual	$114,624	$138,057	$114,732	$103,285	$124,541	$108,278	$99,714	$116,583
Expected	$116,468	$119,810	$120,733	$121,637	$122,531	$124,426	$124,462	$124,661
Actual/Expected	98%	115%	95%	85%	102%	87%	80%	94%
						Total Actual/Expected Ratio		94%

We believe the current assumption remains reasonable for valuing the reimbursement of physical exam costs; however, we rounded the new assumption to the nearest dollar. In addition, we removed the assumption for inflation because the recent data shows the average reimbursement amount is near the maximum of $100. The following table summarizes the change in assumptions related to reimbursement of member physicals.

Member Physicals		
	Current	New
Per Member*	$11.11	$11.00
Inflation**	2.50%	No Increase

**As of 2017 VAVR. Applies to all ages.*
***Consistent with the assumed U.S. CPI National inflation for 2017 VAVR.*

Additional Considerations

The liability associated with the reimbursement for member physicals is a unique medical payment because these expenses generally occur at the beginning of a member's career, are a one-time expense, and in most cases are certain to occur. However, for the purpose of the valuation, we spread the costs of all unfunded benefits over the future working life of all current active members. To test the reasonability of our current assumption, we calculated the average physical reimbursement cost of a new entrant, payable over the new entrant's expected future service. Based on the *June 30, 2016, VFF Actuarial Valuation (VAVR)*, we calculated the normal cost under the Entry Age Normal Actuarial Cost Method to be $10.74, which compares very well to the 2016 VAVR assumption of $10.81.

Temporary Disability

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

BVFF pays temporary disability benefits to members who become physically or mentally disabled, injured, or sick as a result of job-related duties, as defined under *RCW 41.24.150*.

We apply an average annual temporary disability assumption to all relief members. The purpose of the assumption is to capture the total annual cost of temporary disability for all active VFF members paid by the VFF trust fund.

High-Level Takeaways

Over the last 14 years, the average annual cost per member has generally declined.

On an annual basis, we observed lower temporary disability payments than we expected. As a result, we reduced the assumption to move in the direction of plan experience.

Data, Assumptions, and Methodology

For this experience study, BVFF provided our office with nine years of temporary disability data (2008-2016). We supplemented this with data from our prior experience study. We used the data with relief headcounts to determine the average annual cost per person. The following table provides the annual data as well as summarized data, averaged over three time periods including the most recent experience.

Annual Temporary Disability Costs*			
Before Inflation Adjustment			
Fiscal Year	Cost	Number of Relief Members	Average Cost per Member
2002	$162,481	15,769	$10
2003	179,059	15,431	12
2005	150,634	14,185	11
2006	139,983	15,591	9
2007	81,161	14,066	6
2008	139,131	13,393	10
2009	138,783	13,418	10
2010	94,989	13,327	7
2011	140,470	12,982	11
2012	92,412	12,631	7
2013	82,723	12,290	7
2014	60,587	12,151	5
2015	71,827	11,831	6
2016	$82,432	11,532	$7
Average			
14 year	$115,477	13,471	$9
5 year	$77,996	12,087	$6
3 year	$71,615	11,838	$6

**No data was provided for 2004.*

We were unable to analyze this assumption based on age of temporary disability because age-based data was not available. We have asked BVFF to begin collecting this information for future studies.

Results

We began by analyzing actual plan experience against the current assumption. We compared the observed (or actual) temporary disability costs to what we assumed (or expected) to occur. The following table shows the year-by-year Actual and Expected costs. The current assumption was consistently above the actual costs from 2009 through 2016, with an average 57 percent Actual/Expected ratio. The table only goes back to 2009 since this was the first year we developed the assumption for temporary disability benefits.

Temporary Disability Cost Compared to Current Assumption

	2009	2010	2011	2012	2013	2014	2015	2016
Actual	$138,783	$94,989	$140,470	$92,412	$82,723	$60,587	$71,827	$82,432
Expected	$160,211	$164,722	$166,040	$167,234	$168,373	$171,086	$171,195	$171,481
Actual/Expected	87%	58%	85%	55%	49%	35%	42%	48%
							Total Actual/Expected Ratio	**57%**

The disability costs, before inflation adjustments, provide information on how much BVFF has historically paid in temporary disability payments; however, the per-person amount of the temporary disability benefits increases annually with inflation as required under law. In other words, the payment in 2010 would be lower than the payment in 2016.

