



New York City Retirement Systems Part I Experience Study Report - TRS and BERS

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Ms. Krista Olson
Deputy Comptroller for Budget
New York City Comptroller's Office
1 Centre Street, 8th Floor
New York, NY 10007

Re: Part I Experience Study Report – TRS and BERS

Dear Ms. Olson:

We are pleased to present the enclosed report, along with the Milliman Experience Study Tool, of our observations of the Part I Experience Study for the five New York City Retirement Systems (“NYCRS”):

- New York City Employees’ Retirement System (“NYCERS”)
- **Teachers’ Retirement System of the City of New York (“TRS”)**
- **Board of Education Retirement System of the City of New York (“BERS”)**
- New York City Police Pension Fund (“POLICE”)
- New York City Fire Pension Fund (“FIRE”)

This report includes Sections II and III for TRS and BERS.

The purpose of the Part I Experience Study report is to provide high-level observations of the demographic assumptions used in the actuarial valuations performed by the Office of the Actuary (OA) for these systems compared to the experience. The experience includes data from 2012 – 2017 used in prior experience studies, along with updates for the 4-year period ending June 30, 2021.

Part II Experience Study report will incorporate recommendations for changes to the actuarial assumptions reviewed.

This report incorporates analysis performed with the Milliman Experience Study Tool (MEST). MEST enables examination of the experience of the systems using many data elements such as age, service, plan, employee group, etc. The observations included in this report are based on the charts produced by the MEST.

Part I Experience Study Report – TRS and BERS
New York City Retirement Systems

This work product was prepared solely for New York City Comptroller’s Office for the purposes described herein and may not be appropriate to use for other purposes. Milliman does not intend to benefit and assumes no duty or liability to other parties who receive this work.

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In preparing this report, we relied, without audit, on information (some oral and some in writing) supplied by staffs of Office of the Comptroller and the OA. This information includes, but is not limited to, statutory provisions, employee data, administrative policies, and financial information. Since the results are dependent on the integrity of the data supplied, the results can be expected to differ if the underlying data is incomplete or missing. It should be noted that if any data or other information is inaccurate or incomplete, our calculations may need to be revised.

Milliman's work product was prepared exclusively for the New York City Office of the Comptroller, for a specific and limited purpose. It is a complex, technical analysis that requires a high-level of knowledge concerning NYCRS' operations, and is based on NYCRS' data, which Milliman has not audited. Milliman's work product is not intended to be used by, or for the benefit of, any third party for any purpose. Any third party recipient of Milliman's work product who desires professional guidance should not rely upon Milliman's work product, but should engage qualified professionals for advice appropriate to its specific needs.

On the basis of the foregoing, we hereby certify that, to the best of our knowledge and belief, this report is complete and accurate and has been prepared in accordance with generally recognized and accepted actuarial principles and practices which are consistent with the Actuarial Standards of Practice promulgated by the Actuarial Standards Board and the applicable Code of Professional Conduct, amplifying Opinions, and supporting Recommendations of the American Academy of Actuaries.

We are members of the American Academy of Actuaries and meet the Qualification Standards of the American Academy of Actuaries to render the actuarial opinion contained herein.

The consultants who worked on this assignment are actuaries. Milliman's advice is not intended to be a substitute for qualified legal or accounting counsel. The signing actuaries are independent of NYCRS. We are not aware of any relationship that would impair the objectivity of our work.

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We would like to thank the staffs of the Office of the Comptroller and the Office of the Actuary (OA) for their cooperation. Their prompt and courteous responses to our questions and requests for information were of valuable assistance to us and are greatly appreciated.

Respectfully submitted,



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Executive Summary

This report summarizes the Part I Experience Study performed by Milliman of the five New York City Retirement Systems (“NYCRS”):

- Section I - New York City Employees’ Retirement System (NYCERS)
- **Section II - Teachers’ Retirement System of the City of New York (TRS)**
- **Section III - Board of Education Retirement System of the City of New York (BERS)**
- Section IV - New York City Police Pension Fund (POLICE)
- Section V - New York City Fire Pension Fund (FIRE)

This report includes Sections II and III for TRS and BERS.

The primary purposes of the Part I Experience Study Report are to provide high-level observations of the experience for the indicated systems:

- This report provides information on key preretirement demographic assumptions - withdrawal, retirement and disability – used in the actuarial valuations performed by the OA.
- This report provides information on the pre-retirement and postretirement mortality assumptions used in the actuarial valuations performed by the OA.

Part II Experience Study report will incorporate recommendations for changes to the actuarial assumptions reviewed.

The experience study includes information for the 10-year period ending June 30, 2021 as provided by the OA. This includes data from 2012 – 2017 contained in the historical database along with updates for the 4-year period ending June 30, 2021 completed by Milliman.

TRS

The following is a summary of our observations regarding the experience of TRS.

| Summary of TRS Observations | | |
|-----------------------------|--|---|
| Decrement | Observation | Potential Impact |
| Withdrawal | More withdrawals than expected at service less than 15 years or after 25 years. | Increasing withdrawal rates generally results in lower liabilities. |
| Retirement | Change in benefit formula at 20 years of service has a significant impact on rates of retirement. Fewer than expected if less than 20 years and greater than expected at 20 more years of service. Differences are most notable for ages 62 and older. | While increasing the number of members anticipated to receive the 2% formula benefit generally results in higher liabilities, but impact on accrued liabilities and normal cost may vary. |
| Ordinary Disability | Eligibility for retirement and change in benefit formula at 20 years of service has a significant impact on rates of disability; nearly none occurred for members with at least 20 years of service and 62 and older, but greater | Modifying rates of disability based on eligibility for retirement and benefit formula generally results in higher liabilities. |

| Summary of TRS Observations | | |
|------------------------------------|---|---|
| Decrement | Observation | Potential Impact |
| | than expected for those with less than 20 years. | |
| Accidental Disability | More accidental disability retirements than expected, especially at ages 55 and older. | Increasing accidental disability rates generally results in higher liabilities. |
| Ordinary Death | Slightly fewer deaths than expected but not enough data for experience to be considered fully credible. | Reductions in rates of mortality generally results in higher liabilities. |
| Post Retirement Mortality | | |
| Service Retirees | Actual number of deaths was generally within 3% of expectations. | Further review required to compare experience to the most recent published mortality tables but increases in rates of mortality generally results in lower liabilities. |
| Disabled Retirees | Actual number of deaths was greater than expected. | |
| Contingent Beneficiaries | Actual number of deaths was greater than expected, especially for male beneficiaries. | |

BERS

The following is a summary of our observations regarding the experience of BERS.

| Summary of BERS Observations | | |
|-------------------------------------|--|---|
| Decrement | Observation | Potential Impact |
| Withdrawal | Actual experience for males and females appeared to be more similar than the current assumption resulting in fewer than expected for males and greater than expected for females. Much higher rates of withdrawal occurred during 2013 and 2017. | Increasing withdrawal rates generally results in lower liabilities. |
| Retirement | Greater number of retirements than expected. Change in benefit formula at 20 years of service has a significant impact on rates of retirement as greater percentage of retirements occur after completing 20 years of service. Much higher rates of retirement in 2013. | Increasing rates of retirement, especially for members anticipated to receive the 2% formula benefit generally results in higher liabilities. |
| Ordinary Disability | Eligibility for retirement and change in benefit formula at 20 years of service has a significant impact on rates of disability; much fewer than expected for members with at least 20 years of service and 62 and older, but greater than expected for those with less than 20 years. | Modifying rates of disability based on eligibility for retirement and benefit formula generally results in higher liabilities. |
| Accidental Disability | More accidental disability retirements than expected. | Increasing accidental disability rates generally results in higher liabilities. |

| Summary of BERS Observations | | |
|-------------------------------------|--|--|
| Decrement | Observation | Potential Impact |
| Ordinary Death | More deaths than expected but not enough data for experience to be considered fully credible. | Increase in rates of mortality generally results in lower liabilities. |
| Post Retirement Mortality | | |
| Service Retirees | There were significant variations in the mortality experience over time. During 2013 – 2015, the number of deaths decreased significantly. This was followed by a large spike in 2019. | We don't know what generated these anomalous results and if the data is reliable. Further review required. |
| Disabled Retirees | | |
| Contingent Beneficiaries | Actual number of deaths was greater than expected. | |

Introduction

Part I Experience Study Introduction

Milliman’s focus for Part I of the experience study is to provide high-level observations of the experience during the 10-year study period July 1, 2011 – June 30, 2021. Our review splits this study period into three periods:

- Prior period: July 1, 2011 – June 30, 2017 (2012 – 2017), which includes updates made by Milliman to the historical data, primarily in 2017.
- Two-year period July 1, 2017 – June 30, 2019 (2018 – 2019)
- Two-year period July 1, 2019 – June 30, 2021 (2020 – 2021)

Throughout this report we refer to plan years by the end of the plan year. For example, 2012 refers to the period July 1, 2011 to June 30, 2012; 2021 refers to the period July 1, 2020 to June 30, 2021.

Our observations are based on analysis performed with the Milliman Experience Study Tool (MEST) which creates customized experience summaries for the chosen study periods. This report includes various graphs and charts produced by MEST.

This report focuses on key preretirement decrements – withdrawal, retirement and disability – and the mortality assumptions – pre-retirement and postretirement.

An Appendix (to be provided subsequently) describes the data processing in detail. The following sections briefly describe this process.

Selection of Actuarial Assumptions

The purpose of the actuarial valuation is to analyze the resources needed to meet the current and future obligations of the System. To provide the best estimate of the long-term funded status of the System, the actuarial valuation should be predicated on methods and assumptions that will estimate the future obligations of the System in a reasonable manner.

An actuarial valuation uses various methods and two different types of assumptions: economic and demographic. Economic assumptions are related to the general economy and its long-term impact on the System, or to the operation of the System itself. Demographic assumptions are based on the specific experience of the System’s members.

Actuarial Standard of Practice (ASOP) No. 35 governs the selection of demographic and other noneconomic assumptions for measuring pension obligations. ASOP 35 states that the actuary should use professional judgment to estimate possible future outcomes based on past experience and future expectations, and select assumptions based upon application of that professional judgment. The actuary should select reasonable demographic assumptions in light of the particular characteristics of the defined benefit plan that is the subject of the measurement. A reasonable assumption is one that is appropriate for the purpose of the measurement reflecting historical and current demographic data, that reflects the actuary’s professional judgment and estimate of future experience, and that contains no significant bias, i.e., it is not significantly optimistic or pessimistic.

Choosing actuarial assumptions requires the application of actuarial judgment. It is unlikely that any two actuaries, given the same set of experience statistics, would arrive at exactly the same

set of actuarial assumptions for any system as complex as NYCRS. Even allowing for minor variations that occur because of the variability of the underlying statistics and possible data anomalies, differences among actuarial approaches will occur in analyzing trends. Some actuaries prefer to match the results of recent experience very closely in setting future assumptions, while other actuaries will use recent experience as a guide but tend to change existing assumptions gradually over time. Valid arguments can be made for either approach.




Experience Analysis Process

The general procedure in a study of demographic experience is to first determine the number of participants who were exposed to the possibility of retirement, withdrawal, disability, etc. We refer to these events as decrements. The next step is to determine how many actually retired, withdrew, became disabled, etc. Dividing the number of terminations in each age and service cell by the number exposed to the possibility of termination in that cell produces the rate of decrement.

In reviewing the actual rates of decrement, we compare them to the current assumed rates used in the actuarial valuations. For this purpose, the assumed rates are those used in the most recent actuarial valuation report, the June 30, 2020 lag actuarial valuation. For example, the assumed rates of withdrawal that apply in 2016 in this analysis are based on the assumptions from the 2020 lag actuarial valuation, not the assumptions in effect in 2016.

To compare actual rates of decrement to assumed rates of decrement, we produce actual to expected ratios (“A/E” ratio). These ratios compare actual decrements (one set due to retirement, a different set due to withdrawal, a different set due to disability, etc.) with expected decrements based on the actuarial assumptions. An A/E ratio that is greater than one indicates that there were more actual decrements than expected and a ratio that is less than one indicates that there were fewer actual decrements than expected. For example, a ratio of 1.5 means that 50% more members left the plan for that cause than expected. A ratio of 0.8 means that 20% fewer members left the plan for that cause than expected.

To assist reviewers in assessing whether an assumption may need to be modified or not, we incorporated a color-coded metric to indicate how far the actual experience is from that expected:

- A green circle  indicates that the experience is within 10% of that assumed, that is, the A/E ratio is in the range 0.9 – 1.1.
- An orange triangle  indicates that the experience is within 50% of that assumed, but not within 10%, that is, the A/E ratio is in the range 0.5 – 0.9 or 1.1 to 1.5.
- A red diamond  indicates that the experience is outside 50% of what was assumed, that is, the A/E ratio is smaller than 0.5 or greater than 1.5.

Please note that the color-coded symbols are meant to assist the reader to determine how far the actual experience is from that expected. Many factors are used to determine if an assumption should be modified – reason for the deviation, credibility of the data, anticipation that experience in the future would be consistent with the prior experience, actuarial judgment, etc.

Historical Database Update

The OA provided separate historical databases with experience from 2001 to 2017 for each of the systems, the valuation files for the four-year period 2018 – 2021, detailed descriptions of the

various codes contained in the data, and year by year status reconciliations or flow of lives. Milliman reviewed and updated the historical database to ensure completeness and consistency. We verified that the member valuation data provided to us was consistent with the flow of lives and updated the historical database accordingly. The historical database was imported into the MEST and we reviewed to ensure that the number of exposures and actual decrements were captured reasonably. In our review, we noticed that the 2017 status distribution in the historical database did not match the flow of lives or was inconsistent with information contained in the 2018 data. We updated the 2017 status for consistency with the 2018 data.

While the Historical Database contains the status used in each actuarial valuation, there are situations in which this status may not indicate the actual cause of decrement. Two such situations relate to disability retirements and members on leave of absence.

Disability Retirements

There are instances in which members may have applied for disability retirement, but the application had not been approved by the time the data was provided for the annual actuarial valuation. In this situation, a member status could be classified as a termination, leave of absence, etc. in one valuation file but as a disability retirement in a subsequent valuation file. In these situations, we modified the status in the historical database to reflect the eventual approval of the disability retirement. For any record who was active during the study period (2011 or later) and had a subsequent inactive status followed by a disability retirement, the years with an inactive status code were changed to the indicated disability retirement status. These adjustments are applied after any adjustments for leave of absence noted in the following section.

Please note that approvals for disability retirement that took place after June 30, 2021 for members who are indicated as terminated in the experience data are not reflected in this analysis which, consequently, underestimates the number of disability retirements, especially in the latter years of the study.

Leave of Absence

During the study period, the OA used different terminology for identifying members on leave of absence such as active off payroll, nonvested terminated, etc. In the prior experience study, records with a status code of leave of absence had this status code modified to reflect a subsequent event as if that subsequent event occurred when the leave of absence (LOA) occurred. We applied similar adjustments to the status codes in the historical database. LOA status codes exist for years 2016 and 2017 where the prior actuary did not have sufficient information to make an adjustment as well as on the valuation data added for years 2018 – 2021. The following summarizes the adjustments made when a record has a LOA code (“C”):

- If the status code in the year before the LOA code is an “F”, the LOA code was changed to a termination code (“F”).
- If the record has three consecutive LOA codes, then all LOA codes are changed to a termination code (“F”).
- If the record has an active status within 2 years after the first LOA code, then the LOA codes are changed to a rehire status code (“B”).
- If the record has an inactive status within 2 years after the first LOA code, then the LOA codes are changed to that inactive status code.

Due to this methodology, records will retain a LOA status code if:

- It first occurred in 2020 and remained a LOA status code in 2021.
- It first occurred in 2021.

Consistent with past practice, any member with a LOA status code was not included as a decrement because some of these members subsequently returned to active status. Furthermore, all remaining LOA status codes in 2020 are counted as exposures for withdrawal purposes. Therefore, all else being equal, the overall rates of termination are smaller during the two-year period 2020 – 2021 than in other years. Due to this situation, these years are primarily excluded from the analysis. We do note that the vast majority of records with a LOA status code do terminate employment (withdrawal, retire, become disabled, etc.).

Exposures and Decrements

An exposure is a member who is subject to the particular contingency being studied. For example, an active member who has met the conditions for retirement is a retirement exposure. If they have not met that condition, then they are a withdrawal exposure. The following section describes the rules used to determine exposures and decrements in this analysis:

- Any record considered an active employee in the indicated actuarial valuation is considered an exposure for preretirement decrements. This includes status codes of “A” and “B”. For withdrawal purposes, records with a LOA status code of “C” are also included as exposures.
- Members indicated as terminations during the year who do not meet the conditions for retirement are reflected in the termination decrement.
- Members indicated as retirements during the year, or members indicated as terminations who do meet the conditions for retirement, are reflected in the retirement decrement.
- Exposures for ordinary disability exclude service periods prior to the eligibility conditions. For example, if 10 years of service is required to receive an ordinary disability benefit, the exposures exclude all members prior to 10 years of service.

Age and Service Calculations

Age was determined as age nearest on July 1 based on the date of birth and the indicated valuation year. Service is based on the service field contained in each year’s valuation data as imported into the Historical Database and rounded to the nearest integer.

Due to the rounding of ages and service calculations, it may appear that some members retire before they are eligible. In subsequent analyses, we will review to determine if any adjustments should be considered.

Milliman Experience Study Tool (MEST)

The purpose of the MEST is to analyze the experience by System using the status codes in the historical database. The MEST allows easy review of the experience by plan or other parameters for each System.

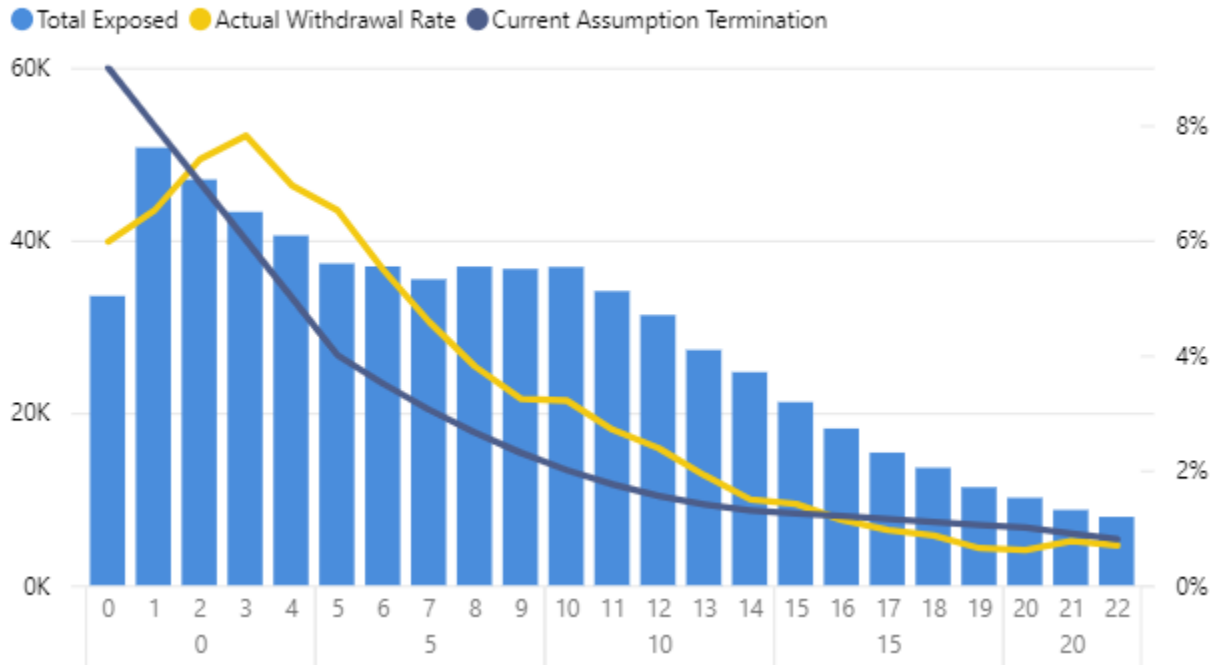
There are four primary charts in MEST for each decrement page. In addition, each of the four charts can be displayed on a service basis, age basis or year-by-year basis. A tool bar at the top of page allows the user to select how the information is displayed. A walkthrough of these charts in MEST has been described below using the withdrawal decrement tab as an example.

The following chart shows withdrawal decrements based on service. The chart includes the actual number of withdrawals, expected number, and the total number. An actual withdrawal rate is computed and compared to the assumption.

| Service | Actual Withdrawals | Expected Withdrawals | Total Exposed | Actual Withdrawal Rate | Current Assumption Termination | Ratio Act/Exp Term |
|--------------|--------------------|----------------------|----------------|------------------------|--------------------------------|--------------------|
| 0 | 2,003 | 3,017.7 | 33,530 | 5.97% | 9.00% | ▲ 0.66 |
| 1 | 3,302 | 4,058.2 | 50,727 | 6.51% | 8.00% | ▲ 0.81 |
| 2 | 3,482 | 3,291.5 | 47,021 | 7.41% | 7.00% | ● 1.06 |
| 3 | 3,382 | 2,596.4 | 43,273 | 7.82% | 6.00% | ▲ 1.30 |
| 4 | 2,818 | 2,026.3 | 40,525 | 6.95% | 5.00% | ▲ 1.39 |
| 5 | 2,431 | 1,491.4 | 37,286 | 6.52% | 4.00% | ◆ 1.63 |
| 6 | 2,026 | 1,293.4 | 36,954 | 5.48% | 3.50% | ◆ 1.57 |
| 7 | 1,623 | 1,081.7 | 35,466 | 4.58% | 3.05% | ◆ 1.50 |
| 8 | 1,404 | 978.7 | 36,931 | 3.80% | 2.65% | ▲ 1.43 |
| 9 | 1,189 | 843.2 | 36,663 | 3.24% | 2.30% | ▲ 1.41 |
| 10 | 1,184 | 737.7 | 36,886 | 3.21% | 2.00% | ◆ 1.60 |
| 11 | 921 | 596.5 | 34,088 | 2.70% | 1.75% | ◆ 1.54 |
| 12 | 746 | 485.3 | 31,310 | 2.38% | 1.55% | ◆ 1.54 |
| 13 | 521 | 381.9 | 27,279 | 1.91% | 1.40% | ▲ 1.36 |
| 14 | 368 | 321.2 | 24,704 | 1.49% | 1.30% | ▲ 1.15 |
| 15 | 300 | 265.4 | 21,229 | 1.41% | 1.25% | ▲ 1.13 |
| 16 | 206 | 218.0 | 18,166 | 1.13% | 1.20% | ● 0.94 |
| 17 | 147 | 176.8 | 15,377 | 0.96% | 1.15% | ▲ 0.83 |
| 18 | 118 | 149.8 | 13,618 | 0.87% | 1.10% | ▲ 0.79 |
| 19 | 73 | 119.2 | 11,357 | 0.64% | 1.05% | ▲ 0.61 |
| 20 | 62 | 101.4 | 10,137 | 0.61% | 1.00% | ▲ 0.61 |
| Total | 28,693 | 24,564.3 | 693,237 | 4.14% | 3.54% | ▲ 1.17 |

The following chart compares the actual withdrawal rate (yellow line) to the current assumption (blue line) by service (or by age or plan year depending on selection). The blue bars show the number of exposures allowing the user to identify situations where there are relatively few exposures for that bucket and that the data may not be fully credible.

Exposure Distribution w/ Withdrawal Rate - Actual and Expected; by Service



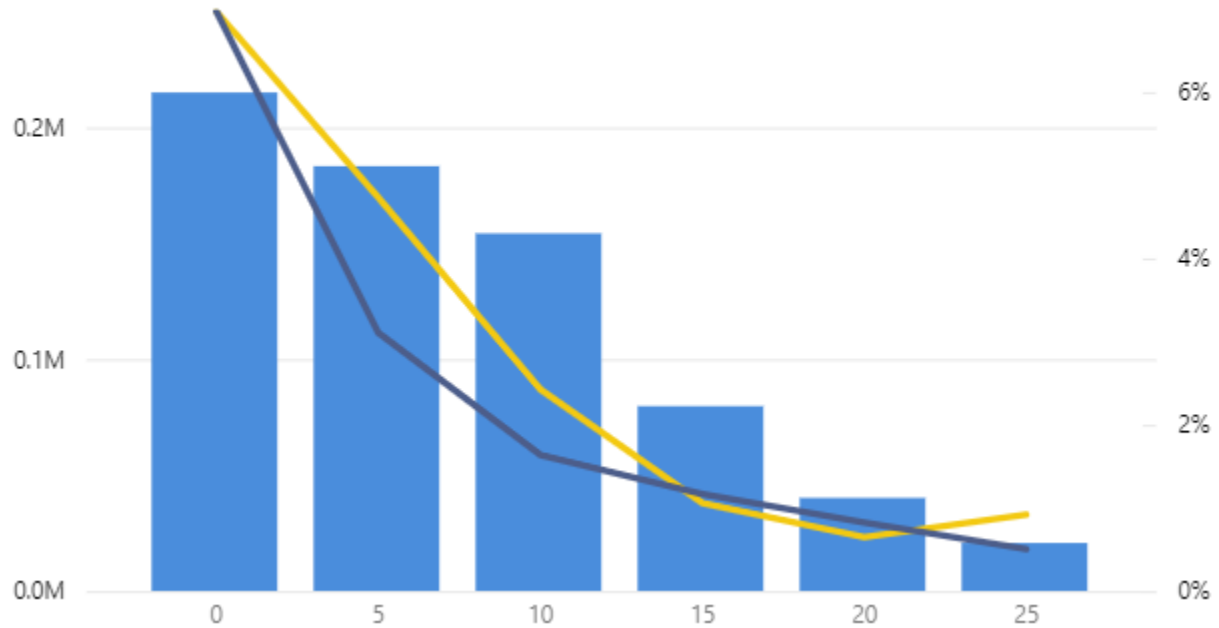
Also, this chart can be used to review the experience in 5-year service or age bins. In the chart above, the second row in the x-axis shows 0, 5, 10, etc. indicating the service bin from 0-4 years, 5-9 years, 10-14 years, etc.

The following chart shows the results based on service bins.

Exposure Distribution w/ Withdrawal Rate - Actual and Expected; by Service

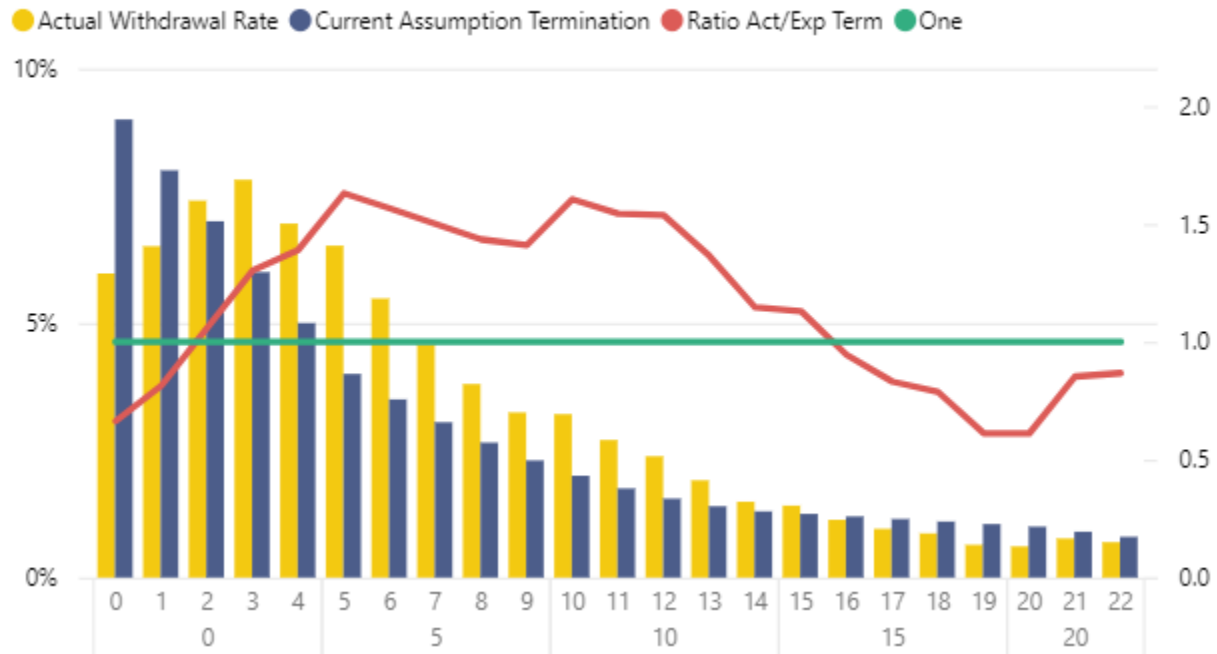


● Total Exposed ● Actual Withdrawal Rate ● Current Assumption Termination



In the next chart, the A/E ratio is graphed as the red line and compared to the green line which is the 1.0 baseline (meaning that the actual experience is equal to that assumed). This provides the user with a different viewpoint in comparing the results of the study. The actual withdrawal rate and the current assumption are shown on the graph in the yellow and blue bars, respectively.

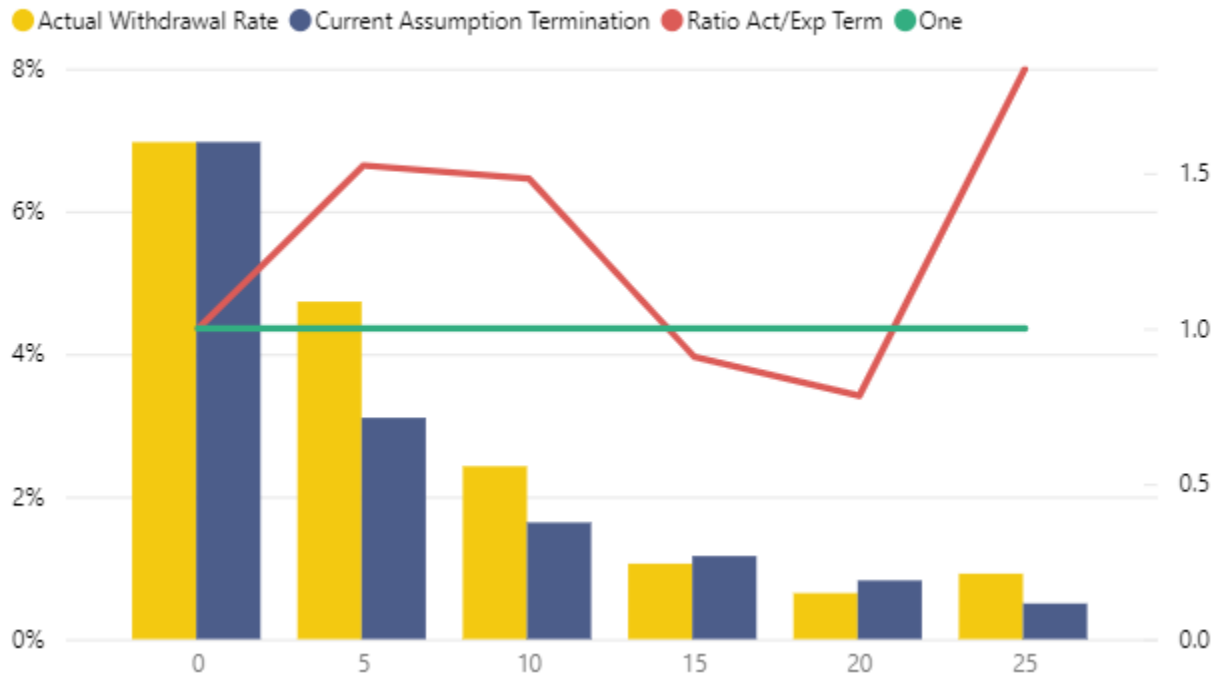
Withdrawal Rate - Actual, Expected, and Ratio; by Service



Also, this chart can be used to review the experience in 5-year service or age bins. In the chart above, the second row in the x-axis shows 0, 5, 10, etc. indicating the service bin from 0-4 years, 5-9 years, 10-14 years, etc.

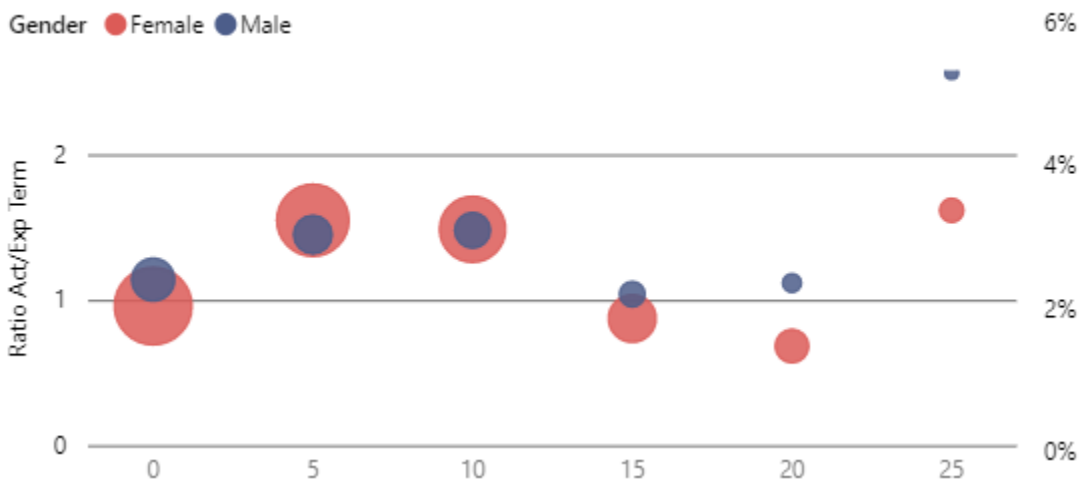
The following chart shows the results based on service bins.

Withdrawal Rate - Actual, Expected, and Ratio; by Service



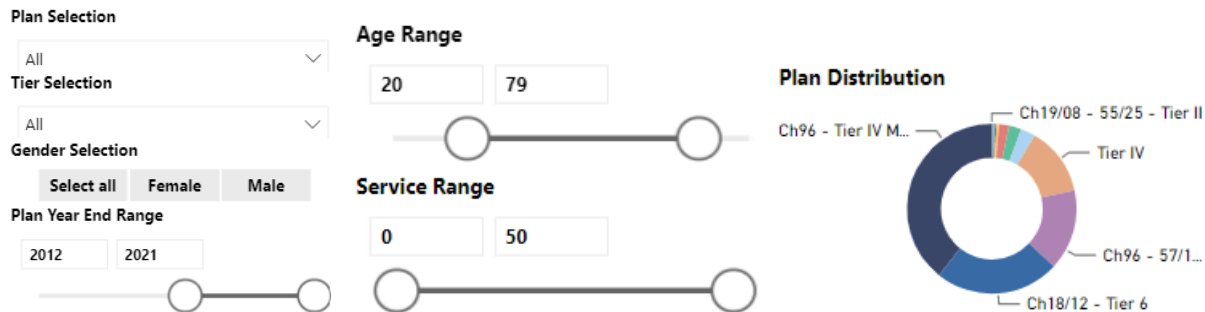
Finally, a bubble chart displaying the A/E ratios by gender is shown. The size of the bubble reflects the number of exposures.

Actual vs. Expected - Withdrawal Rate w/ Exposure Bubbles; by Service



In MEST, there are various items that the user can select. Once a selection is made, the charts update in real time and the totals are based on the selections.

- Plan selections – a drop-down box allows the user to select the available plan codes for that system (the options in the drop-down box depend on the selected system).
- Tier selections – a drop-down box allows the user to select the available tier codes for that system.
- Gender – male or female or both can be selected.
- Plan Year End Range – the user can select the specific years (years selected must be consecutive). Plan year 2021 contains the experience from July 1, 2020 to June 30, 2021.
- Age and Service Ranges – can be adjusted and combined with the different displays to delve deeper into the experience. For example, if a user wants to view the results by age for those who terminated with 10 or more years of service, the user can select the service range from 10 years to up to the maximum contained in the data and view results by age.
- Plan and Tier distributions provide the user with the number of exposures in each bucket (hover over the indicated cell). The user can select a specific plan or tier to see how those results differ from the totals, but we recommend using the drop-down boxes above.



Section II – Teachers’ Retirement System of the City of New York (TRS)

Exposures and Decrements

To set the exposures and actual decrements for TRS, the following table details the age and service conditions for unreduced retirement and reduced retirement. If a member has not met any of these conditions for the indicated plan code by year, the member is considered a withdrawal exposure. Otherwise, if the member did meet any of these conditions, they would be considered a retirement exposure. Members with a status code of termination who, nonetheless, have met the conditions for retirement, are included as actual retirements.

Using the age and service slider, a user can drill down to view the results that reflect a variety of conditions by plan code, such as reduced retirement, retirement at first eligibility, or other conditions for retirement.

TRS Retirement Eligibility Chart

| Plan Code | Plan Description | Mandated | Formula | Unreduced Retirement | | Unreduced Retirement | | Reduced Retirement | |
|-----------|---------------------------------|----------|------------|----------------------|-------------|----------------------|-----------|--------------------|---------|
| | | | Bump at 20 | Condition 1 | Condition 2 | Condition | Age | Service | |
| | | | YOS | Age 1 | Service 1 | Age 2 | Service 2 | Age | Service |
| A | CPP (Plan A) | TRUE | | 55 | 5 | | | | |
| B | ISF (Plan B) | TRUE | | 55 | 5 | | | | |
| C | Modified CPP (Plan C) | TRUE | | 62 | 25 | 55 | 30 | 55 | 5 |
| D | Modified ISF (Plan D) | TRUE | | 62 | 5 | | | 55 | 5 |
| F | Tier IV | TRUE | TRUE | 62 | 5 | 55 | 30 | 55 | 5 |
| G | Ch19/08 55/25 Plan [OPTIONAL] | FALSE | TRUE | 62 | 5 | 55 | 25 | 55 | 5 |
| H | Ch19/08 55/27 Plan [MANDATORY] | TRUE | TRUE | 62 | 5 | 55 | 27 | 55 | 5 |
| I | Ch504/09 55/27 Plan [MANDATORY] | TRUE | TRUE | 62 | 10 | 55 | 27 | 55 | 10 |
| J | CH18/12 (Tier 6) [MANDATORY] | TRUE | TRUE | 63 | 10 | | | 55 | 5 |
| O | Other | TRUE | TRUE | 62 | 5 | | | | |

Please note that exposures for Plan Codes A – D and O were excluded from the tool because there are very few of them, except when examining pre-retirement death.

For certain plans, such as the Tier 6 plans and the Ch 504/09 – 55/27 [Mandatory] plan, the vesting requirement was reduced from 10 years to 5 years due to the passage of Chapter 56, Laws of 2022. Since 10-year vesting was required during the study period, we have used 10 years in this report.

OA’s retirement assumptions depend on whether a member can choose a certain retirement plan. If a member had a choice and elected the improved plan, the assumed rates of retirement are higher than those in which the member was mandated into the specific retirement plan. Higher rates of retirement apply to the indicated plan when the Mandated column is set to False. All Tier 6 plans are considered Mandated plans.

We understand that for certain elected plans (plan codes G, H and I) the OA assumes immediate reduced retirement for members who have not met the stated condition for unreduced retirement but have met the condition for early retirement under the Tier IV basic plan (age 55 and completion 5 years of service). In these situations, OA applies the rates of termination at these age/service conditions and not reduced rates of retirement. Accordingly, we have coded these members as withdrawal exposures.

Due to the rounding of ages, there can be members with a recorded age at retirement of 54 but who actually retired when first attained age 55 (or age 56 when first attained age 57 in the age 57 plan). In this report, we have excluded their experience.

Withdrawal

The current withdrawal assumption varies by service.

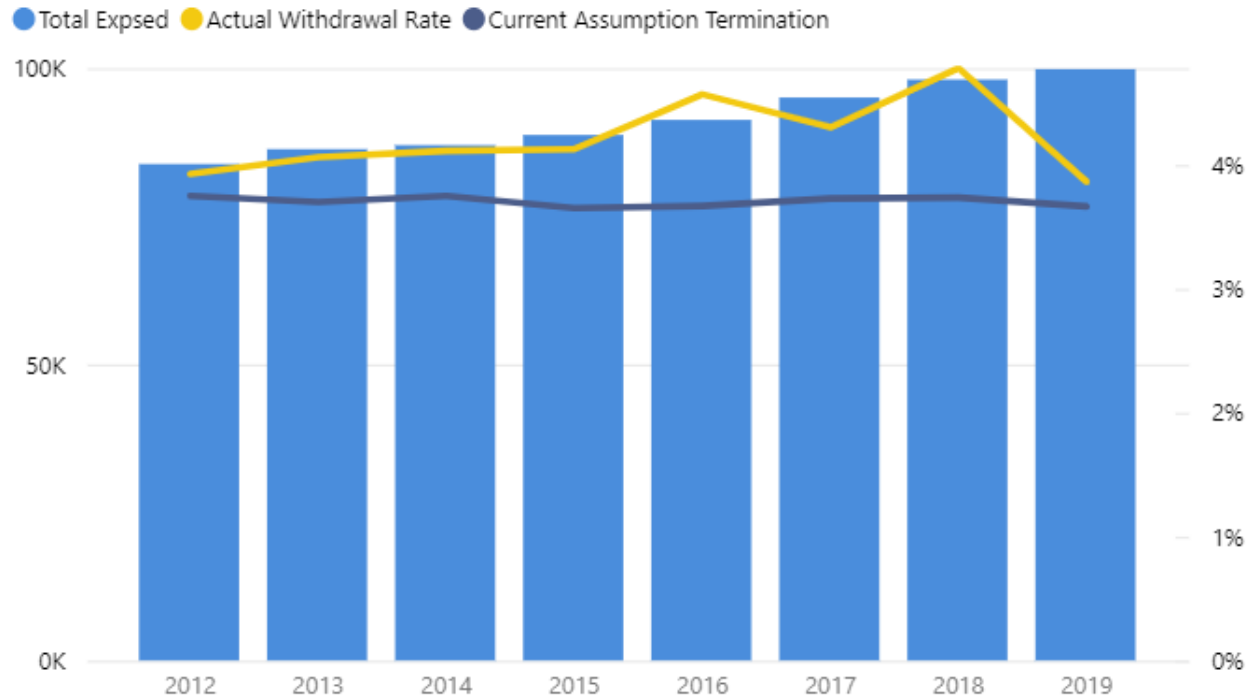
The following table shows the experience for withdrawal by year for the age range (20 to 79), and for the service range (0 to 40). Based on the current assumptions, the overall expected rate of withdrawal averaged 3.67%, whereas the actual rate was 3.78%.

| Plan Year | Actual Withdrawals | Expected Withdrawals | Total Exposed | Actual Withdrawal Rate | Current Assumption Termination | Ratio Act/Exp Term |
|--------------|--------------------|----------------------|----------------|------------------------|--------------------------------|--------------------|
| 2012 | 3,291 | 3,142.2 | 83,814 | 3.93% | 3.75% | 1.05 |
| 2013 | 3,508 | 3,194.5 | 86,322 | 4.06% | 3.70% | 1.10 |
| 2014 | 3,579 | 3,262.2 | 87,001 | 4.11% | 3.75% | 1.10 |
| 2015 | 3,662 | 3,239.4 | 88,717 | 4.13% | 3.65% | 1.13 |
| 2016 | 4,171 | 3,347.7 | 91,265 | 4.57% | 3.67% | 1.25 |
| 2017 | 4,090 | 3,544.2 | 95,040 | 4.30% | 3.73% | 1.15 |
| 2018 | 4,689 | 3,663.9 | 98,073 | 4.78% | 3.74% | 1.28 |
| 2019 | 3,857 | 3,659.0 | 99,835 | 3.86% | 3.67% | 1.05 |
| 2020 | 3,367 | 3,637.3 | 101,343 | 3.32% | 3.59% | 0.93 |
| 2021 | 1,055 | 3,615.8 | 102,868 | 1.03% | 3.51% | 0.29 |
| Total | 35,269 | 34,306.2 | 934,278 | 3.78% | 3.67% | 1.03 |

The rate of termination during 2020 and 2021 may be artificially low due to members with a LOA status code. A record with a LOA status code is included as an exposure and not a decrement. Note that from 2016 to 2020, between 12% and 20% of the records with a status code of LOA were changed to rehire. Hence, between 80% and 88% of the LOA records are eventually coded as withdrawal, retired, disabled or death. Excluding these two years, the actual rate of termination of 4.23% exceeded the assumed rate of 3.71% for an A/E ratio of 1.14 as shown in the following tables.

| Plan Year | Actual Withdrawals | Expected Withdrawals | Total Exposed | Actual Withdrawal Rate | Current Assumption Termination | Ratio Act/Exp Term |
|--------------|--------------------|----------------------|----------------|------------------------|--------------------------------|--------------------|
| 2012 | 3,291 | 3,142.2 | 83,814 | 3.93% | 3.75% | 1.05 |
| 2013 | 3,508 | 3,194.5 | 86,322 | 4.06% | 3.70% | 1.10 |
| 2014 | 3,579 | 3,262.2 | 87,001 | 4.11% | 3.75% | 1.10 |
| 2015 | 3,662 | 3,239.4 | 88,717 | 4.13% | 3.65% | 1.13 |
| 2016 | 4,171 | 3,347.7 | 91,265 | 4.57% | 3.67% | 1.25 |
| 2017 | 4,090 | 3,544.2 | 95,040 | 4.30% | 3.73% | 1.15 |
| 2018 | 4,689 | 3,663.9 | 98,073 | 4.78% | 3.74% | 1.28 |
| 2019 | 3,857 | 3,659.0 | 99,835 | 3.86% | 3.67% | 1.05 |
| Total | 30,847 | 27,053.1 | 730,067 | 4.23% | 3.71% | 1.14 |

Exposure Distribution w/ Withdrawal Rate - Actual and Expected; by Year



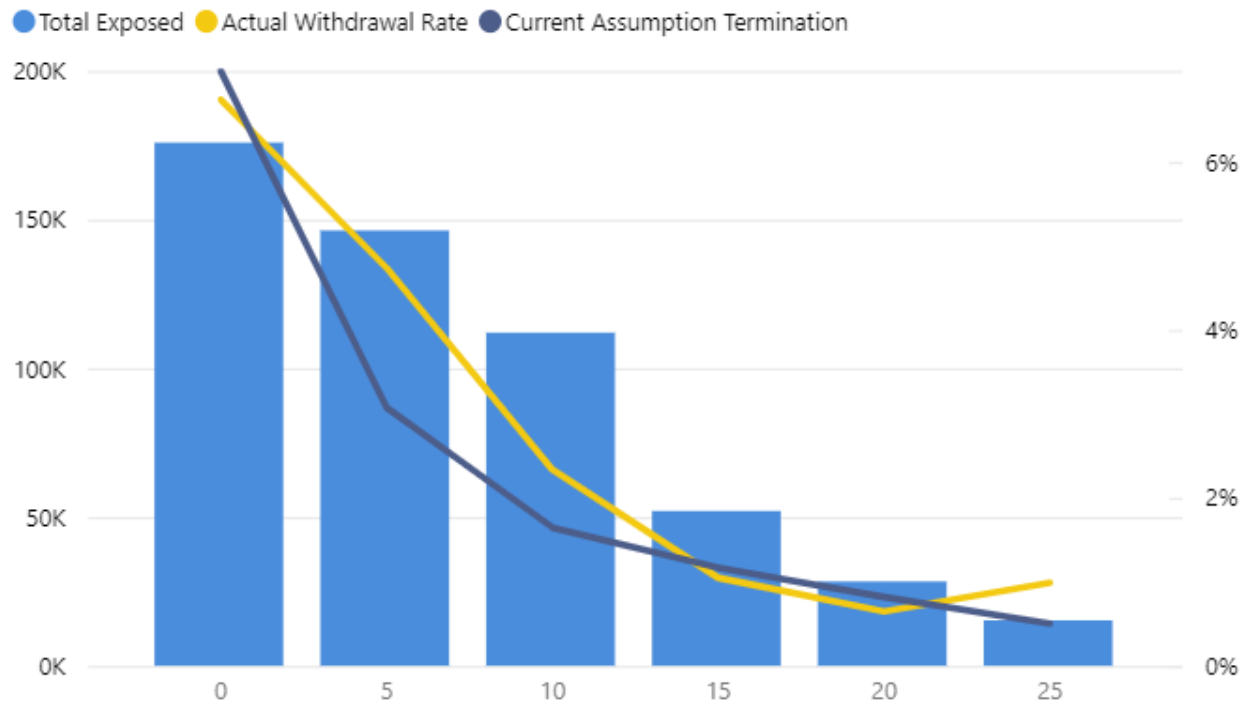
Specific observations on results through 2019:

- Every year, the actual rate of withdrawal exceeded the assumption. The difference was at least 25% greater in 2016 and 2018 when the actual rate of withdrawal exceeded 4.5%.
- The experience for female members (A/E ratio of 1.12) and male members (A/E ratio of 1.22) were similar.

The following charts show the results by service (0 to 29 years) in the experience study period through 2017, prior to the addition of new data.

| Service | Actual Withdrawals | Expected Withdrawals | Total Exposed | Actual Withdrawal Rate | Current Assumption Termination | Ratio Act/Exp Term |
|--------------|--------------------|----------------------|----------------|------------------------|--------------------------------|--------------------|
| 0 | 1,776 | 3,029.1 | 33,657 | 5.28% | 9.00% | ▲ 0.59 |
| 1 | 2,646 | 3,441.8 | 43,023 | 6.15% | 8.00% | ▲ 0.77 |
| 2 | 2,799 | 2,473.0 | 35,329 | 7.92% | 7.00% | ▲ 1.13 |
| 3 | 2,529 | 1,943.1 | 32,385 | 7.81% | 6.00% | ▲ 1.30 |
| 4 | 2,108 | 1,574.2 | 31,483 | 6.70% | 5.00% | ▲ 1.34 |
| 5 | 1,827 | 1,104.8 | 27,619 | 6.62% | 4.00% | ◆ 1.65 |
| 6 | 1,588 | 978.2 | 27,950 | 5.68% | 3.50% | ◆ 1.62 |
| 7 | 1,368 | 895.5 | 29,361 | 4.66% | 3.05% | ◆ 1.53 |
| 8 | 1,197 | 830.0 | 31,320 | 3.82% | 2.65% | ▲ 1.44 |
| 9 | 951 | 691.8 | 30,078 | 3.16% | 2.30% | ▲ 1.37 |
| 10 | 849 | 557.2 | 27,858 | 3.05% | 2.00% | ◆ 1.52 |
| 11 | 653 | 447.9 | 25,597 | 2.55% | 1.75% | ▲ 1.46 |
| 12 | 520 | 351.9 | 22,704 | 2.29% | 1.55% | ▲ 1.48 |
| 13 | 368 | 273.2 | 19,511 | 1.89% | 1.40% | ▲ 1.35 |
| 14 | 224 | 212.1 | 16,315 | 1.37% | 1.30% | ● 1.06 |
| 15 | 188 | 175.3 | 14,024 | 1.34% | 1.25% | ● 1.07 |
| 16 | 128 | 142.5 | 11,874 | 1.08% | 1.20% | ▲ 0.90 |
| 17 | 97 | 114.1 | 9,921 | 0.98% | 1.15% | ▲ 0.85 |
| 18 | 75 | 94.8 | 8,622 | 0.87% | 1.10% | ▲ 0.79 |
| 19 | 57 | 79.8 | 7,599 | 0.75% | 1.05% | ▲ 0.71 |
| 20 | 42 | 67.1 | 6,711 | 0.63% | 1.00% | ▲ 0.63 |
| 21 | 51 | 55.2 | 6,134 | 0.83% | 0.90% | ● 0.92 |
| 22 | 40 | 45.7 | 5,707 | 0.70% | 0.80% | ▲ 0.88 |
| 23 | 25 | 36.4 | 5,206 | 0.48% | 0.70% | ▲ 0.69 |
| 24 | 26 | 27.5 | 4,586 | 0.57% | 0.60% | ● 0.94 |
| 25 | 50 | 20.4 | 4,080 | 1.23% | 0.50% | ◆ 2.45 |
| 26 | 44 | 18.5 | 3,693 | 1.19% | 0.50% | ◆ 2.38 |
| 27 | 24 | 15.8 | 3,161 | 0.76% | 0.50% | ◆ 1.52 |
| 28 | 21 | 12.5 | 2,505 | 0.84% | 0.50% | ◆ 1.68 |
| 29 | 12 | 9.2 | 1,838 | 0.65% | 0.50% | ▲ 1.31 |
| Total | 22,283 | 19,718.6 | 529,851 | 4.21% | 3.72% | ▲ 1.13 |

Exposure Distribution w/ Withdrawal Rate - Actual and Expected; by Service



Specific observations:

- For service periods from 2 to 15 years, actual withdrawal rates were higher than the assumed rates (A/E ratio of 1.37).
- For those with between 16 and 24 years of service, the actual experience was lower than the assumed rates (A/E ratio of 0.82).
- For members with at least 25 years of service the actual number of terminations was nearly twice than expected (A/E ratio of 1.92). However, we point out that at these later service points the number of exposures and withdrawals is small.

The following chart shows the results for the two-year period July 1, 2017 – June 30, 2019 (2018 and 2019) by service (0 to 29 years). As noted earlier, the actual rates of withdrawal were higher than expected, especially in 2018.

| Service | Actual Withdrawals | Expected Withdrawals | Total Exposed | Actual Withdrawal Rate | Current Assumption Termination | Ratio Act/Exp Term |
|--------------|--------------------|----------------------|----------------|------------------------|--------------------------------|--------------------|
| 0 | 845 | 904.9 | 10,055 | 8.40% | 9.00% | 0.93 |
| 1 | 1,277 | 1,371.0 | 17,137 | 7.45% | 8.00% | 0.93 |
| 2 | 1,257 | 1,187.4 | 16,963 | 7.41% | 7.00% | 1.06 |
| 3 | 990 | 837.9 | 13,965 | 7.09% | 6.00% | 1.18 |
| 4 | 815 | 602.3 | 12,046 | 6.77% | 5.00% | 1.35 |
| 5 | 648 | 428.9 | 10,722 | 6.04% | 4.00% | 1.51 |
| 6 | 460 | 347.7 | 9,934 | 4.63% | 3.50% | 1.32 |
| 7 | 259 | 201.9 | 6,621 | 3.91% | 3.05% | 1.28 |
| 8 | 210 | 157.2 | 5,931 | 3.54% | 2.65% | 1.34 |
| 9 | 240 | 154.7 | 6,727 | 3.57% | 2.30% | 1.55 |
| 10 | 333 | 180.1 | 9,003 | 3.70% | 2.00% | 1.85 |
| 11 | 267 | 148.2 | 8,470 | 3.15% | 1.75% | 1.80 |
| 12 | 225 | 132.8 | 8,566 | 2.63% | 1.55% | 1.69 |
| 13 | 152 | 108.4 | 7,742 | 1.96% | 1.40% | 1.40 |
| 14 | 144 | 108.6 | 8,350 | 1.72% | 1.30% | 1.33 |
| 15 | 112 | 89.8 | 7,181 | 1.56% | 1.25% | 1.25 |
| 16 | 77 | 75.2 | 6,270 | 1.23% | 1.20% | 1.02 |
| 17 | 50 | 62.5 | 5,431 | 0.92% | 1.15% | 0.80 |
| 18 | 43 | 54.7 | 4,975 | 0.86% | 1.10% | 0.79 |
| 19 | 16 | 39.2 | 3,734 | 0.43% | 1.05% | 0.41 |
| 20 | 20 | 34.0 | 3,398 | 0.59% | 1.00% | 0.59 |
| 21 | 16 | 23.2 | 2,579 | 0.62% | 0.90% | 0.69 |
| 22 | 15 | 17.5 | 2,192 | 0.68% | 0.80% | 0.86 |
| 23 | 11 | 12.6 | 1,795 | 0.61% | 0.70% | 0.88 |
| 24 | 13 | 10.4 | 1,730 | 0.75% | 0.60% | 1.25 |
| 25 | 10 | 7.3 | 1,467 | 0.68% | 0.50% | 1.36 |
| 26 | 8 | 6.2 | 1,246 | 0.64% | 0.50% | 1.28 |
| 27 | 8 | 4.8 | 965 | 0.83% | 0.50% | 1.66 |
| 28 | 8 | 4.8 | 962 | 0.83% | 0.50% | 1.66 |
| 29 | 4 | 3.3 | 667 | 0.60% | 0.50% | 1.20 |
| Total | 8,533 | 7,317.5 | 196,824 | 4.34% | 3.72% | 1.17 |

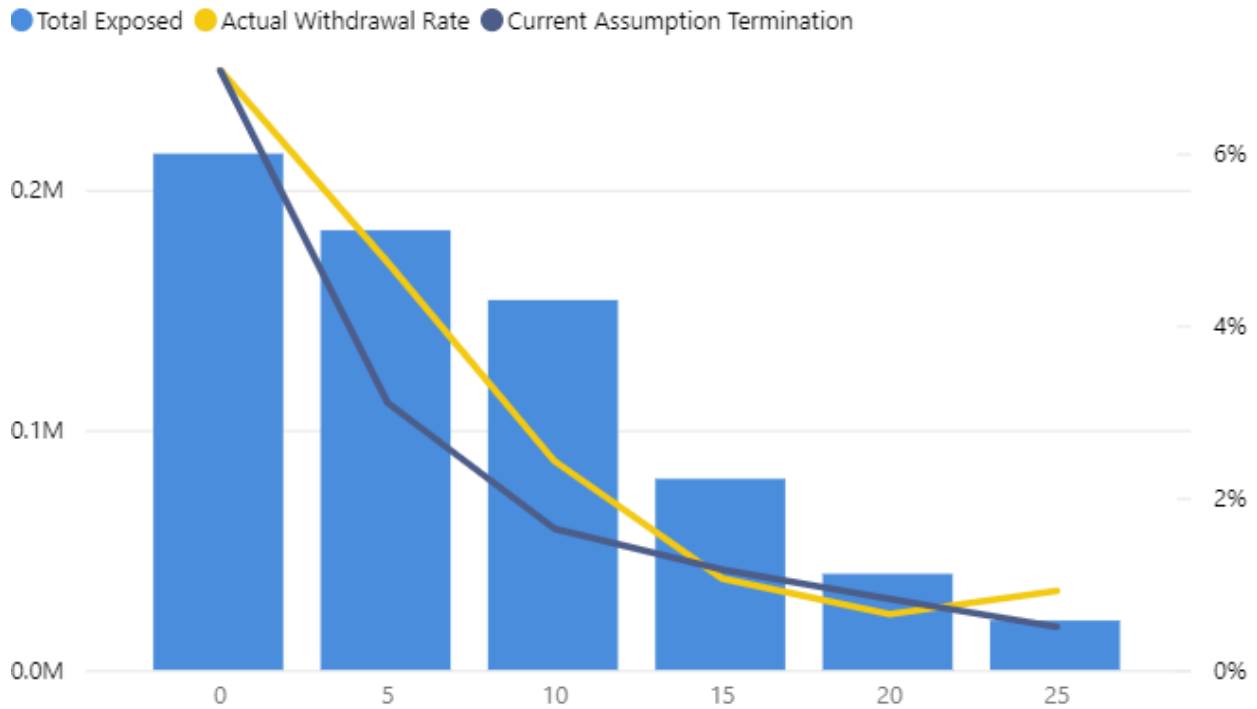
Specific observations for the 2-year period 2018-2019:

- The experience during 2018 – 2019 was very similar to the experience from 2012 – 2017.
 - For service periods between 2 and 15 years, the A/E ratio was 1.30, which is close to the 1.37 A/E ratio of the period 2012 to 2017.
 - For service periods between 16 and 24 years, the A/E ratio was 0.79 vs 0.82.
 - For service periods of 25 or more years (including service greater than 29 years), the A/E ratio was 1.60 vs 1.92.

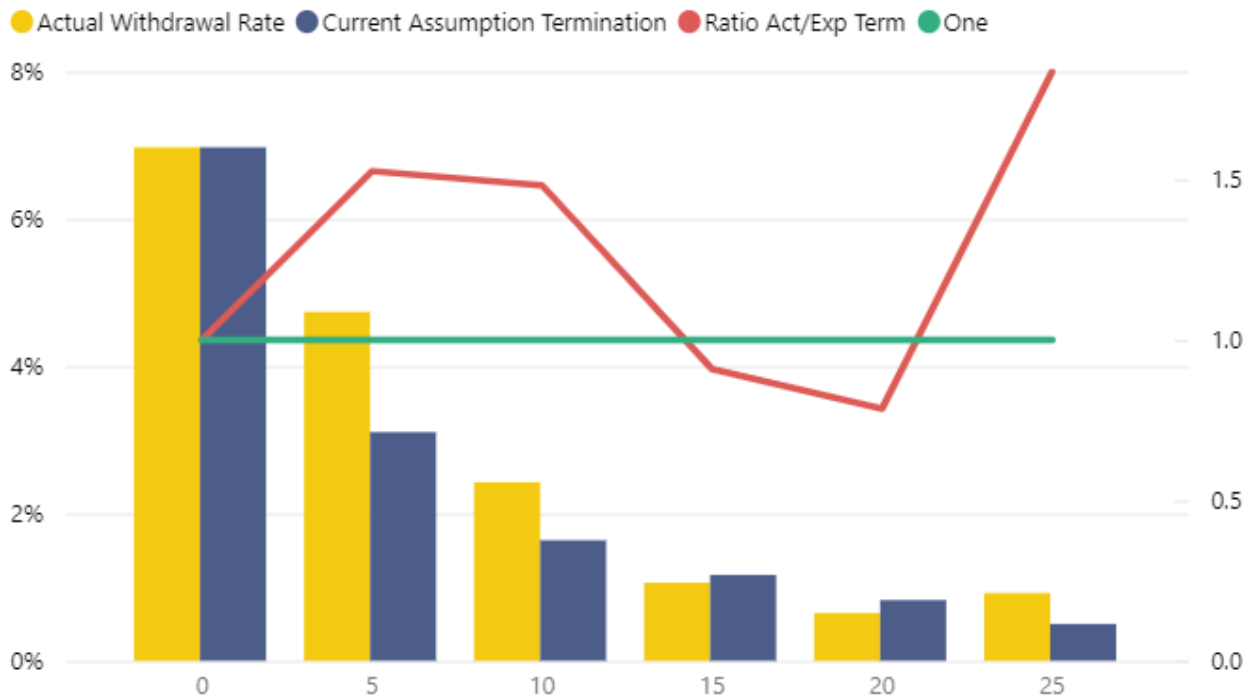
The following charts show the combined results for 2012 - 2019 by service (0 to 29 years) for the age range 25 to 54.

| Service | Actual Withdrawals | Expected Withdrawals | Total Exposed | Actual Withdrawal Rate | Current Assumption Termination | Ratio Act/Exp Term |
|--------------|--------------------|----------------------|----------------|------------------------|--------------------------------|--------------------|
| 0 | 2,003 | 3,016.7 | 33,519 | 5.98% | 9.00% | ▲ 0.66 |
| 1 | 3,303 | 4,060.9 | 50,761 | 6.51% | 8.00% | ▲ 0.81 |
| 2 | 3,483 | 3,293.2 | 47,046 | 7.40% | 7.00% | ● 1.06 |
| 3 | 3,384 | 2,596.1 | 43,268 | 7.82% | 6.00% | ▲ 1.30 |
| 4 | 2,818 | 2,025.4 | 40,507 | 6.96% | 5.00% | ▲ 1.39 |
| 5 | 2,431 | 1,490.5 | 37,262 | 6.52% | 4.00% | ◆ 1.63 |
| 6 | 2,026 | 1,292.4 | 36,925 | 5.49% | 3.50% | ◆ 1.57 |
| 7 | 1,623 | 1,080.9 | 35,438 | 4.58% | 3.05% | ◆ 1.50 |
| 8 | 1,404 | 978.0 | 36,904 | 3.80% | 2.65% | ▲ 1.44 |
| 9 | 1,189 | 842.6 | 36,635 | 3.25% | 2.30% | ▲ 1.41 |
| 10 | 1,182 | 737.2 | 36,858 | 3.21% | 2.00% | ◆ 1.60 |
| 11 | 920 | 596.2 | 34,066 | 2.70% | 1.75% | ◆ 1.54 |
| 12 | 745 | 484.6 | 31,267 | 2.38% | 1.55% | ◆ 1.54 |
| 13 | 520 | 381.5 | 27,251 | 1.91% | 1.40% | ▲ 1.36 |
| 14 | 368 | 320.6 | 24,662 | 1.49% | 1.30% | ▲ 1.15 |
| 15 | 300 | 265.0 | 21,202 | 1.41% | 1.25% | ▲ 1.13 |
| 16 | 205 | 217.7 | 18,140 | 1.13% | 1.20% | ● 0.94 |
| 17 | 147 | 176.5 | 15,349 | 0.96% | 1.15% | ▲ 0.83 |
| 18 | 118 | 149.6 | 13,596 | 0.87% | 1.10% | ▲ 0.79 |
| 19 | 73 | 119.0 | 11,332 | 0.64% | 1.05% | ▲ 0.61 |
| 20 | 62 | 101.1 | 10,107 | 0.61% | 1.00% | ▲ 0.61 |
| 21 | 67 | 78.4 | 8,712 | 0.77% | 0.90% | ▲ 0.85 |
| 22 | 55 | 63.2 | 7,898 | 0.70% | 0.80% | ▲ 0.87 |
| 23 | 36 | 49.0 | 6,998 | 0.51% | 0.70% | ▲ 0.73 |
| 24 | 39 | 37.9 | 6,315 | 0.62% | 0.60% | ● 1.03 |
| 25 | 60 | 27.7 | 5,545 | 1.08% | 0.50% | ◆ 2.16 |
| 26 | 52 | 24.7 | 4,936 | 1.05% | 0.50% | ◆ 2.11 |
| 27 | 32 | 20.6 | 4,124 | 0.78% | 0.50% | ◆ 1.55 |
| 28 | 29 | 17.3 | 3,467 | 0.84% | 0.50% | ◆ 1.67 |
| 29 | 16 | 12.5 | 2,505 | 0.64% | 0.50% | ▲ 1.28 |
| Total | 28,690 | 24,556.8 | 692,595 | 4.14% | 3.55% | ▲ 1.17 |

Exposure Distribution w/ Withdrawal Rate - Actual and Expected; by Service



Withdrawal Rate - Actual, Expected, and Ratio; by Service



The following charts show the combined results for 2012 - 2019 by age (25 to 54) for members with service (0 to 29).

| Age | Actual Withdrawals | Expected Withdrawals | Total Exposed | Actual Withdrawal Rate | Current Assumption Termination | Ratio Act/Exp Term |
|--------------|--------------------|----------------------|----------------|------------------------|--------------------------------|--------------------|
| 25 | 1,022 | 848.5 | 11,452 | 8.92% | 7.41% | ▲ 1.20 |
| 26 | 1,306 | 1,113.2 | 15,893 | 8.22% | 7.00% | ▲ 1.17 |
| 27 | 1,552 | 1,302.2 | 19,879 | 7.81% | 6.55% | ▲ 1.19 |
| 28 | 1,878 | 1,379.3 | 22,747 | 8.26% | 6.06% | ▲ 1.36 |
| 29 | 1,915 | 1,377.2 | 24,619 | 7.78% | 5.59% | ▲ 1.39 |
| 30 | 1,916 | 1,325.4 | 25,727 | 7.45% | 5.15% | ▲ 1.45 |
| 31 | 1,805 | 1,255.1 | 26,462 | 6.82% | 4.74% | ▲ 1.44 |
| 32 | 1,764 | 1,180.2 | 26,965 | 6.54% | 4.38% | ▲ 1.49 |
| 33 | 1,619 | 1,103.1 | 27,160 | 5.96% | 4.06% | ▲ 1.47 |
| 34 | 1,521 | 1,034.2 | 27,246 | 5.58% | 3.80% | ▲ 1.47 |
| 35 | 1,342 | 960.5 | 26,982 | 4.97% | 3.56% | ▲ 1.40 |
| 36 | 1,168 | 894.5 | 26,583 | 4.39% | 3.36% | ▲ 1.31 |
| 37 | 1,051 | 833.0 | 25,860 | 4.06% | 3.22% | ▲ 1.26 |
| 38 | 935 | 776.8 | 25,075 | 3.73% | 3.10% | ▲ 1.20 |
| 39 | 855 | 738.2 | 24,589 | 3.48% | 3.00% | ▲ 1.16 |
| 40 | 760 | 706.8 | 24,141 | 3.15% | 2.93% | ● 1.08 |
| 41 | 707 | 681.1 | 23,897 | 2.96% | 2.85% | ● 1.04 |
| 42 | 552 | 652.2 | 23,477 | 2.35% | 2.78% | ▲ 0.85 |
| 43 | 543 | 632.8 | 23,119 | 2.35% | 2.74% | ▲ 0.86 |
| 44 | 512 | 612.7 | 22,786 | 2.25% | 2.69% | ▲ 0.84 |
| 45 | 478 | 599.6 | 22,708 | 2.10% | 2.64% | ▲ 0.80 |
| 46 | 477 | 580.6 | 22,617 | 2.11% | 2.57% | ▲ 0.82 |
| 47 | 423 | 562.2 | 22,464 | 1.88% | 2.50% | ▲ 0.75 |
| 48 | 419 | 542.5 | 22,285 | 1.88% | 2.43% | ▲ 0.77 |
| 49 | 418 | 522.7 | 21,881 | 1.91% | 2.39% | ▲ 0.80 |
| 50 | 357 | 506.9 | 21,740 | 1.64% | 2.33% | ▲ 0.70 |
| 51 | 374 | 485.7 | 21,605 | 1.73% | 2.25% | ▲ 0.77 |
| 52 | 368 | 470.1 | 21,387 | 1.72% | 2.20% | ▲ 0.78 |
| 53 | 367 | 448.3 | 20,881 | 1.76% | 2.15% | ▲ 0.82 |
| 54 | 286 | 431.1 | 20,368 | 1.40% | 2.12% | ▲ 0.66 |
| Total | 28,690 | 24,556.8 | 692,595 | 4.14% | 3.55% | ▲ 1.17 |

The following chart shows results by age for the service period between 2 - 15 years, from 2012 - 2019.

| Age | Actual Withdrawals | Expected Withdrawals | Total Exposed | Actual Withdrawal Rate | Current Assumption Termination | Ratio Act/Exp Term |
|--------------|--------------------|----------------------|----------------|------------------------|--------------------------------|--------------------|
| 25 | 684 | 364.6 | 5,560 | 12.30% | 6.56% | 1.88 |
| 26 | 921 | 585.4 | 9,465 | 9.73% | 6.18% | 1.57 |
| 27 | 1,192 | 785.3 | 13,591 | 8.77% | 5.78% | 1.52 |
| 28 | 1,473 | 921.3 | 17,192 | 8.57% | 5.36% | 1.60 |
| 29 | 1,560 | 970.0 | 19,696 | 7.92% | 4.92% | 1.61 |
| 30 | 1,610 | 964.7 | 21,374 | 7.53% | 4.51% | 1.67 |
| 31 | 1,517 | 937.4 | 22,638 | 6.70% | 4.14% | 1.62 |
| 32 | 1,526 | 893.2 | 23,532 | 6.48% | 3.80% | 1.71 |
| 33 | 1,403 | 836.0 | 23,970 | 5.85% | 3.49% | 1.68 |
| 34 | 1,304 | 785.1 | 24,274 | 5.37% | 3.23% | 1.66 |
| 35 | 1,142 | 736.5 | 24,306 | 4.70% | 3.03% | 1.55 |
| 36 | 1,008 | 687.4 | 24,086 | 4.19% | 2.85% | 1.47 |
| 37 | 883 | 632.1 | 23,343 | 3.78% | 2.71% | 1.40 |
| 38 | 768 | 579.3 | 21,921 | 3.50% | 2.64% | 1.33 |
| 39 | 672 | 529.5 | 20,398 | 3.29% | 2.60% | 1.27 |
| 40 | 582 | 491.0 | 18,988 | 3.07% | 2.59% | 1.19 |
| 41 | 538 | 465.5 | 17,796 | 3.02% | 2.62% | 1.16 |
| 42 | 409 | 428.4 | 16,504 | 2.48% | 2.60% | 0.95 |
| 43 | 391 | 406.6 | 15,448 | 2.53% | 2.63% | 0.96 |
| 44 | 381 | 382.3 | 14,388 | 2.65% | 2.66% | 1.00 |
| 45 | 331 | 366.2 | 13,605 | 2.43% | 2.69% | 0.90 |
| 46 | 326 | 350.6 | 12,920 | 2.52% | 2.71% | 0.93 |
| 47 | 268 | 331.0 | 12,159 | 2.20% | 2.72% | 0.81 |
| 48 | 263 | 316.7 | 11,619 | 2.26% | 2.73% | 0.83 |
| 49 | 254 | 302.1 | 11,025 | 2.30% | 2.74% | 0.84 |
| 50 | 208 | 290.7 | 10,612 | 1.96% | 2.74% | 0.72 |
| 51 | 221 | 279.8 | 10,227 | 2.16% | 2.74% | 0.79 |
| 52 | 192 | 267.5 | 9,881 | 1.94% | 2.71% | 0.72 |
| 53 | 221 | 253.9 | 9,483 | 2.33% | 2.68% | 0.87 |
| 54 | 145 | 244.0 | 9,290 | 1.56% | 2.63% | 0.59 |
| Total | 22,393 | 16,384.0 | 489,291 | 4.58% | 3.35% | 1.37 |

The following chart shows the results by age for service period between 16 - 34 years from 2012 - 2019.

| Age | Actual Withdrawals | Expected Withdrawals | Total Exposed | Actual Withdrawal Rate | Current Assumption Termination | Ratio Act/Exp Term |
|--------------|--------------------|----------------------|----------------|------------------------|--------------------------------|--------------------|
| 35 | 2 | 0.2 | 24 | 8.33% | 1.03% | 8.08 |
| 36 | 1 | 0.7 | 59 | 1.69% | 1.11% | 1.53 |
| 37 | 6 | 1.9 | 169 | 3.55% | 1.15% | 3.08 |
| 38 | 13 | 11.5 | 969 | 1.34% | 1.18% | 1.13 |
| 39 | 36 | 23.7 | 2,020 | 1.78% | 1.17% | 1.52 |
| 40 | 37 | 35.0 | 3,027 | 1.22% | 1.16% | 1.06 |
| 41 | 46 | 47.0 | 4,127 | 1.11% | 1.14% | 0.98 |
| 42 | 35 | 56.0 | 5,010 | 0.70% | 1.12% | 0.63 |
| 43 | 46 | 62.8 | 5,764 | 0.80% | 1.09% | 0.73 |
| 44 | 56 | 69.0 | 6,511 | 0.86% | 1.06% | 0.81 |
| 45 | 63 | 73.8 | 7,238 | 0.87% | 1.02% | 0.85 |
| 46 | 62 | 77.5 | 7,919 | 0.78% | 0.98% | 0.80 |
| 47 | 63 | 80.2 | 8,547 | 0.74% | 0.94% | 0.79 |
| 48 | 76 | 80.7 | 9,000 | 0.84% | 0.90% | 0.94 |
| 49 | 87 | 79.5 | 9,259 | 0.94% | 0.86% | 1.09 |
| 50 | 73 | 79.3 | 9,604 | 0.76% | 0.83% | 0.92 |
| 51 | 81 | 80.6 | 10,078 | 0.80% | 0.80% | 1.00 |
| 52 | 87 | 82.2 | 10,558 | 0.82% | 0.78% | 1.06 |
| 53 | 75 | 84.7 | 11,098 | 0.68% | 0.76% | 0.89 |
| 54 | 76 | 84.8 | 11,326 | 0.67% | 0.75% | 0.90 |
| Total | 1,021 | 1,111.3 | 122,307 | 0.83% | 0.91% | 0.92 |

Summary

We find that the actual withdrawal experience is greater than expected by the current assumption for service periods 2 to 15 years, lower than expected for service periods of 16 to 24 years, and then higher than expected for service periods of 25 or more years. Age may influence the withdrawal rates – the withdrawal rates of members who are 40 years old and younger seem to be higher than the withdrawal rates of members who are older than 40 years, even when adjusting for the differing levels of service that currently drive the assumptions.

In subsequent analyses, we will develop the experience on a salary-weighted basis as lower paid members may exhibit higher rates of termination but would have less impact on the liability.

Retirement

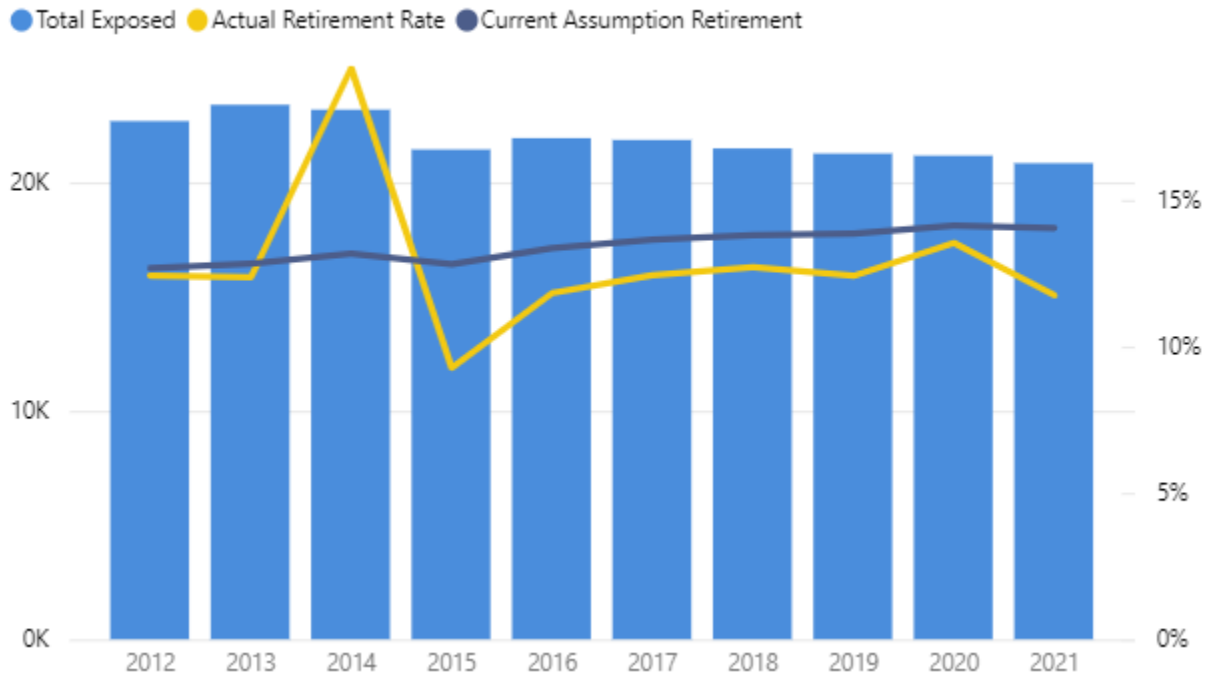
The current retirement assumption varies by age and eligibility for unreduced retirement with higher rates occurring at first eligibility. Furthermore, higher rates of retirement are assumed for members who had the option to elect an improved program.

Since Tier 6 became effective on April 1, 2012, and required 10 years of service for vesting, there is little to no retirement experience associated with these plans. Chapter 56 Laws of 2022 changed the vesting requirements for the Tier 6 plans and the Ch 504/09 – 55/27 [Mandatory]] plan to five years of service. Since the vesting requirement was 10 years during the study period, we used the 10-year requirement in this report.

The following table shows the retirement experience results of all the plans by year based on the age range (55 – 79) and service range (5 – 50). Based on the current assumptions, the overall expected rate of retirement averaged 13.41% during this period whereas the actual rate was 12.87%, for an A/E ratio of 0.96.

| Plan Year | Actual Retirements | Expected Retirements | Total Exposed | Actual Retirement Rate | Current Assumption Retirement | Ratio Act/Exp Ret |
|--------------|--------------------|----------------------|----------------|------------------------|-------------------------------|-------------------|
| 2012 | 2,816 | 2,874.7 | 22,682 | 12.42% | 12.67% | 0.98 |
| 2013 | 2,893 | 3,000.0 | 23,395 | 12.37% | 12.82% | 0.96 |
| 2014 | 4,521 | 3,052.8 | 23,181 | 19.50% | 13.17% | 1.48 |
| 2015 | 1,987 | 2,746.9 | 21,438 | 9.27% | 12.81% | 0.72 |
| 2016 | 2,594 | 2,930.2 | 21,936 | 11.83% | 13.36% | 0.89 |
| 2017 | 2,717 | 2,981.4 | 21,857 | 12.43% | 13.64% | 0.91 |
| 2018 | 2,729 | 2,965.0 | 21,485 | 12.70% | 13.80% | 0.92 |
| 2019 | 2,639 | 2,944.3 | 21,261 | 12.41% | 13.85% | 0.90 |
| 2020 | 2,865 | 2,989.9 | 21,169 | 13.53% | 14.12% | 0.96 |
| 2021 | 2,448 | 2,925.2 | 20,839 | 11.75% | 14.04% | 0.84 |
| Total | 28,209 | 29,410.3 | 219,243 | 12.87% | 13.41% | 0.96 |

Exposure Distribution w/ Retirement Rate - Actual and Expected; by Year



The rate of retirement during 2020 and 2021 may be slightly lower than shown in this report due to the treatment of members with a LOA status code. While the percentage of members with a LOA code who have a retired status code in the following two years is approximately 1%, the number of retirements not captured in each of these two years could be roughly 500 per year. Excluding these two years, the A/E ratio of 0.97 in years 2012 – 2019 is very similar to the results with these years included (2012 – 2021). We note that the actual rate of retirement during 2020 is higher than in all years but 2014.

Specific observations:

- The rate of retirement during 2014 was 19.50%, which was much higher than in the other years.
- From 2015 – 2021, the actual number of retirements was less than expected by 12% (A/E ratio of 0.88).

Year 2014

It is our understanding that in June 2014, New York City reached an agreement with the United Federation of Teachers (UFT). At that time, the City agreed to make a lump sum compensation payment for teachers who retired by June 30, 2014. Teachers who retired after June 30, 2014 would instead receive the compensation payment in installments paid over a 5- year period. To determine whether this feature impacted the timing of retirements, the following table shows the distribution of benefit commencement dates from the most recent data (excluding LOA adjustments) for teachers who retired during the study period.

| | | TRS | | | | | | | | | |
|---------------------------|-------|--|-------|-------|-------|-------|-------|-------|-------|-------|--|
| | | Number of Pensioners by Month and Year of Commencement | | | | | | | | | |
| Month | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | |
| Jan | | 302 | 254 | 234 | 281 | 306 | 304 | 352 | 358 | 251 | |
| Feb | | 175 | 245 | 202 | 236 | 165 | 125 | 133 | 139 | 156 | |
| Mar | | 94 | 129 | 131 | 105 | 104 | 117 | 101 | 88 | 62 | |
| Apr | | 116 | 86 | 92 | 90 | 83 | 96 | 68 | 88 | 47 | |
| May | | 92 | 78 | 76 | 86 | 96 | 74 | 97 | 68 | 47 | |
| Jun | | 77 | 2,135 | 354 | 108 | 96 | 65 | 79 | 55 | 46 | |
| Jul | 1,710 | 1,708 | 443 | 1,343 | 1,478 | 1,509 | 1,389 | 1,579 | 1,159 | | |
| Aug | 204 | 229 | 176 | 178 | 232 | 191 | 223 | 285 | 222 | | |
| Sep | 279 | 287 | 248 | 221 | 260 | 254 | 244 | 226 | 340 | | |
| Oct | 211 | 237 | 179 | 188 | 179 | 183 | 194 | 167 | 197 | | |
| Nov | 128 | 156 | 147 | 177 | 195 | 192 | 172 | 196 | 161 | | |
| Dec | 94 | 125 | 128 | 131 | 153 | 146 | 139 | 126 | 140 | | |
| Total by Plan Year | | 3,482 | 5,669 | 2,410 | 3,144 | 3,347 | 3,256 | 3,191 | 3,375 | 2,828 | |

As shown in the chart, July is the typical month in which most teachers commence benefits. However, the highlighted cells show that a significant number of retirements occurred during June 2014. As a result of the union contract, it appears that teachers who might have typically retired in July 2014 moved up their retirement date to June 2014. This change led to more retirements during the 2014 plan year and fewer during the 2015 plan year. The overall number of retirements was higher during these two plan years than in other 2-year periods.

Analysis

The results below are based on the period 2016 – 2019 because the years 2014 – 2015 appear to be outliers.

We will review the retirement experience split by three plan codes:

1. Tier IV (plan code F) – normal retirement at age 62 with reduced retirement benefits at age 55 and mandated plan retirement rates. No reduction occurs once a member accrues at least 30 years of service.
2. Chapter 19 55/25 Plan (Plan Code G) – normal retirement is age 55 with 25 years of service and elected improved plan retirement rates.
3. Chapter 19 and Chapter 504 55/27 Plan (Plan Codes H and I) – normal retirement is age 55 with 27 years of service and mandated plan retirement rates.
 - a. Chapter 504 allows reduced retirement at age 55 and requires 10 years of service.

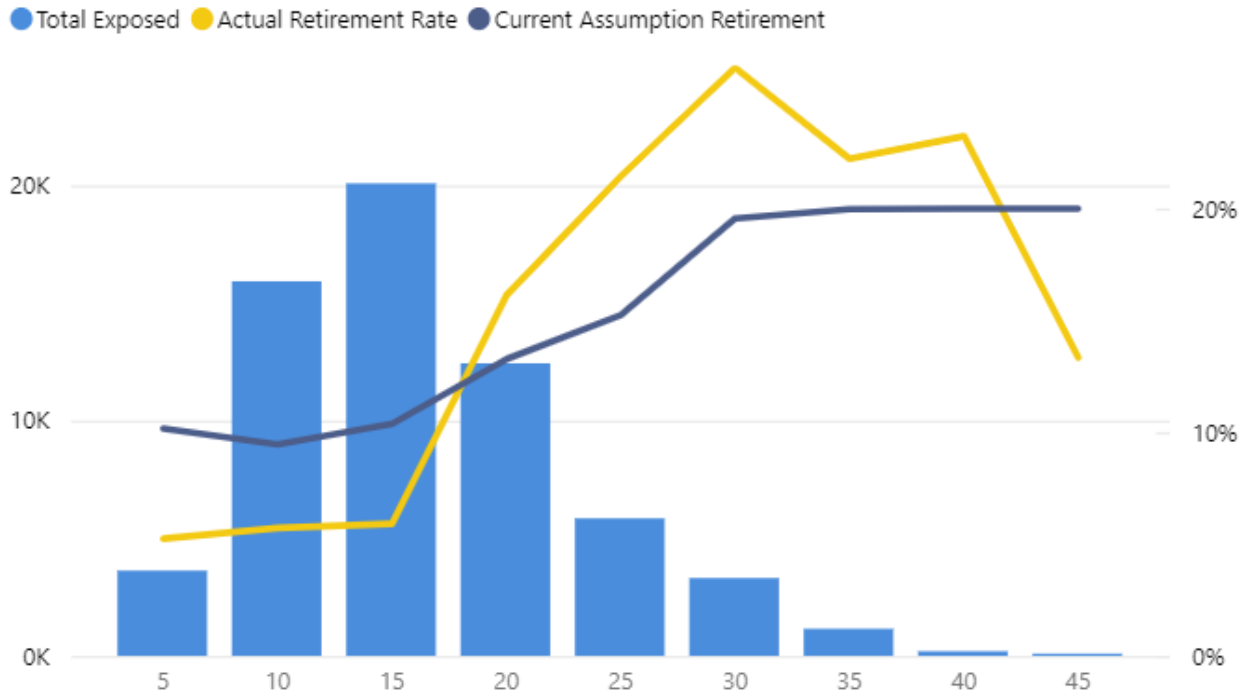
Basic Tier IV Plan

The following charts display the experience of Basic Tier IV Plan by service based on the age range (55 to 79) and service range (5 to 50) for the period 2016 – 2019.