For our analysis, we adjusted the observed costs for historical inflation[3] in order to calculate the costs in "2017 dollars". As an example, the cost in 2010 would have seven years of inflation added. We believe adjusting historical temporary disability costs for inflation provides a reasonable comparison of year-to-year costs.

The table to the right summarizes the estimated annual temporary disability costs, in 2017 dollars, that we used to develop our assumption.

Annual Temporary Disability Costs*

After Inflation Adjustment

Fiscal Year	Cost**	Number of Relief Members	Average Cost per Member
2002	$220,836	15,769	$14
2003	238,053	15,431	15
2005	188,540	14,185	13
2006	169,749	15,591	11
2007	95,684	14,066	7
2008	157,589	13,393	12
2009	158,261	13,418	12
2010	106,124	13,327	8
2011	151,549	12,982	12
2012	97,649	12,631	8
2013	86,231	12,290	7
2014	62,221	12,151	5
2015	74,071	11,831	6
2016	$84,184	11,532	$7
Average			
14 year	$135,053	13,471	$10
5 year	$80,871	12,087	$7
3 year	$73,492	11,838	$6

**No historical data was provided for 2004.*

***Adjusted for inflation.*

[3] *Historical inflation relies on the Bureau of Labor Statistics Consumer Price Index trend (Urban Wage Earners & Clerical Works, U.S. city average). The average inflation over the observed time period was approximately 2 percent.*

We set the new temporary disability assumption at $10 per member. The new assumption is approximately the inflation-adjusted average annual cost per member over the observed 14-year period, although recent experience suggests a lower average cost. We will continue to monitor this assumption and make additional downward adjustments if experience continues to show a lower trend of costs.

Additionally, we assume this benefit will continue to increase annually with inflation. The following table summarizes the change in the temporary disability assumption.

Temporary Disability	Current	New
Per Member*	$15.27	$10.00
Inflation**	2.50%	2.50%

**As of 2017 VAVR. Applies to all ages.*
***Consistent with the assumed U.S. CPI National inflation for 2017 VAVR.*

The following table summarizes the expected temporary disability costs as well as the change in Actual/Expected ratio under the new assumption.

Temporary Disability Cost Compared to New Assumption	2009	2010	2011	2012	2013	2014	2015	2016
Actual	$138,783	$94,989	$140,470	$92,412	$82,723	$60,587	$71,827	$82,432
Expected	$108,002	$110,220	$110,319	$110,288	$110,262	$112,013	$112,062	$112,234
Actual/Expected	128%	86%	127%	84%	75%	54%	64%	73%
							Total Actual/Expected Ratio	**86%**

Additional Considerations

We considered the impact of the Great Recession on temporary disability payments; however, the data is not sufficient to make a determination on its impact. We also considered the impact to the system if a large-scale incident occurred that resulted in higher levels of temporary disability. We have not observed an incident like this in the data but we retained some conservatism in the new assumption to account for this possibility.

Duty-Related Disability

What is the Duty-Related Disability Assumption and How Do We Use it?

Rates of duty-related disability represent the probability that a member will receive a permanent duty-related disability benefit.

If a permanent duty-related disability occurs then BVFF will provide a monthly benefit to the member for their lifetime, as defined under *RCW 41.24.150.* Where applicable, the member's spouse and dependent children will also receive a benefit.[4]

High-Level Takeaways

Over the last 11 years, we observed fewer occurrences of permanent duty-related disability than expected. As a result, we reduced the assumption to move in the direction of plan experience.

We simplified the new assumption to a flat rate, for all ages, because we do not have enough credible data to make an age-based assumption. In addition, the limited data we received does not suggest higher rates of permanent duty-related disability for older members. For the prior experience study, we assumed that rates of duty-related disability increase with age.

Generally, we set disability assumptions using longer periods of data than what was available for this study. As an example, we used up to 18 years of disability data for the Washington State retirement systems during the *2007-12 Demographic Experience Study*. We will continue to collect data, monitor this assumption, and make adjustments accordingly.

Data, Assumptions, and Methodology

We have 11 years of data (2006-2016) for this experience study. We relied on annual valuation data from BVFF to perform our analysis. BVFF provides us with records of members receiving permanent disability benefits and the amount of the monthly benefit paid to each member. With this data, we were able to determine that 15 members have received benefits and two new permanent duty-related disabilities occurred over the study period.

The following table summarizes the age that the permanent duty-related disability occurred.

Age of Permanent Duty-Related Disability		
Age	Count	% of Total
< 30	1	7%
30 - 39	4	27%
40 - 49	4	27%
50 - 59	4	27%
60+	2	13%

[4] *The spouse of a permanent duty-related disabled member is eligible to receive a benefit for the member's lifetime; however, the benefit ceases upon divorce. Each dependent child is eligible to receive the benefit until age 18.*

Results

We began by analyzing actual plan experience against the current assumption. We compared the observed (or actual) number of new permanent duty-related disability recipients to what we assumed (or expected) to occur. The following table shows the year-by-year Actual and Expected number of new permanent duty-related disabilities. The current assumption was high from 2006 through 2016, where we observed a 12 percent Actual to Expected (Actual/Expected) ratio.

Number of New Permanent Duty-Related Disabilities Compared to Current Assumption

	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	Total
Actual	0	0	1	0	0	0	0	0	1	0	0	2
Expected	1.9	1.7	1.6	1.6	1.6	1.6	1.5	1.5	1.5	1.4	1.4	17.2
											Total Actual/Expected Ratio	**12%**

Based on our Actual/Expected analysis, the current assumption has consistently been high over the observed time period. On an annual basis, we expected approximately 1.5 new permanent duty-related disability recipients; however, we observed only about 0.2. We lowered the new assumption to assume approximately one new permanent duty-related disability every two years (or rather, 0.5 per year).

The following table summarizes the change in duty-related disability rates. We assume all disabilities are permanent duty-related disabilities and all other disabilities leave the system as a termination.

Probability of Duty-Related Disability

Age	Current*	New
19	0.000%	0.005%
20	0.008%	0.005%
40	0.012%	0.005%
79	0.020%	0.005%
80	0.000%	0.000%

**The rates are linearly interpolated between the ages.*

The following table summarizes the expected number of new permanent duty-related disabilities as well as the change in the Actual/Expected ratio under the new assumption.

Number of New Permanent Duty-Related Disabilities Compared to New Assumption

	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	Total
Actual	0	0	1	0	0	0	0	0	1	0	0	2
Expected	0.8	0.7	0.7	0.7	0.7	0.6	0.6	0.6	0.6	0.6	0.6	7.2
											Total Actual/Expected Ratio	**28%**

The Actual/Expected ratio improves from 12 percent to 28 percent under the new assumption. We did not move the assumption more because we have limited data and we're exercising caution since the benefits provided for a duty-related disability are approximately ten times larger than the average pension benefits earned under the plan. As such, any increase in the number of recipients of these benefits can have a large impact to the costs of the plan. The change we made, on an annual basis, lowers the expected number of new permanent duty-related disability recipients by 67 percent (from 1.5 to 0.5). We will continue to monitor this assumption and make additional downward adjustments if future experience shows a similar trend.

Additional Considerations

We considered an age-based duty-related disability assumption but we ultimately decided to simplify the assumption using a flat rate. An older member may be more likely to have a job-related injury than a younger member may but we do not have enough credible data to develop an age-based assumption.

We also considered the impact to the system if a large-scale incident occurred that resulted in multiple permanent duty-related disabilities. We have not observed an incident like this in the data but we retained some conservatism in the new assumption to account for this possibility.

Duty-Related Death

What is the Duty-Related Death Assumption and How Do We Use it?

The duty-related death assumption represents the likelihood that a VFF member dies while performing VFF duties.

If a duty-related death occurs then BVFF will provide a one-time lump sum of $214,000 (plus $2,000 funeral and burial expenses) to the member's survivor (or estate), as defined under *RCW 41.24.160* and *RCW 41.24.230*. Additionally, a surviving spouse and eligible dependent children would receive monthly benefits.[5]

High-Level Takeaways

Over the last seven years, we observed fewer occurrences of duty-related deaths than expected. As a result, we reduced this assumption to move in the direction of plan experience.

Generally, we set duty-related death assumptions using longer periods of data than used for this study. As an example, we used up to 23 years of mortality data for the Washington State retirement systems during the *2007-12 Demographic Experience Study*. We will continue to collect data and monitor this assumption. If future experience continues to be lower than the assumption, then we will move the assumption accordingly.