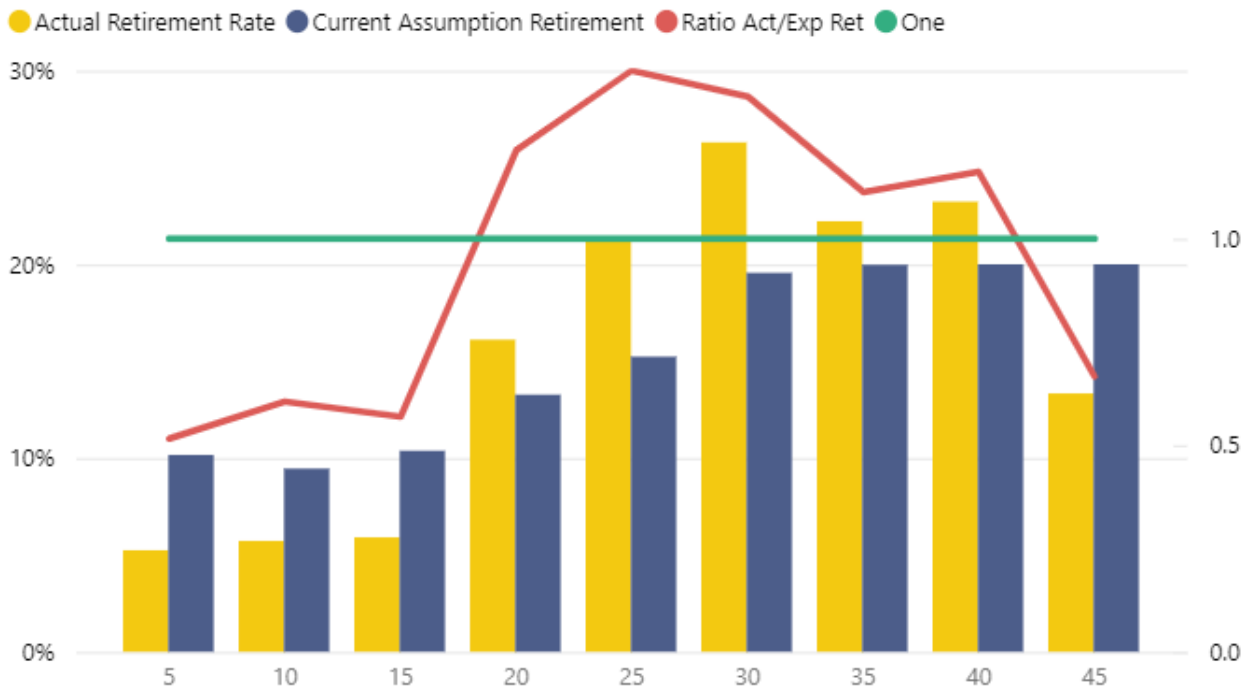
| Service | Actual Retirements | Expected Retirements | Total Exposed | Actual Retirement Rate | Current Assumption Retirement | Ratio Act/Exp Ret |
|---------|--------------------|----------------------|---------------|------------------------|-------------------------------|-------------------|
| 5 | 32 | 41.3 | 343 | 9.33% | 12.03% | ▲ 0.78 |
| 6 | 21 | 52.3 | 404 | 5.20% | 12.95% | ◆ 0.40 |
| 7 | 41 | 53.3 | 511 | 8.02% | 10.44% | ▲ 0.77 |
| 8 | 41 | 84.2 | 899 | 4.56% | 9.36% | ◆ 0.49 |
| 9 | 55 | 137.3 | 1,469 | 3.74% | 9.34% | ◆ 0.40 |
| 10 | 163 | 224.6 | 2,353 | 6.93% | 9.55% | ▲ 0.73 |
| 11 | 165 | 258.5 | 2,797 | 5.90% | 9.24% | ▲ 0.64 |
| 12 | 190 | 315.0 | 3,374 | 5.63% | 9.34% | ▲ 0.60 |
| 13 | 180 | 330.2 | 3,493 | 5.15% | 9.45% | ▲ 0.55 |
| 14 | 213 | 377.4 | 3,908 | 5.45% | 9.66% | ▲ 0.56 |
| 15 | 278 | 403.3 | 4,078 | 6.82% | 9.89% | ▲ 0.69 |
| 16 | 269 | 416.5 | 4,191 | 6.42% | 9.94% | ▲ 0.65 |
| 17 | 246 | 413.8 | 4,055 | 6.07% | 10.20% | ▲ 0.59 |
| 18 | 221 | 439.9 | 4,126 | 5.36% | 10.66% | ▲ 0.50 |
| 19 | 172 | 410.7 | 3,638 | 4.73% | 11.29% | ◆ 0.42 |
| 20 | 596 | 421.2 | 3,435 | 17.35% | 12.26% | ▲ 1.42 |
| 21 | 411 | 331.0 | 2,673 | 15.38% | 12.38% | ▲ 1.24 |
| 22 | 342 | 305.9 | 2,346 | 14.58% | 13.04% | ▲ 1.12 |
| 23 | 293 | 280.3 | 1,990 | 14.72% | 14.08% | ● 1.05 |
| 24 | 362 | 312.4 | 1,995 | 18.15% | 15.66% | ▲ 1.16 |
| 25 | 435 | 273.8 | 1,666 | 26.11% | 16.43% | ◆ 1.59 |
| 26 | 326 | 213.0 | 1,318 | 24.73% | 16.16% | ◆ 1.53 |
| 27 | 201 | 160.1 | 1,044 | 19.25% | 15.34% | ▲ 1.26 |
| 28 | 162 | 133.1 | 943 | 17.18% | 14.11% | ▲ 1.22 |
| 29 | 129 | 110.6 | 876 | 14.73% | 12.62% | ▲ 1.17 |

| | | | | | | | |
|--------------|--------------|----------------|---------------|---------------|---------------|---|-------------|
| 30 | 281 | 179.7 | 934 | 30.09% | 19.24% | ◆ | 1.56 |
| 31 | 193 | 147.9 | 754 | 25.60% | 19.61% | ▲ | 1.31 |
| 32 | 184 | 139.8 | 713 | 25.81% | 19.61% | ▲ | 1.32 |
| 33 | 123 | 102.4 | 520 | 23.65% | 19.69% | ▲ | 1.20 |
| 34 | 89 | 77.4 | 388 | 22.94% | 19.94% | ▲ | 1.15 |
| 35 | 72 | 58.2 | 292 | 24.66% | 19.93% | ▲ | 1.24 |
| 36 | 61 | 55.0 | 275 | 22.18% | 20.00% | ▲ | 1.11 |
| 37 | 47 | 48.1 | 241 | 19.50% | 19.97% | ● | 0.98 |
| 38 | 41 | 40.6 | 203 | 20.20% | 20.00% | ● | 1.01 |
| 39 | 35 | 28.2 | 141 | 24.82% | 20.00% | ▲ | 1.24 |
| 40 | 26 | 18.8 | 94 | 27.66% | 20.00% | ▲ | 1.38 |
| 41 | 8 | 7.8 | 39 | 20.51% | 20.00% | ● | 1.03 |
| 42 | 7 | 5.6 | 28 | 25.00% | 20.00% | ▲ | 1.25 |
| 43 | 3 | 3.8 | 19 | 15.79% | 20.00% | ▲ | 0.79 |
| 44 | 2 | 3.6 | 18 | 11.11% | 20.00% | ▲ | 0.56 |
| 45 | 2 | 2.2 | 11 | 18.18% | 20.00% | ● | 0.91 |
| 46 | 0 | 2.0 | 10 | 0.00% | 20.00% | ◆ | 0.00 |
| 47 | 1 | 1.0 | 5 | 20.00% | 20.00% | ● | 1.00 |
| 48 | 0 | 0.6 | 3 | 0.00% | 20.00% | ◆ | 0.00 |
| 49 | 1 | 0.2 | 1 | 100.00% | 20.00% | ◆ | 5.00 |
| Total | 6,720 | 7,422.4 | 62,614 | 10.73% | 11.85% | ● | 0.91 |

Exposure Distribution w/ Retirement Rate - Actual and Expected; by Service



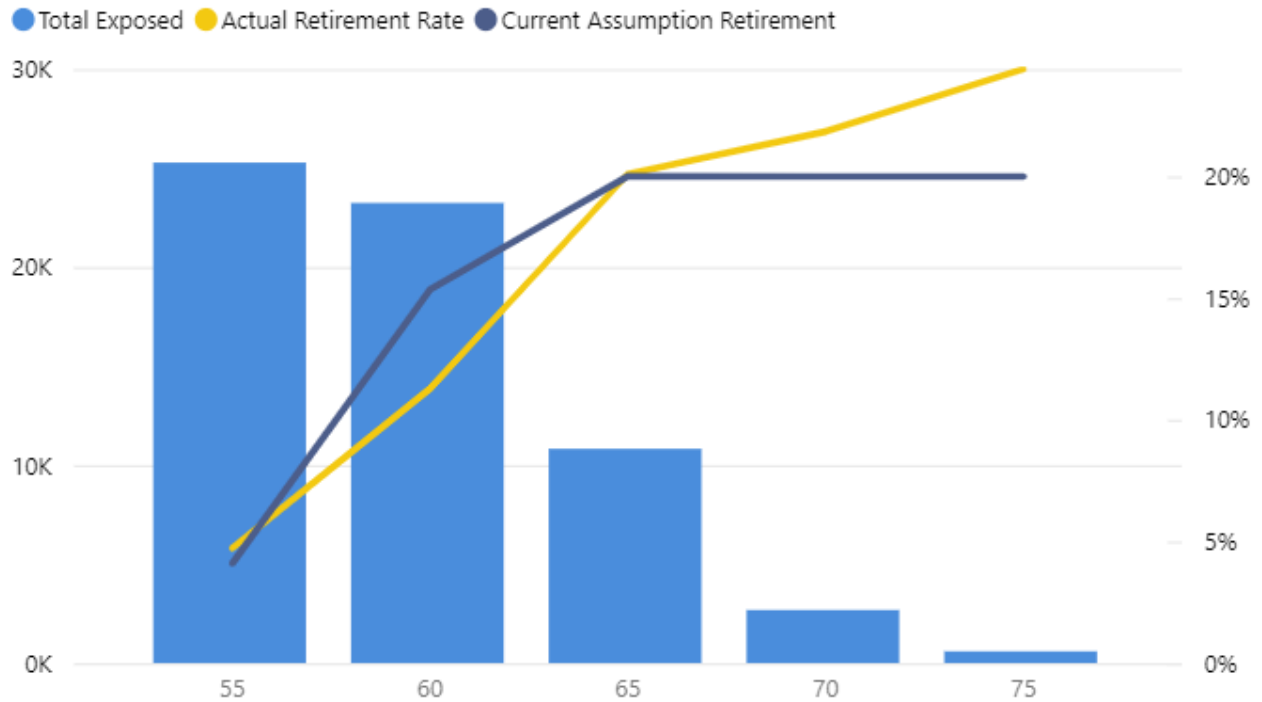
Retirement Rate - Actual, Expected, and Ratio; by Service



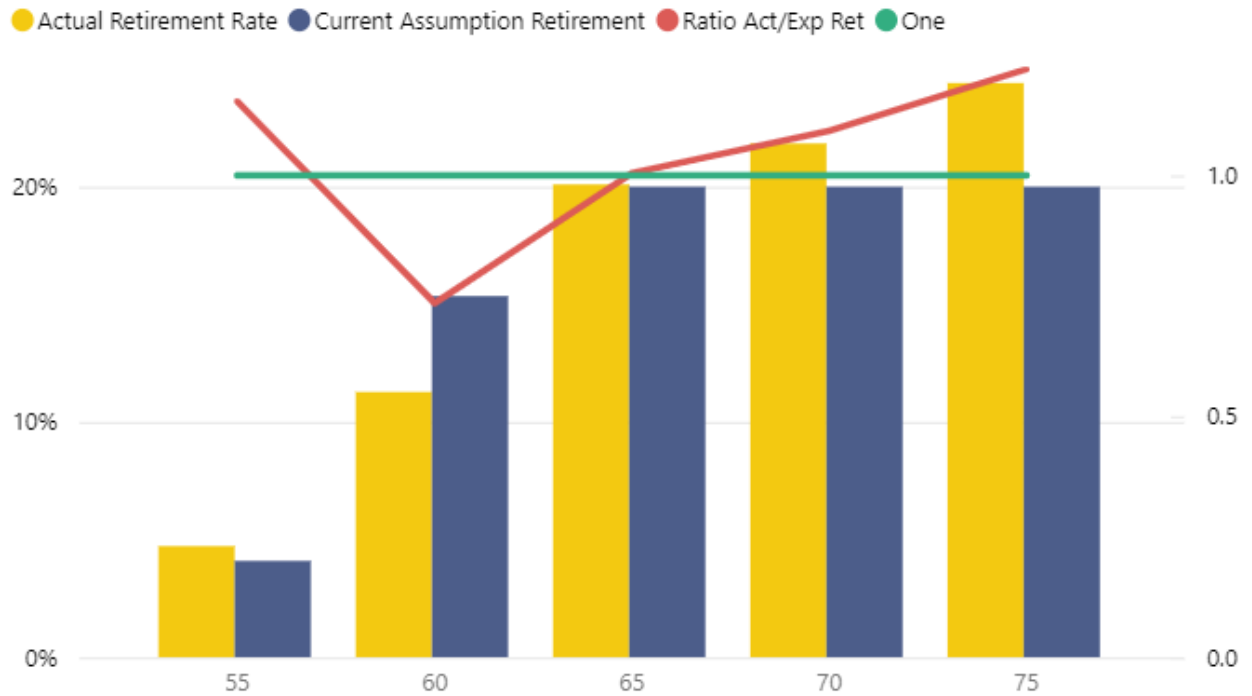
The following charts display the experience of Tier IV by age for the period 2016 – 2019.

| Age | Actual Retirements | Expected Retirements | Total Exposed | Actual Retirement Rate | Current Assumption Retirement | Ratio Act/Exp Ret |
|--------------|--------------------|----------------------|---------------|------------------------|-------------------------------|-------------------|
| 55 | 345 | 210.8 | 5,028 | 6.86% | 4.19% | 1.64 |
| 56 | 229 | 201.1 | 4,974 | 4.60% | 4.04% | 1.14 |
| 57 | 193 | 189.7 | 4,963 | 3.89% | 3.82% | 1.02 |
| 58 | 197 | 189.0 | 5,151 | 3.82% | 3.67% | 1.04 |
| 59 | 230 | 244.5 | 5,161 | 4.46% | 4.74% | 0.94 |
| 60 | 258 | 300.5 | 5,203 | 4.96% | 5.78% | 0.86 |
| 61 | 332 | 352.8 | 5,127 | 6.48% | 6.88% | 0.94 |
| 62 | 884 | 1,328.1 | 4,975 | 17.77% | 26.69% | 0.67 |
| 63 | 655 | 851.3 | 4,258 | 15.38% | 19.99% | 0.77 |
| 64 | 491 | 734.8 | 3,676 | 13.36% | 19.99% | 0.67 |
| 65 | 553 | 650.0 | 3,243 | 17.05% | 20.04% | 0.85 |
| 66 | 622 | 534.3 | 2,673 | 23.27% | 19.99% | 1.16 |
| 67 | 413 | 410.0 | 2,052 | 20.13% | 19.98% | 1.01 |
| 68 | 331 | 318.8 | 1,595 | 20.75% | 19.98% | 1.04 |
| 69 | 256 | 251.3 | 1,258 | 20.35% | 19.98% | 1.02 |
| 70 | 228 | 190.6 | 953 | 23.92% | 20.00% | 1.20 |
| 71 | 144 | 133.4 | 667 | 21.59% | 20.00% | 1.08 |
| 72 | 88 | 92.2 | 461 | 19.09% | 20.00% | 0.95 |
| 73 | 81 | 69.8 | 349 | 23.21% | 20.00% | 1.16 |
| 74 | 45 | 50.6 | 253 | 17.79% | 20.00% | 0.89 |
| 75 | 52 | 38.4 | 192 | 27.08% | 20.00% | 1.35 |
| 76 | 36 | 28.6 | 143 | 25.17% | 20.00% | 1.26 |
| 77 | 25 | 21.6 | 108 | 23.15% | 20.00% | 1.16 |
| 78 | 19 | 16.8 | 84 | 22.62% | 20.00% | 1.13 |
| 79 | 13 | 13.4 | 67 | 19.40% | 20.00% | 0.97 |
| Total | 6,720 | 7,422.4 | 62,614 | 10.73% | 11.85% | 0.91 |

Exposure Distribution w/ Retirement Rate - Actual and Expected; by Age



Retirement Rate - Actual, Expected, and Ratio; by Age



Specific observations:

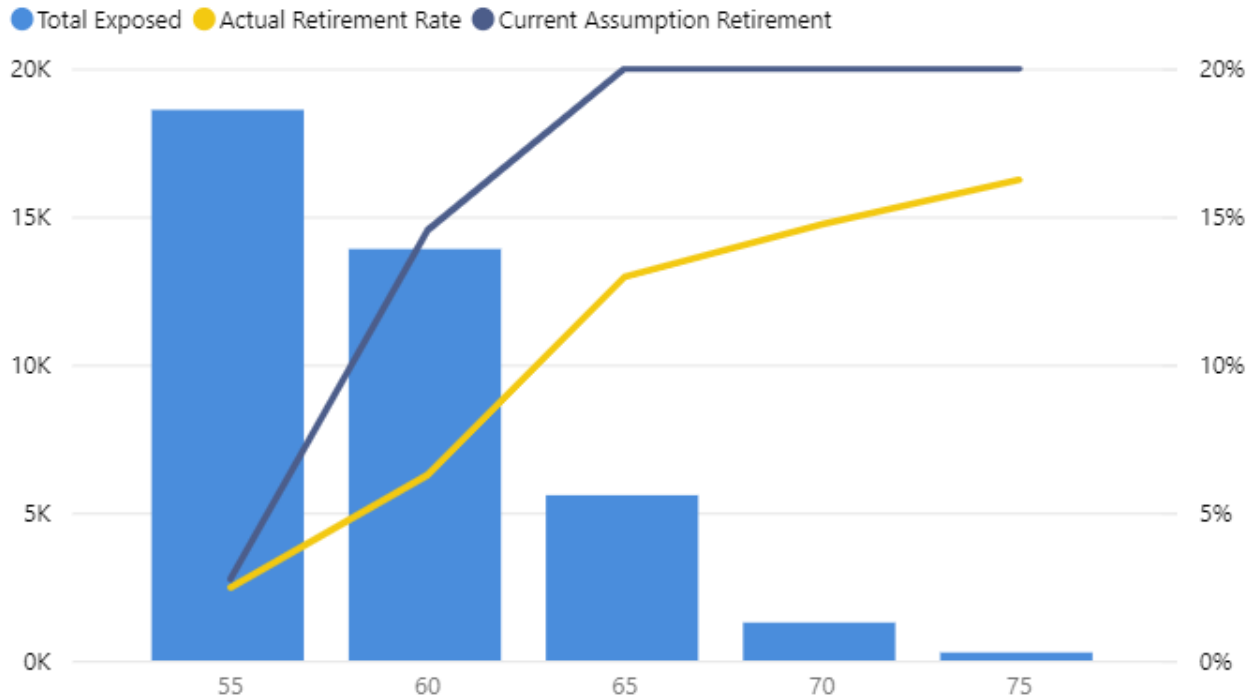
- In total, actual retirements were less than assumed by 9% (A/E ratio of 0.91).
- Actual rates are much lower than expected rates for up to 19 years of service (A/E ratio of 0.58) and even lower between 6 and 9 years of service (A/E ratio of 0.48).
- For 20 or more years of service, the relationship is reversed, and actual rates of retirement exceeded the assumption (A/E ratio of 1.28).
 - Some of the largest differences occurred at 20, 25, 26, and 30 years of service, for which the A/E ratio ranged from 1.42 to 1.59 at these specific points.
 - This is probably due to the benefit formula that applies a 2% multiplier to all years of service once 20 years are accrued and unreduced retirement occurs at 30 years of service.
- During reduced retirement periods (ages 55 to 61), actual rates of retirement were smaller for members with less than 20 years of service (2.83% for an A/E ratio of 0.81) than for members with at least 20 years of service but no more than 30 years of service (5.53% for an A/E ratio of 1.39).
- Relatively higher rates of retirement occur at ages 62 and 66 for those with at least 20 years of service.

The following charts show the retirement experience split by members with less than 20 years of service, members with between 20 and 29 years of service, and members with at least 30 years of service. Members under age 62 are not eligible for unreduced retirement benefits unless they have accrued 30 years of service. Please note that due to rounding there may be some members with an assigned retirement age of 61 who actually retired when they first attained age 62, and members with an assigned service of 29 years who actually retired when they first accrued 30 years of service. We will review potential adjustments in subsequent analyses.

The following charts show the retirement experience by age of members with less than 20 years of service.

| Age | Actual Retirements | Expected Retirements | Total Exposed | Actual Retirement Rate | Current Assumption Retirement | Ratio Act/Exp Ret |
|--------------|--------------------|----------------------|---------------|------------------------|-------------------------------|-------------------|
| 55 | 107 | 92.6 | 3,704 | 2.89% | 2.50% | ▲ 1.16 |
| 56 | 88 | 93.9 | 3,757 | 2.34% | 2.50% | ● 0.94 |
| 57 | 79 | 93.2 | 3,728 | 2.12% | 2.50% | ▲ 0.85 |
| 58 | 85 | 94.2 | 3,769 | 2.26% | 2.50% | ● 0.90 |
| 59 | 100 | 136.7 | 3,644 | 2.74% | 3.75% | ▲ 0.73 |
| 60 | 113 | 173.9 | 3,478 | 3.25% | 5.00% | ▲ 0.65 |
| 61 | 142 | 197.8 | 3,165 | 4.49% | 6.25% | ▲ 0.72 |
| 62 | 273 | 762.2 | 2,823 | 9.67% | 27.00% | ◆ 0.36 |
| 63 | 167 | 472.7 | 2,365 | 7.06% | 19.99% | ◆ 0.35 |
| 64 | 176 | 413.4 | 2,069 | 8.51% | 19.98% | ◆ 0.43 |
| 65 | 185 | 348.2 | 1,734 | 10.67% | 20.08% | ▲ 0.53 |
| 66 | 201 | 277.9 | 1,391 | 14.45% | 19.98% | ▲ 0.72 |
| 67 | 137 | 209.6 | 1,050 | 13.05% | 19.96% | ▲ 0.65 |
| 68 | 113 | 157.2 | 787 | 14.36% | 19.97% | ▲ 0.72 |
| 69 | 88 | 124.1 | 622 | 14.15% | 19.96% | ▲ 0.71 |
| 70 | 70 | 91.2 | 456 | 15.35% | 20.00% | ▲ 0.77 |
| 71 | 43 | 63.0 | 315 | 13.65% | 20.00% | ▲ 0.68 |
| 72 | 28 | 45.8 | 229 | 12.23% | 20.00% | ▲ 0.61 |
| 73 | 31 | 33.2 | 166 | 18.67% | 20.00% | ● 0.93 |
| 74 | 17 | 23.2 | 116 | 14.66% | 20.00% | ▲ 0.73 |
| 75 | 17 | 17.4 | 87 | 19.54% | 20.00% | ● 0.98 |
| 76 | 9 | 12.4 | 62 | 14.52% | 20.00% | ▲ 0.73 |
| 77 | 6 | 10.0 | 50 | 12.00% | 20.00% | ▲ 0.60 |
| 78 | 7 | 8.0 | 40 | 17.50% | 20.00% | ▲ 0.88 |
| 79 | 5 | 6.4 | 32 | 15.63% | 20.00% | ▲ 0.78 |
| Total | 2,287 | 3,958.2 | 39,639 | 5.77% | 9.99% | ▲ 0.58 |

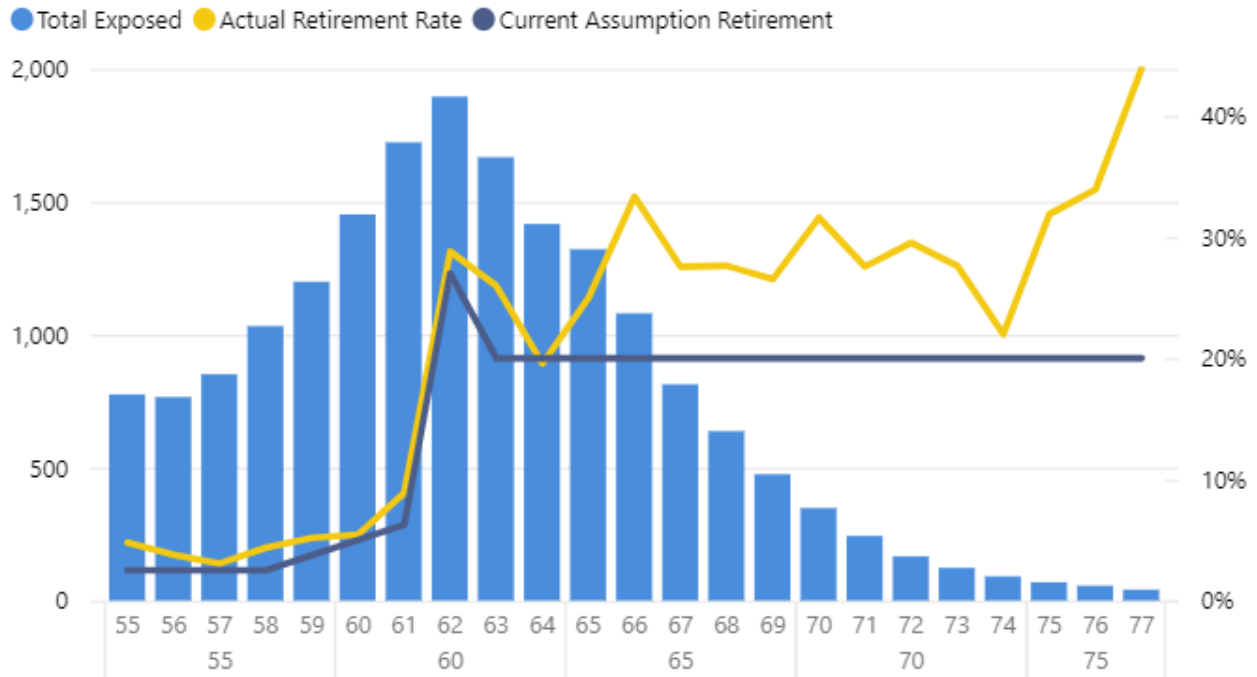
Exposure Distribution w/ Retirement Rate - Actual and Expected; by Age



The following charts show the retirement experience by age of members with between 20 and 29 years of service.

| Age | Actual Retirements | Expected Retirements | Total Exposed | Actual Retirement Rate | Current Assumption Retirement | Ratio Act/Exp Ret |
|--------------|--------------------|----------------------|---------------|------------------------|-------------------------------|-------------------|
| 55 | 37 | 19.4 | 775 | 4.77% | 2.50% | 1.91 |
| 56 | 29 | 19.1 | 765 | 3.79% | 2.50% | 1.52 |
| 57 | 26 | 21.3 | 851 | 3.06% | 2.50% | 1.22 |
| 58 | 45 | 25.8 | 1,032 | 4.36% | 2.50% | 1.74 |
| 59 | 62 | 45.0 | 1,199 | 5.17% | 3.75% | 1.38 |
| 60 | 79 | 72.6 | 1,452 | 5.44% | 5.00% | 1.09 |
| 61 | 153 | 107.7 | 1,723 | 8.88% | 6.25% | 1.42 |
| 62 | 546 | 511.7 | 1,895 | 28.81% | 27.00% | 1.07 |
| 63 | 433 | 333.4 | 1,667 | 25.97% | 20.00% | 1.30 |
| 64 | 277 | 283.2 | 1,416 | 19.56% | 20.00% | 0.98 |
| 65 | 330 | 264.2 | 1,321 | 24.98% | 20.00% | 1.25 |
| 66 | 360 | 216.0 | 1,080 | 33.33% | 20.00% | 1.67 |
| 67 | 224 | 162.6 | 813 | 27.55% | 20.00% | 1.38 |
| 68 | 176 | 127.4 | 637 | 27.63% | 20.00% | 1.38 |
| 69 | 126 | 95.0 | 475 | 26.53% | 20.00% | 1.33 |
| 70 | 110 | 69.6 | 348 | 31.61% | 20.00% | 1.58 |
| 71 | 67 | 48.6 | 243 | 27.57% | 20.00% | 1.38 |
| 72 | 49 | 33.2 | 166 | 29.52% | 20.00% | 1.48 |
| 73 | 34 | 24.6 | 123 | 27.64% | 20.00% | 1.38 |
| 74 | 20 | 18.2 | 91 | 21.98% | 20.00% | 1.10 |
| 75 | 22 | 13.8 | 69 | 31.88% | 20.00% | 1.59 |
| 76 | 19 | 11.2 | 56 | 33.93% | 20.00% | 1.70 |
| 77 | 18 | 8.2 | 41 | 43.90% | 20.00% | 2.20 |
| 78 | 8 | 5.4 | 27 | 29.63% | 20.00% | 1.48 |
| 79 | 7 | 4.2 | 21 | 33.33% | 20.00% | 1.67 |
| Total | 3,257 | 2,541.3 | 18,286 | 17.81% | 13.90% | 1.28 |

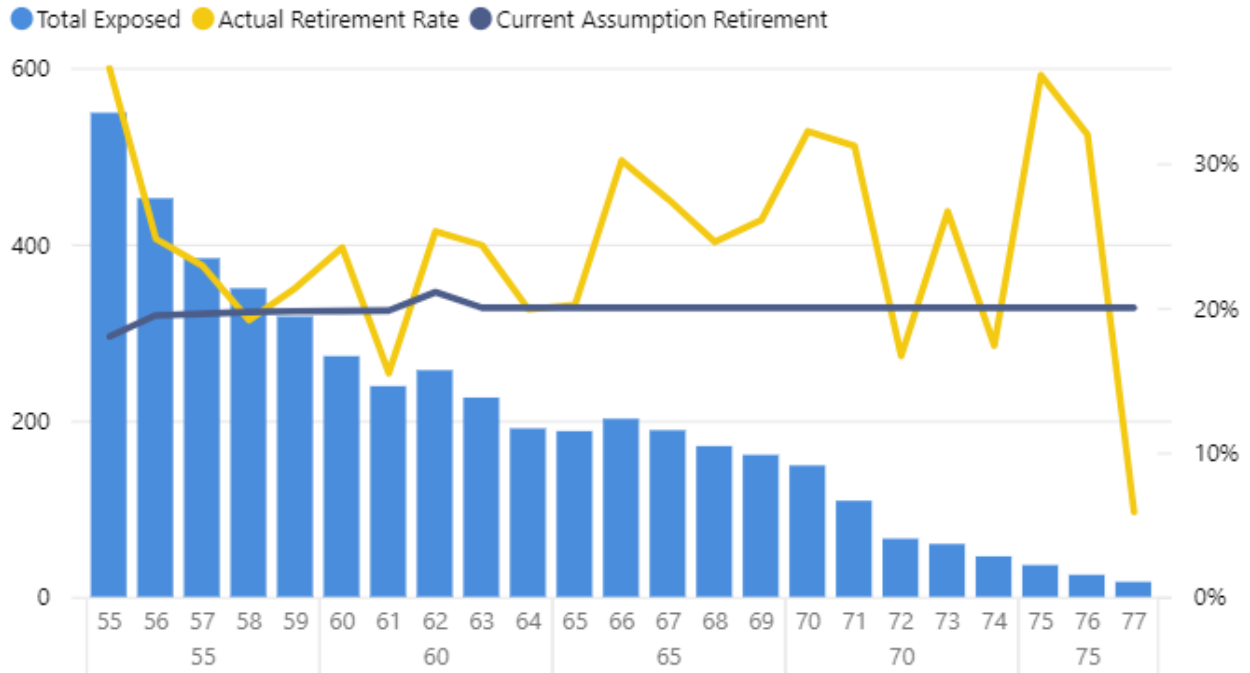
Exposure Distribution w/ Retirement Rate - Actual and Expected; by Age



The following charts show the retirement experience of members with at least 30 years of service.

| Age | Actual Retirements | Expected Retirements | Total Exposed | Actual Retirement Rate | Current Assumption Retirement | Ratio Act/Exp Ret |
|--------------|--------------------|----------------------|---------------|------------------------|-------------------------------|-------------------|
| 55 | 201 | 98.8 | 549 | 36.61% | 18.00% | 2.03 |
| 56 | 112 | 88.0 | 452 | 24.78% | 19.48% | 1.27 |
| 57 | 88 | 75.2 | 384 | 22.92% | 19.59% | 1.17 |
| 58 | 67 | 69.0 | 350 | 19.14% | 19.71% | 0.97 |
| 59 | 68 | 62.9 | 318 | 21.38% | 19.77% | 1.08 |
| 60 | 66 | 54.0 | 273 | 24.18% | 19.78% | 1.22 |
| 61 | 37 | 47.3 | 239 | 15.48% | 19.81% | 0.78 |
| 62 | 65 | 54.2 | 257 | 25.29% | 21.09% | 1.20 |
| 63 | 55 | 45.2 | 226 | 24.34% | 20.00% | 1.22 |
| 64 | 38 | 38.2 | 191 | 19.90% | 20.00% | 0.99 |
| 65 | 38 | 37.6 | 188 | 20.21% | 20.00% | 1.01 |
| 66 | 61 | 40.4 | 202 | 30.20% | 20.00% | 1.51 |
| 67 | 52 | 37.8 | 189 | 27.51% | 20.00% | 1.38 |
| 68 | 42 | 34.2 | 171 | 24.56% | 20.00% | 1.23 |
| 69 | 42 | 32.2 | 161 | 26.09% | 20.00% | 1.30 |
| 70 | 48 | 29.8 | 149 | 32.21% | 20.00% | 1.61 |
| 71 | 34 | 21.8 | 109 | 31.19% | 20.00% | 1.56 |
| 72 | 11 | 13.2 | 66 | 16.67% | 20.00% | 0.83 |
| 73 | 16 | 12.0 | 60 | 26.67% | 20.00% | 1.33 |
| 74 | 8 | 9.2 | 46 | 17.39% | 20.00% | 0.87 |
| 75 | 13 | 7.2 | 36 | 36.11% | 20.00% | 1.81 |
| 76 | 8 | 5.0 | 25 | 32.00% | 20.00% | 1.60 |
| 77 | 1 | 3.4 | 17 | 5.88% | 20.00% | 0.29 |
| 78 | 4 | 3.4 | 17 | 23.53% | 20.00% | 1.18 |
| 79 | 1 | 2.8 | 14 | 7.14% | 20.00% | 0.36 |
| Total | 1,176 | 922.9 | 4,689 | 25.08% | 19.68% | 1.27 |

Exposure Distribution w/ Retirement Rate - Actual and Expected; by Age

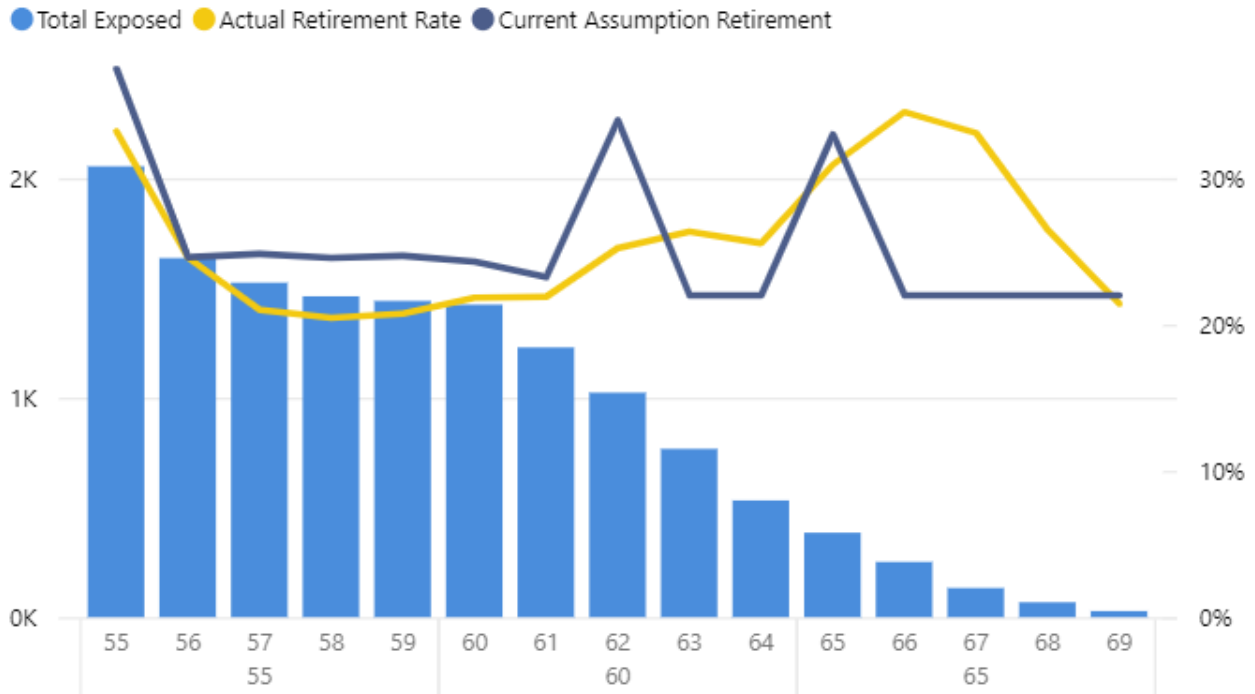


Age 55 and 25 Plan

The following charts display the experience of the age 55 and 25 plan by age, for the age range 55 to 69, for members with service or greater than or equal to 25 years, during the period 2016 – 2019.

| Age | Actual Retirements | Expected Retirements | Total Exposed | Actual Retirement Rate | Current Assumption Retirement | Ratio Act/Exp Ret |
|--------------|--------------------|----------------------|---------------|------------------------|-------------------------------|-------------------|
| 55 | 682 | 770.3 | 2,054 | 33.20% | 37.50% | ▲ 0.89 |
| 56 | 402 | 402.4 | 1,636 | 24.57% | 24.60% | ● 1.00 |
| 57 | 320 | 378.4 | 1,524 | 21.00% | 24.83% | ▲ 0.85 |
| 58 | 299 | 358.8 | 1,462 | 20.45% | 24.54% | ▲ 0.83 |
| 59 | 299 | 355.9 | 1,441 | 20.75% | 24.70% | ▲ 0.84 |
| 60 | 311 | 346.0 | 1,424 | 21.84% | 24.30% | ▲ 0.90 |
| 61 | 269 | 285.6 | 1,229 | 21.89% | 23.24% | ● 0.94 |
| 62 | 258 | 347.6 | 1,023 | 25.22% | 33.98% | ▲ 0.74 |
| 63 | 202 | 168.7 | 767 | 26.34% | 22.00% | ▲ 1.20 |
| 64 | 136 | 117.0 | 532 | 25.56% | 22.00% | ▲ 1.16 |
| 65 | 119 | 127.0 | 385 | 30.91% | 33.00% | ● 0.94 |
| 66 | 87 | 55.4 | 252 | 34.52% | 22.00% | ◆ 1.57 |
| 67 | 44 | 29.3 | 133 | 33.08% | 22.00% | ◆ 1.50 |
| 68 | 18 | 15.0 | 68 | 26.47% | 22.00% | ▲ 1.20 |
| 69 | 6 | 6.2 | 28 | 21.43% | 22.00% | ● 0.97 |
| Total | 3,452 | 3,763.6 | 13,958 | 24.73% | 26.96% | ● 0.92 |

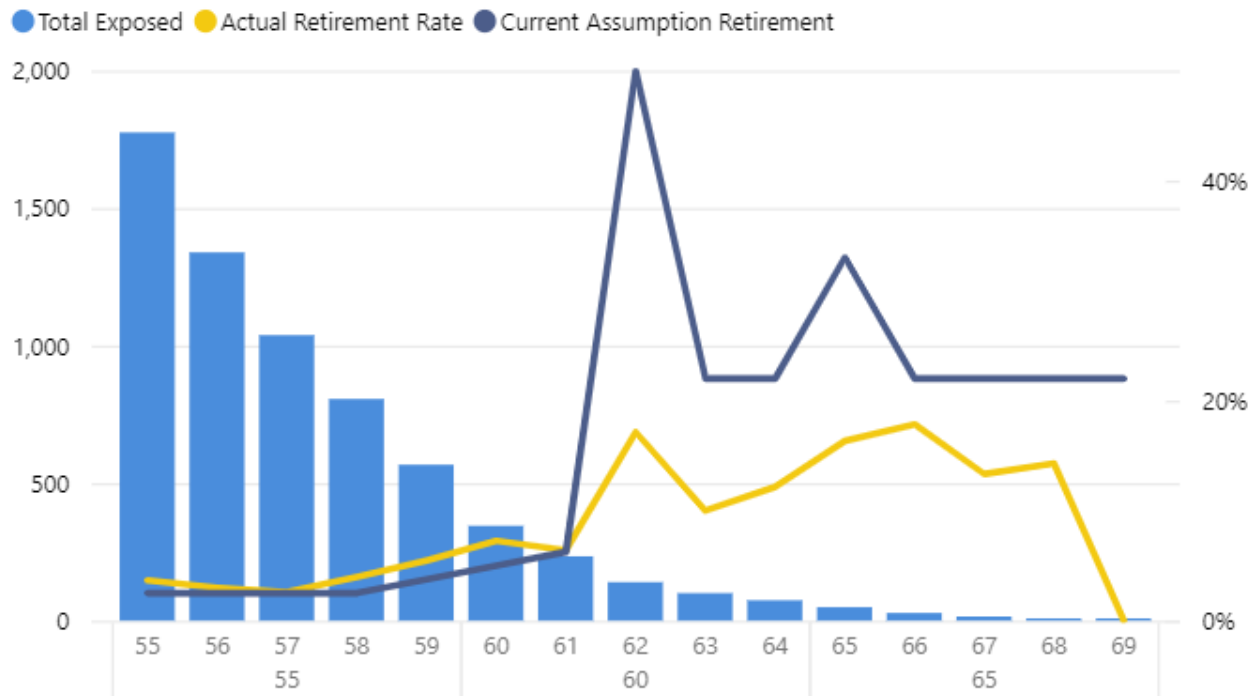
Exposure Distribution w/ Retirement Rate - Actual and Expected; by Age



The following charts display the experience of the age 55 and 25 plans, by age, for the age range 55 to 69, for members with service less than 25 years, during the period 2016 – 2019.

| Age | Actual Retirements | Expected Retirements | Total Exposed | Actual Retirement Rate | Current Assumption Retirement | Ratio Act/Exp Ret |
|--------------|--------------------|----------------------|---------------|------------------------|-------------------------------|-------------------|
| 55 | 65 | 44.4 | 1,775 | 3.66% | 2.50% | ▲ 1.46 |
| 56 | 40 | 33.5 | 1,339 | 2.99% | 2.50% | ▲ 1.19 |
| 57 | 27 | 26.0 | 1,038 | 2.60% | 2.50% | ● 1.04 |
| 58 | 32 | 20.1 | 806 | 3.97% | 2.50% | ◆ 1.59 |
| 59 | 31 | 21.3 | 567 | 5.47% | 3.75% | ▲ 1.46 |
| 60 | 25 | 17.2 | 345 | 7.25% | 5.00% | ▲ 1.45 |
| 61 | 15 | 14.6 | 234 | 6.41% | 6.25% | ● 1.03 |
| 62 | 24 | 70.0 | 140 | 17.14% | 50.00% | ◆ 0.34 |
| 63 | 10 | 22.0 | 100 | 10.00% | 22.00% | ◆ 0.45 |
| 64 | 9 | 16.3 | 74 | 12.16% | 22.00% | ▲ 0.55 |
| 65 | 8 | 16.2 | 49 | 16.33% | 33.00% | ◆ 0.49 |
| 66 | 5 | 6.2 | 28 | 17.86% | 22.00% | ▲ 0.81 |
| 67 | 2 | 3.3 | 15 | 13.33% | 22.00% | ▲ 0.61 |
| 68 | 1 | 1.5 | 7 | 14.29% | 22.00% | ▲ 0.65 |
| 69 | 0 | 1.1 | 5 | 0.00% | 22.00% | ◆ 0.00 |
| Total | 294 | 313.6 | 6,522 | 4.51% | 4.81% | ● 0.94 |

Exposure Distribution w/ Retirement Rate - Actual and Expected; by Age



Specific observations:

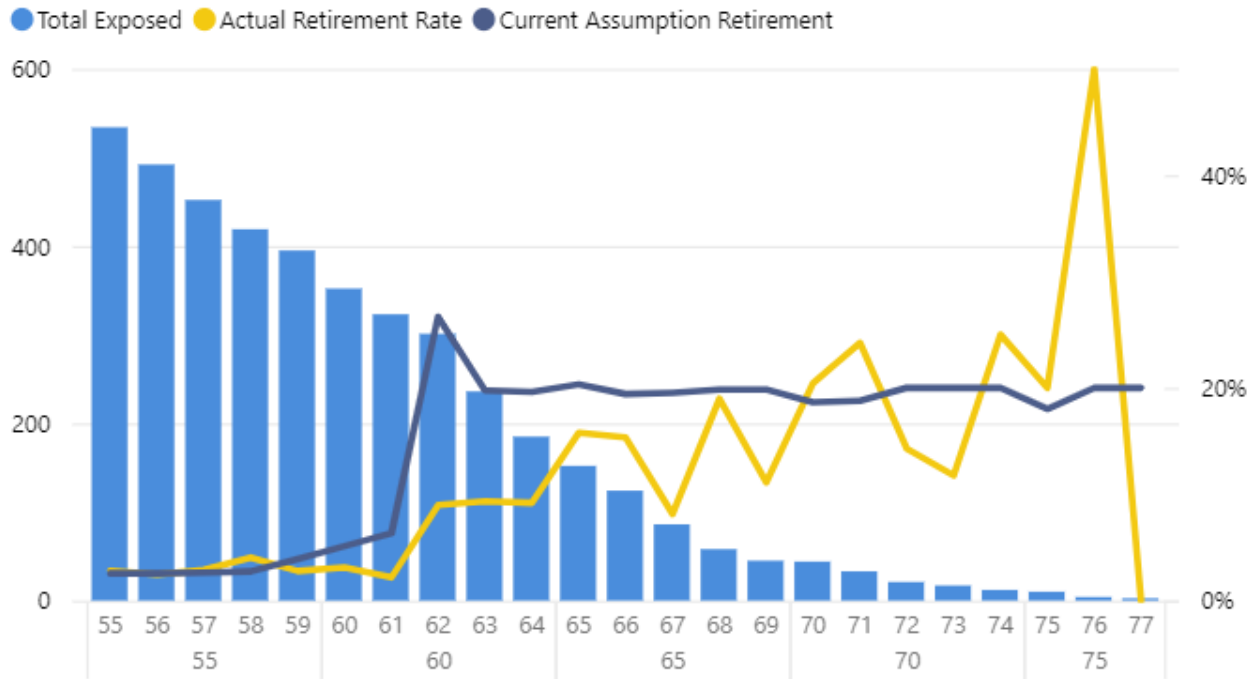
- The number of exposures was relatively small for those at older ages, especially members with less than 25 years of service. Therefore, we anticipate larger differences between the actual experience and expectations at older ages and for longer periods of service.
- The current assumption uses the elected improved plan rates of retirement.
- For members with at least 25 years of service, the actual experience was less than expected (A/E ratio of 0.92).
 - For members under 62 years of age, the A/E ratio was 0.89.
 - For members 62 and older, the A/E ratio was 1.00, although higher actual rates at ages 66 and 67 offset lower actual rates at age 62.
 - At first eligibility (members with 25 years of service and 55 to 62 years old, and members with more than 25 years of service 55 years old), the A/E ratio was 0.84. Adjusting for retirements at age 54 that actually occurred when the member first attained 25 years of service, the A/E ratio increases to approximately 0.90.
- While the A/E ratio of members with less than 25 years of service was 0.94, it was greater (A/E ratio of 1.33) for members with less than age 62 but smaller (A/E ratio of 0.43) for members 62 and older.

Age 55 and 27 Plan

The following charts display the experience of the age 55 and 27 plans by age (55 to 79), for service periods (5 to 50), during the period 2012 – 2019 (plan selections Ch 19/08 – 55/27 [Mandatory] and Ch 504/09 – 55/27 [Mandatory]). We used the entire study period because there was little experience available in 2013 and 2014 that would be impacted by the 2014 union agreement.

| Age | Actual Retirements | Expected Retirements | Total Exposed | Actual Retirement Rate | Current Assumption Retirement | Ratio Act/Exp Ret |
|--------------|--------------------|----------------------|---------------|------------------------|-------------------------------|-------------------|
| 55 | 15 | 13.7 | 534 | 2.81% | 2.56% | 1.10 |
| 56 | 12 | 12.6 | 492 | 2.44% | 2.57% | 0.95 |
| 57 | 13 | 11.9 | 452 | 2.88% | 2.64% | 1.09 |
| 58 | 17 | 11.5 | 419 | 4.06% | 2.74% | 1.48 |
| 59 | 11 | 15.4 | 395 | 2.78% | 3.91% | 0.71 |
| 60 | 11 | 18.0 | 352 | 3.13% | 5.12% | 0.61 |
| 61 | 7 | 20.5 | 323 | 2.17% | 6.33% | 0.34 |
| 62 | 27 | 80.3 | 301 | 8.97% | 26.68% | 0.34 |
| 63 | 22 | 46.6 | 236 | 9.32% | 19.74% | 0.47 |
| 64 | 17 | 36.3 | 185 | 9.19% | 19.62% | 0.47 |
| 65 | 24 | 30.9 | 152 | 15.79% | 20.34% | 0.78 |
| 66 | 19 | 24.1 | 124 | 15.32% | 19.42% | 0.79 |
| 67 | 7 | 16.8 | 86 | 8.14% | 19.53% | 0.42 |
| 68 | 11 | 11.5 | 58 | 18.97% | 19.83% | 0.96 |
| 69 | 5 | 8.9 | 45 | 11.11% | 19.82% | 0.56 |
| 70 | 9 | 8.2 | 44 | 20.45% | 18.64% | 1.10 |
| 71 | 8 | 6.2 | 33 | 24.24% | 18.79% | 1.29 |
| 72 | 3 | 4.2 | 21 | 14.29% | 20.00% | 0.71 |
| 73 | 2 | 3.4 | 17 | 11.76% | 20.00% | 0.59 |
| 74 | 3 | 2.4 | 12 | 25.00% | 20.00% | 1.25 |
| 75 | 2 | 1.8 | 10 | 20.00% | 18.00% | 1.11 |
| 76 | 2 | 0.8 | 4 | 50.00% | 20.00% | 2.50 |
| 77 | 0 | 0.4 | 2 | 0.00% | 20.00% | 0.00 |
| 78 | 0 | 0.4 | 2 | 0.00% | 20.00% | 0.00 |
| Total | 247 | 386.8 | 4,299 | 5.75% | 9.00% | 0.64 |

Exposure Distribution w/ Retirement Rate - Actual and Expected; by Age



Specific observations:

- Due to when these plans were adopted, there was nearly no retirement experience for members with 27 or more years of service. In essence, the experience of members retiring under this plan code is consistent with the experience of members retiring under the Basic Tier IV plan. The overall A/E ratio of this group is 0.64.

All Plans Up to 20 Years of Service

Upon examining the experience of each plan, we believe that all of them can be reviewed in the aggregate for ages 62 and older. In this section, we review the experience for members with less than 20 years of service. The following charts display the experience by service and age for the period 2016 – 2019.

| Service | Actual Retirements | Expected Retirements | Total Exposed | Actual Retirement Rate | Current Assumption Retirement | Ratio Act/Exp Ret |
|--------------|--------------------|----------------------|---------------|------------------------|-------------------------------|-------------------|
| 5 | 24 | 37.0 | 181 | 13.26% | 20.44% | ▲ 0.65 |
| 6 | 24 | 64.2 | 310 | 7.74% | 20.71% | ◆ 0.37 |
| 7 | 29 | 72.2 | 345 | 8.41% | 20.92% | ◆ 0.40 |
| 8 | 33 | 102.2 | 475 | 6.95% | 21.51% | ◆ 0.32 |
| 9 | 48 | 146.9 | 683 | 7.03% | 21.50% | ◆ 0.33 |
| 10 | 144 | 216.4 | 1,013 | 14.22% | 21.36% | ▲ 0.67 |
| 11 | 130 | 214.8 | 1,001 | 12.99% | 21.45% | ▲ 0.61 |
| 12 | 142 | 255.7 | 1,183 | 12.00% | 21.61% | ▲ 0.56 |
| 13 | 126 | 260.9 | 1,218 | 10.34% | 21.42% | ◆ 0.48 |
| 14 | 148 | 301.4 | 1,394 | 10.62% | 21.62% | ◆ 0.49 |
| 15 | 209 | 325.6 | 1,506 | 13.88% | 21.62% | ▲ 0.64 |
| 16 | 194 | 334.1 | 1,553 | 12.49% | 21.52% | ▲ 0.58 |
| 17 | 176 | 333.3 | 1,544 | 11.40% | 21.58% | ▲ 0.53 |
| 18 | 165 | 362.5 | 1,679 | 9.83% | 21.59% | ◆ 0.46 |
| 19 | 133 | 347.0 | 1,605 | 8.29% | 21.62% | ◆ 0.38 |
| Total | 1,725 | 3,374.1 | 15,690 | 10.99% | 21.50% | ▲ 0.51 |

| Age | Actual Retirements | Expected Retirements | Total Exposed | Actual Retirement Rate | Current Assumption Retirement | Ratio Act/Exp Ret |
|--------------|--------------------|----------------------|---------------|------------------------|-------------------------------|-------------------|
| 62 | 302 | 857.6 | 3,121 | 9.68% | 27.48% | 0.35 |
| 63 | 186 | 520.0 | 2,597 | 7.16% | 20.02% | 0.36 |
| 64 | 189 | 450.8 | 2,254 | 8.39% | 20.00% | 0.42 |
| 65 | 204 | 383.1 | 1,892 | 10.78% | 20.25% | 0.53 |
| 66 | 220 | 302.0 | 1,513 | 14.54% | 19.96% | 0.73 |
| 67 | 148 | 226.5 | 1,135 | 13.04% | 19.95% | 0.65 |
| 68 | 124 | 168.6 | 844 | 14.69% | 19.98% | 0.74 |
| 69 | 91 | 132.2 | 662 | 13.75% | 19.97% | 0.69 |
| 70 | 78 | 97.0 | 488 | 15.98% | 19.88% | 0.80 |
| 71 | 51 | 68.4 | 344 | 14.83% | 19.88% | 0.75 |
| 72 | 31 | 49.2 | 246 | 12.60% | 20.00% | 0.63 |
| 73 | 33 | 36.2 | 181 | 18.23% | 20.00% | 0.91 |
| 74 | 20 | 25.2 | 126 | 15.87% | 20.00% | 0.79 |
| 75 | 18 | 18.8 | 95 | 18.95% | 19.79% | 0.96 |
| 76 | 11 | 13.2 | 66 | 16.67% | 20.00% | 0.83 |
| 77 | 6 | 10.2 | 51 | 11.76% | 20.00% | 0.59 |
| 78 | 8 | 8.6 | 43 | 18.60% | 20.00% | 0.93 |
| 79 | 5 | 6.4 | 32 | 15.63% | 20.00% | 0.78 |
| Total | 1,725 | 3,374.1 | 15,690 | 10.99% | 21.50% | 0.51 |

Specific observations:

- Actual experience is approximately half of what was expected, with an A/E ratio of 0.51.
- Lower rates of retirement occurred at 6 – 9 years of service, and at ages under 66.

All Plans 20 or More Years of Service

In this section we combine the experience of all the plans for members at least 62 years old with service of at least 20 years. The following charts display the experience by service (20 to 39 years) and age (62 to 79) in the period 2016 – 2019.

| Service | Actual Retirements | Expected Retirements | Total Exposed | Actual Retirement Rate | Current Assumption Retirement | Ratio Act/Exp Ret |
|--------------|--------------------|----------------------|---------------|------------------------|-------------------------------|-------------------|
| 20 | 515 | 362.8 | 1,694 | 30.40% | 21.42% | ▲ 1.42 |
| 21 | 340 | 289.9 | 1,333 | 25.51% | 21.75% | ▲ 1.17 |
| 22 | 286 | 268.9 | 1,239 | 23.08% | 21.70% | ● 1.06 |
| 23 | 257 | 257.6 | 1,173 | 21.91% | 21.96% | ● 1.00 |
| 24 | 346 | 304.0 | 1,371 | 25.24% | 22.18% | ▲ 1.14 |
| 25 | 425 | 293.5 | 1,293 | 32.87% | 22.70% | ▲ 1.45 |
| 26 | 347 | 246.0 | 1,109 | 31.29% | 22.18% | ▲ 1.41 |
| 27 | 254 | 220.2 | 971 | 26.16% | 22.67% | ▲ 1.15 |
| 28 | 214 | 211.0 | 916 | 23.36% | 23.04% | ● 1.01 |
| 29 | 192 | 202.3 | 862 | 22.27% | 23.47% | ● 0.95 |
| 30 | 265 | 206.1 | 869 | 30.49% | 23.72% | ▲ 1.29 |
| 31 | 183 | 151.6 | 640 | 28.59% | 23.69% | ▲ 1.21 |
| 32 | 159 | 132.4 | 569 | 27.94% | 23.28% | ▲ 1.20 |
| 33 | 121 | 94.4 | 398 | 30.40% | 23.72% | ▲ 1.28 |
| 34 | 82 | 76.5 | 326 | 25.15% | 23.46% | ● 1.07 |
| 35 | 62 | 62.1 | 262 | 23.66% | 23.70% | ● 1.00 |
| 36 | 68 | 60.3 | 264 | 25.76% | 22.82% | ▲ 1.13 |
| 37 | 44 | 44.1 | 199 | 22.11% | 22.16% | ● 1.00 |
| 38 | 40 | 40.2 | 187 | 21.39% | 21.51% | ● 0.99 |
| 39 | 34 | 26.9 | 131 | 25.95% | 20.53% | ▲ 1.26 |
| Total | 4,234 | 3,550.8 | 15,806 | 26.79% | 22.46% | ▲ 1.19 |

| Age | Actual Retirements | Expected Retirements | Total Exposed | Actual Retirement Rate | Current Assumption Retirement | Ratio Act/Exp Ret |
|--------------|--------------------|----------------------|---------------|------------------------|-------------------------------|-------------------|
| 62 | 880 | 944.7 | 3,228 | 27.26% | 29.27% | 0.93 |
| 63 | 692 | 555.0 | 2,693 | 25.70% | 20.61% | 1.25 |
| 64 | 454 | 442.3 | 2,155 | 21.07% | 20.52% | 1.03 |
| 65 | 489 | 431.6 | 1,894 | 25.82% | 22.79% | 1.13 |
| 66 | 501 | 309.4 | 1,521 | 32.94% | 20.34% | 1.62 |
| 67 | 317 | 226.5 | 1,119 | 28.33% | 20.24% | 1.40 |
| 68 | 228 | 171.3 | 850 | 26.82% | 20.15% | 1.33 |
| 69 | 172 | 130.4 | 649 | 26.50% | 20.09% | 1.32 |
| 70 | 163 | 100.0 | 499 | 32.67% | 20.04% | 1.63 |
| 71 | 101 | 68.0 | 340 | 29.71% | 20.01% | 1.48 |
| 72 | 59 | 45.8 | 229 | 25.76% | 20.01% | 1.29 |
| 73 | 49 | 36.2 | 181 | 27.07% | 20.01% | 1.35 |
| 74 | 28 | 27.4 | 137 | 20.44% | 20.03% | 1.02 |
| 75 | 35 | 20.8 | 104 | 33.65% | 20.02% | 1.68 |
| 76 | 27 | 16.0 | 80 | 33.75% | 20.00% | 1.69 |
| 77 | 19 | 11.2 | 56 | 33.93% | 20.00% | 1.70 |
| 78 | 12 | 8.0 | 40 | 30.00% | 20.00% | 1.50 |
| 79 | 8 | 6.2 | 31 | 25.81% | 20.00% | 1.29 |
| Total | 4,234 | 3,550.8 | 15,806 | 26.79% | 22.46% | 1.19 |

Specific observations:

- The rates of retirement of these members are higher than for members of the same age who have less than 20 years of service.
- Actual rates of retirement were greater than assumed for members who are older than 62 with 20 or more years of service (A/E ratio of 1.19).
- The assumed retirement rate is greater for members who attained age 62 than for older members. Based on the experience, the retirement rate may be slightly greater at this age, but the disparity does not appear to be as large as the current assumption suggests.

Disability

The current ordinary disability assumption varies by age and gender but does not apply during the 10-year eligibility service period. Furthermore, a separate rate applies for accidental disability during all service periods. The ordinary disability benefit is equal to 1/60 times final average salary for each year of service accrued but no less than 1/3 of the member’s final average salary. The accidental disability retirement is 2/3 of the final average salary. The benefit is payable during the lifetime of the member and members may select any optional forms of payment. For members who have accrued at least 20 years of service, the service retirement benefit is greater than the ordinary disability retirement benefit if the member has met the conditions for an unreduced retirement benefit.

Ordinary Disability

In performing the experience analysis, it is necessary to reassign disability retirement codes retroactively to reflect the eventual approval of a disability retirement. Members with a disability code in a given year had all inactive status codes in prior years changed to a disability status code. We made adjustments as far back as 2012. Rates of disability were highest during the 2012 – 2015 period, moderate during the 2016 – 2017 period, and low during the 2019 – 2021 period. Ordinary disability rates declined each year since 2014.

It is difficult to determine how future years would impact the experience during the study period as we believe that this type of retroactive adjustment will be required in subsequent iterations of this study. The consequence will be a restatement of the number of disability retirements experienced during this study period, specifically 2019 – 2021.

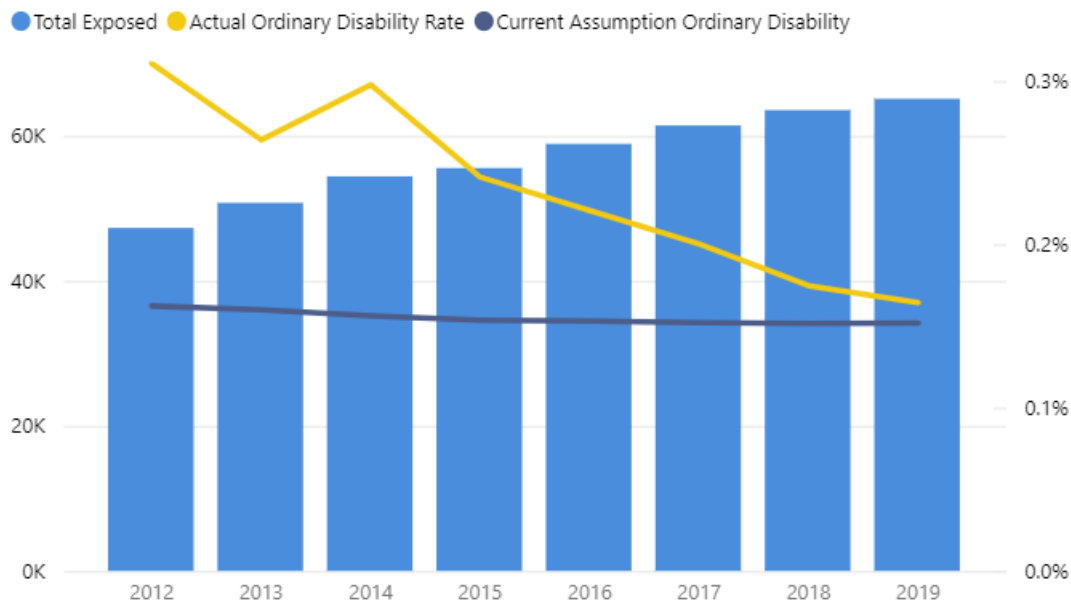
The following tables show the experience of ordinary disability retirement for all plans, by year, for males and females combined, based on the age range 30 to 79 and service range 10 to 50, through 2021.

| Plan Year | Actual Ordinary Disabilities | Expected Ordinary Disabilities | Total Exposed | Actual Ordinary Disability Rate | Current Assumption Ordinary Disability | Ratio Act/Exp Ordinary Disability |
|--------------|------------------------------|--------------------------------|----------------|---------------------------------|--|-----------------------------------|
| 2012 | 147 | 76.7 | 47,296 | 0.3108% | 0.1622% | ◆ 1.92 |
| 2013 | 134 | 81.1 | 50,760 | 0.2640% | 0.1598% | ◆ 1.65 |
| 2014 | 162 | 85.0 | 54,421 | 0.2977% | 0.1562% | ◆ 1.91 |
| 2015 | 134 | 85.3 | 55,562 | 0.2412% | 0.1535% | ◆ 1.57 |
| 2016 | 130 | 90.1 | 58,894 | 0.2207% | 0.1529% | ▲ 1.44 |
| 2017 | 123 | 93.4 | 61,436 | 0.2002% | 0.1521% | ▲ 1.32 |
| 2018 | 111 | 96.3 | 63,552 | 0.1747% | 0.1515% | ▲ 1.15 |
| 2019 | 107 | 98.8 | 65,113 | 0.1643% | 0.1518% | ● 1.08 |
| 2020 | 77 | 99.9 | 65,038 | 0.1184% | 0.1536% | ▲ 0.77 |
| 2021 | 27 | 100.4 | 64,758 | 0.0417% | 0.1551% | ◆ 0.27 |
| Total | 1,152 | 907.1 | 586,830 | 0.1963% | 0.1546% | ▲ 1.27 |

The following tables show the experience of ordinary disability retirement for all plans, by year, for males and females combined, for the age range 30 to 79 and service range 10 to 50 years, during 2012 - 2019.

| Plan Year | Actual Ordinary Disabilities | Expected Ordinary Disabilities | Total Exposed | Actual Ordinary Disability Rate | Current Assumption Ordinary Disability | Ratio Act/Exp Ordinary Disability |
|--------------|------------------------------|--------------------------------|----------------|---------------------------------|--|-----------------------------------|
| 2012 | 147 | 76.7 | 47,296 | 0.3108% | 0.1622% | 1.92 |
| 2013 | 134 | 81.1 | 50,760 | 0.2640% | 0.1598% | 1.65 |
| 2014 | 162 | 85.0 | 54,421 | 0.2977% | 0.1562% | 1.91 |
| 2015 | 134 | 85.3 | 55,562 | 0.2412% | 0.1535% | 1.57 |
| 2016 | 130 | 90.1 | 58,894 | 0.2207% | 0.1529% | 1.44 |
| 2017 | 123 | 93.4 | 61,436 | 0.2002% | 0.1521% | 1.32 |
| 2018 | 111 | 96.3 | 63,552 | 0.1747% | 0.1515% | 1.15 |
| 2019 | 107 | 98.8 | 65,113 | 0.1643% | 0.1518% | 1.08 |
| Total | 1,048 | 706.7 | 457,034 | 0.2293% | 0.1546% | 1.48 |

Exposure Distribution w/ Ordinary Disability Rate - Actual and Expected; by Year



The following tables show the experience of ordinary disability retirement, for all the plans, by age, based on the age range of 30 to 69, with the service range 10 to 39 years, by gender. Based on the current assumptions, the actual rate of disability retirements was much greater than expected for both male members (A/E ratio of 1.51) and female members (A/E ratio of 1.48) from 2012 - 2019.

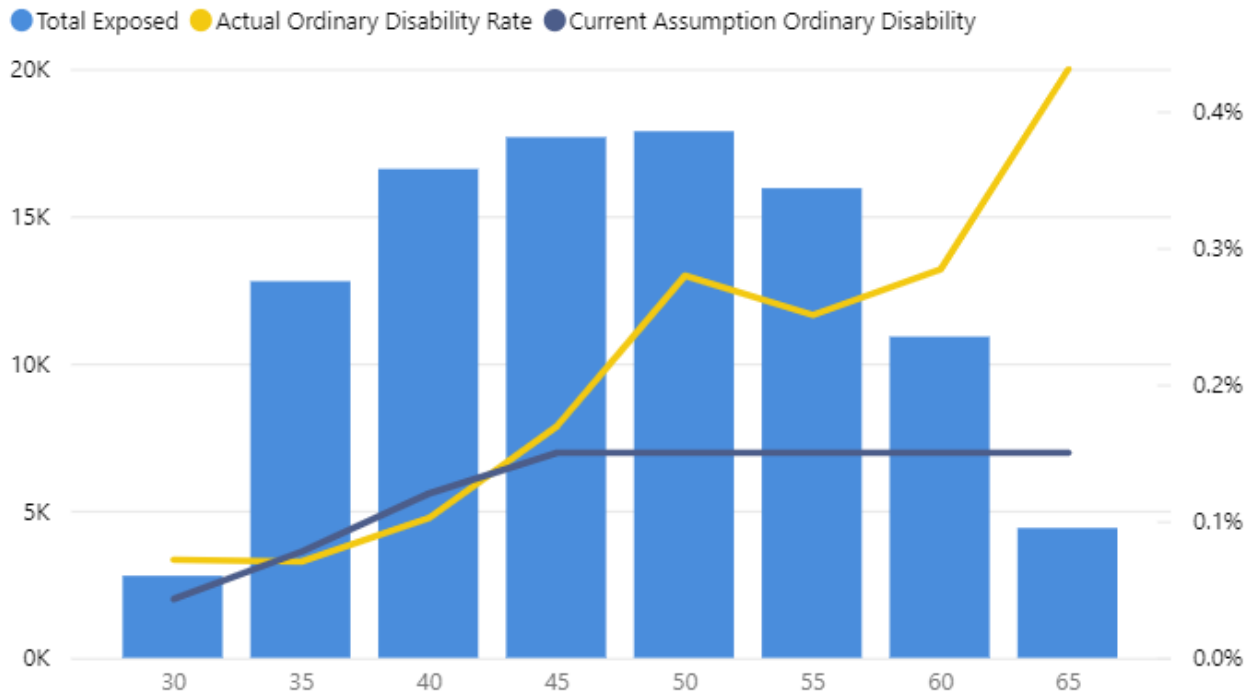
Males

The following tables are for male members.

| Age | Actual Ordinary Disabilities | Expected Ordinary Disabilities | Total Exposed | Actual Ordinary Disability Rate | Current Assumption Ordinary Disability | Ratio Act/Exp Ordinary Disability |
|-----|------------------------------|--------------------------------|---------------|---------------------------------|--|-----------------------------------|
| 30 | 0 | 0.0 | 32 | 0.0000% | 0.0100% | 0.00 |
| 31 | 0 | 0.0 | 58 | 0.0000% | 0.0200% | 0.00 |
| 32 | 0 | 0.1 | 386 | 0.0000% | 0.0300% | 0.00 |
| 33 | 1 | 0.3 | 868 | 0.1152% | 0.0400% | 2.88 |
| 34 | 1 | 0.7 | 1,442 | 0.0693% | 0.0500% | 1.39 |
| 35 | 0 | 1.2 | 1,938 | 0.0000% | 0.0600% | 0.00 |
| 36 | 2 | 1.6 | 2,357 | 0.0849% | 0.0680% | 1.25 |
| 37 | 2 | 2.0 | 2,670 | 0.0749% | 0.0760% | 0.99 |
| 38 | 3 | 2.4 | 2,831 | 0.1060% | 0.0840% | 1.26 |
| 39 | 2 | 2.8 | 2,991 | 0.0669% | 0.0920% | 0.73 |
| 40 | 1 | 3.2 | 3,150 | 0.0317% | 0.1000% | 0.32 |
| 41 | 5 | 3.6 | 3,282 | 0.1523% | 0.1100% | 1.38 |
| 42 | 2 | 4.1 | 3,387 | 0.0590% | 0.1200% | 0.49 |
| 43 | 3 | 4.4 | 3,399 | 0.0883% | 0.1300% | 0.68 |
| 44 | 6 | 4.7 | 3,382 | 0.1774% | 0.1400% | 1.27 |
| 45 | 4 | 5.2 | 3,486 | 0.1147% | 0.1500% | 0.76 |
| 46 | 7 | 5.3 | 3,546 | 0.1974% | 0.1500% | 1.32 |
| 47 | 7 | 5.3 | 3,551 | 0.1971% | 0.1500% | 1.31 |
| 48 | 6 | 5.4 | 3,568 | 0.1682% | 0.1500% | 1.12 |
| 49 | 6 | 5.3 | 3,528 | 0.1701% | 0.1500% | 1.13 |
| 50 | 10 | 5.2 | 3,481 | 0.2873% | 0.1500% | 1.92 |

| | | | | | | | |
|--------------|------------|--------------|---------------|----------------|----------------|----------|-------------|
| 51 | 8 | 5.2 | 3,485 | 0.2296% | 0.1500% | ◆ | 1.53 |
| 52 | 16 | 5.4 | 3,572 | 0.4479% | 0.1500% | ◆ | 2.99 |
| 53 | 9 | 5.4 | 3,624 | 0.2483% | 0.1500% | ◆ | 1.66 |
| 54 | 7 | 5.6 | 3,717 | 0.1883% | 0.1500% | ▲ | 1.26 |
| 55 | 8 | 5.5 | 3,695 | 0.2165% | 0.1500% | ▲ | 1.44 |
| 56 | 11 | 5.0 | 3,325 | 0.3308% | 0.1500% | ◆ | 2.21 |
| 57 | 4 | 4.7 | 3,129 | 0.1278% | 0.1500% | ▲ | 0.85 |
| 58 | 11 | 4.5 | 2,973 | 0.3700% | 0.1500% | ◆ | 2.47 |
| 59 | 6 | 4.2 | 2,824 | 0.2125% | 0.1500% | ▲ | 1.42 |
| 60 | 11 | 4.1 | 2,727 | 0.4034% | 0.1500% | ◆ | 2.69 |
| 61 | 5 | 3.8 | 2,523 | 0.1982% | 0.1500% | ▲ | 1.32 |
| 62 | 6 | 3.4 | 2,268 | 0.2646% | 0.1500% | ◆ | 1.76 |
| 63 | 7 | 2.8 | 1,836 | 0.3813% | 0.1500% | ◆ | 2.54 |
| 64 | 2 | 2.3 | 1,551 | 0.1289% | 0.1500% | ▲ | 0.86 |
| 65 | 6 | 2.1 | 1,368 | 0.4386% | 0.1500% | ◆ | 2.92 |
| 66 | 3 | 1.7 | 1,109 | 0.2705% | 0.1500% | ◆ | 1.80 |
| 67 | 4 | 1.2 | 833 | 0.4802% | 0.1500% | ◆ | 3.20 |
| 68 | 4 | 0.9 | 623 | 0.6421% | 0.1500% | ◆ | 4.28 |
| 69 | 2 | 0.7 | 475 | 0.4211% | 0.1500% | ◆ | 2.81 |
| Total | 198 | 131.3 | 98,990 | 0.2000% | 0.1327% | ◆ | 1.51 |

Exposure Distribution w/ Ordinary Disability Rate - Actual and Expected; by Age



Females

The following tables are for female members.

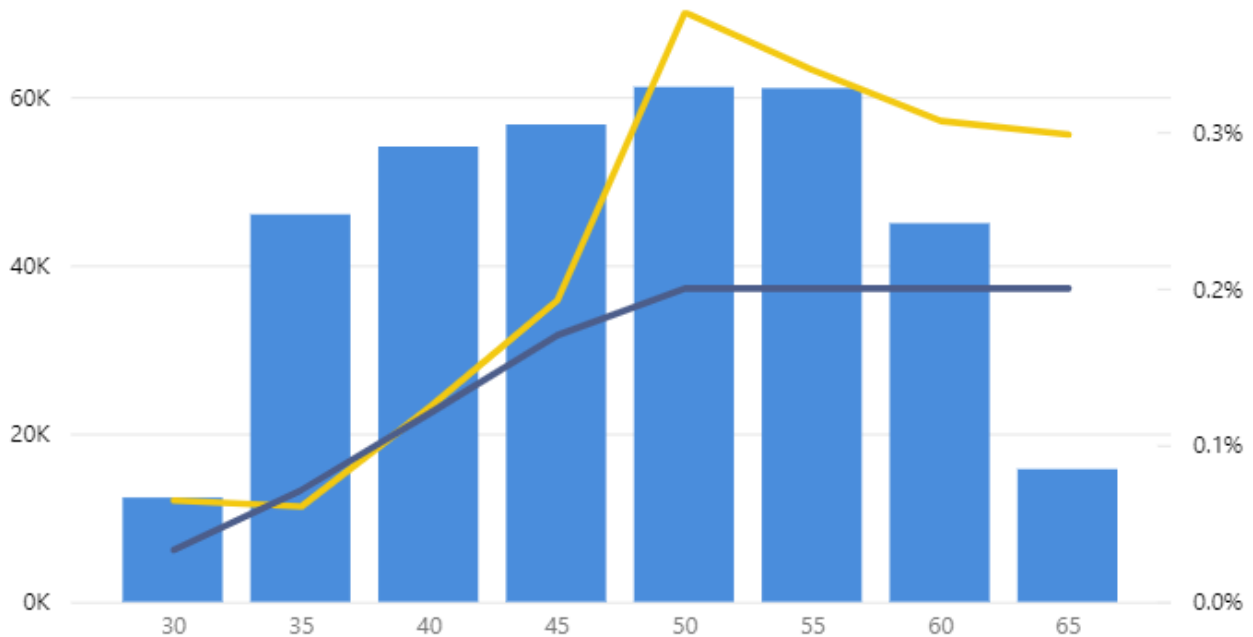
| Age | Actual Ordinary Disabilities | Expected Ordinary Disabilities | Total Exposed | Actual Ordinary Disability Rate | Current Assumption Ordinary Disability | Ratio Act/Exp Ordinary Disability |
|-----|------------------------------|--------------------------------|---------------|---------------------------------|--|-----------------------------------|
| 30 | 3 | 0.0 | 46 | 6.5217% | 0.0100% | ◇ 652.17 |
| 31 | 0 | 0.0 | 156 | 0.0000% | 0.0100% | ◇ 0.00 |
| 32 | 1 | 0.4 | 1,895 | 0.0528% | 0.0200% | ◇ 2.64 |
| 33 | 2 | 1.2 | 4,150 | 0.0482% | 0.0300% | ◇ 1.61 |
| 34 | 2 | 2.5 | 6,138 | 0.0326% | 0.0400% | ▲ 0.81 |
| 35 | 4 | 3.8 | 7,650 | 0.0523% | 0.0500% | ● 1.05 |
| 36 | 3 | 5.3 | 8,794 | 0.0341% | 0.0600% | ▲ 0.57 |
| 37 | 1 | 6.6 | 9,490 | 0.0105% | 0.0700% | ◇ 0.15 |
| 38 | 7 | 7.9 | 9,867 | 0.0709% | 0.0800% | ▲ 0.89 |
| 39 | 13 | 9.2 | 10,222 | 0.1272% | 0.0900% | ▲ 1.41 |
| 40 | 6 | 10.5 | 10,490 | 0.0572% | 0.1000% | ▲ 0.57 |
| 41 | 8 | 11.9 | 10,775 | 0.0742% | 0.1100% | ▲ 0.67 |
| 42 | 15 | 13.1 | 10,895 | 0.1377% | 0.1200% | ▲ 1.15 |
| 43 | 16 | 14.2 | 10,906 | 0.1467% | 0.1300% | ▲ 1.13 |
| 44 | 22 | 15.4 | 11,014 | 0.1997% | 0.1400% | ▲ 1.43 |
| 45 | 15 | 16.7 | 11,145 | 0.1346% | 0.1500% | ▲ 0.90 |
| 46 | 13 | 18.0 | 11,237 | 0.1157% | 0.1600% | ▲ 0.72 |
| 47 | 21 | 19.4 | 11,410 | 0.1840% | 0.1700% | ● 1.08 |
| 48 | 23 | 20.6 | 11,463 | 0.2006% | 0.1800% | ▲ 1.11 |
| 49 | 37 | 21.8 | 11,448 | 0.3232% | 0.1900% | ◇ 1.70 |
| 50 | 37 | 23.1 | 11,562 | 0.3200% | 0.2000% | ◇ 1.60 |

| | | | | | | | |
|--------------|------------|--------------|----------------|----------------|----------------|---|-------------|
| 51 | 49 | 23.7 | 11,852 | 0.4134% | 0.2000% | ◆ | 2.07 |
| 52 | 58 | 24.3 | 12,155 | 0.4772% | 0.2000% | ◆ | 2.39 |
| 53 | 34 | 25.0 | 12,522 | 0.2715% | 0.2000% | ▲ | 1.36 |
| 54 | 52 | 26.1 | 13,068 | 0.3979% | 0.2000% | ◆ | 1.99 |
| 55 | 38 | 26.5 | 13,272 | 0.2863% | 0.2000% | ▲ | 1.43 |
| 56 | 38 | 24.7 | 12,355 | 0.3076% | 0.2000% | ◆ | 1.54 |
| 57 | 44 | 24.0 | 12,021 | 0.3660% | 0.2000% | ◆ | 1.83 |
| 58 | 47 | 23.7 | 11,839 | 0.3970% | 0.2000% | ◆ | 1.98 |
| 59 | 40 | 23.1 | 11,530 | 0.3469% | 0.2000% | ◆ | 1.73 |
| 60 | 36 | 22.3 | 11,168 | 0.3223% | 0.2000% | ◆ | 1.61 |
| 61 | 31 | 20.9 | 10,469 | 0.2961% | 0.2000% | ▲ | 1.48 |
| 62 | 32 | 19.1 | 9,528 | 0.3359% | 0.2000% | ◆ | 1.68 |
| 63 | 19 | 15.2 | 7,600 | 0.2500% | 0.2000% | ▲ | 1.25 |
| 64 | 20 | 12.4 | 6,206 | 0.3223% | 0.2000% | ◆ | 1.61 |
| 65 | 18 | 10.4 | 5,175 | 0.3478% | 0.2000% | ◆ | 1.74 |
| 66 | 12 | 8.0 | 4,005 | 0.2996% | 0.2000% | ▲ | 1.50 |
| 67 | 10 | 5.7 | 2,871 | 0.3483% | 0.2000% | ◆ | 1.74 |
| 68 | 3 | 4.2 | 2,093 | 0.1433% | 0.2000% | ▲ | 0.72 |
| 69 | 4 | 3.2 | 1,621 | 0.2468% | 0.2000% | ▲ | 1.23 |
| Total | 834 | 564.3 | 352,103 | 0.2369% | 0.1603% | ▲ | 1.48 |

Exposure Distribution w/ Ordinary Disability Rate - Actual and Expected; by Age



● Total Exposed ● Actual Ordinary Disability Rate ● Current Assumption Ordinary Disability



Specific observations:

Part I Experience Study Report – TRS and BERS
 New York City Retirement Systems

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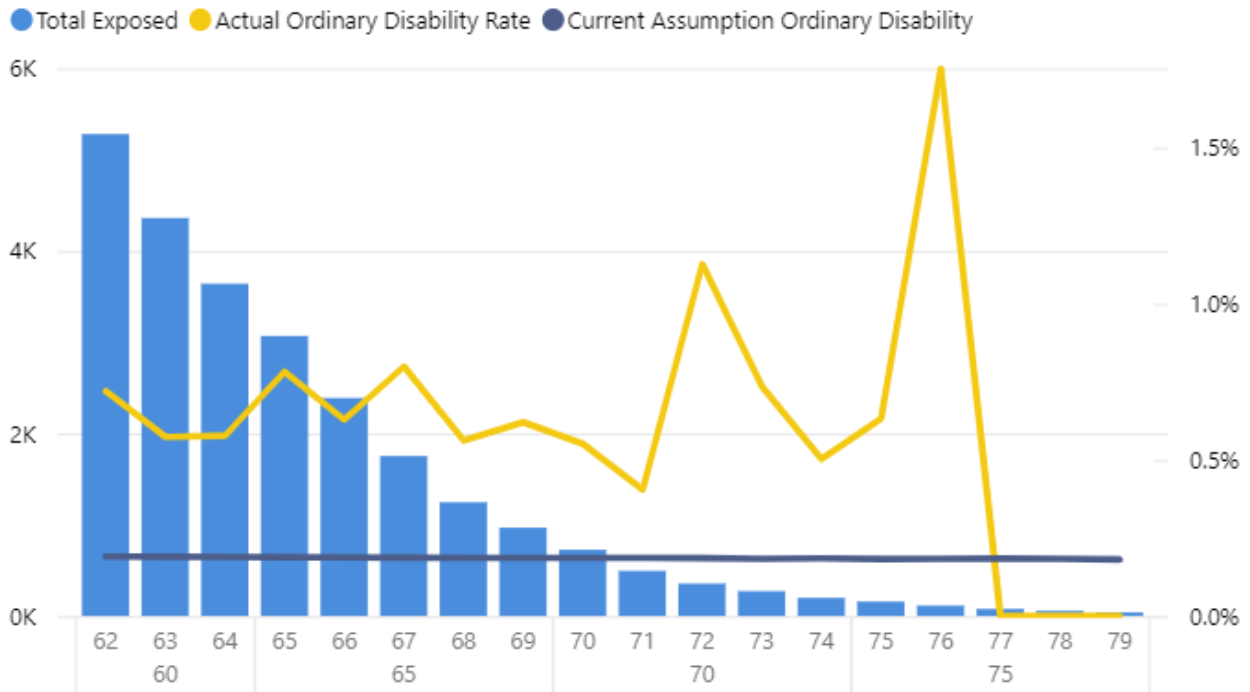
- The number of actual disabilities is influenced by whether the member has accrued 20 years of service or not. This finding is consistent with the fact that the disability benefit is smaller than the member’s accrued benefit with 20 or more years of service.
- This issue was pronounced in the rates experienced for ages 62 and older. For members with at least 20 years of service, there were only two ordinary disability retirements but 57 expected.
- For members with less than 20 years of service, 62 years old and older, there were 166 ordinary disability retirements but only 48 expected (A/E ratio of 3.50).
- While the rates of disability vary by gender, the overall observations compared to expectations are consistent by gender and thus, the following tables are shown on a combined basis.