Data, Assumptions, and Methodology

We have seven years of data (2010-2016) to study for this assumption. We relied on annual valuation data from BVFF to perform our analysis. BVFF provides us with records of spouses receiving monthly duty-related death benefits and the amount of the monthly benefit paid to each spouse. We have not received data for members who die in a duty-related event but do not have a survivor. However, BVFF has confirmed that there have not been any recent duty-related deaths without survivors.

With this data, we were able to determine that 15 survivors have received benefits and one new duty-related death occurred over the study period.

[5] *The spouse of a member who has a duty-related death is eligible to receive a benefit for their lifetime; however, the benefit ceases upon remarriage. Each dependent child is eligible to receive a benefit until age 18.*

Results

We began by analyzing actual plan experience against the current assumption. We compared the observed (or actual) number of new duty-related deaths to what we assumed (or expected) to occur. The following table shows the year-by-year Actual and Expected numbers. The current assumption was high throughout the study period and we observed an overall 14 percent Actual to Expected (Actual/Expected) ratio.

Number of New Duty-Related Deaths Compared to Current Assumption								
	2010	2011	2012	2013	2014	2015	2016	Total
Actual	1*	0	0	0	0	0	0	1
Expected	1.1	1.1	1.1	1.0	1.0	1.0	1.0	7.2
						Total Actual/Expected Ratio		14%

**Reported in 2015 but occurred in 2010.*

On an annual basis, we expected approximately 1.0 new duty-related deaths; however, we observed only about 0.2. We set the new assumption at approximately one duty-related death every two years (or rather, 0.5 per year).

The following table summarizes the change in the duty-related death assumption.

Duty-Related Death Assumption	
Current	New
0.0083%	0.0050%

The duty-related death assumption represents the likelihood that a death occurs from a work-related event. The assumption is constant at all ages. For instance, we expect a 25 year old to have the same likelihood of a duty-related death as a 55 year old. Since mortality rates (duty and non-duty) increase as a member becomes older, duty-related deaths are a higher portion of total deaths in early ages and a lower portion of total deaths in later ages.

The following table summarizes the expected number of new duty-related deaths as well as the change in Actual/Expected ratio under the new assumption.

Number of New Duty-Related Deaths Compared to New Assumption								
	2010	2011	2012	2013	2014	2015	2016	Total
Actual	1*	0	0	0	0	0	0	1
Expected	0.7	0.6	0.6	0.6	0.6	0.6	0.6	4.3
						Total Actual/Expected Ratio		23%

**Reported in 2015 but occurred in 2010.*

The Actual/Expected ratio improves from 14 percent to 23 percent under the new assumption. We did not move the assumption more because we have limited data and we are exercising caution since the benefits provided for a duty-related death are approximately ten times larger than the average pension benefits earned under the plan. As such, any increase in the number

of recipients of these benefits can have a large impact to the costs of the plan. The change we made, on an annual basis, lowers the expected number of new duty-related deaths by 50 percent (from 1.0 to 0.5). We will continue to monitor this assumption and make additional downward adjustments if future experience shows a similar trend.

Additional Considerations

We considered an age-based assumption but ultimately decided to rely on a constant probability at all ages. Duty-related deaths are too infrequent to have credible data for developing an age-based assumption.

We compared the assumption developed for this experience study to our assumption for other Washington State retirement systems. As of the *2017 Actuarial Valuation Report*, we assumed duty-related deaths would occur at a rate of 0.0018 percent for the Public Employees' Retirement System (PERS) and 0.035 percent for the Law Enforcement Officers' and Fire Fighters' Retirement System (LEOFF). Given we set the assumption for this Relief Experience Study at 0.005 percent, this is consistent with our expectation that VFF duty-related deaths would be between PERS and LEOFF.

We considered the impact to the system if a large-scale incident occurred that resulted in multiple duty-related deaths. We have not observed an incident like this in the data but we retained some conservatism in the new assumption to reflect this possibility.

Percent Married

What is the Percent Married Assumption and How Do We Use it?

The percent married assumption models the likelihood that a VFF member has a spouse.

A member's spouse is eligible to receive relief benefits if the member dies or becomes permanently disabled because of a duty-related event.

High-Level Takeaways

BVFF does not collect data on this assumption so we relied on data from the United States Census Bureau. The current assumption relied on data from LEOFF. The new assumption is within 1 percent of the current assumption.

Data, Assumptions, and Methodology

BVFF does not collect data on marital status, so we relied on an outside source. The United States Census Bureau website summarizes 2016 marital status estimates for Washington State, by age and gender, as shown in the following table.