Age 62 and older

The following charts show the results of members aged 62 and older with less than 20 years of service, males and females combined.

| Age | Actual Ordinary Disabilities | Expected Ordinary Disabilities | Total Exposed | Actual Ordinary Disability Rate | Current Assumption Ordinary Disability | Ratio Act/Exp Ordinary Disability |
|--------------|------------------------------|--------------------------------|---------------|---------------------------------|--|-----------------------------------|
| 62 | 38 | 10.0 | 5,278 | 0.7200% | 0.1903% | 3.78 |
| 63 | 25 | 8.3 | 4,359 | 0.5735% | 0.1900% | 3.02 |
| 64 | 21 | 6.9 | 3,639 | 0.5771% | 0.1892% | 3.05 |
| 65 | 24 | 5.8 | 3,067 | 0.7825% | 0.1881% | 4.16 |
| 66 | 15 | 4.5 | 2,387 | 0.6284% | 0.1876% | 3.35 |
| 67 | 14 | 3.3 | 1,752 | 0.7991% | 0.1867% | 4.28 |
| 68 | 7 | 2.3 | 1,245 | 0.5622% | 0.1861% | 3.02 |
| 69 | 6 | 1.8 | 967 | 0.6205% | 0.1861% | 3.33 |
| 70 | 4 | 1.4 | 725 | 0.5517% | 0.1862% | 2.96 |
| 71 | 2 | 0.9 | 494 | 0.4049% | 0.1861% | 2.18 |
| 72 | 4 | 0.7 | 355 | 1.1268% | 0.1851% | 6.09 |
| 73 | 2 | 0.5 | 272 | 0.7353% | 0.1833% | 4.01 |
| 74 | 1 | 0.4 | 199 | 0.5025% | 0.1849% | 2.72 |
| 75 | 1 | 0.3 | 158 | 0.6329% | 0.1823% | 3.47 |
| 76 | 2 | 0.2 | 114 | 1.7544% | 0.1833% | 9.57 |
| 77 | 0 | 0.1 | 77 | 0.0000% | 0.1838% | 0.00 |
| 78 | 0 | 0.1 | 57 | 0.0000% | 0.1833% | 0.00 |
| 79 | 0 | 0.1 | 39 | 0.0000% | 0.1808% | 0.00 |
| Total | 166 | 47.5 | 25,184 | 0.6591% | 0.1884% | 3.50 |

Exposure Distribution w/ Ordinary Disability Rate - Actual and Expected; by Age

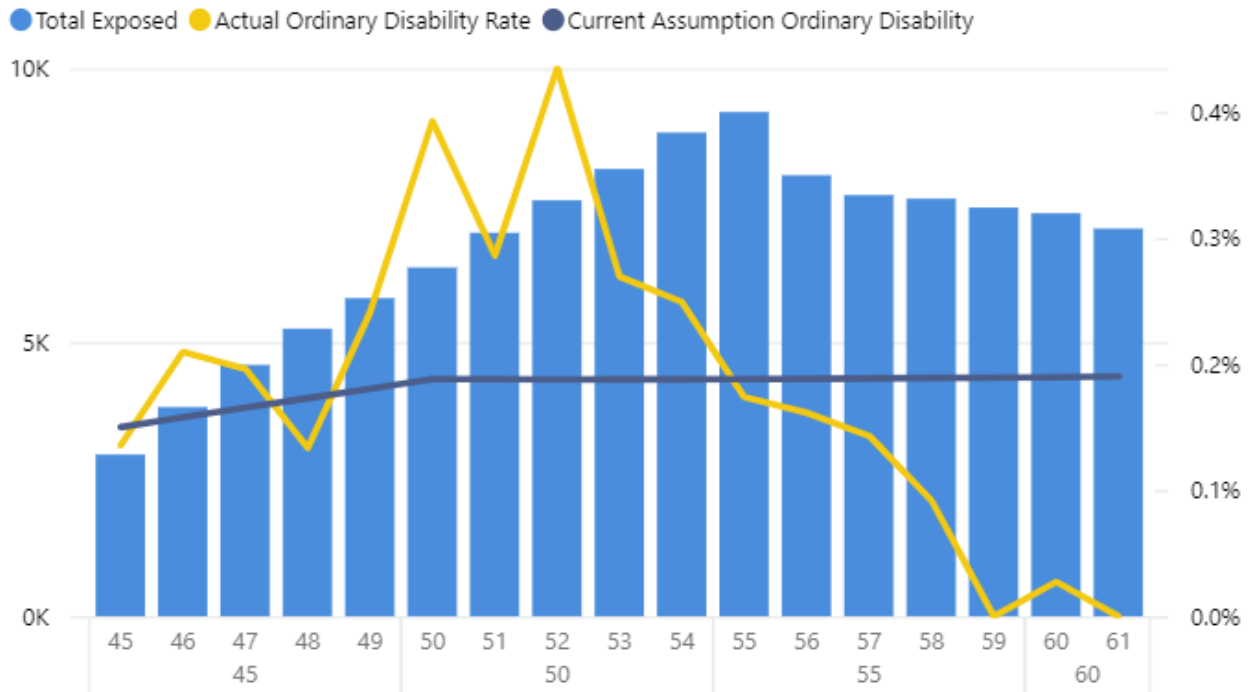


Service Greater than 20 Years and Less than Age 62

The following tables display the results for members for the age range 45 to 61 for members with at least 20 years of service, males and females combined.

| Age | Actual Ordinary Disabilities | Expected Ordinary Disabilities | Total Exposed | Actual Ordinary Disability Rate | Current Assumption Ordinary Disability | Ratio Act/Exp Ordinary Disability |
|--------------|------------------------------|--------------------------------|----------------|---------------------------------|--|-----------------------------------|
| 45 | 4 | 4.4 | 2,951 | 0.1355% | 0.1500% | 0.90 |
| 46 | 8 | 6.0 | 3,818 | 0.2095% | 0.1578% | 1.33 |
| 47 | 9 | 7.6 | 4,586 | 0.1962% | 0.1654% | 1.19 |
| 48 | 7 | 9.1 | 5,247 | 0.1334% | 0.1730% | 0.77 |
| 49 | 14 | 10.5 | 5,805 | 0.2412% | 0.1806% | 1.34 |
| 50 | 25 | 12.0 | 6,364 | 0.3928% | 0.1881% | 2.09 |
| 51 | 20 | 13.2 | 6,997 | 0.2858% | 0.1881% | 1.52 |
| 52 | 33 | 14.3 | 7,590 | 0.4348% | 0.1879% | 2.31 |
| 53 | 22 | 15.3 | 8,161 | 0.2696% | 0.1879% | 1.43 |
| 54 | 22 | 16.6 | 8,826 | 0.2493% | 0.1880% | 1.33 |
| 55 | 16 | 17.3 | 9,200 | 0.1739% | 0.1881% | 0.92 |
| 56 | 13 | 15.2 | 8,047 | 0.1616% | 0.1883% | 0.86 |
| 57 | 11 | 14.5 | 7,685 | 0.1431% | 0.1887% | 0.76 |
| 58 | 7 | 14.4 | 7,620 | 0.0919% | 0.1891% | 0.49 |
| 59 | 0 | 14.1 | 7,458 | 0.0000% | 0.1893% | 0.00 |
| 60 | 2 | 13.9 | 7,354 | 0.0272% | 0.1896% | 0.14 |
| 61 | 0 | 13.5 | 7,074 | 0.0000% | 0.1902% | 0.00 |
| Total | 213 | 211.8 | 114,783 | 0.1856% | 0.1845% | 1.01 |

Exposure Distribution w/ Ordinary Disability Rate - Actual and Expected; by Age



Specific observations:

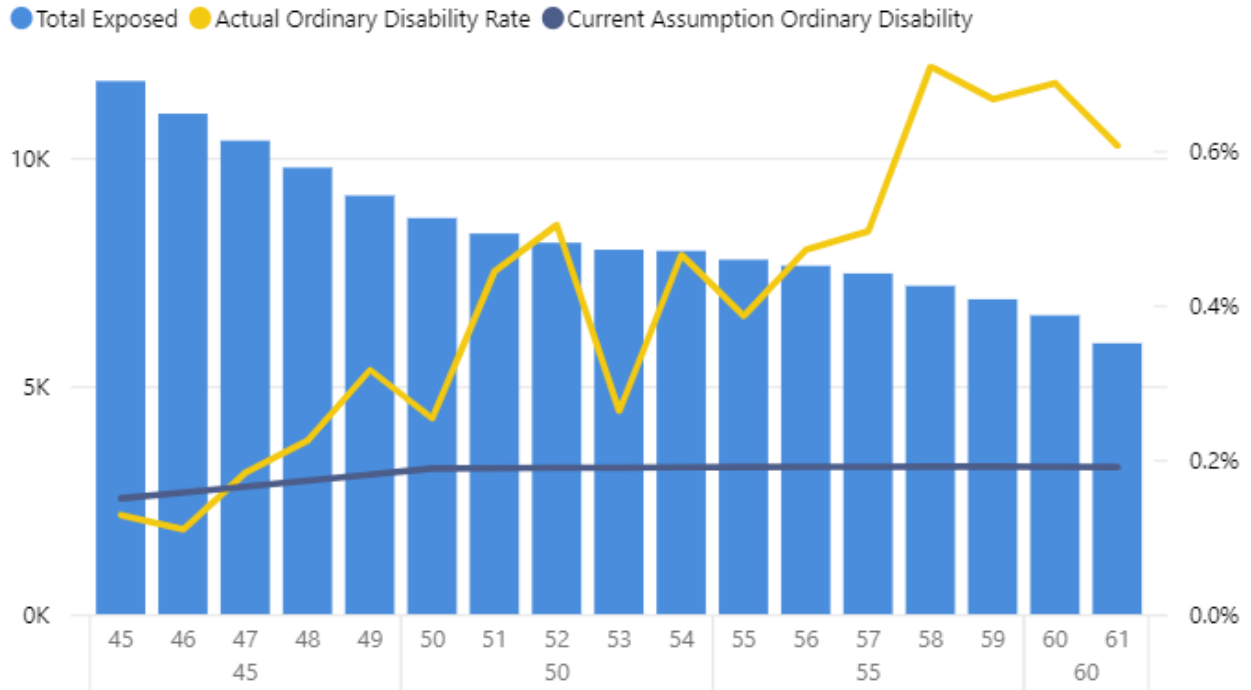
- Overall, for these ages, the number of actual ordinary disability retirements is consistent with expectations (A/E ratio of 1.01).
- The actual rate of disability retirements is highest for members in their early 50s; it declines beginning at age 55, when members become eligible for early retirement.

Service Less than 20 Years and Under Age 62

The following tables display the results by age for members with less than 20 years of service, and younger than age 62, males and females combined.

| Age | Actual Ordinary Disabilities | Expected Ordinary Disabilities | Total Exposed | Actual Ordinary Disability Rate | Current Assumption Ordinary Disability | Ratio Act/Exp Ordinary Disability |
|--------------|------------------------------|--------------------------------|----------------|---------------------------------|--|-----------------------------------|
| 45 | 15 | 17.5 | 11,680 | 0.1284% | 0.1500% | ▲ 0.86 |
| 46 | 12 | 17.3 | 10,965 | 0.1094% | 0.1575% | ▲ 0.69 |
| 47 | 19 | 17.1 | 10,375 | 0.1831% | 0.1652% | ▲ 1.11 |
| 48 | 22 | 16.9 | 9,784 | 0.2249% | 0.1728% | ▲ 1.30 |
| 49 | 29 | 16.6 | 9,172 | 0.3162% | 0.1806% | ◆ 1.75 |
| 50 | 22 | 16.4 | 8,679 | 0.2535% | 0.1887% | ▲ 1.34 |
| 51 | 37 | 15.8 | 8,340 | 0.4436% | 0.1891% | ◆ 2.35 |
| 52 | 41 | 15.4 | 8,137 | 0.5039% | 0.1894% | ◆ 2.66 |
| 53 | 21 | 15.1 | 7,985 | 0.2630% | 0.1897% | ▲ 1.39 |
| 54 | 37 | 15.1 | 7,959 | 0.4649% | 0.1900% | ◆ 2.45 |
| 55 | 30 | 14.8 | 7,767 | 0.3862% | 0.1903% | ◆ 2.03 |
| 56 | 36 | 14.5 | 7,633 | 0.4716% | 0.1905% | ◆ 2.48 |
| 57 | 37 | 14.2 | 7,465 | 0.4956% | 0.1907% | ◆ 2.60 |
| 58 | 51 | 13.7 | 7,193 | 0.7090% | 0.1909% | ◆ 3.71 |
| 59 | 46 | 13.2 | 6,900 | 0.6667% | 0.1911% | ◆ 3.49 |
| 60 | 45 | 12.5 | 6,547 | 0.6873% | 0.1909% | ◆ 3.60 |
| 61 | 36 | 11.3 | 5,935 | 0.6066% | 0.1903% | ◆ 3.19 |
| Total | 536 | 257.5 | 142,516 | 0.3761% | 0.1807% | ◆ 2.08 |

Exposure Distribution w/ Ordinary Disability Rate - Actual and Expected; by Age



Specific observations:

- Overall, for these ages, the number of actual ordinary disability retirements is more than double the expected number (A/E ratio of 2.08).

Summary

Retirement eligibility and the change in the benefit accrual rate upon completing 20 years of service have a significant impact on the number of members who apply for disability retirement. Consequently, consideration should be given to varying the rates of disability to take into account these two variables.

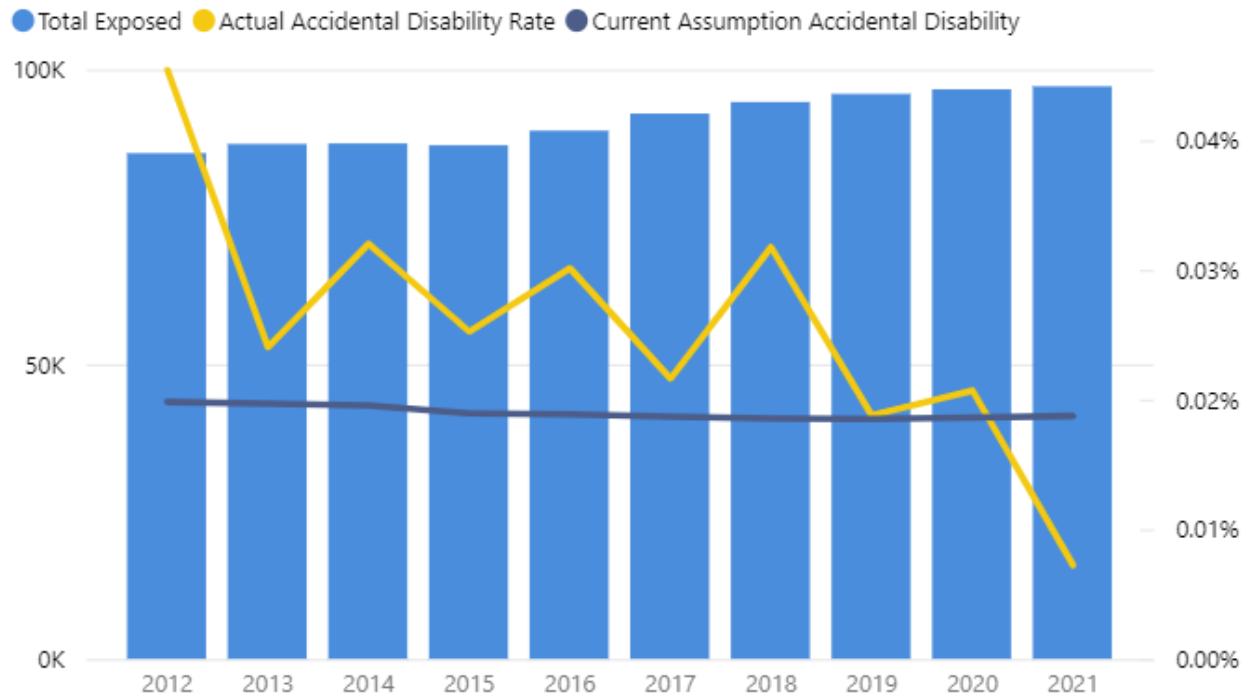
Accidental Disability

As noted in the ordinary disability section, it is necessary to reassign disability retirement codes retroactively to reflect the eventual approval of a disability retirement. Members with a disability code in a given year had all inactive status codes in prior years changed to a disability status code. Rates of accidental disability were highest during 2012 and then declined. While the number of accidentally disability retirements was higher in even years than in odd years, we believe this is due to random fluctuations that result from the small number of accidentally disability retirements.

The following tables show the experience results of accidental disability retirements, for all the plans, by year, for the age range 20 to 79, service range 0 to 50 years, for female members.

| Plan Year | Actual Accidental Disabilities | Expected Accidental Disabilities | Total Exposed | Actual Accidental Disability Rate | Current Assumption Accidental Disability | Ratio Act/Exp Accidental Disability |
|--------------|--------------------------------|----------------------------------|----------------|-----------------------------------|--|-------------------------------------|
| 2012 | 39 | 17.0 | 85,809 | 0.0454% | 0.0198% | 2.29 |
| 2013 | 21 | 17.2 | 87,373 | 0.0240% | 0.0197% | 1.22 |
| 2014 | 28 | 17.1 | 87,461 | 0.0320% | 0.0195% | 1.64 |
| 2015 | 22 | 16.5 | 87,155 | 0.0252% | 0.0189% | 1.33 |
| 2016 | 27 | 16.9 | 89,632 | 0.0301% | 0.0189% | 1.60 |
| 2017 | 20 | 17.3 | 92,528 | 0.0216% | 0.0187% | 1.16 |
| 2018 | 30 | 17.5 | 94,493 | 0.0317% | 0.0185% | 1.71 |
| 2019 | 18 | 17.7 | 95,864 | 0.0188% | 0.0185% | 1.02 |
| 2020 | 20 | 18.0 | 96,646 | 0.0207% | 0.0186% | 1.11 |
| 2021 | 7 | 18.2 | 97,153 | 0.0072% | 0.0187% | 0.38 |
| Total | 232 | 173.4 | 914,114 | 0.0254% | 0.0190% | 1.34 |

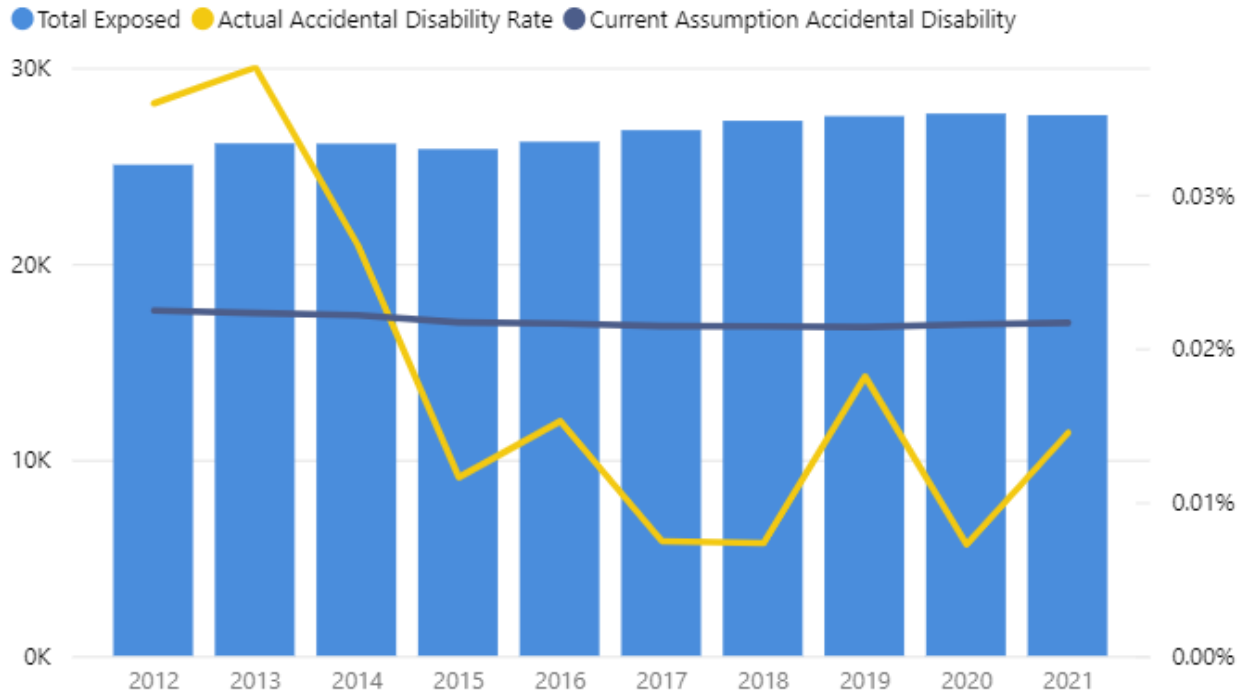
Exposure Distribution w/ Accidental Disability Rate - Actual and Expected; by Year



The following tables show the experience results of accidental disability retirements, for all the plans, by year, for the age range 20 to 79, service range of 0 to 50 years, for male members.

| Plan Year | Actual Accidental Disabilities | Expected Accidental Disabilities | Total Exposed | Actual Accidental Disability Rate | Current Assumption Accidental Disability | Ratio Act/Exp Accidental Disability |
|--------------|--------------------------------|----------------------------------|----------------|-----------------------------------|--|-------------------------------------|
| 2012 | 9 | 5.6 | 25,047 | 0.0359% | 0.0225% | 1.60 |
| 2013 | 10 | 5.8 | 26,135 | 0.0383% | 0.0223% | 1.72 |
| 2014 | 7 | 5.8 | 26,121 | 0.0268% | 0.0222% | 1.21 |
| 2015 | 3 | 5.6 | 25,844 | 0.0116% | 0.0217% | 0.54 |
| 2016 | 4 | 5.7 | 26,219 | 0.0153% | 0.0216% | 0.71 |
| 2017 | 2 | 5.7 | 26,809 | 0.0075% | 0.0214% | 0.35 |
| 2018 | 2 | 5.8 | 27,286 | 0.0073% | 0.0214% | 0.34 |
| 2019 | 5 | 5.9 | 27,523 | 0.0182% | 0.0214% | 0.85 |
| 2020 | 2 | 6.0 | 27,654 | 0.0072% | 0.0215% | 0.34 |
| 2021 | 4 | 6.0 | 27,573 | 0.0145% | 0.0217% | 0.67 |
| Total | 48 | 57.9 | 266,211 | 0.0180% | 0.0218% | 0.83 |

Exposure Distribution w/ Accidental Disability Rate - Actual and Expected; by Year

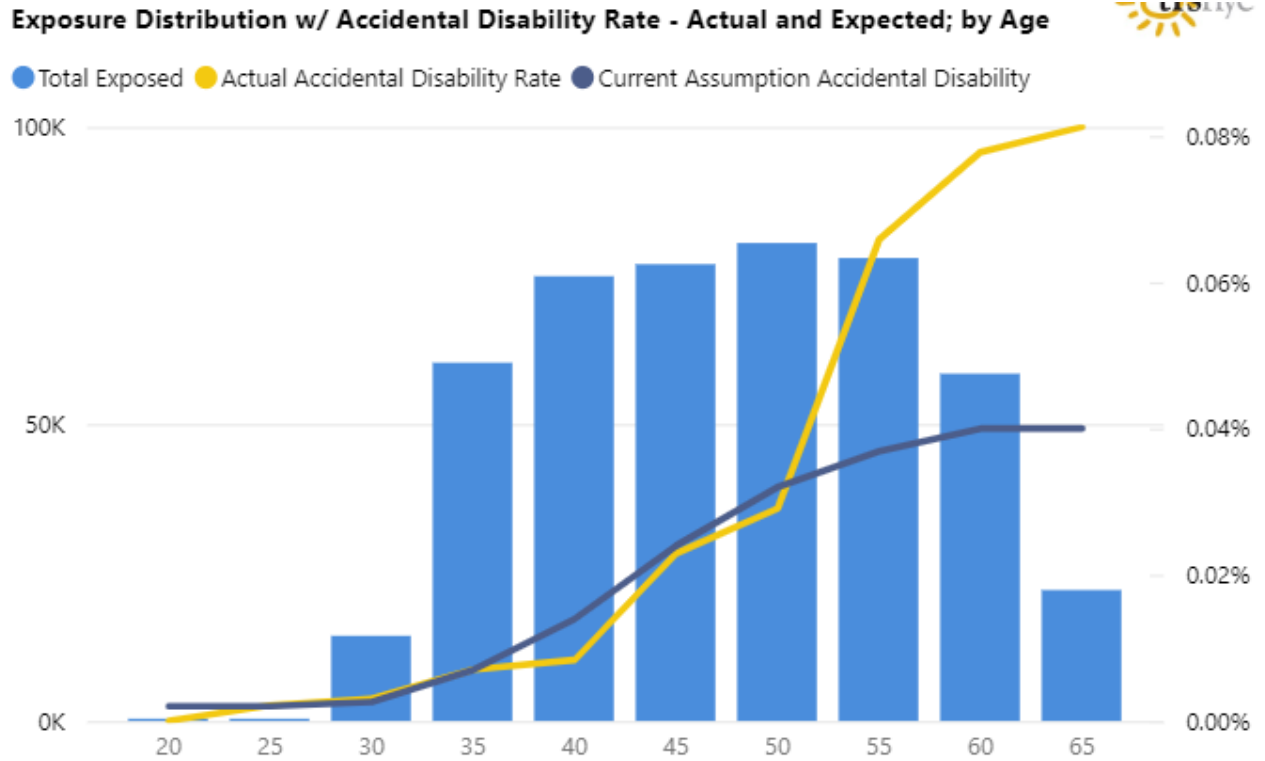


Specific observations:

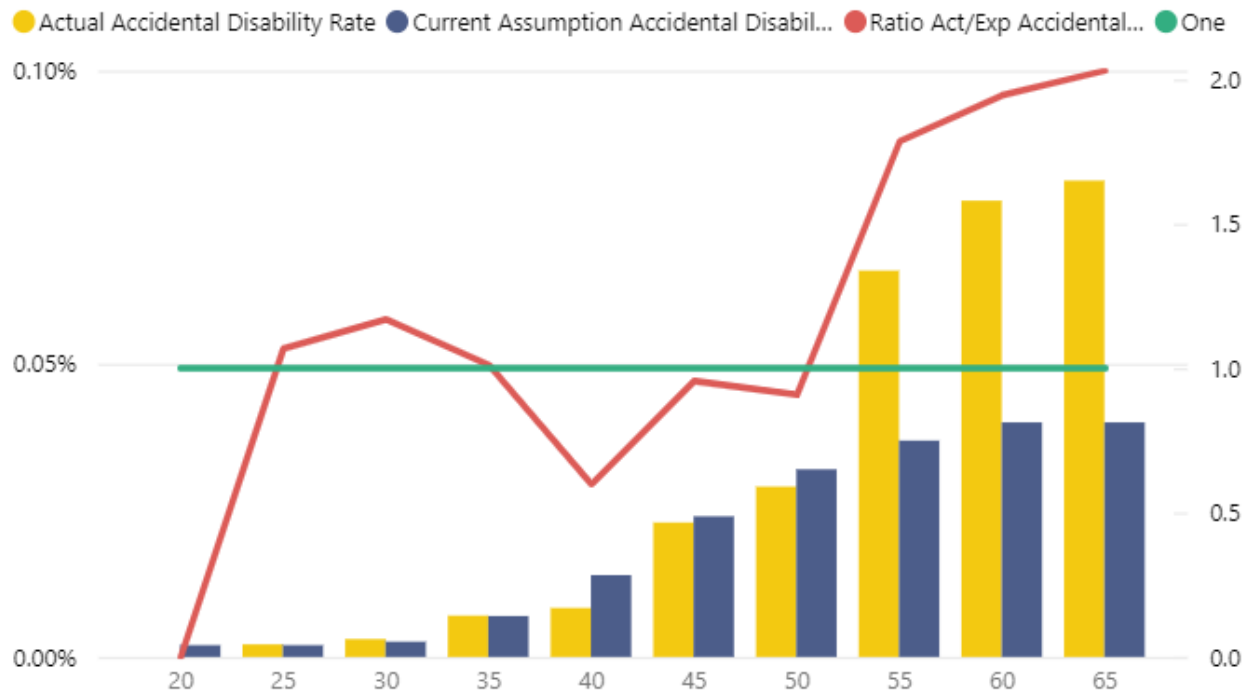
- The small number of accidental disability retirements produces high year-to-year variations, especially for male members.
- The normal retirement benefit is greater than the accidental disability benefit when a member completes 35 years of service. Only one accidental disability retirement was recorded for members with at least 35 years of service.
- While there is no service requirement, rates of disability appear to vary by a member’s length of service.

Females

The following tables display the results by age for females with an age range of 20 to 69, and a service range 0 to 34 years.



Accidental Disability Rate - Actual, Expected, and Ratio; by Age



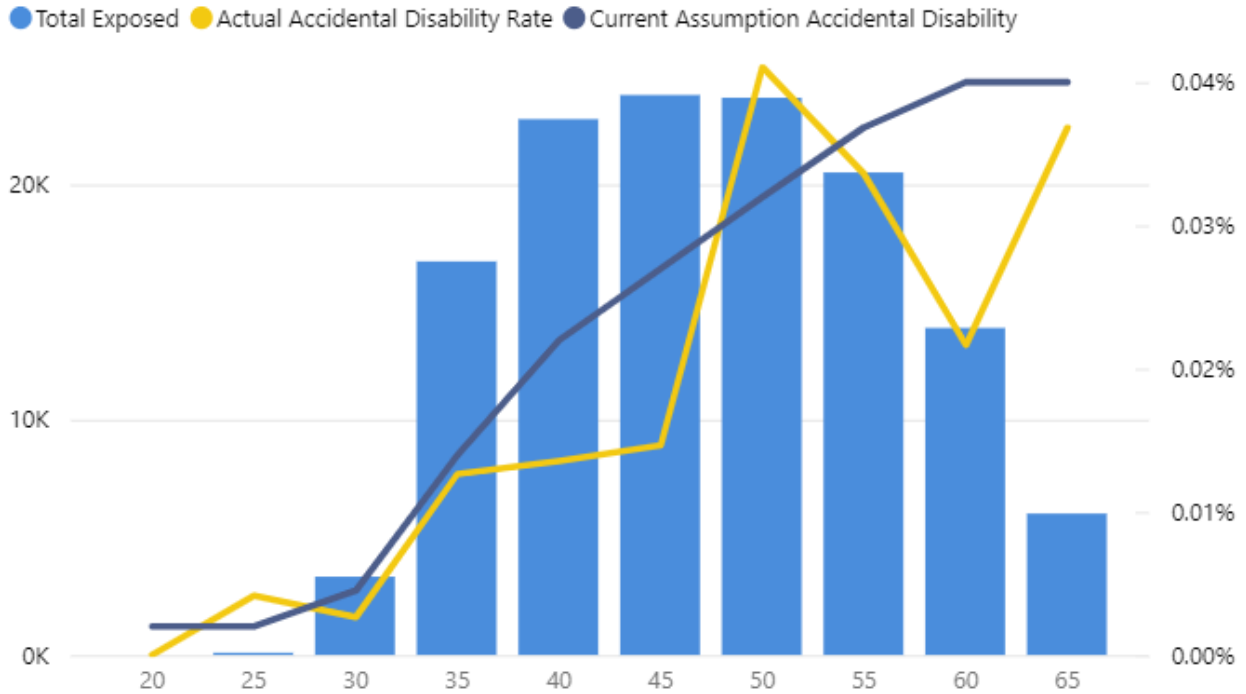
Specific observations:

- Overall, the actual number of accidental disability retirements was more than expected for female members (A/E ratio of 1.33).
- The current age-based assumption appears to track the experience on an age basis until age 55.
- After age 55, the number of accidental disability retirements exceeds the current assumption by 88% (A/E ratio of 1.88).

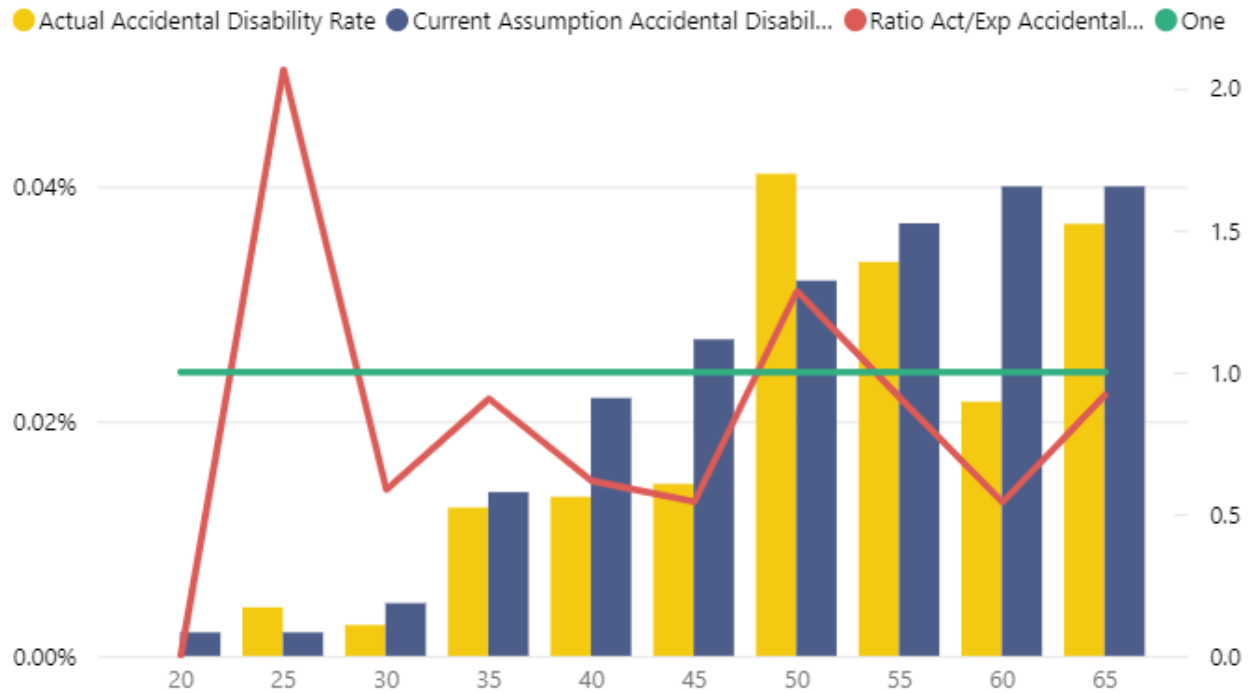
Males

The following tables display the results by age for male members with an age range of 20 to 69, and a service range 0 to 34 years.

Exposure Distribution w/ Accidental Disability Rate - Actual and Expected; by Age



Accidental Disability Rate - Actual, Expected, and Ratio; by Age



Specific observations:

- The small number of accidental disability retirements produces statistical variations in the comparisons by age and by length of service.
- Overall, the actual number of accidental disability retirements was less than expected for male members (A/E ratio of 0.83).
- The current accidental disability retirement by age assumption appears to track the actual experience.

Pre-retirement Death

Plan codes excluded in the analysis of other contingencies are part of the analysis of pre-retirement death.

Mortality assumptions involve two components: a base table and a mortality improvement scale. The mortality improvement scale adjusts the mortality rates of the base table to reflect that generally rates of mortality are anticipated to improve over time.

The Society of Actuaries (SOA) has published mortality improvement scales (MP scales) each year from 2014 to 2021. In the last several actuarial valuations, OA has used the mortality improvement scale that coincides with the valuation date. For example, OA used the MP-2020 scale in its June 30, 2020 lag actuarial valuation. In this analysis, we used the most recent improvement scale (MP-2021) published by the SOA as of the date of this analysis. Please note that the SOA did not publish a MP-2022 scale.

In this study the base table corresponds to the year 2012; expected mortality rates in future years are obtained from the base table and the MP-2021 scale. For example, the 2017 (July 1, 2016 – June 30, 2017) mortality rates are derived from the base table (2012) adjusted with four years of improvements. This method links mortality rates across the years and, consequently, allows mortality comparisons from one year to another.

The SOA MP-2021 improvement scale is based on data through 2019 (before the onset of Covid) from the Social Security Administration (SSA). Even though the aggregate (for all ages) long-term trend has been towards mortality improvements, this is not always the case for each age. Therefore, there are situations where the expected mortality rate in a later year is higher than base rate.

There is much discussion in the actuarial profession and among retirement systems about the development of mortality tables and treatment of excess deaths due to the Covid pandemic, which occurred in 2020 – 2022. The purpose of this analysis is to share our observations about the experience during the study period. In subsequent analyses, we will recommend changes to mortality assumptions as appropriate.

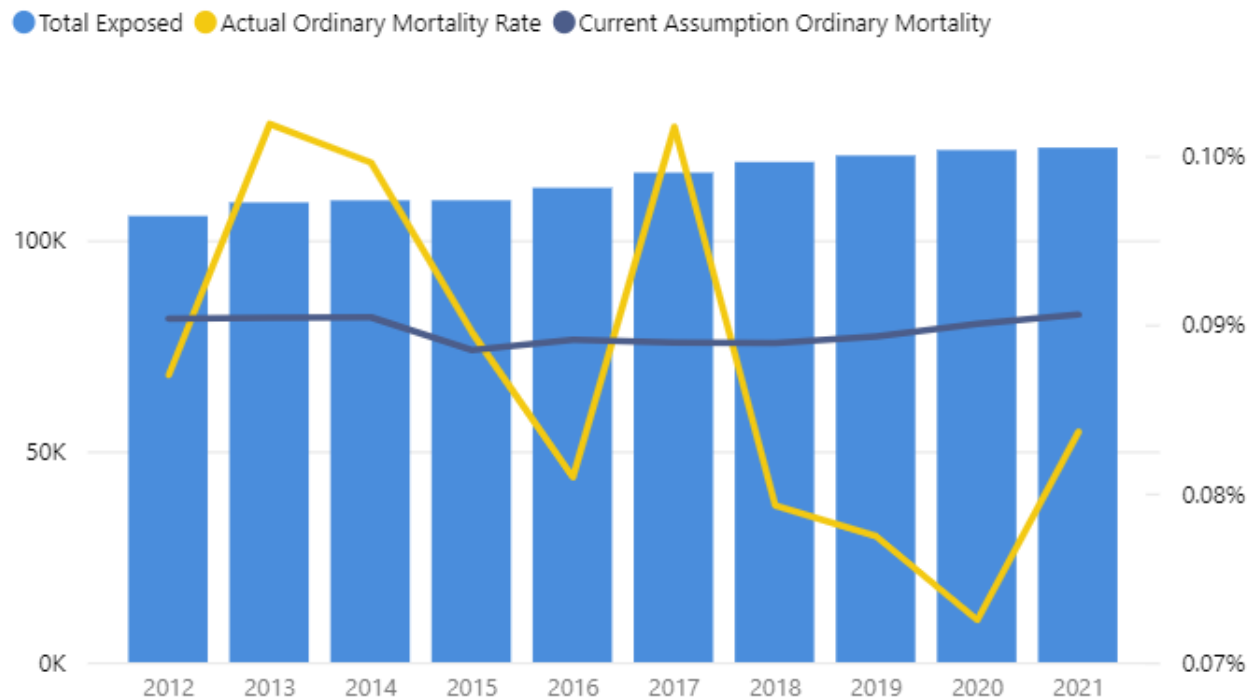
Please note that the charts by age are based on 5-year brackets. For example, the age bracket 45 should be interpreted as the interval 45 – 49.

Ordinary Death

The following charts show the results of ordinary death by year, for males and females combined, for the age range (20 to 69) and service range (0 to 50 years), during the period 2012 – 2021.

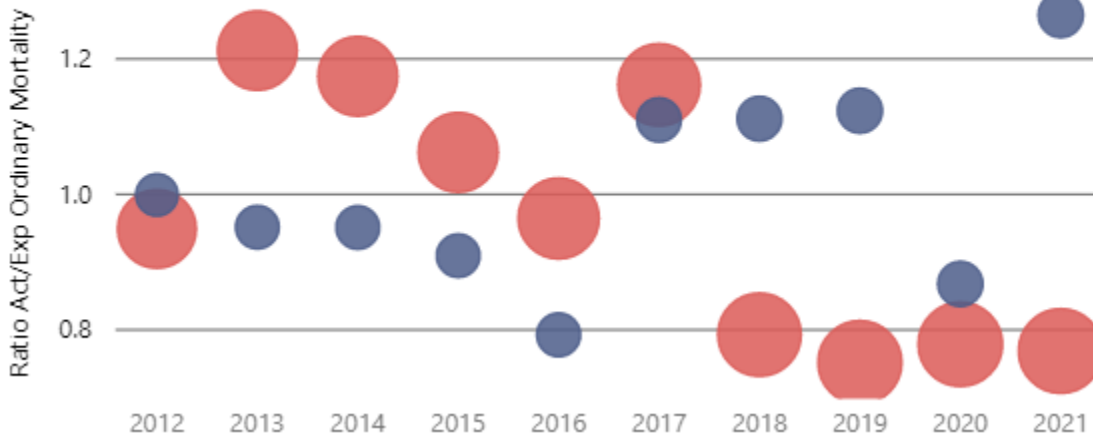
| Plan Year | Actual Ordinary Deaths | Expected Ordinary Deaths | Total Exposed | Actual Ordinary Mortality Rate | Current Assumption Ordinary Mortality | Ratio Act/Exp Ordinary Mortality |
|--------------|------------------------|--------------------------|------------------|--------------------------------|---------------------------------------|----------------------------------|
| 2012 | 92 | 95.5 | 105,737 | 0.0870% | 0.0903% | 0.96 |
| 2013 | 111 | 98.5 | 108,946 | 0.1019% | 0.0904% | 1.13 |
| 2014 | 109 | 99.0 | 109,438 | 0.0996% | 0.0904% | 1.10 |
| 2015 | 98 | 96.9 | 109,455 | 0.0895% | 0.0885% | 1.01 |
| 2016 | 91 | 100.2 | 112,420 | 0.0809% | 0.0891% | 0.91 |
| 2017 | 118 | 103.2 | 116,015 | 0.1017% | 0.0889% | 1.14 |
| 2018 | 94 | 105.4 | 118,544 | 0.0793% | 0.0889% | 0.89 |
| 2019 | 93 | 107.2 | 120,069 | 0.0775% | 0.0893% | 0.87 |
| 2020 | 88 | 109.3 | 121,373 | 0.0725% | 0.0901% | 0.81 |
| 2021 | 102 | 110.5 | 121,927 | 0.0837% | 0.0906% | 0.92 |
| Total | 996 | 1,025.6 | 1,143,924 | 0.0871% | 0.0897% | 0.97 |

Exposure Distribution w/ Ordinary Mortality Rate - Actual and Expected; by Year



Actual vs. Expected - Ordinary Mortality Rate w/ Exposure Bubbles; by Year

Gender ● Female ● Male



Specific observations:

- Actual deaths were slightly less than expected during the study period (A/E ratio of 0.97).
- During 2020 - 2021, actual deaths were fewer than expected (A/E ratio of 0.86).
- Actual rates of death among males (A/E ratio of 1.01) were higher relative to the assumption than females (0.95)

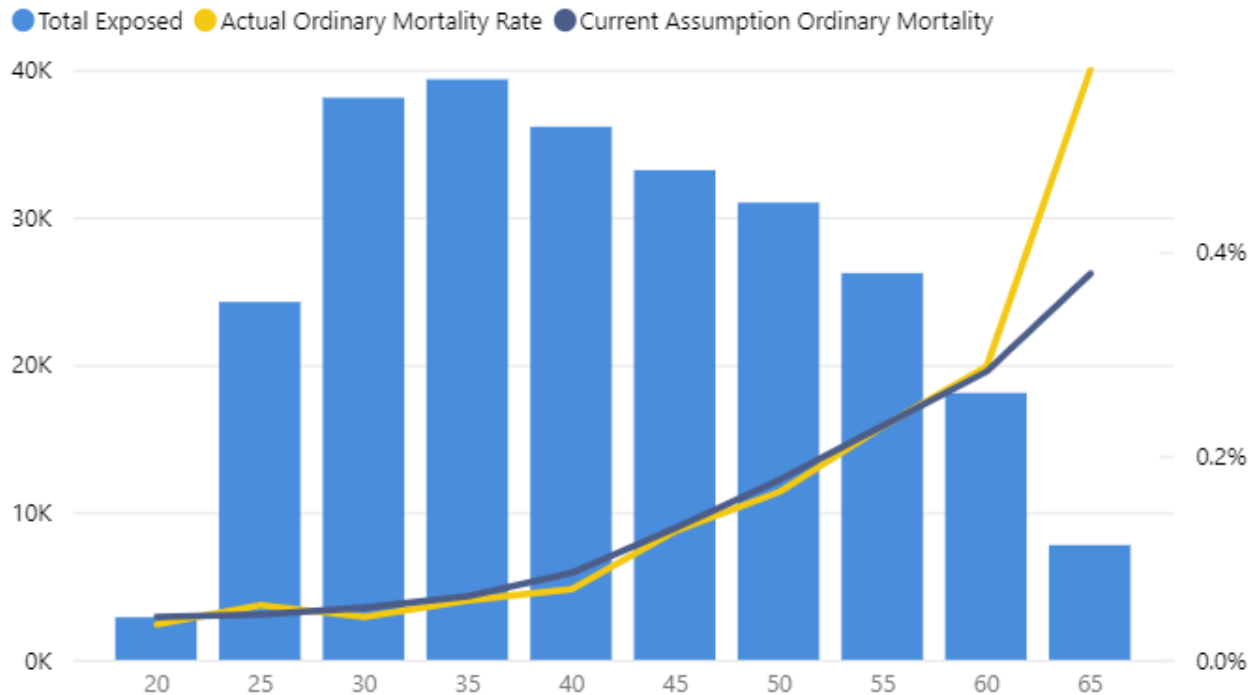
Due to lower deaths than expected during 2020 – 2021, we have included those years in the following analysis despite the Covid pandemic.

Males

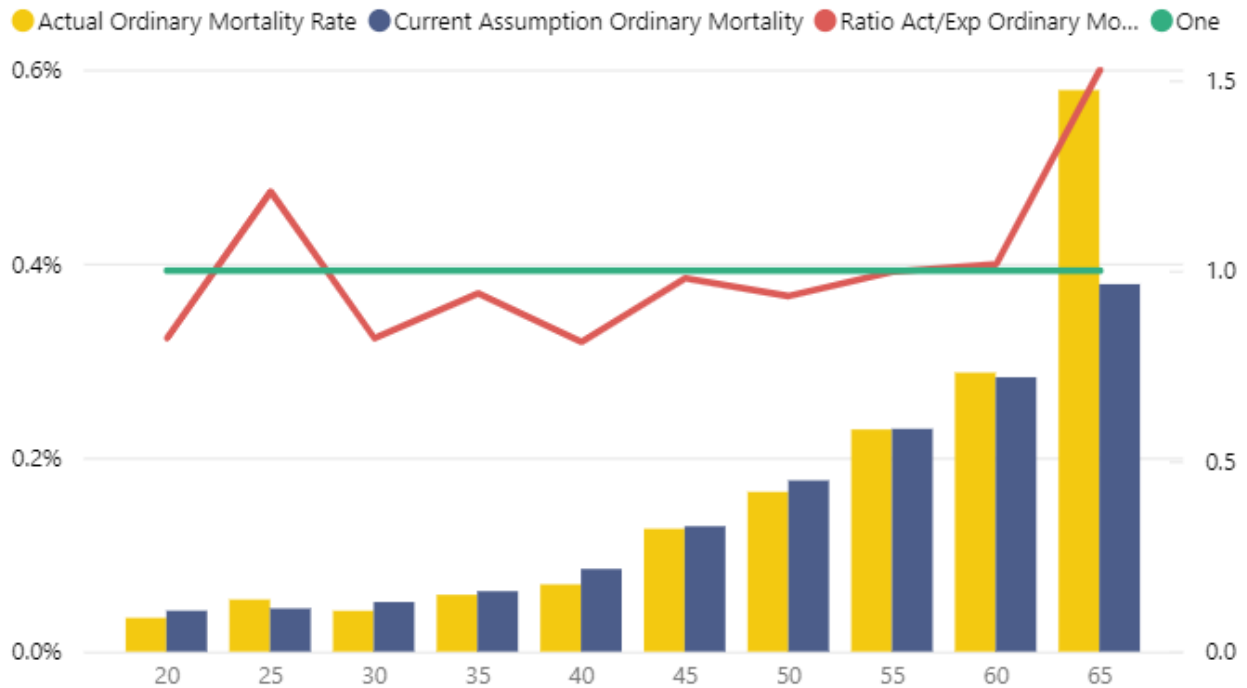
The following tables show the experience of ordinary death by age, for males, for the age range (20 to 69) and service range (0 to 50 years) during the period 2012 – 2021.

| Age (bins) | Actual Ordinary Deaths | Expected Ordinary Deaths | Total Exposed | Actual Ordinary Mortality Rate | Current Assumption Ordinary Mortality | Ratio Act/Exp Ordinary Mortality |
|--------------|------------------------|--------------------------|----------------|--------------------------------|---------------------------------------|----------------------------------|
| 20 | 1 | 1.2 | 2,884 | 0.0347% | 0.0421% | ▲ 0.82 |
| 25 | 13 | 10.8 | 24,250 | 0.0536% | 0.0444% | ▲ 1.21 |
| 30 | 16 | 19.4 | 38,091 | 0.0420% | 0.0511% | ▲ 0.82 |
| 35 | 23 | 24.5 | 39,338 | 0.0585% | 0.0622% | ● 0.94 |
| 40 | 25 | 30.8 | 36,125 | 0.0692% | 0.0851% | ▲ 0.81 |
| 45 | 42 | 42.9 | 33,190 | 0.1265% | 0.1291% | ● 0.98 |
| 50 | 51 | 54.7 | 30,987 | 0.1646% | 0.1764% | ● 0.93 |
| 55 | 60 | 60.2 | 26,210 | 0.2289% | 0.2296% | ● 1.00 |
| 60 | 52 | 51.1 | 18,086 | 0.2875% | 0.2827% | ● 1.02 |
| 65 | 45 | 29.4 | 7,776 | 0.5787% | 0.3787% | ◆ 1.53 |
| Total | 328 | 324.9 | 256,937 | 0.1277% | 0.1265% | ● 1.01 |

Exposure Distribution w/ Ordinary Mortality Rate - Actual and Expected; by Age



Ordinary Mortality Rate - Actual, Expected, and Ratio; by Age



Specific observations:

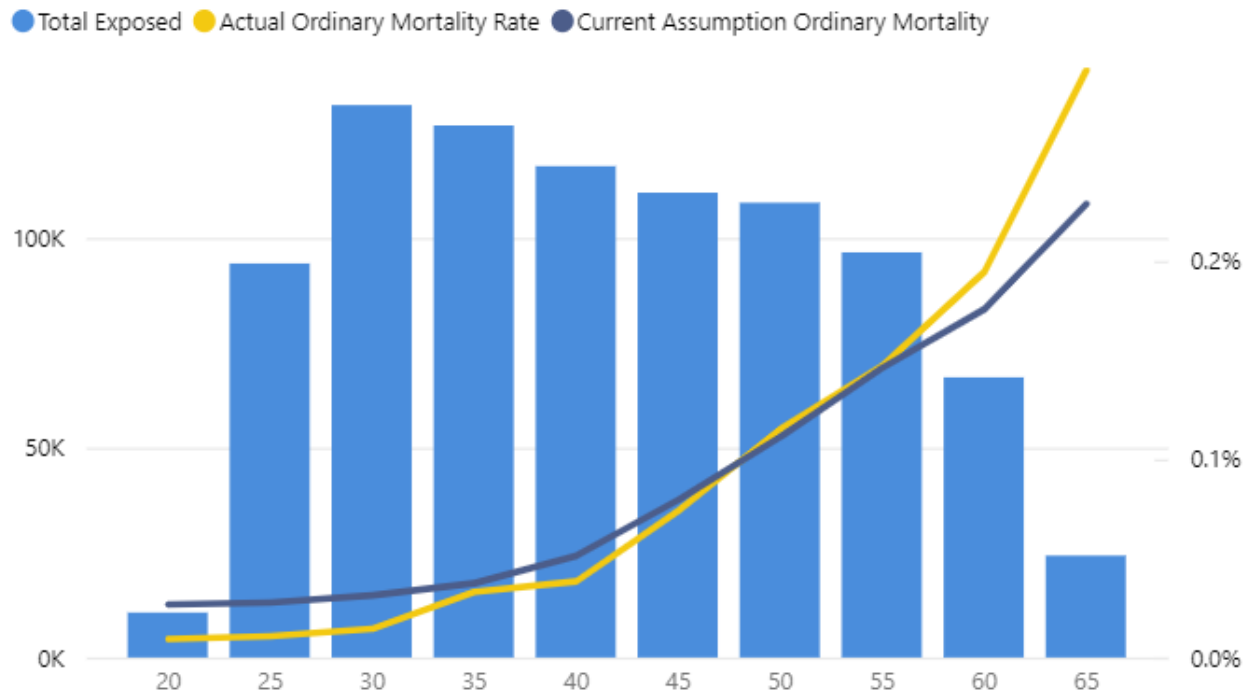
- Actual deaths were slightly less than expected for ages 20 – 59 (A/E ratio of 0.95).
- Actual deaths were greater than expected for ages 60 – 69 (A/E ratio of 1.20).

Females

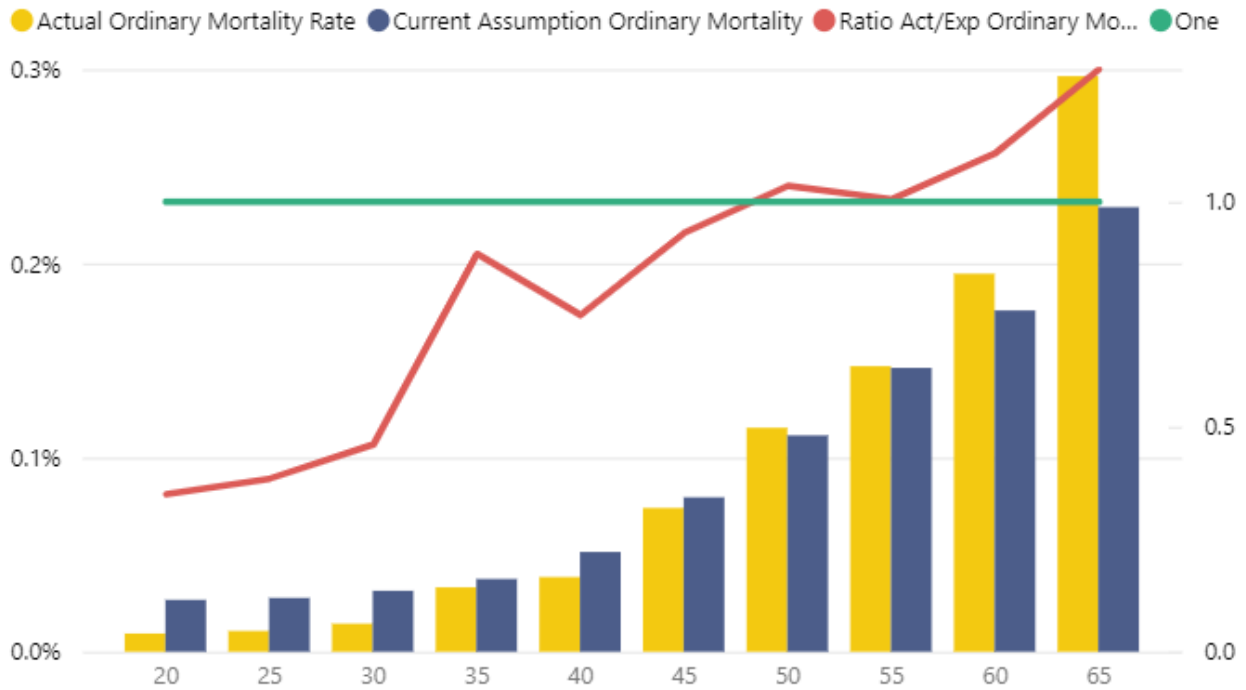
The following tables show the experience of ordinary death by age, for females, for the age range (20 to 69) and service range (0 to 50 years), during the period 2012 – 2021.

| Age (bins) | Actual Ordinary Deaths | Expected Ordinary Deaths | Total Exposed | Actual Ordinary Mortality Rate | Current Assumption Ordinary Mortality | Ratio Act/Exp Ordinary Mortality |
|--------------|------------------------|--------------------------|----------------|--------------------------------|---------------------------------------|----------------------------------|
| 20 | 1 | 2.9 | 10,707 | 0.0093% | 0.0267% | 0.35 |
| 25 | 10 | 26.0 | 93,905 | 0.0106% | 0.0277% | 0.38 |
| 30 | 19 | 41.3 | 131,657 | 0.0144% | 0.0314% | 0.46 |
| 35 | 42 | 47.5 | 126,809 | 0.0331% | 0.0374% | 0.88 |
| 40 | 45 | 60.1 | 117,110 | 0.0384% | 0.0514% | 0.75 |
| 45 | 82 | 88.1 | 110,783 | 0.0740% | 0.0795% | 0.93 |
| 50 | 125 | 120.7 | 108,391 | 0.1153% | 0.1114% | 1.04 |
| 55 | 142 | 141.2 | 96,568 | 0.1470% | 0.1462% | 1.01 |
| 60 | 130 | 117.3 | 66,769 | 0.1947% | 0.1758% | 1.11 |
| 65 | 72 | 55.6 | 24,288 | 0.2964% | 0.2290% | 1.29 |
| Total | 668 | 700.7 | 886,987 | 0.0753% | 0.0790% | 0.95 |

Exposure Distribution w/ Ordinary Mortality Rate - Actual and Expected; by Age



Ordinary Mortality Rate - Actual, Expected, and Ratio; by Age



Specific observations:

- Actual deaths were slightly less than expected for ages 20 – 49 (A/E ratio of 0.75).
- Actual deaths were greater than expected for ages 50 – 69 (A/E ratio of 1.08).

Postretirement Mortality

In addition to gender, the post-retirement mortality assumption depends on the type of inactive member:

- 1) Service Retirees
- 2) Disabled Retirees
- 3) Contingent Beneficiaries

The MEST contains all retirees on one page and beneficiaries on another page. On the retiree page, the experience can be examined by status to review disabled retirees versus service retirees. Service retirees include members who have commenced their pension benefit from a terminated vested status. Vested members prior to commencement are included in the MEST but are essentially excluded in the analysis below.

Analogous to the pre-retirement death assumption, the mortality assumption involves two components: a base table and a mortality improvement scale. The mortality improvement scale adjusts the mortality rates of the base table to reflect that generally rates of mortality are anticipated to improve over time. The same mortality improvement scale applies to the post-retirement mortality base table that applies to the pre-retirement death base table. In this study the base table corresponds to the year 2012.

Many mortality studies have found that greater benefits are positively correlated with smaller mortality rates and longer life expectancy. Accordingly, the OA utilizes adjustment factors to convert post-retirement mortality weighted by headcounts to post-retirement mortality weighted by benefit amounts. The adjustment factors used by the OA are:

| Post-Retirement Mortality Adjustment Factor To Convert from Headcount-Weighted to Amount-Weighted | | |
|--|-------|---------|
| | Males | Females |
| Service Retiree | 0.908 | 0.944 |
| Disabled Retiree | 0.940 | 0.962 |
| Contingent Beneficiary | 0.890 | 0.951 |

We examined the implications of using both types of weights in the post-retirement mortality analysis. Pure mortality is the same as post-retirement mortality weighted by headcounts; pure mortality multiplied by the adjustment factor is post-retirement mortality weighted by benefit amount. The benefit amount weighting approach was not applied to the experience prior to 2015 because the historical database did not contain benefit amounts prior to 2015.

There is much discussion in the actuarial profession and among retirement systems about the development of mortality tables and treatment of excess deaths due to Covid that occurred in 2020 – 2022. The purpose of this analysis is to share our observations about the experience during the study period. In subsequent analyses, we will recommend changes to mortality assumptions as appropriate.

The charts by age are based on 5-year age brackets. For example, the age bracket 45 should be interpreted as the interval 45-49.

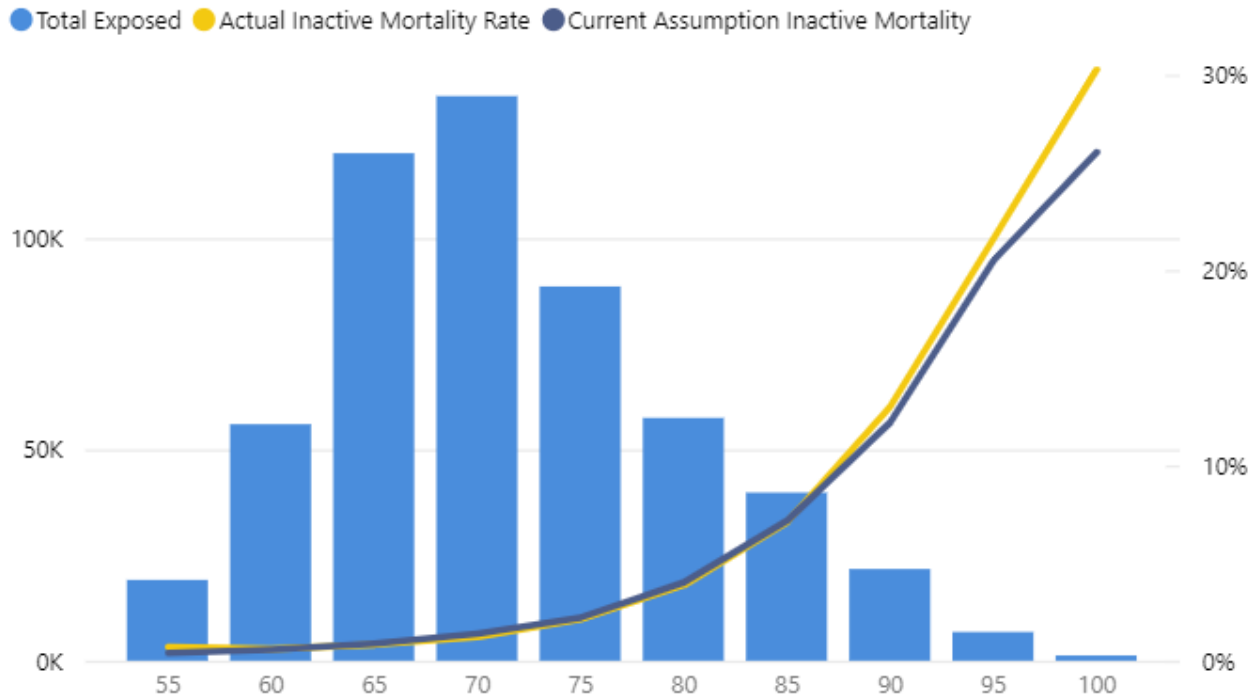
Postretirement Mortality – Service Retirees

The following charts show postretirement mortality experience on a headcount-weighted basis, by year and by age, for males and females combined, for the age range (55 to 104) during the period 2015 – 2021.

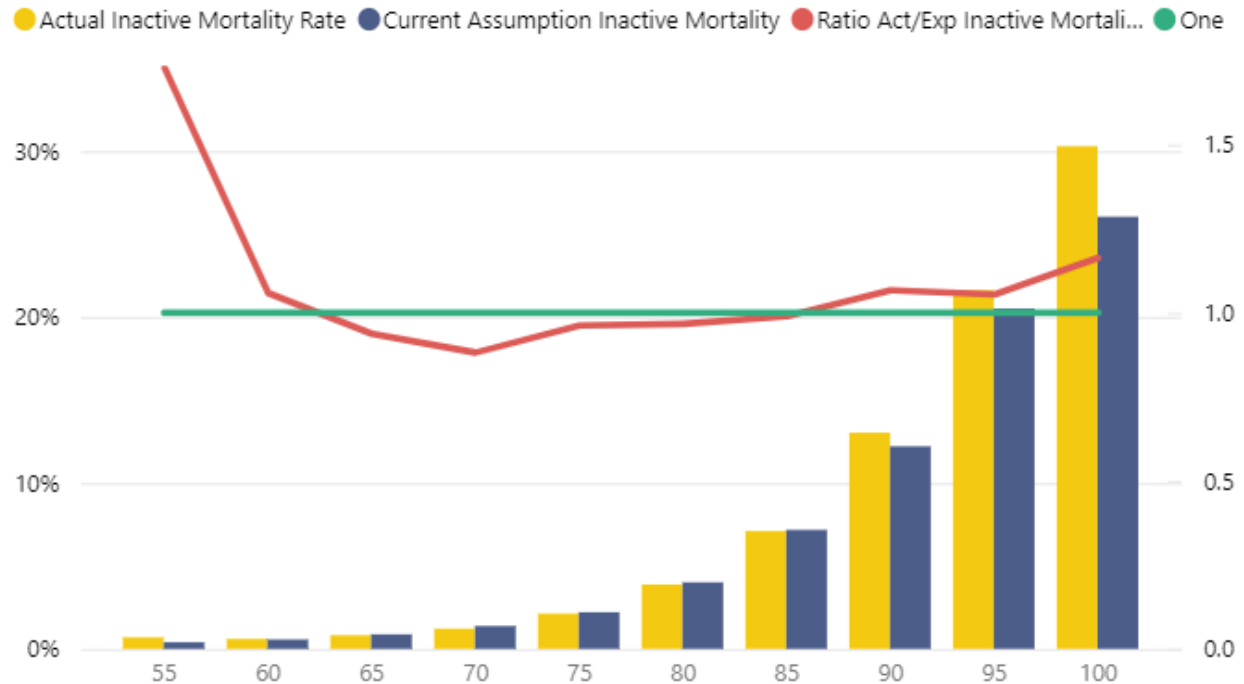
| Plan Year | Actual Inactive Deaths | Expected Inactive Deaths | Total Exposed | Actual Inactive Mortality Rate | Current Assumption Inactive Mortality | Ratio Act/Exp Inactive Mortality |
|--------------|------------------------|--------------------------|----------------|--------------------------------|---------------------------------------|----------------------------------|
| 2015 | 1,660 | 1,936.6 | 74,921 | 2.2157% | 2.5848% | ▲ 0.86 |
| 2016 | 1,964 | 2,003.1 | 75,544 | 2.5998% | 2.6516% | ● 0.98 |
| 2017 | 2,101 | 2,060.8 | 76,641 | 2.7414% | 2.6889% | ● 1.02 |
| 2018 | 1,949 | 2,100.8 | 77,517 | 2.5143% | 2.7101% | ● 0.93 |
| 2019 | 2,175 | 2,167.3 | 78,764 | 2.7614% | 2.7516% | ● 1.00 |
| 2020 | 2,450 | 2,236.3 | 80,130 | 3.0575% | 2.7909% | ● 1.10 |
| 2021 | 2,400 | 2,280.0 | 80,869 | 2.9678% | 2.8193% | ● 1.05 |
| Total | 14,699 | 14,784.9 | 544,386 | 2.7001% | 2.7159% | ● 0.99 |

| Age (bins) | Actual Inactive Deaths | Expected Inactive Deaths | Total Exposed | Actual Inactive Mortality Rate | Current Assumption Inactive Mortality | Ratio Act/Exp Inactive Mortality |
|--------------|------------------------|--------------------------|----------------|--------------------------------|---------------------------------------|----------------------------------|
| 55 | 133 | 77.0 | 19,126 | 0.6954% | 0.4024% | ◆ 1.73 |
| 60 | 338 | 319.4 | 55,970 | 0.6039% | 0.5706% | ● 1.06 |
| 65 | 988 | 1,054.3 | 120,101 | 0.8226% | 0.8779% | ● 0.94 |
| 70 | 1,628 | 1,847.2 | 133,618 | 1.2184% | 1.3825% | ▲ 0.88 |
| 75 | 1,885 | 1,959.5 | 88,564 | 2.1284% | 2.2126% | ● 0.96 |
| 80 | 2,229 | 2,305.8 | 57,476 | 3.8781% | 4.0118% | ● 0.97 |
| 85 | 2,825 | 2,854.8 | 39,786 | 7.1005% | 7.1754% | ● 0.99 |
| 90 | 2,827 | 2,649.5 | 21,704 | 13.0252% | 12.2073% | ● 1.07 |
| 95 | 1,471 | 1,395.0 | 6,803 | 21.6228% | 20.5051% | ● 1.05 |
| 100 | 375 | 322.4 | 1,238 | 30.2908% | 26.0398% | ▲ 1.16 |
| Total | 14,699 | 14,784.9 | 544,386 | 2.7001% | 2.7159% | ● 0.99 |

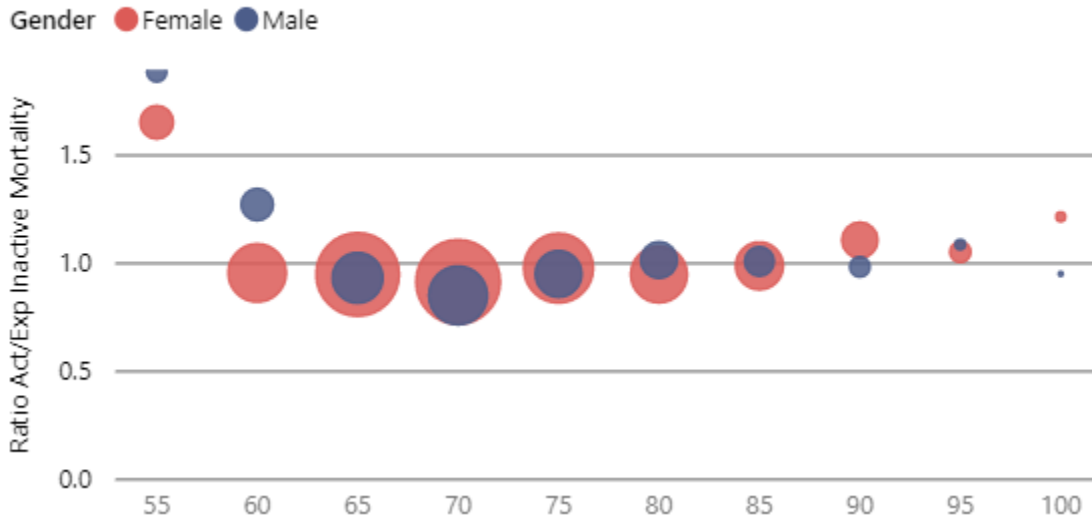
Exposure Distribution w/ Inactive Mortality Rate - Actual and Expected; by Age



Inactive Mortality Rate - Actual, Expected, and Ratio; by Age




Actual vs. Expected - Inactive Mortality Rate w/ Exposure Bubbles; by Age

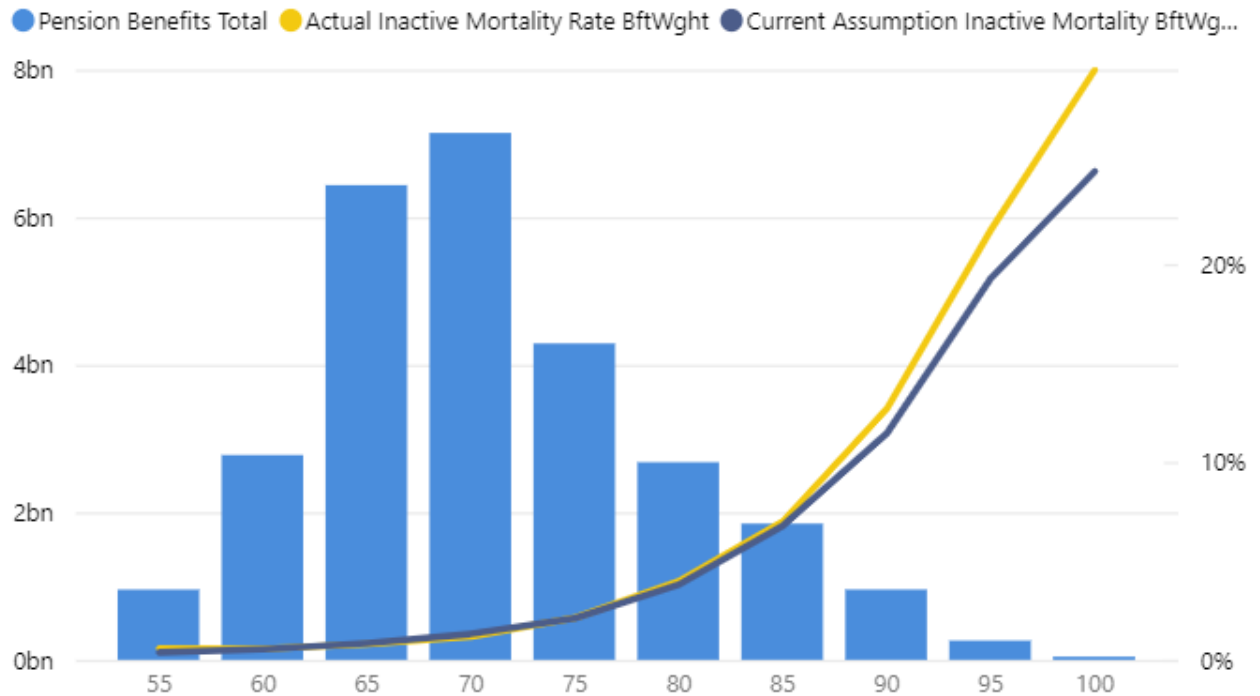


The following charts show postretirement mortality experience, on an amount-weighted basis by year and by age, for males and females combined, for the age range (55 to 104) during the period 2015 – 2021.

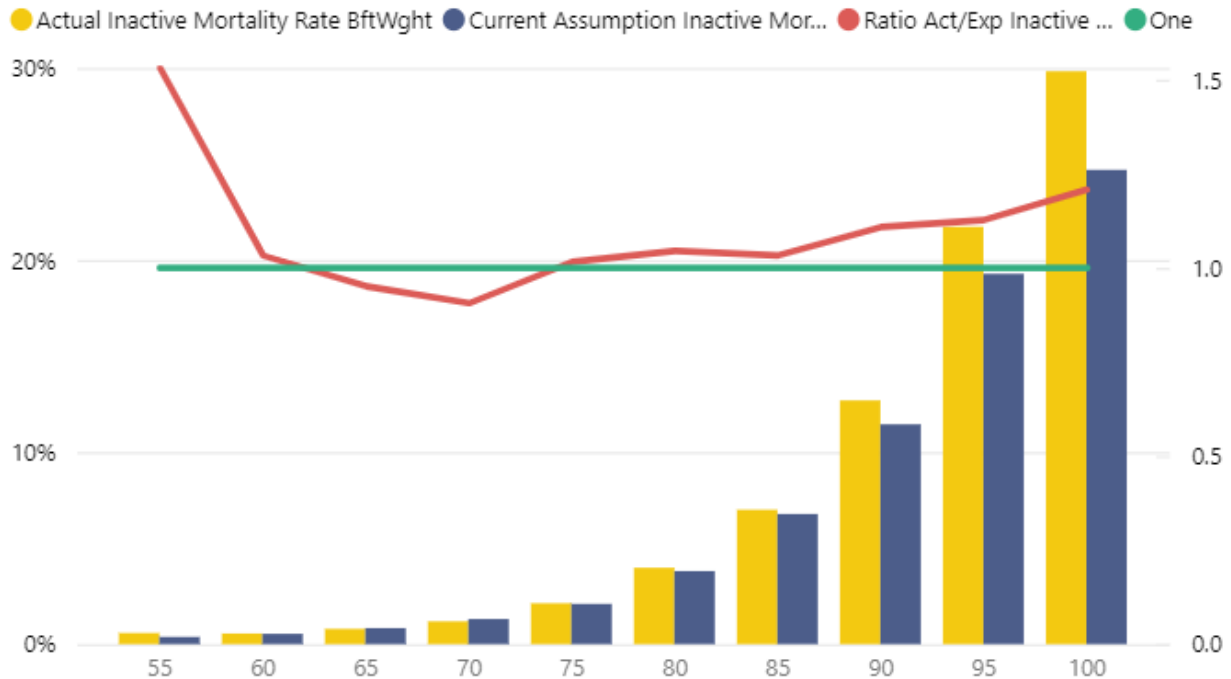
| Plan Year | Actual Svc. Retiree Benefits Released | Expected Inactive Benefits Released | Pension Benefits Total | Actual Inactive Mortality Rate BftWght | Current Assumption Inactive Mortality BftWght | Ratio Act/Exp Inactive Mortality BftWght |
|--------------|---------------------------------------|-------------------------------------|------------------------|--|---|--|
| 2015 | 78,227K | 85,812K | 3,773,594K | 2.0730% | 2.2740% | 0.91 |
| 2016 | 91,497K | 89,763K | 3,876,891K | 2.3601% | 2.3153% | 1.02 |
| 2017 | 97,977K | 93,098K | 3,952,571K | 2.4788% | 2.3554% | 1.05 |
| 2018 | 92,730K | 95,894K | 4,014,106K | 2.3101% | 2.3889% | 0.97 |
| 2019 | 104,430K | 99,241K | 3,969,901K | 2.6305% | 2.4998% | 1.05 |
| 2020 | 116,835K | 104,438K | 4,063,005K | 2.8756% | 2.5705% | 1.12 |
| 2021 | 92,233K | 84,101K | 3,729,788K | 2.4729% | 2.2548% | 1.10 |
| Total | 673,928K | 652,347K | 27,379,857K | 2.4614% | 2.3826% | 1.03 |

| Age (bins) | Actual Inactive Benefits Released | Expected Inactive Benefits Released | Pension Benefits Total | Actual Inactive Mortality Rate BftWght | Current Assumption Inactive Mortality BftWght | Ratio Act/Exp Inactive Mortality BftWght |
|--------------|-----------------------------------|-------------------------------------|------------------------|--|---|--|
| 55 | 5,499K | 3,590K | 952,831K | 0.5771% | 0.3768% | 1.53 |
| 60 | 15,340K | 14,850K | 2,776,547K | 0.5525% | 0.5349% | 1.03 |
| 65 | 51,056K | 53,684K | 6,435,214K | 0.7934% | 0.8342% | 0.95 |
| 70 | 84,596K | 93,380K | 7,142,406K | 1.1844% | 1.3074% | 0.91 |
| 75 | 91,292K | 89,867K | 4,289,540K | 2.1282% | 2.0950% | 1.02 |
| 80 | 106,455K | 101,848K | 2,678,851K | 3.9739% | 3.8019% | 1.05 |
| 85 | 129,261K | 125,143K | 1,847,304K | 6.9973% | 6.7743% | 1.03 |
| 90 | 120,968K | 109,102K | 953,372K | 12.6884% | 11.4438% | 1.11 |
| 95 | 56,750K | 50,360K | 261,175K | 21.7288% | 19.2820% | 1.13 |
| 100 | 12,710K | 10,523K | 42,617K | 29.8244% | 24.6925% | 1.21 |
| Total | 673,928K | 652,347K | 27,379,857K | 2.4614% | 2.3826% | 1.03 |

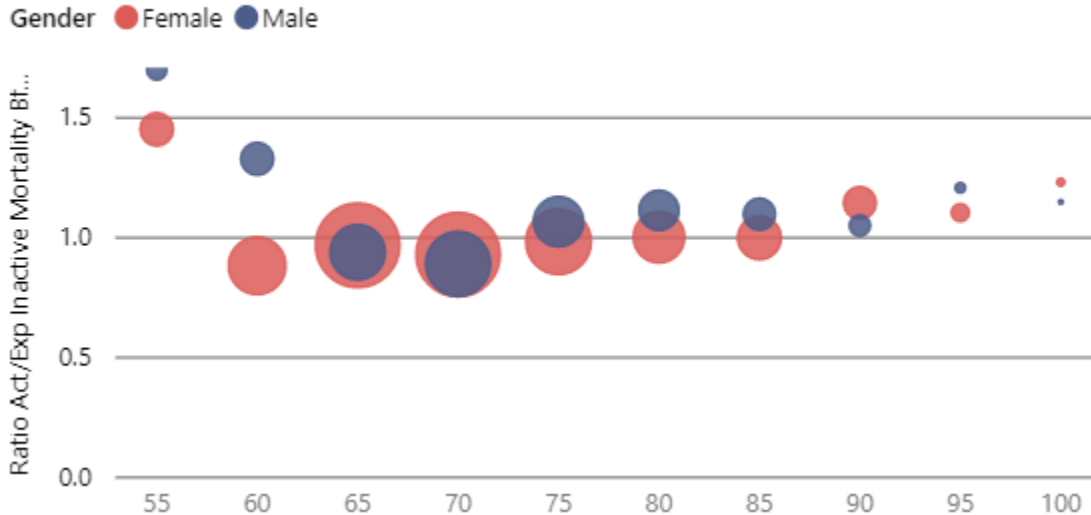
Pension Benefit Distribution w/ Inactive Mortality Rate - Actual and Expected; by Age 



Inactive Mortality Rate - Actual, Expected, and Ratio; by Age



Actual vs. Expected - Inactive Mortality Rate w/ Benefit Bubbles; by Age



Specific observations:

- From 2015 – 2021, the actual number of deaths was similar to expectations on a headcount basis (A/E ratio of 0.99) but slightly greater on a benefit basis (A/E ratio of 1.03).
- During 2020 – 2021, the actual experience was greater than in previous years (A/E ratio of 1.11 on a benefits basis).

- For ages 75 to 99, actual deaths exceeded expectations (A/E ratio of 1.06 on a benefits basis).
- For ages 55 to 74, actual deaths were smaller than expected (A/E ratio of 0.95 on a benefits basis).
- For males, the rate of mortality on an amount-weighted basis was 96.1% of the rate of mortality on a headcount-weighted basis, versus the ratio on an expected basis of 89.3%. The assumed percentage is 90.8%. The actual weighting of benefits will result in a difference from the assumed percentage.
- For females, the rate of mortality on an amount-weighted basis was 86.8% of the rate of mortality on a headcount-weighted basis, versus the ratio on an expected basis of 85.2%. The assumed percentage is 94.4%. The actual weighting of benefits will result in a difference from the assumed percentage.
- The mortality rates for members retiring from active service are lower than the mortality rates for members commencing a pension benefit from vested status.

The following chart shows the postretirement mortality experience of members retiring from active service excluding members retiring from a vested terminated status, on an amount-weighted basis, by age, for males and females combined, for the age range (55 to 104), in the period 2015 – 2021.

| Age (bins) | Actual Inactive Benefits Released | Expected Inactive Benefits Released | Pension Benefits Total | Actual Inactive Mortality Rate BftWght | Current Assumption Inactive Mortality BftWght | Ratio Act/Exp Inactive Mortality BftWght |
|--------------|-----------------------------------|-------------------------------------|------------------------|--|---|--|
| 55 | 5,138K | 3,434K | 912,684K | 0.5630% | 0.3763% | ▲ 1.50 |
| 60 | 14,709K | 14,434K | 2,701,040K | 0.5446% | 0.5344% | ● 1.02 |
| 65 | 49,245K | 51,829K | 6,220,565K | 0.7917% | 0.8332% | ● 0.95 |
| 70 | 80,701K | 89,988K | 6,889,108K | 1.1714% | 1.3062% | ▲ 0.90 |
| 75 | 85,071K | 86,446K | 4,126,970K | 2.0613% | 2.0947% | ● 0.98 |
| 80 | 102,088K | 98,450K | 2,586,782K | 3.9465% | 3.8059% | ● 1.04 |
| 85 | 125,329K | 121,730K | 1,794,993K | 6.9821% | 6.7817% | ● 1.03 |
| 90 | 117,554K | 106,250K | 927,840K | 12.6697% | 11.4513% | ▲ 1.11 |
| 95 | 55,703K | 49,655K | 257,461K | 21.6354% | 19.2864% | ▲ 1.12 |
| 100 | 12,642K | 10,327K | 41,825K | 30.2253% | 24.6904% | ▲ 1.22 |
| Total | 648,180K | 632,543K | 26,459,269K | 2.4497% | 2.3906% | ● 1.02 |

The following chart shows the postretirement mortality experience of members commencing retirement from a vested terminated status on an amount-weighted basis, by age, for males and females combined, for the age range (55 to 104), during the period 2015 – 2021.

| Age (bins) | Actual Inactive Benefits Released | Expected Inactive Benefits Released | Pension Benefits Total | Actual Inactive Mortality Rate BftWght | Current Assumption Inactive Mortality BftWght | Ratio Act/Exp Inactive Mortality BftWght |
|--------------|-----------------------------------|-------------------------------------|------------------------|--|---|--|
| 55 | 360K | 156K | 40,148K | 0.8975% | 0.3886% | 2.31 |
| 60 | 631K | 417K | 75,507K | 0.8362% | 0.5519% | 1.52 |
| 65 | 1,810K | 1,856K | 214,649K | 0.8434% | 0.8645% | 0.98 |
| 70 | 3,895K | 3,392K | 253,298K | 1.5377% | 1.3391% | 1.15 |
| 75 | 6,221K | 3,421K | 162,570K | 3.8269% | 2.1041% | 1.82 |
| 80 | 4,367K | 3,398K | 92,068K | 4.7437% | 3.6909% | 1.29 |
| 85 | 3,932K | 3,412K | 52,311K | 7.5175% | 6.5231% | 1.15 |
| 90 | 3,413K | 2,852K | 25,532K | 13.3696% | 11.1699% | 1.20 |
| 95 | 1,047K | 704K | 3,713K | 28.2078% | 18.9722% | 1.49 |
| 100 | 69K | 196K | 792K | 8.6580% | 24.8061% | 0.35 |
| Total | 25,748K | 19,804K | 920,587K | 2.7969% | 2.1512% | 1.30 |

Specific observations:


- Although there is not enough mortality experience of members commencing to receive retirement benefits from vested status to be credible, it is interesting that this group exhibits greater mortality experience versus members retiring from active service.