Washington Marriage Statistics*				
	Males		Females	
Age	Number	Percent Married	Number	Percent Married
15-19 years	229,187	0.7%	221,590	1.4%
20-34 years	806,838	28.6%	749,908	38.7%
35-44 years	475,982	62.4%	468,052	65.9%
45-54 years	478,187	65.4%	473,040	63.9%
55-64 years	462,091	67.7%	485,587	62.0%
65+ years	491,452	71.6%	587,361	46.7%
Total	2,943,737		2,985,538	

**Source: United States Census Bureau. Washington State Marital Status (2016 American Community Survey 1-Year Estimates).*

The prior experience study also did not have data to set this assumption, so we relied on an assumption we felt was representative of this plan. In LEOFF 2, we make an assumption on the likelihood of a duty-related death resulting in a survivor selecting an annuity. We feel the majority of the LEOFF 2 duty-related death survivors would select an annuity so the 64.2 percent seemed like a reasonable estimate on percent of members with a spouse.

Results

We expect 65 percent of members who have a duty-related death or permanent disability will have a spouse eligible for benefits under the plan. Our assumption focused on the Census Bureau data for ages 35 to 64 because our data showed the average age of duty-related disability and death is 41. We used data from the 2016 VAVR and new assumptions from this report.

The following table summarizes how the percent married assumption changed.

Percent Married Assumption	
Current	New
64.2%	65%

Child-Related Assumptions

What are the Child-Related Assumptions and How Do We Use Them?

The child-related assumptions model the number and age of dependent children of VFF members.

Eligible dependent children can receive relief benefits if the member dies or becomes permanently disabled because of a duty-related event.

High-Level Takeaways

We have not observed any dependent children receiving relief benefits in our valuation data. As such, we decided to simplify our valuation model and remove the child-related assumptions. Instead of valuing specific child benefits, we will increase the underlying benefits for duty-related disability and death annuities by a factor. The factor (also known as a load) will account for the potential of future child benefits paid by the plan.

Data, Assumptions, and Methodology

We looked at the valuation data used in the **Duty-Related Disability** and **Duty-Related Death** sections and did not observe any occurrences of child payments.

Results

Given that the available data shows VFF has paid no benefits to dependent children, we decided to simplify our valuation model and use a load to value the liability for future potential dependent child benefits. Please see **Methodology (Load for Relief Annuities)** section of this report for additional detail.

The following table summarizes how our child-related assumptions changed.

Child-Related Assumptions		
Number of Dependent Children		
	Current	**New**
Number	0.61	N/A
Age of Dependent Children		
	Current	**New**
Age	8	N/A

We will continue to monitor the load assumptions and consider updating the methodology if data on dependent children becomes available for the next experience study.

Spouse-Related Assumptions

What are the Spouse-Related Assumptions and How Do We Use Them?

The spouse-related assumptions model the duration that we expect a spouse to receive relief benefits from the plan.

A spouse is eligible to receive relief benefits if the member dies or becomes permanently disabled because of a duty-related event. Relief benefits to the spouse cease when the spouse dies, when the permanently disabled member dies, when the spouse divorces the member, or when the spouse remarries.

High-Level Takeaways

BVFF has not observed any remarriage among line of duty death survivors.

Data, Assumptions, and Methodology

There was limited BVFF data available to set an assumption.

Results

We made no change to the current assumptions due to limited data.

If we set an assumption for divorce or remarriage, it would lower the relief benefit liabilities but we expect the impact would be immaterial.

The following table summarizes the spouse-related assumptions.

Spouse-Related Assumptions	
Duty-Related Disability	
	Current/New
Duration	Member's lifetime
Marital Status	No assumed divorce
Duty-Related Death	
	Current/New
Duration	Spouse's lifetime
Marital Status	No assumed remarriage

Methodology

Load for Relief Annuities

We eliminated specific assumptions for modeling child benefits in our valuation software. Instead, we increase the underlying benefits for duty-related disability and death annuities by a factor.[6] We set the factor (also known as a load) to account for expected costs of child benefits that may become payable from the plan in the future.

The load assumptions are summarized in the following table.