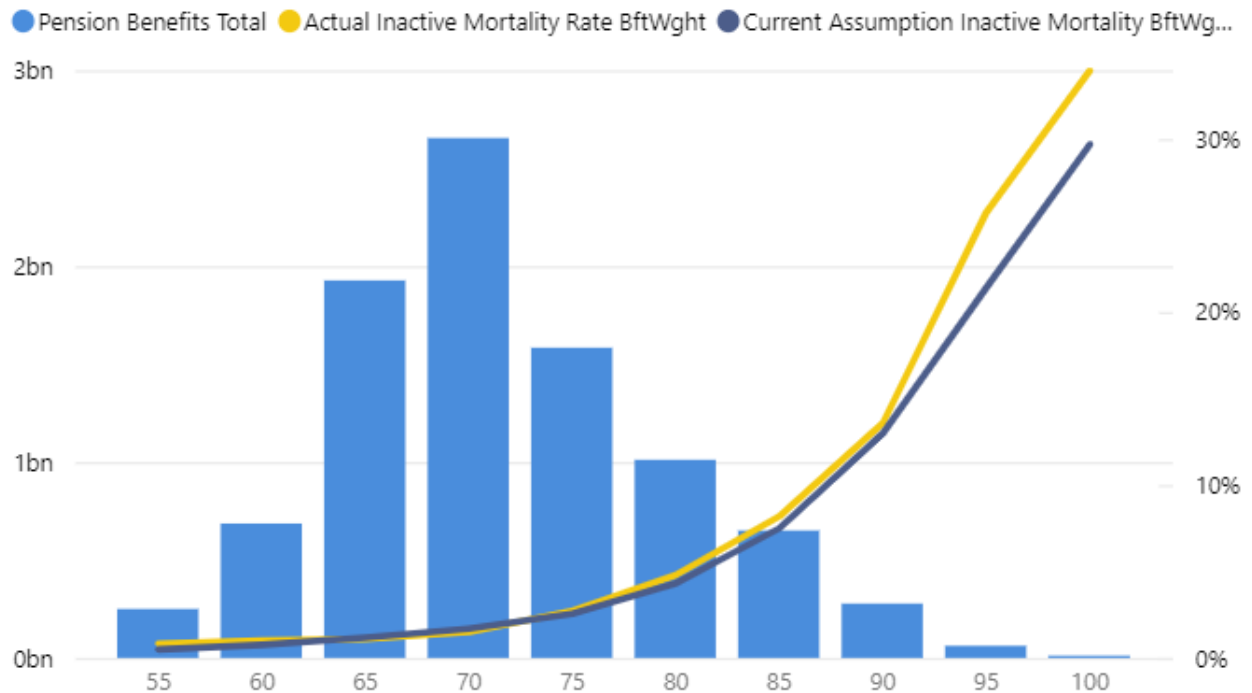
While the overall rates of mortality for 2020 and 2021 are somewhat greater than prior years, we included the experience of these years in the analysis. The A/E ratio on a benefits basis decreases from 1.03 to 1.00 when these two years are excluded. Since amount-weighted mortality rates are not available prior to 2015, the following analysis contains the entire study period from 2015 – 2021.

Service Retirees - Males

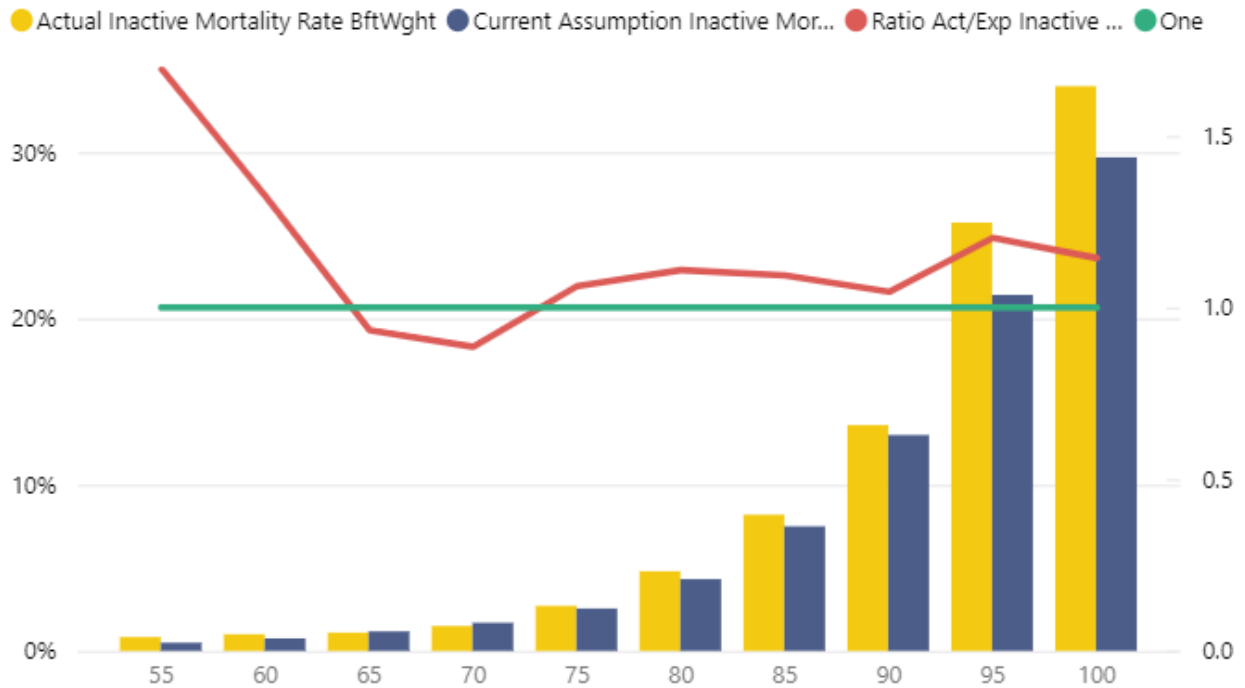
The following charts show postretirement mortality experience on an amount-weighted basis by age, for males, for the age range (55 to 104) in the period 2015 – 2021.

| Age (bins) | Actual Inactive Benefits Released | Expected Inactive Benefits Released | Pension Benefits Total | Actual Inactive Mortality Rate BftWght | Current Assumption Inactive Mortality BftWght | Ratio Act/Exp Inactive Mortality BftWght |
|--------------|-----------------------------------|-------------------------------------|------------------------|--|---|--|
| 55 | 2,074K | 1,224K | 249,931K | 0.8298% | 0.4898% | 1.69 |
| 60 | 6,832K | 5,160K | 686,134K | 0.9957% | 0.7520% | 1.32 |
| 65 | 21,093K | 22,578K | 1,927,247K | 1.0944% | 1.1715% | 0.93 |
| 70 | 39,726K | 44,850K | 2,654,155K | 1.4968% | 1.6898% | 0.89 |
| 75 | 42,860K | 40,358K | 1,583,725K | 2.7063% | 2.5483% | 1.06 |
| 80 | 48,426K | 43,659K | 1,011,572K | 4.7872% | 4.3160% | 1.11 |
| 85 | 53,272K | 48,729K | 650,441K | 8.1901% | 7.4917% | 1.09 |
| 90 | 37,679K | 36,029K | 277,476K | 13.5792% | 12.9847% | 1.05 |
| 95 | 15,997K | 13,298K | 62,095K | 25.7629% | 21.4152% | 1.20 |
| 100 | 2,735K | 2,391K | 8,052K | 33.9732% | 29.6927% | 1.14 |
| Total | 270,694K | 258,276K | 9,110,828K | 2.9711% | 2.8348% | 1.05 |

Pension Benefit Distribution w/ Inactive Mortality Rate - Actual and Expected; by Age 



Inactive Mortality Rate - Actual, Expected, and Ratio; by Age




Specific observations:

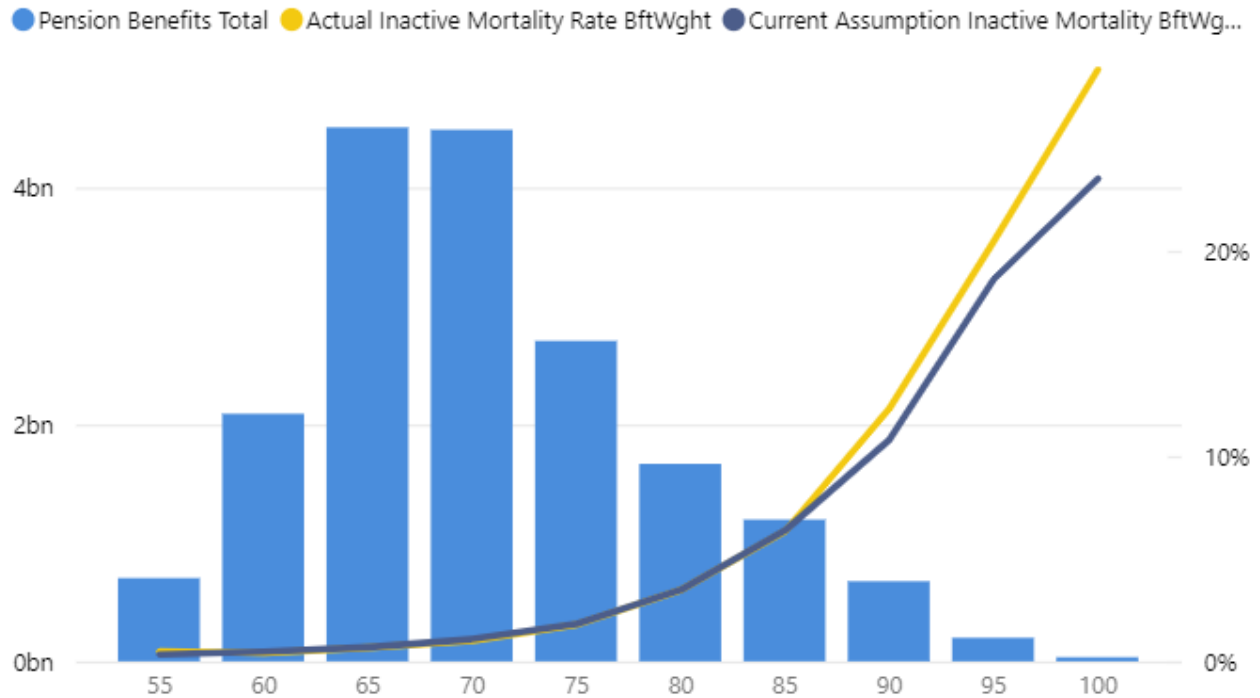
- From 2015 - 2021, the actual number of male deaths was smaller than expected on a headcount basis (A/E ratio of 0.97) and benefit basis (A/E ratio of 1.05).
 - Excluding 2020 – 2021, A/E ratios were 0.94 and 1.02, respectively.
- For ages 75 to 99, actual deaths exceeded expectations (A/E ratio of 1.09 on a benefits basis).
- For ages 55 to 74, the number of actual deaths was smaller than expected (A/E ratio of 0.94 on a benefits basis).

Service Retirees - Females

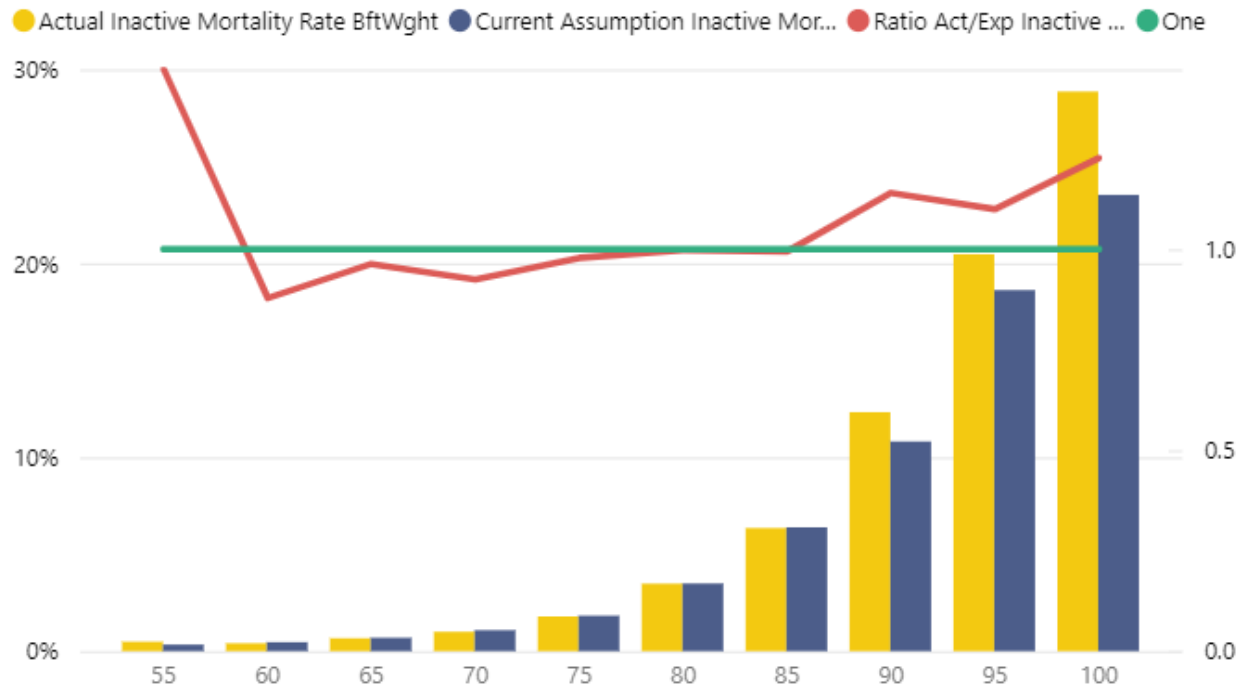
The following charts show postretirement mortality on an amount-weighted basis of by age, for females, for the age range (55 to 104) during the period 2015 – 2021.

| Age (bins) | Actual Inactive Benefits Released | Expected Inactive Benefits Released | Pension Benefits Total | Actual Inactive Mortality Rate BftWght | Current Assumption Inactive Mortality BftWght | Ratio Act/Exp Inactive Mortality BftWght |
|--------------|-----------------------------------|-------------------------------------|------------------------|--|---|--|
| 55 | 3,425K | 2,366K | 702,900K | 0.4872% | 0.3367% | ▲ 1.45 |
| 60 | 8,509K | 9,691K | 2,090,413K | 0.4070% | 0.4636% | ▲ 0.88 |
| 65 | 29,963K | 31,106K | 4,507,967K | 0.6647% | 0.6900% | ● 0.96 |
| 70 | 44,870K | 48,530K | 4,488,251K | 0.9997% | 1.0813% | ● 0.92 |
| 75 | 48,432K | 49,509K | 2,705,815K | 1.7899% | 1.8297% | ● 0.98 |
| 80 | 58,030K | 58,189K | 1,667,279K | 3.4805% | 3.4900% | ● 1.00 |
| 85 | 75,989K | 76,414K | 1,196,863K | 6.3491% | 6.3845% | ● 0.99 |
| 90 | 83,289K | 73,072K | 675,896K | 12.3228% | 10.8112% | ▲ 1.14 |
| 95 | 40,753K | 37,062K | 199,080K | 20.4706% | 18.6166% | ● 1.10 |
| 100 | 9,975K | 8,132K | 34,565K | 28.8580% | 23.5278% | ▲ 1.23 |
| Total | 403,234K | 394,070K | 18,269,029K | 2.2072% | 2.1570% | ● 1.02 |

Pension Benefit Distribution w/ Inactive Mortality Rate - Actual and Expected; by Age 



Inactive Mortality Rate - Actual, Expected, and Ratio; by Age



Specific observations:

- From 2015 - 2021, the actual number of female deaths was similar to expectations on a headcount basis (A/E ratio of 1.00) and benefit basis (A/E ratio of 1.02).
 - Excluding 2020 – 2021, A/E ratios were 0.97 and 0.99, respectively.

Postretirement Mortality – Disability Retirees

The following charts show postretirement mortality on a headcount-weighted basis and on an amount-weighted basis by year and by age, for males and females combined, for the age range 45 to 99, during the period 2015 – 2021.

| Plan Year | Actual Inactive Deaths | Expected Inactive Deaths | Total Exposed | Actual Inactive Mortality Rate | Current Assumption Inactive Mortality | Ratio Act/Exp Inactive Mortality |
|--------------|------------------------|--------------------------|---------------|--------------------------------|---------------------------------------|----------------------------------|
| 2015 | 86 | 93.9 | 3,221 | 2.6700% | 2.9163% | 0.92 |
| 2016 | 99 | 95.2 | 3,324 | 2.9783% | 2.8636% | 1.04 |
| 2017 | 112 | 95.4 | 3,386 | 3.3077% | 2.8171% | 1.17 |
| 2018 | 98 | 95.1 | 3,420 | 2.8655% | 2.7808% | 1.03 |
| 2019 | 132 | 96.8 | 3,478 | 3.7953% | 2.7826% | 1.36 |
| 2020 | 134 | 97.8 | 3,494 | 3.8351% | 2.8004% | 1.37 |
| 2021 | 142 | 97.0 | 3,458 | 4.1064% | 2.8062% | 1.46 |
| Total | 803 | 671.3 | 23,781 | 3.3766% | 2.8227% | 1.20 |

| Plan Year | Actual Inactive Benefits Released | Expected Inactive Benefits Released | Pension Benefits Total | Actual Inactive Mortality Rate BftWght | Current Assumption Inactive Mortality BftWght | Ratio Act/Exp Inactive Mortality BftWght |
|--------------|-----------------------------------|-------------------------------------|------------------------|--|---|--|
| 2015 | 2,055K | 2,443K | 84,236K | 2.4395% | 2.8998% | 0.84 |
| 2016 | 2,618K | 2,516K | 88,200K | 2.9680% | 2.8521% | 1.04 |
| 2017 | 2,868K | 2,563K | 90,798K | 3.1587% | 2.8227% | 1.12 |
| 2018 | 2,514K | 2,595K | 92,524K | 2.7176% | 2.8046% | 0.97 |
| 2019 | 3,411K | 2,368K | 92,313K | 3.6948% | 2.5648% | 1.44 |
| 2020 | 2,985K | 2,431K | 94,499K | 3.1591% | 2.5730% | 1.23 |
| 2021 | 3,271K | 2,405K | 93,495K | 3.4988% | 2.5727% | 1.36 |
| Total | 19,723K | 17,321K | 636,066K | 3.1007% | 2.7231% | 1.14 |

Specific observations:

- From 2015 - 2021, the actual number of deaths was greater than expected on both a headcount basis (A/E ratio of 1.20) and a benefit basis (A/E ratio of 1.14).
- During 2020 – 2021, the actual experience was higher than previous years (A/E ratio of 1.42 on a headcount basis and 1.29 on a benefits basis).
- For males, the rate of mortality on an amount-weighted basis was 88.8% of the rate of mortality on a headcount-weighted basis, versus the ratio on an expected basis of 96.2%.

The assumed percentage is 96.2%. The actual weighting of benefits may result in a difference from the assumed percentage.

- For females, the rate of mortality on an amount-weighted basis was 91.7% of the rate of mortality on a headcount-weighted basis, versus the ratio on an expected basis of 95.2%. The assumed percentage is 95.2%. The actual weighting of benefits may result in a difference from the assumed percentage.

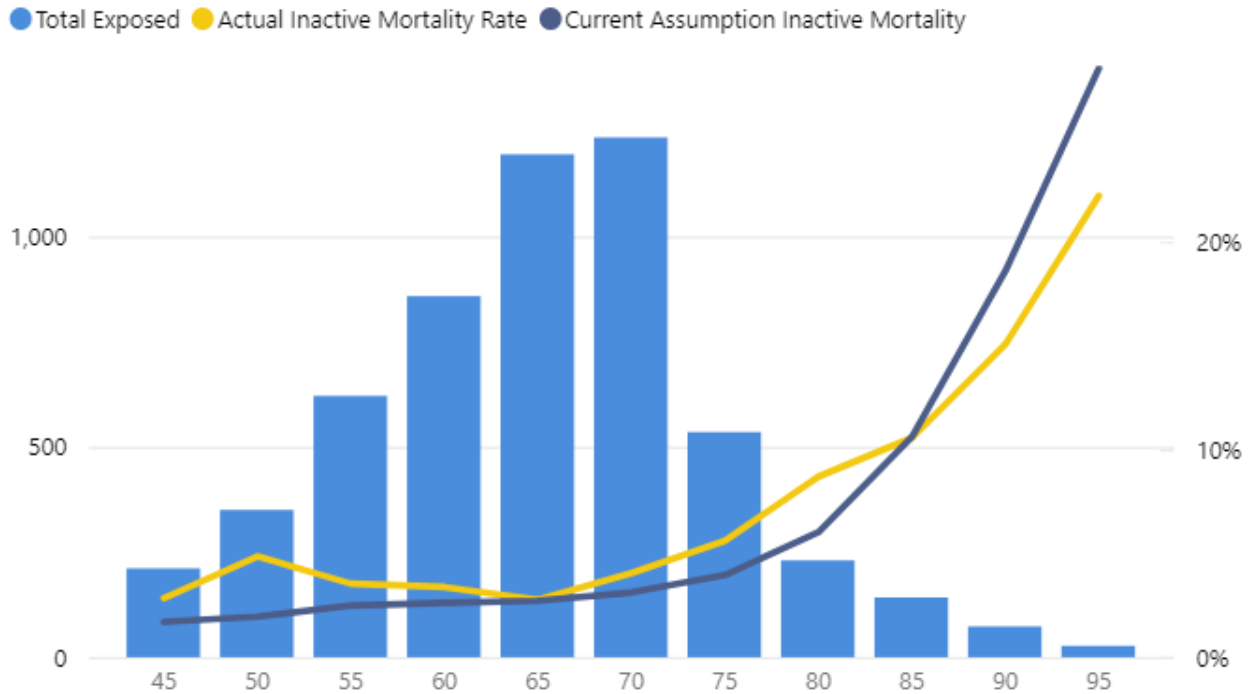
Disabled Retirees - Males

The following charts show postretirement mortality experience on a headcount-weighted basis by age, for males, for the age range 45 to 99 during the period 2015 – 2021.

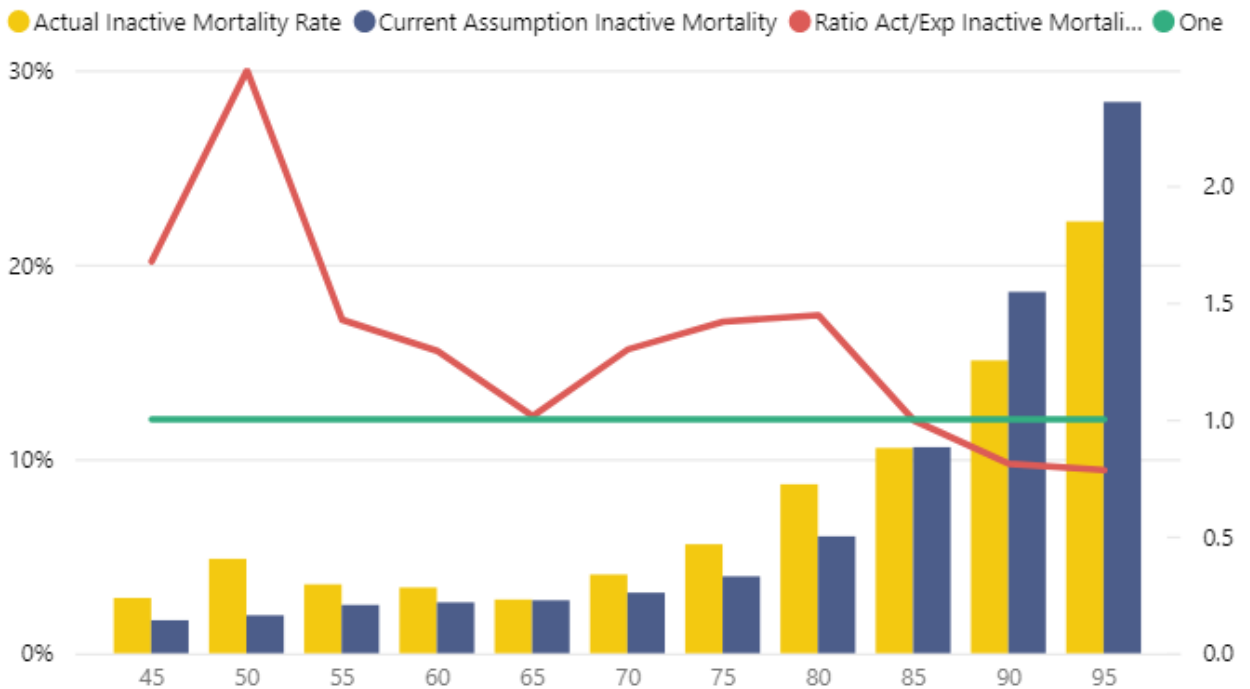
| Age (bins) | Actual Inactive Deaths | Expected Inactive Deaths | Total Exposed | Actual Inactive Mortality Rate | Current Assumption Inactive Mortality | Ratio Act/Exp Inactive Mortality |
|--------------|------------------------|--------------------------|---------------|--------------------------------|---------------------------------------|----------------------------------|
| 45 | 6 | 3.6 | 211 | 2.8436% | 1.6966% | 1.68 |
| 50 | 17 | 6.8 | 350 | 4.8571% | 1.9481% | 2.49 |
| 55 | 22 | 15.4 | 621 | 3.5427% | 2.4849% | 1.43 |
| 60 | 29 | 22.4 | 858 | 3.3800% | 2.6144% | 1.29 |
| 65 | 33 | 32.5 | 1,195 | 2.7615% | 2.7214% | 1.01 |
| 70 | 50 | 38.5 | 1,235 | 4.0486% | 3.1149% | 1.30 |
| 75 | 30 | 21.2 | 535 | 5.6075% | 3.9544% | 1.42 |
| 80 | 20 | 13.8 | 230 | 8.6957% | 6.0143% | 1.45 |
| 85 | 15 | 15.1 | 142 | 10.5634% | 10.6041% | 1.00 |
| 90 | 11 | 13.6 | 73 | 15.0685% | 18.5974% | 0.81 |
| 95 | 6 | 7.7 | 27 | 22.2222% | 28.3714% | 0.78 |
| Total | 239 | 190.5 | 5,477 | 4.3637% | 3.4788% | 1.25 |



Exposure Distribution w/ Inactive Mortality Rate - Actual and Expected; by Age



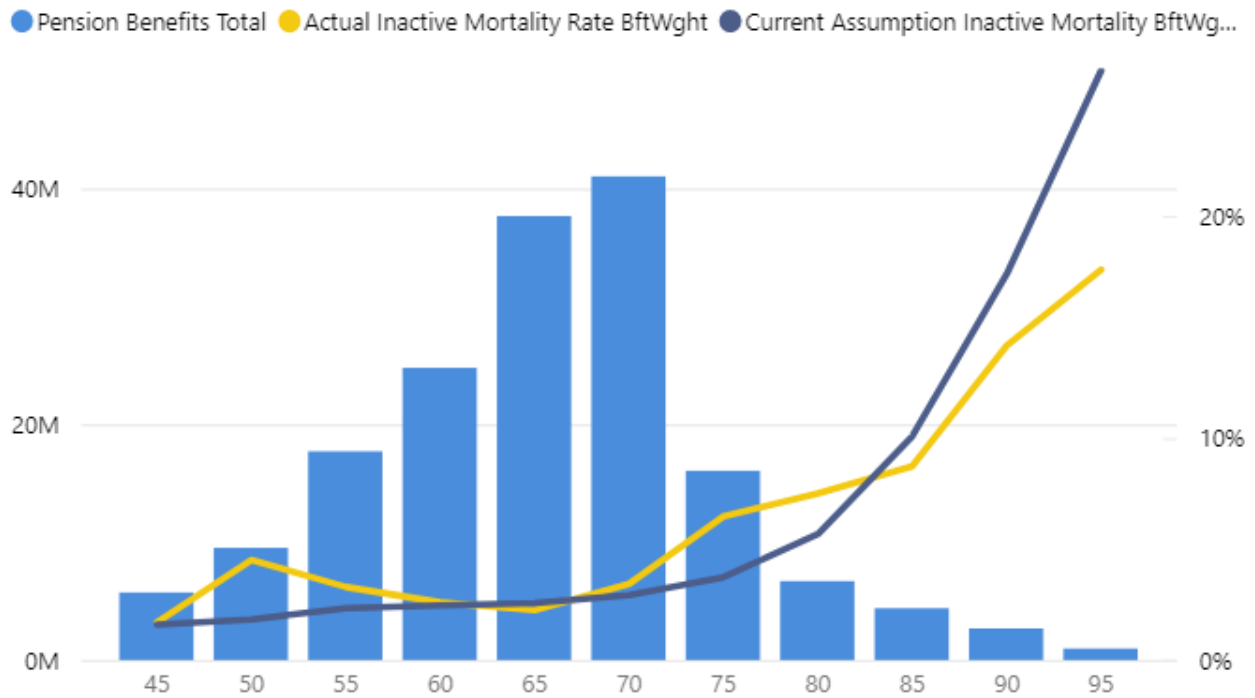
Inactive Mortality Rate - Actual, Expected, and Ratio; by Age



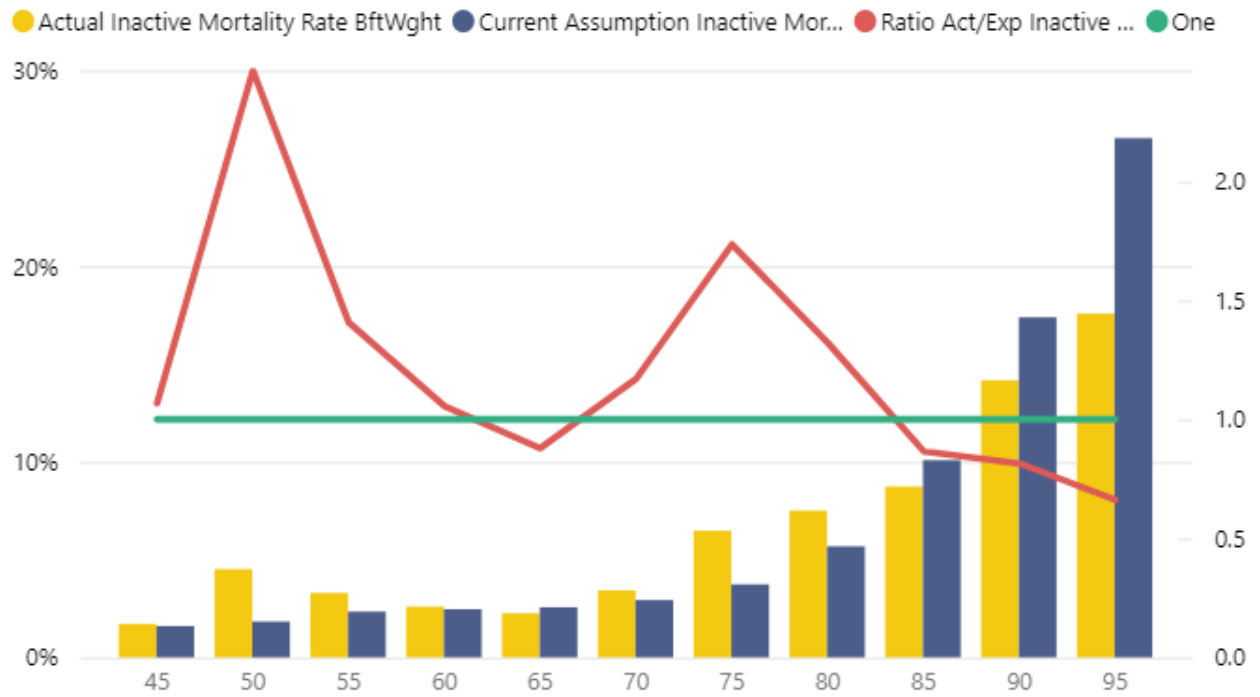
The following charts show postretirement mortality experience on an amount-weighted basis, by age, for males, for the age range 45 to 99, during the period 2015 – 2021.

| Age (bins) | Actual Inactive Benefits Released | Expected Inactive Benefits Released | Pension Benefits Total | Actual Inactive Mortality Rate BftWght | Current Assumption Inactive Mortality BftWght | Ratio Act/Exp Inactive Mortality BftWght |
|--------------|-----------------------------------|-------------------------------------|------------------------|--|---|--|
| 45 | 98K | 92K | 5,730K | 1.7074% | 1.5980% | 1.07 |
| 50 | 429K | 174K | 9,514K | 4.5099% | 1.8286% | 2.47 |
| 55 | 583K | 414K | 17,702K | 3.2915% | 2.3377% | 1.41 |
| 60 | 643K | 609K | 24,788K | 2.5949% | 2.4585% | 1.06 |
| 65 | 848K | 965K | 37,657K | 2.2514% | 2.5616% | 0.88 |
| 70 | 1,404K | 1,200K | 41,022K | 3.4223% | 2.9250% | 1.17 |
| 75 | 1,039K | 599K | 16,053K | 6.4697% | 3.7285% | 1.74 |
| 80 | 502K | 380K | 6,693K | 7.4997% | 5.6720% | 1.32 |
| 85 | 383K | 443K | 4,392K | 8.7289% | 10.0796% | 0.87 |
| 90 | 380K | 466K | 2,680K | 14.1612% | 17.3808% | 0.81 |
| 95 | 171K | 258K | 972K | 17.5722% | 26.5425% | 0.66 |
| Total | 6,479K | 5,598K | 167,202K | 3.8748% | 3.3481% | 1.16 |

Pension Benefit Distribution w/ Inactive Mortality Rate - Actual and Expected; by Age



Inactive Mortality Rate - Actual, Expected, and Ratio; by Age



Specific observations:

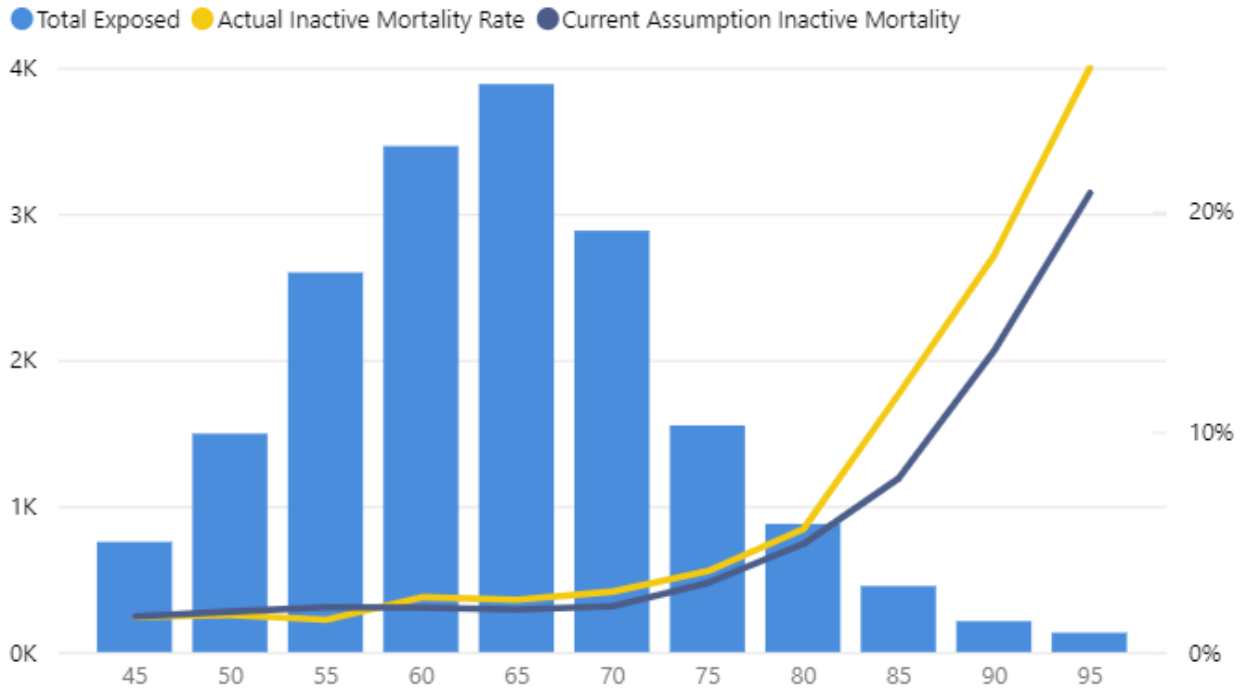
- The mortality experience of disabled male members is not fully credible.
- From 2015 - 2021, the actual number of deaths was greater than expected on both a headcount basis (A/E ratio of 1.25) and a benefit basis (A/E ratio of 1.16).
- The largest difference between the number of actual and expected deaths occurred during 2020 – 2021 (A/E ratio of 1.55 on a headcount basis and A/E ratio of 1.48 on a benefits basis).
- If these two years were excluded, the A/E ratios would have been 1.14 on a headcount basis and 1.04 on a benefits basis.

Disabled Retirees - Females

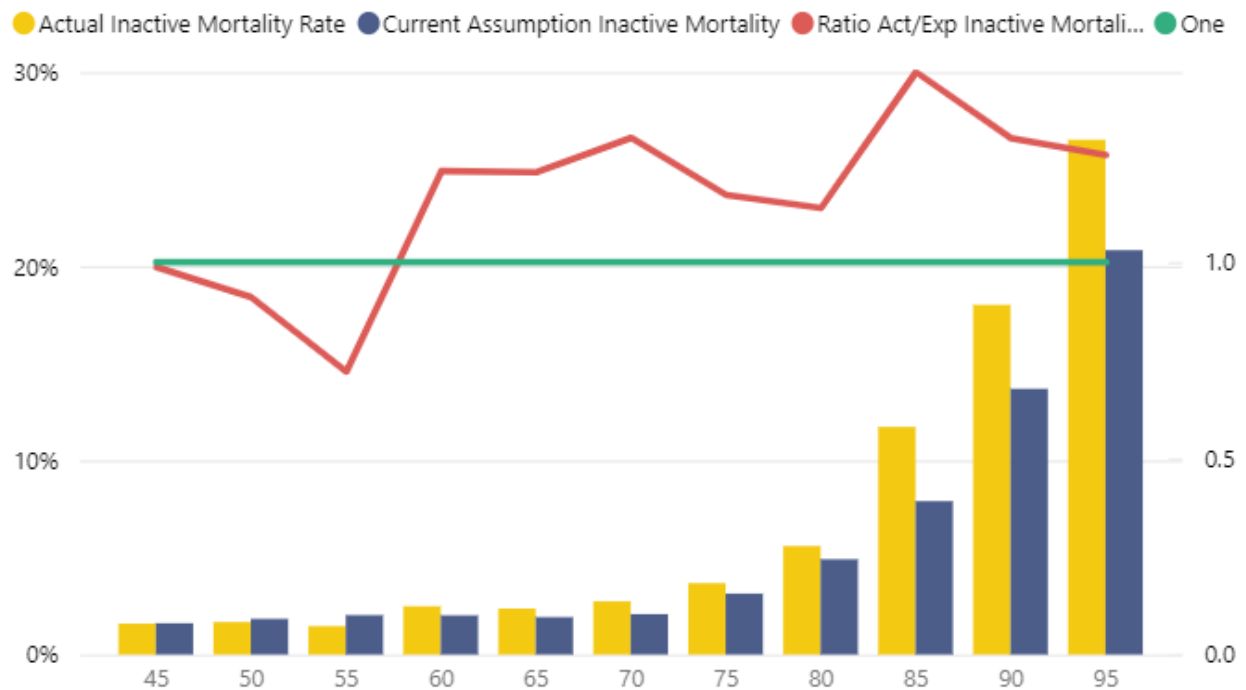
The following charts show postretirement mortality experience on a headcount-weighted basis by age, for females, for the age range 45 to 99, during the period 2015 – 2021.

| Age (bins) | Actual Inactive Deaths | Expected Inactive Deaths | Total Exposed | Actual Inactive Mortality Rate | Current Assumption Inactive Mortality | Ratio Act/Exp Inactive Mortality |
|--------------|------------------------|--------------------------|---------------|--------------------------------|---------------------------------------|----------------------------------|
| 45 | 12 | 12.2 | 754 | 1.5915% | 1.6120% | 0.99 |
| 50 | 25 | 27.5 | 1,495 | 1.6722% | 1.8369% | 0.91 |
| 55 | 38 | 52.7 | 2,598 | 1.4627% | 2.0295% | 0.72 |
| 60 | 86 | 69.8 | 3,463 | 2.4834% | 2.0154% | 1.23 |
| 65 | 92 | 74.8 | 3,887 | 2.3669% | 1.9250% | 1.23 |
| 70 | 79 | 60.0 | 2,884 | 2.7393% | 2.0803% | 1.32 |
| 75 | 57 | 48.7 | 1,551 | 3.6750% | 3.1379% | 1.17 |
| 80 | 49 | 43.0 | 877 | 5.5872% | 4.9080% | 1.14 |
| 85 | 53 | 35.7 | 452 | 11.7257% | 7.8985% | 1.48 |
| 90 | 38 | 28.9 | 211 | 18.0095% | 13.6890% | 1.32 |
| 95 | 35 | 27.5 | 132 | 26.5152% | 20.8259% | 1.27 |
| Total | 564 | 480.7 | 18,304 | 3.0813% | 2.6264% | 1.17 |

Exposure Distribution w/ Inactive Mortality Rate - Actual and Expected; by Age




Inactive Mortality Rate - Actual, Expected, and Ratio; by Age

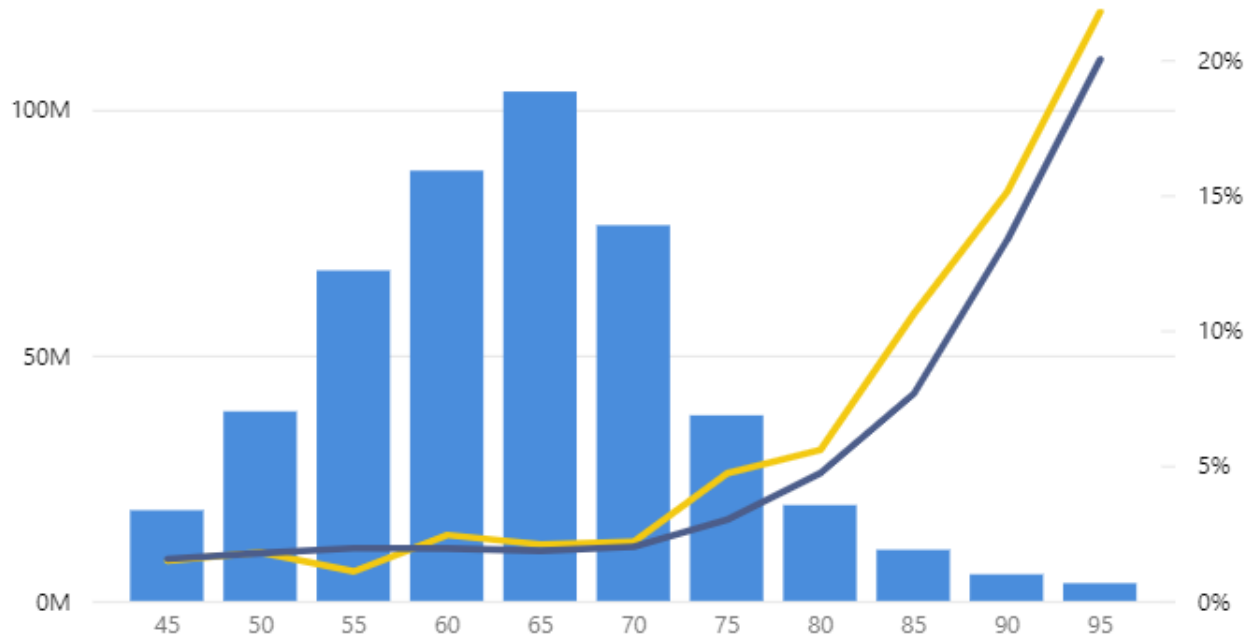


The following charts show postretirement mortality experience on an amount-weighted basis by age, for females, for the age range 45 to 99, during the period 2015 – 2021.