Load Assumption	
	Load
Duty-Related Disability	5%
Duty-Related Death	10%

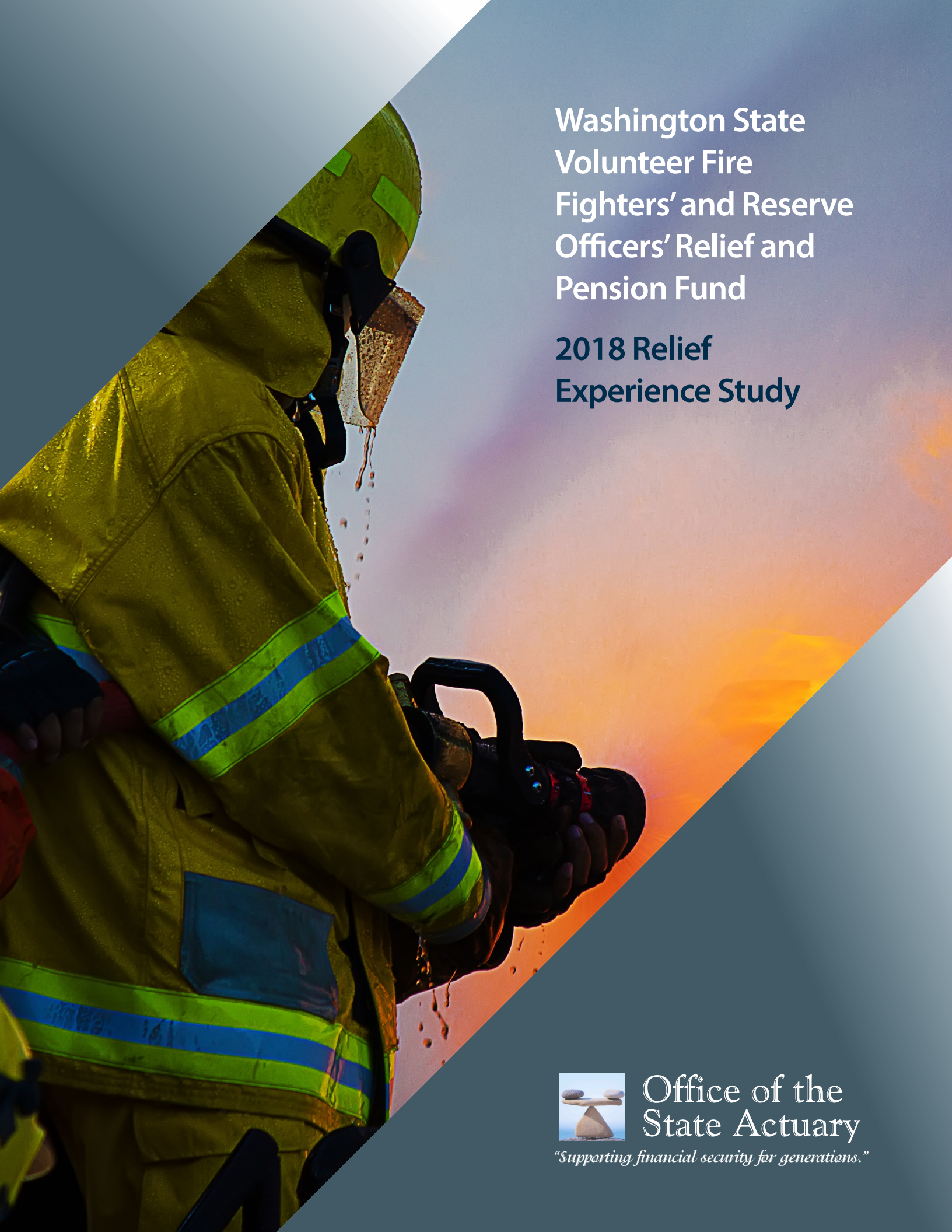
The load assumption replaces prior programming that independently calculated the benefits payable to eligible children. The purpose of the load is to add modeling simplicity while maintaining a reasonable estimate of the liability.

Medical Benefits Methodology

Beginning with the 2017 VAVR, we will program the three medical assumptions (medical claims, member physicals, and temporary disability) with payment timing consistent with other benefits in our valuation software.

Previously, we programmed these medical assumptions using an approximation since prior versions of our valuation software had limited options for valuing this type of liability (a benefit paid to active members during their volunteer career; i.e. pre-retirement). A recent update to the valuation software we use provides an "in-service" contingency that models medical benefits paid while members are actively volunteering.

[6] *For duty-related disability, a load is applied to the disabled member's annuity benefit. For duty-related death, a load is applied to the surviving spouse's annuity benefit.*



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