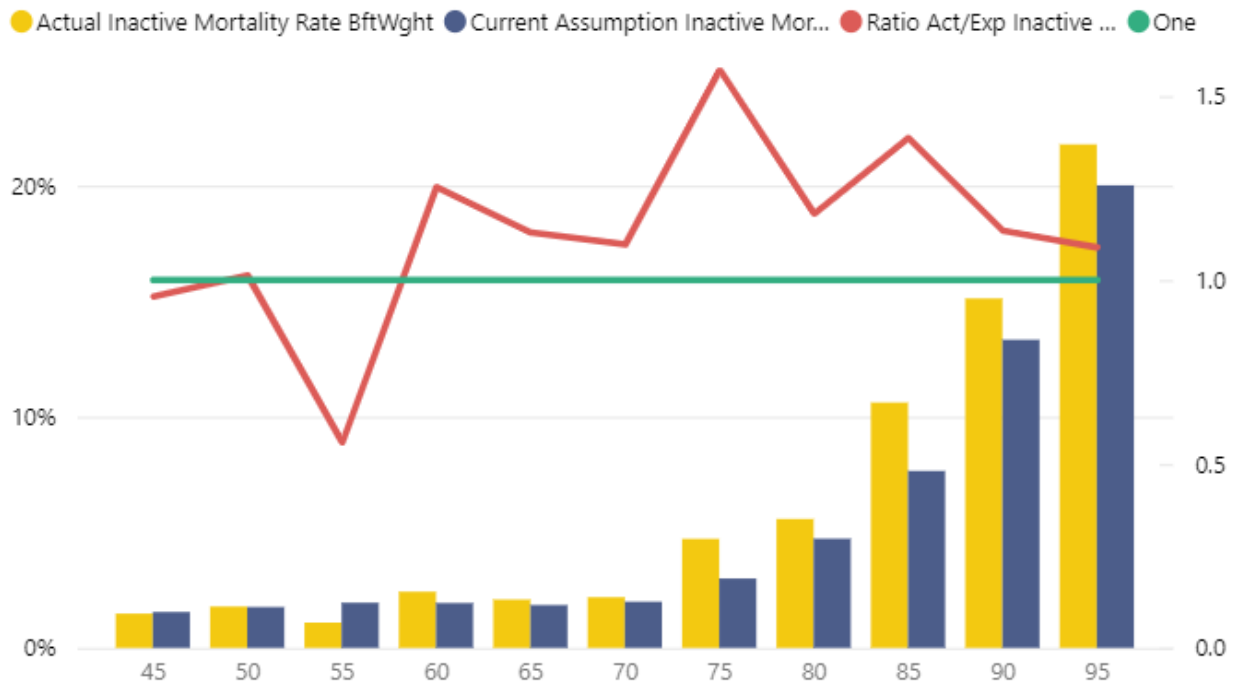
| Age (bins) | Actual Inactive Benefits Released | Expected Inactive Benefits Released | Pension Benefits Total | Actual Inactive Mortality Rate BftWght | Current Assumption Inactive Mortality BftWght | Ratio Act/Exp Inactive Mortality BftWght |
|--------------|-----------------------------------|-------------------------------------|------------------------|--|---|--|
| 45 | 273K | 286K | 18,464K | 1.4807% | 1.5504% | 0.96 |
| 50 | 690K | 681K | 38,592K | 1.7876% | 1.7656% | 1.01 |
| 55 | 734K | 1,314K | 67,278K | 1.0903% | 1.9525% | 0.56 |
| 60 | 2,128K | 1,699K | 87,607K | 2.4292% | 1.9393% | 1.25 |
| 65 | 2,167K | 1,920K | 103,711K | 2.0898% | 1.8514% | 1.13 |
| 70 | 1,674K | 1,527K | 76,483K | 2.1892% | 1.9967% | 1.10 |
| 75 | 1,782K | 1,134K | 37,788K | 4.7145% | 3.0008% | 1.57 |
| 80 | 1,088K | 922K | 19,513K | 5.5754% | 4.7231% | 1.18 |
| 85 | 1,105K | 797K | 10,415K | 10.6118% | 7.6545% | 1.39 |
| 90 | 817K | 721K | 5,408K | 15.1152% | 13.3300% | 1.13 |
| 95 | 785K | 721K | 3,605K | 21.7794% | 20.0099% | 1.09 |
| Total | 13,244K | 11,723K | 468,865K | 2.8247% | 2.5002% | 1.13 |

Pension Benefit Distribution w/ Inactive Mortality Rate - Actual and Expected; by Age 

● Pension Benefits Total ● Actual Inactive Mortality Rate BftWght ● Current Assumption Inactive Mortality BftWg...



Inactive Mortality Rate - Actual, Expected, and Ratio; by Age



Specific observations:

- There are more deaths among female disabled members than among male disabled members, but the results are not credible due to low data volume.
- From 2015 - 2021, the actual number of deaths was greater than expected on both a headcount basis (A/E ratio of 1.17) and a benefit basis (A/E ratio of 1.13).
- The greatest difference between the number of actual and expected deaths occurred during 2020 – 2021 (A/E ratio of 1.37 on a headcount basis and A/E ratio of 1.21 on a benefits basis).
- If these two years were excluded, the A/E ratios are 1.09 on a headcount basis and 1.10 on a benefits basis.

Postretirement Mortality – Contingent Beneficiaries

The following charts show postretirement mortality experience on a headcount-weighted basis and amount-weighted basis of postretirement mortality by year and by age, for males and females combined, for the age range 60 to 109, during the period 2015 – 2021.

| Plan Year | Actual Beneficiary Deaths | Expected Beneficiary Deaths | Total Exposed | Actual Beneficiary Mortality Rate | Current Assumption Beneficiary Mortality | Ratio Act/Exp Beneficiary Mortality |
|--------------|---------------------------|-----------------------------|---------------|-----------------------------------|--|-------------------------------------|
| 2015 | 185 | 283.7 | 3,819 | 4.8442% | 7.4298% | ▲ 0.65 |
| 2016 | 344 | 284.8 | 3,881 | 8.8637% | 7.3375% | ▲ 1.21 |
| 2017 | 388 | 291.9 | 4,005 | 9.6879% | 7.2889% | ▲ 1.33 |
| 2018 | 370 | 297.1 | 4,090 | 9.0465% | 7.2640% | ▲ 1.25 |
| 2019 | 391 | 295.2 | 4,132 | 9.4627% | 7.1435% | ▲ 1.32 |
| 2020 | 483 | 318.2 | 4,463 | 10.8223% | 7.1305% | ◆ 1.52 |
| 2021 | 486 | 321.3 | 4,620 | 10.5195% | 6.9536% | ◆ 1.51 |
| Total | 2,647 | 2,092.2 | 29,010 | 9.1244% | 7.2120% | ▲ 1.27 |

| Plan Year | Actual Beneficiary Benefits Released | Expected Beneficiary Benefits Released | Pension Benefits Total | Actual Beneficiary Mortality Rate BftWght | Current Assumption Beneficiary Mortality BftWght | Ratio Act/Exp Beneficiary Mortality BftWght |
|--------------|--------------------------------------|--|------------------------|---|--|---|
| 2015 | 6,495K | 9,133K | 141,507K | 4.5900% | 6.4541% | ▲ 0.71 |
| 2016 | 12,840K | 9,244K | 145,823K | 8.8050% | 6.3393% | ▲ 1.39 |
| 2017 | 14,904K | 9,647K | 152,789K | 9.7546% | 6.3138% | ◆ 1.54 |
| 2018 | 13,184K | 9,801K | 156,333K | 8.4330% | 6.2693% | ▲ 1.35 |
| 2019 | 14,628K | 10,235K | 171,359K | 8.5367% | 5.9730% | ▲ 1.43 |
| 2020 | 17,737K | 11,387K | 186,841K | 9.4933% | 6.0947% | ◆ 1.56 |
| 2021 | 18,424K | 12,053K | 196,606K | 9.3708% | 6.1304% | ◆ 1.53 |
| Total | 98,212K | 71,500K | 1,151,258K | 8.5308% | 6.2106% | ▲ 1.37 |

Specific observations:

- From 2015 - 2021, the actual number of deaths was greater than expected on both a headcount basis (A/E ratio of 1.27) and a benefit basis (A/E ratio of 1.37).
- During 2020 – 2021, the actual experience was higher than previous years (A/E ratio of 1.52 on a headcount basis and 1.54 on a benefits basis).
- For males, the rate of mortality on an amount-weighted basis was 98.8% of the rate of mortality on a headcount-weighted basis, versus the ratio on an expected basis of 85.7%. The assumed percentage is 89%. The actual weighting of benefits will result in a difference from the assumed percentage.

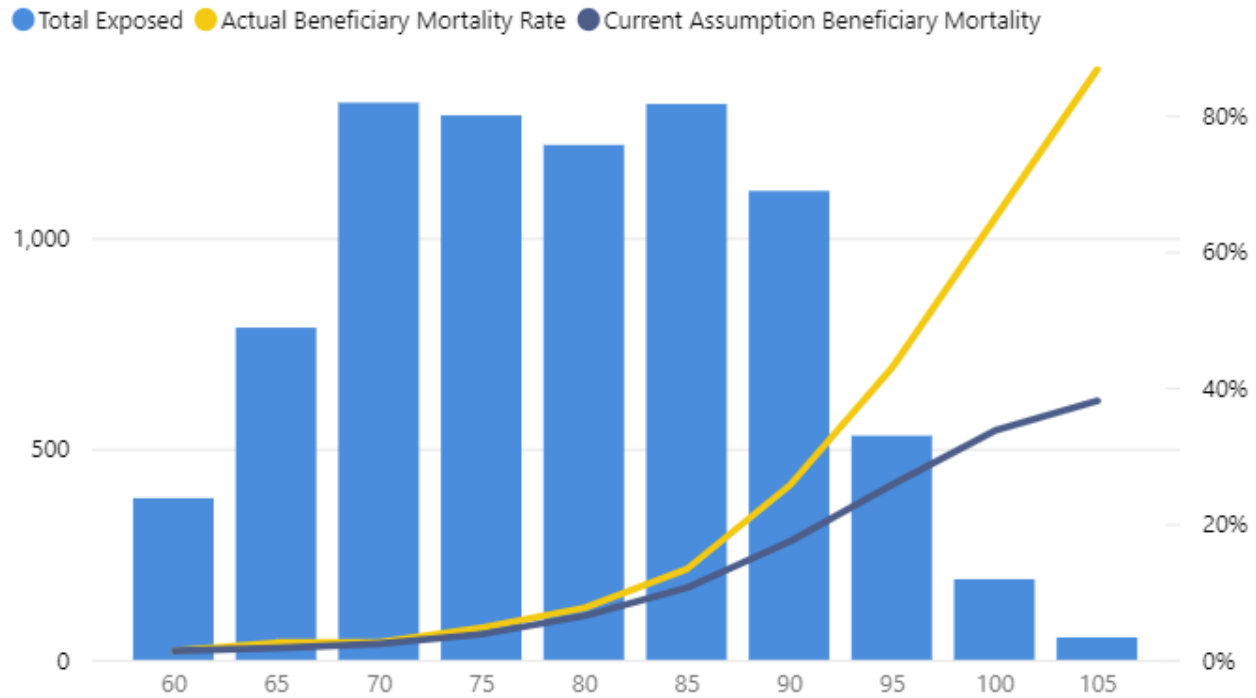
- For females, the rate of mortality on an amount-weighted basis was 95.3% of the rate of mortality on a headcount-weighted basis, versus the ratio on an expected basis of 88.4%. The assumed percentage is 95.1%. The actual weighting of benefits will result in a difference from the assumed percentage. For females, the rate of mortality on an amount-weighted basis was 95.3% of the rate of mortality on a headcount-weighted basis versus the assumed percentage of 95.1%.
- The rates of mortality of contingent beneficiaries were more than three times greater than the rates of mortality of service retirees for ages 60 to 99.

Contingent Beneficiaries - Males

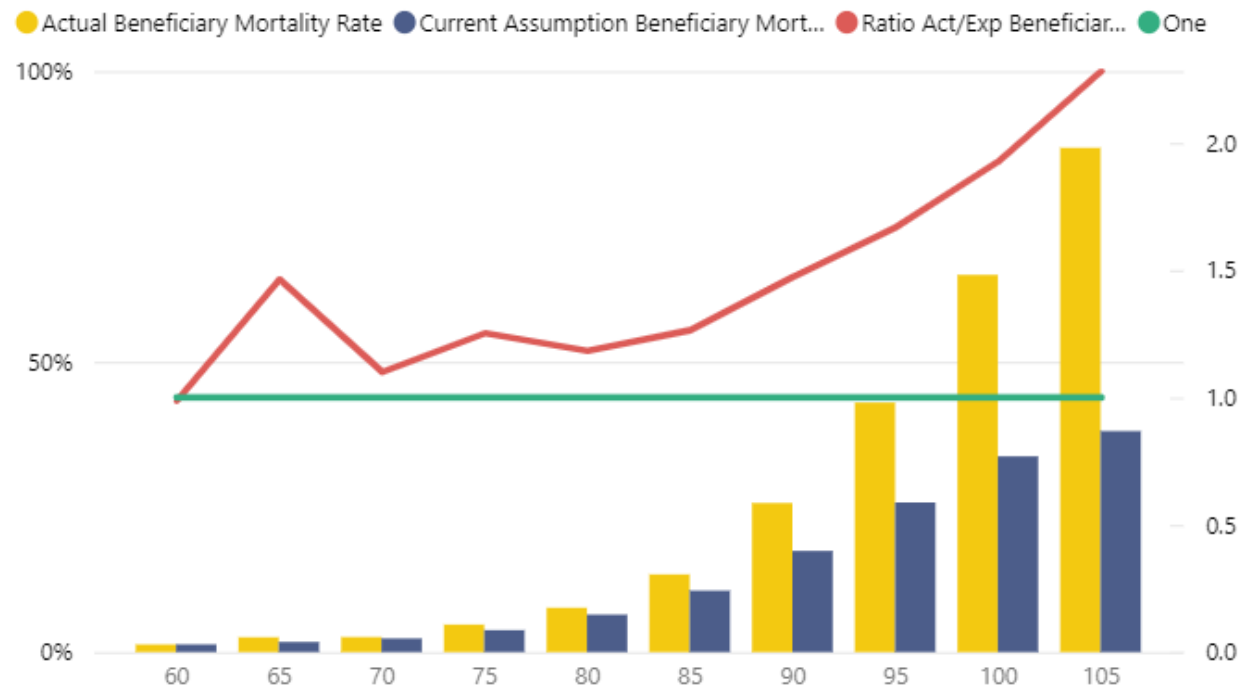
The following charts show postretirement mortality experience on a headcount-weighted basis by age, for males, for the age range 60 to 109, during the period 2015 – 2021.

| Age Bene (bins) | Actual Beneficiary Deaths | Expected Beneficiary Deaths | Total Exposed | Actual Beneficiary Mortality Rate | Current Assumption Beneficiary Mortality | Ratio Act/Exp Beneficiary Mortality |
|-----------------|---------------------------|-----------------------------|---------------|-----------------------------------|--|-------------------------------------|
| 60 | 5 | 5.1 | 383 | 1.3055% | 1.3228% | 0.99 |
| 65 | 20 | 13.7 | 787 | 2.5413% | 1.7359% | 1.46 |
| 70 | 34 | 30.9 | 1,320 | 2.5758% | 2.3406% | 1.10 |
| 75 | 61 | 48.7 | 1,290 | 4.7287% | 3.7782% | 1.25 |
| 80 | 93 | 78.6 | 1,220 | 7.6230% | 6.4423% | 1.18 |
| 85 | 176 | 139.2 | 1,317 | 13.3637% | 10.5712% | 1.26 |
| 90 | 285 | 193.4 | 1,111 | 25.6526% | 17.4050% | 1.47 |
| 95 | 228 | 136.7 | 531 | 42.9379% | 25.7467% | 1.67 |
| 100 | 124 | 64.3 | 191 | 64.9215% | 33.6886% | 1.93 |
| 105 | 46 | 20.2 | 53 | 86.7925% | 38.0341% | 2.28 |
| Total | 1,072 | 730.8 | 8,203 | 13.0684% | 8.9086% | 1.47 |

Exposure Distribution w/ Beneficiary Mortality Rate - Actual and Expected;



Beneficiary Mortality Rate - Actual, Expected, and Ratio; by Age

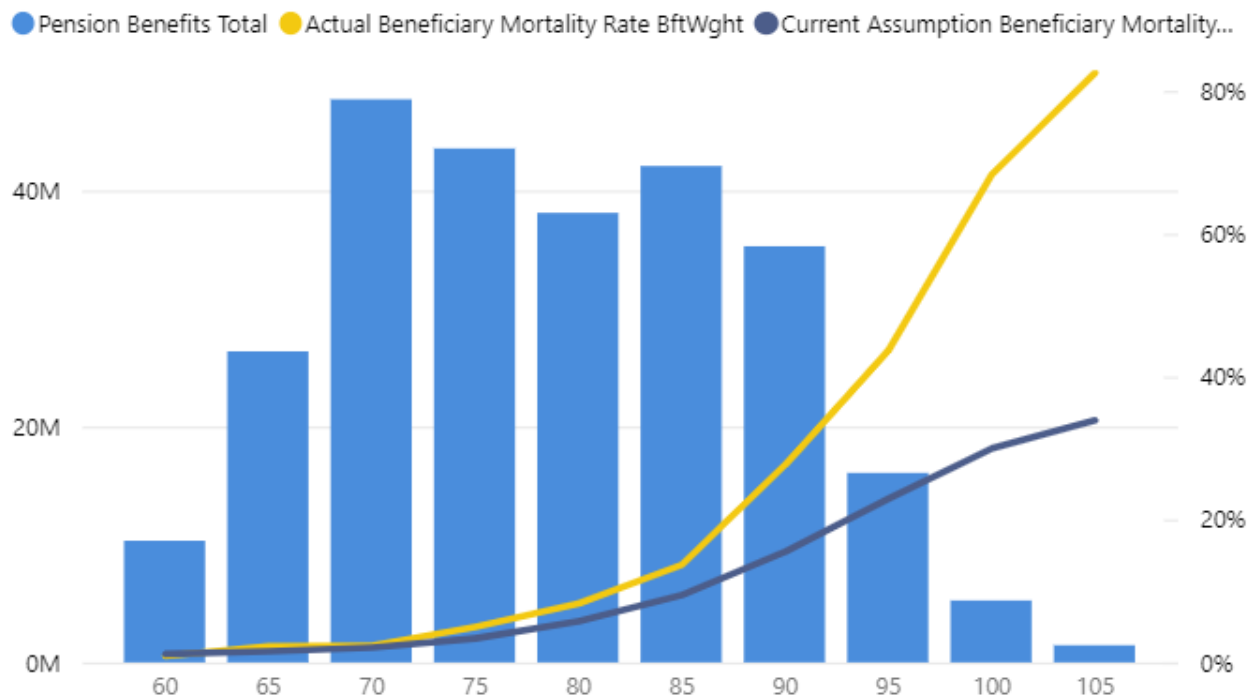


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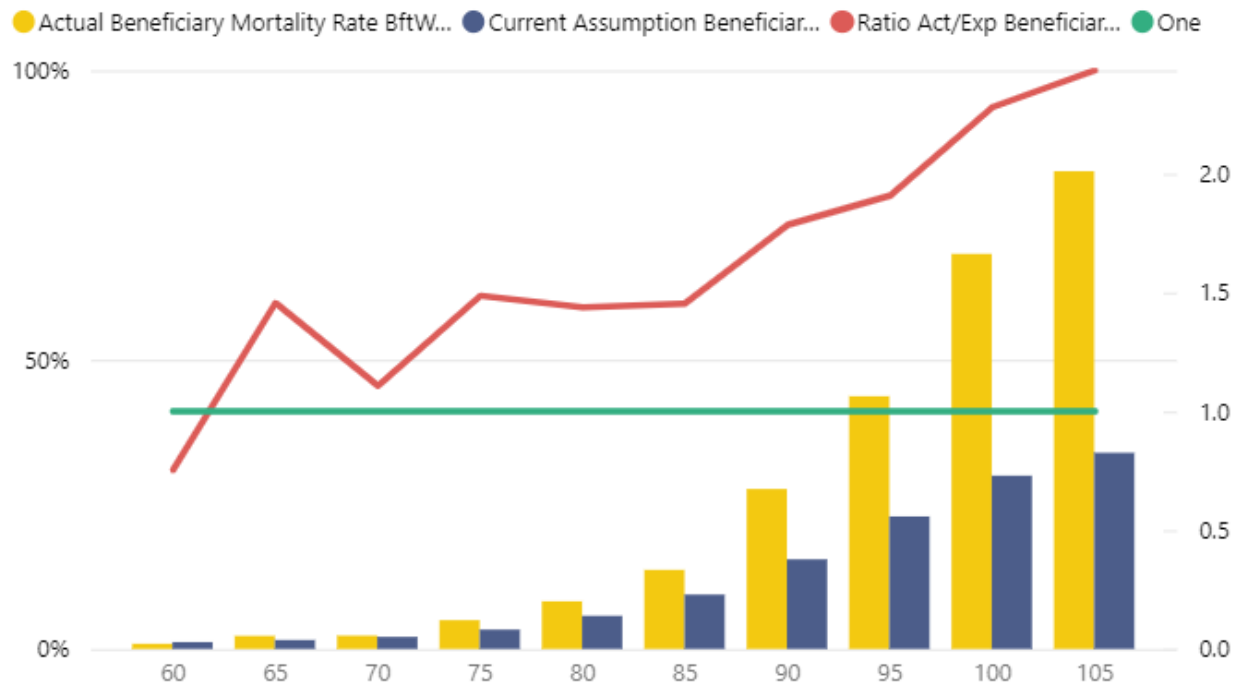
The following charts show postretirement mortality experience on an amount-weighted basis by age, for males, for the age range 60 to 109, during the period 2015 – 2021.

| Age Bene (bins) | Actual Beneficiary Benefits Released | Expected Beneficiary Benefits Released | Pension Benefits Total | Actual Beneficiary Mortality Rate BftWght | Current Assumption Beneficiary Mortality BftWght | Ratio Act/Exp Beneficiary Mortality BftWght |
|-----------------|--------------------------------------|--|------------------------|---|--|---|
| 60 | 92K | 122K | 10,313K | 0.8917% | 1.1829% | 0.75 |
| 65 | 595K | 409K | 26,369K | 2.2570% | 1.5504% | 1.46 |
| 70 | 1,099K | 993K | 47,736K | 2.3029% | 2.0799% | 1.11 |
| 75 | 2,167K | 1,458K | 43,569K | 4.9737% | 3.3468% | 1.49 |
| 80 | 3,137K | 2,183K | 38,110K | 8.2321% | 5.7289% | 1.44 |
| 85 | 5,749K | 3,955K | 42,081K | 13.6617% | 9.3984% | 1.45 |
| 90 | 9,752K | 5,464K | 35,279K | 27.6422% | 15.4872% | 1.78 |
| 95 | 7,016K | 3,678K | 16,064K | 43.6753% | 22.8960% | 1.91 |
| 100 | 3,584K | 1,572K | 5,249K | 68.2734% | 29.9417% | 2.28 |
| 105 | 1,198K | 492K | 1,451K | 82.5534% | 33.8973% | 2.44 |
| Total | 34,390K | 20,326K | 266,221K | 12.9177% | 7.6348% | 1.69 |

Pension Benefit Distribution w/ Beneficiary Mortality Rate - Actual and Expected; by Age 



Beneficiary Mortality Rate - Actual, Expected, and Ratio; by Age



Specific observations:

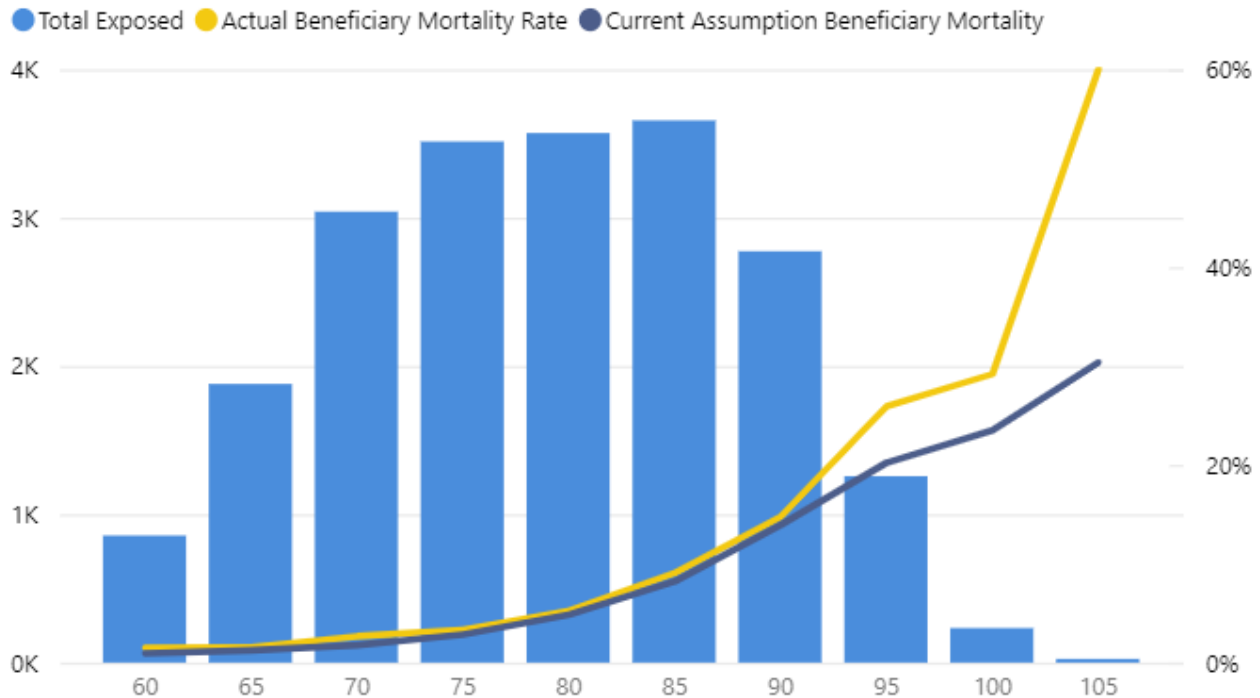
- The mortality experience of male contingent beneficiaries is not fully credible.
- From 2015 - 2021, the actual number of deaths was greater than expected on both a headcount basis (A/E ratio of 1.47) and a benefit basis (A/E ratio of 1.69).
- The largest difference between the number of actual and expected deaths occurred during 2020 – 2021 (A/E ratio of 1.80 on a headcount basis and A/E ratio of 1.96 on a benefits basis).
- If these two years were excluded, the A/E ratios are 1.31 on a headcount basis and 1.56 on a benefits basis.

Contingent Beneficiaries - Females

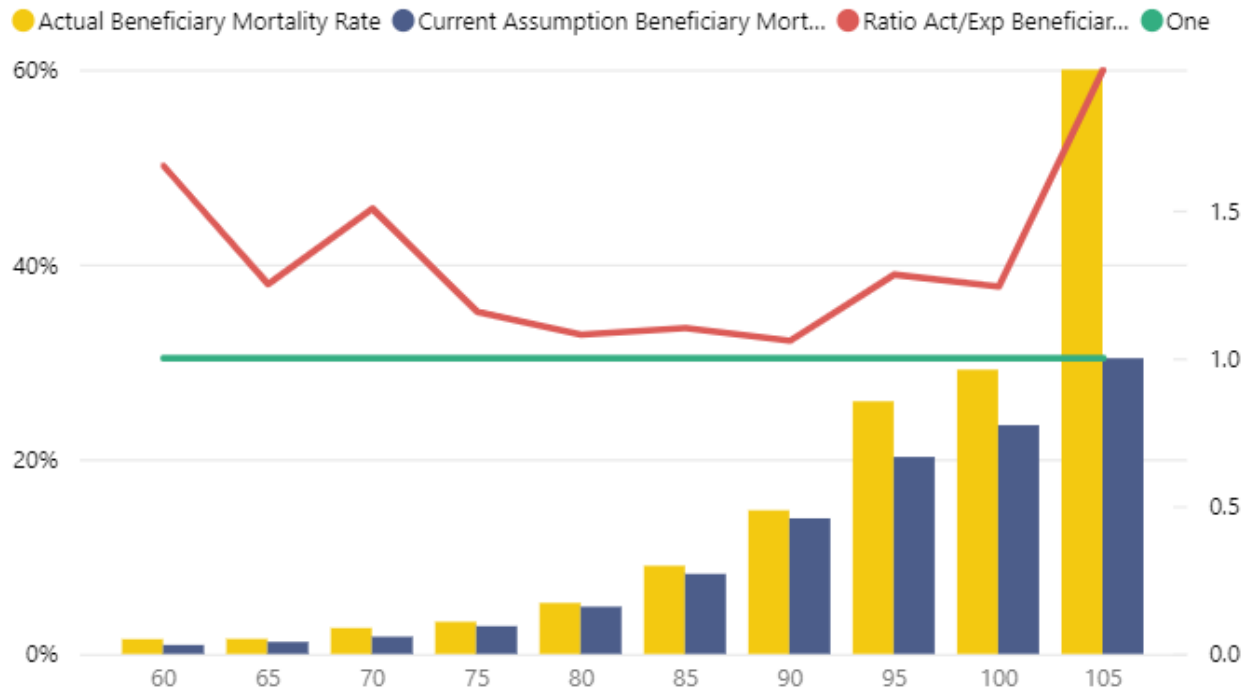
The following charts show postretirement mortality experience on a headcount-weighted basis by age, for females, for the age range 60 to 109, during the period 2015 – 2021.

| Age Bene (bins) | Actual Beneficiary Deaths | Expected Beneficiary Deaths | Total Exposed | Actual Beneficiary Mortality Rate | Current Assumption Beneficiary Mortality | Ratio Act/Exp Beneficiary Mortality |
|-----------------|---------------------------|-----------------------------|---------------|-----------------------------------|--|-------------------------------------|
| 60 | 13 | 7.9 | 857 | 1.5169% | 0.9193% | 1.65 |
| 65 | 29 | 23.2 | 1,879 | 1.5434% | 1.2345% | 1.25 |
| 70 | 81 | 53.8 | 3,041 | 2.6636% | 1.7683% | 1.51 |
| 75 | 116 | 100.2 | 3,514 | 3.3011% | 2.8519% | 1.16 |
| 80 | 187 | 173.1 | 3,571 | 5.2366% | 4.8486% | 1.08 |
| 85 | 331 | 300.5 | 3,656 | 9.0536% | 8.2190% | 1.10 |
| 90 | 409 | 386.2 | 2,774 | 14.7441% | 13.9218% | 1.06 |
| 95 | 326 | 254.2 | 1,257 | 25.9348% | 20.2251% | 1.28 |
| 100 | 68 | 54.7 | 233 | 29.1845% | 23.4853% | 1.24 |
| 105 | 15 | 7.6 | 25 | 60.0000% | 30.3603% | 1.98 |
| Total | 1,575 | 1,361.4 | 20,807 | 7.5696% | 6.5431% | 1.16 |

Exposure Distribution w/ Beneficiary Mortality Rate - Actual and Expected; by Age



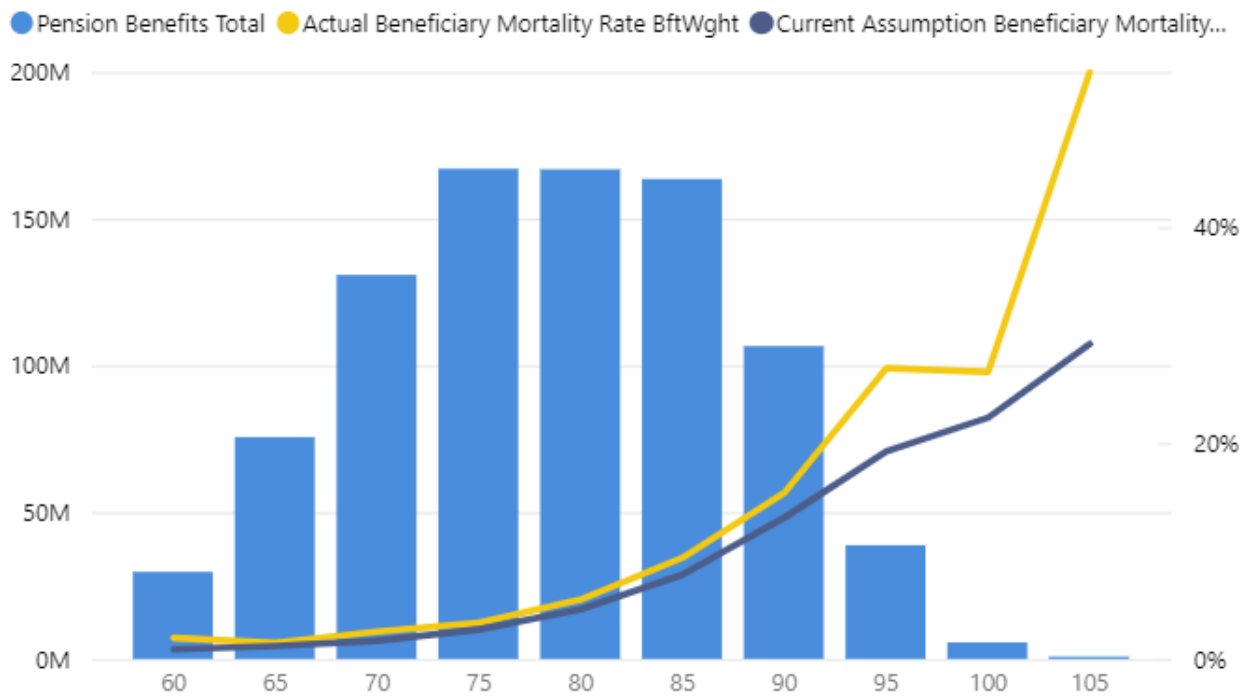
Beneficiary Mortality Rate - Actual, Expected, and Ratio; by Age



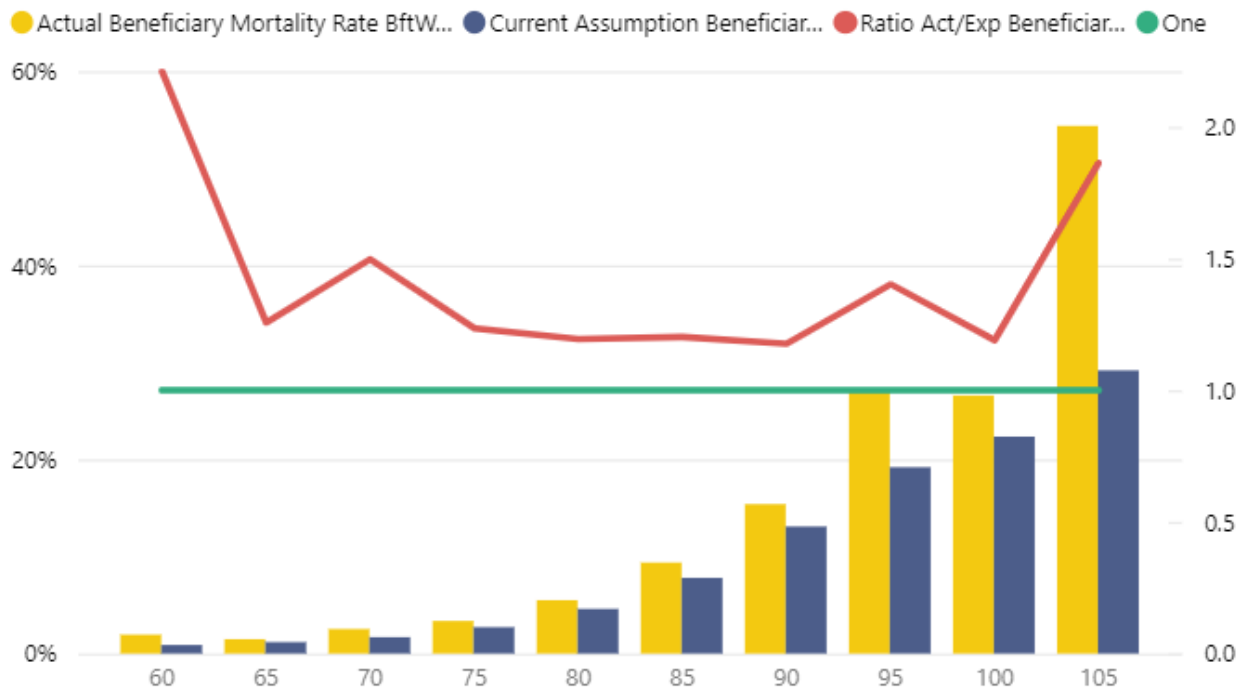
The following charts show postretirement mortality experience on an amount-weighted basis by age, for females, for the age range 60 to 109, during the period 2015 – 2021.

| Age Bene (bins) | Actual Beneficiary Benefits Released | Expected Beneficiary Benefits Released | Pension Benefits Total | Actual Beneficiary Mortality Rate BftWght | Current Assumption Beneficiary Mortality BftWght | Ratio Act/Exp Beneficiary Mortality BftWght |
|-----------------|--------------------------------------|--|------------------------|---|--|---|
| 60 | 576K | 261K | 29,654K | 1.9433% | 0.8786% | 2.21 |
| 65 | 1,116K | 889K | 75,560K | 1.4773% | 1.1759% | 1.26 |
| 70 | 3,306K | 2,207K | 130,833K | 2.5268% | 1.6867% | 1.50 |
| 75 | 5,604K | 4,540K | 166,996K | 3.3558% | 2.7184% | 1.23 |
| 80 | 9,169K | 7,675K | 166,804K | 5.4971% | 4.6013% | 1.19 |
| 85 | 15,325K | 12,750K | 163,523K | 9.3719% | 7.7968% | 1.20 |
| 90 | 16,404K | 13,947K | 106,574K | 15.3921% | 13.0867% | 1.18 |
| 95 | 10,430K | 7,438K | 38,737K | 26.9245% | 19.2005% | 1.40 |
| 100 | 1,497K | 1,258K | 5,630K | 26.5850% | 22.3497% | 1.19 |
| 105 | 395K | 212K | 726K | 54.3692% | 29.1696% | 1.86 |
| Total | 63,822K | 51,175K | 885,036K | 7.2113% | 5.7822% | 1.25 |

Pension Benefit Distribution w/ Beneficiary Mortality Rate - Actual and Expected; by Age



Beneficiary Mortality Rate - Actual, Expected, and Ratio; by Age



Specific observations:

Part I Experience Study Report – TRS and BERS
 New York City Retirement Systems

This work product was prepared solely for New York City Comptroller’s Office for the purposes described herein and may not be appropriate to use for other purposes. Milliman does not intend to benefit and assumes no duty or liability to other parties who receive this work.

- From 2015 - 2021, the actual number of deaths was greater than expected on both a headcount basis (A/E ratio of 1.16) and a benefit basis (A/E ratio of 1.25).
- The largest difference between the number of actual and expected deaths occurred during 2020 – 2021 (A/E ratio of 1.35 on a headcount basis and A/E ratio of 1.38 on a benefits basis).
- If these two years were excluded, the A/E ratios are 1.07 on a headcount basis and 1.18 on a benefits basis.

Section III – Board of Education Retirement System of the City of New York (BERS)

Exposures and Decrements

To set the exposures and actual decrements for BERS, the following table details the age and service conditions for unreduced retirement and reduced retirement. If a member has not met any of these conditions for the indicated plan code by year, the member is considered a withdrawal exposure. Otherwise, if the member did meet any of these conditions, they would be considered a retirement exposure. Members with a status code of termination who, nonetheless, have met the conditions for retirement, are included as actual retirements.

Using the age and service slider, a user can drill down to view the results that reflect a variety of conditions by plan code, such as reduced retirement, retirement at first eligibility, or other conditions for retirement.

BERS Retirement Eligibility Chart

| Plan Code | Plan Description | Mandated | Formula | Unreduced Retirement | | Unreduced Retirement | | Reduced Retirement | |
|-----------|--------------------------------|----------|------------|----------------------|-------------|----------------------|-----------|--------------------|---------|
| | | | Bump at 20 | Condition 1 | Condition 2 | Condition | Condition | | |
| | | | YOS | Age 1 | Service 1 | Age 2 | Service 2 | Age | Service |
| A | CPP (Plan A) | TRUE | | 55 | 25 | | | | |
| B | ISF | TRUE | | 55 | 25 | | | | |
| C | Modified CPP | TRUE | | 62 | 5 | | | 55 | 25 |
| D | Modified ISF | TRUE | | 62 | 5 | | | | |
| F | Tier IV | TRUE | TRUE | 62 | 5 | | | 55 | 5 |
| G | Ch96 - Tier II | FALSE | TRUE | 55 | 25 | 62 | 5 | | |
| H | Ch96 - Tier IV | FALSE | TRUE | 55 | 25 | 62 | 5 | | |
| W | Ch96 - Tier IV PhyTax | FALSE | TRUE | 50 | 25 | 62 | 5 | | |
| I | Ch96 - 57/10 Mandated | TRUE | TRUE | 57 | 5 | | | | |
| J | Ch19/08 - 55/25 - Tier II | FALSE | TRUE | 55 | 25 | 62 | 5 | | |
| K | Ch19/08 - 55/25 - Tier IV | FALSE | TRUE | 55 | 25 | 62 | 5 | | |
| L | Special Officers - Tier IV | TRUE | FALSE | 40 | 25 | 62 | 5 | | |
| M | Ch96 - Tier IV Mandated | TRUE | TRUE | 57 | 5 | | | | |
| N | Ch96 - Tier IV Mandated PhyTax | TRUE | TRUE | 50 | 25 | 57 | 5 | | |
| P | Ch19/08 - 55/27 Mandated | TRUE | TRUE | 55 | 27 | 62 | 5 | | |
| Q | Ch504/09 - 55/27 Mandated | TRUE | TRUE | 55 | 27 | 62 | 10 | 55 | 10 |
| R | Ch18/12 - Tier 6 | TRUE | TRUE | 63 | 10 | | | 55 | 10 |
| T | Special Officers - Tier 6 | TRUE | FALSE | 40 | 25 | 63 | 10 | | |
| U | Automechanics Tier 4 | FALSE | FALSE | 50 | 25 | 62 | 5 | | |
| V | Automechanics Tier 6 | TRUE | FALSE | 50 | 25 | 63 | 10 | | |

Please note that withdrawal and retirement exposures for Plan Codes A – D and J were excluded from the tool because there are very few of them remaining at the end of the study period.

For certain plans such as the Tier 6 plans and the Ch 504/09 – 55/27 Mandated plan, the vesting requirement was reduced from 10 years to 5 years with the passage of Chapter 56, Laws of 2022. Since 10-year vesting was required during the study period, we have used 10 years in this report.

OA’s retirement assumptions depend on whether a member can choose a certain retirement plan. If a member had a choice and elected the improved plan, the assumed rates of retirement are higher than those in which the member was mandated into the specific retirement plan. Higher rates of retirement apply to the indicated plan when the Mandated column is set to False. All Tier 6 plans are considered Mandated plans.

Members whose work involved physically taxing activities are subject to less stringent requirements to qualify for benefits in terms of retirement age. To facilitate the analysis of these members, we created two new codes:

- Plan Code N – for Tier IV Chapter 96 age 57 plan members, who were initially included in Plan Code I or Plan Code M. Plan Code I and Plan Code M are the same plan, but in some years the plan was referred to as Plan Code I and in other years as Plan Code M.
- Plan Code W – for Tier IV Chapter 96 optional 55 and 25 members, who were initially included in Plan Code H.

We understand that for certain elected plans with unreduced retirement benefits at age 55 and 25 or 27 years of service, the OA assumes immediate reduced retirement for members who have not met the stated condition for unreduced retirement but have met the condition for early retirement under the Tier IV basic plan (age 55 and completion of 5 years of service). In these situations, OA applies the rates of termination at these age/service conditions and not reduced rates of retirement. Accordingly, we have coded these members as withdrawal exposures.

Due to the rounding of ages, there can be members with a recorded age at retirement of 54 but who actually retired when first attained age 55. In this version of the MEST, we have excluded their experience.

Withdrawal

The current withdrawal assumption varies by gender and service.

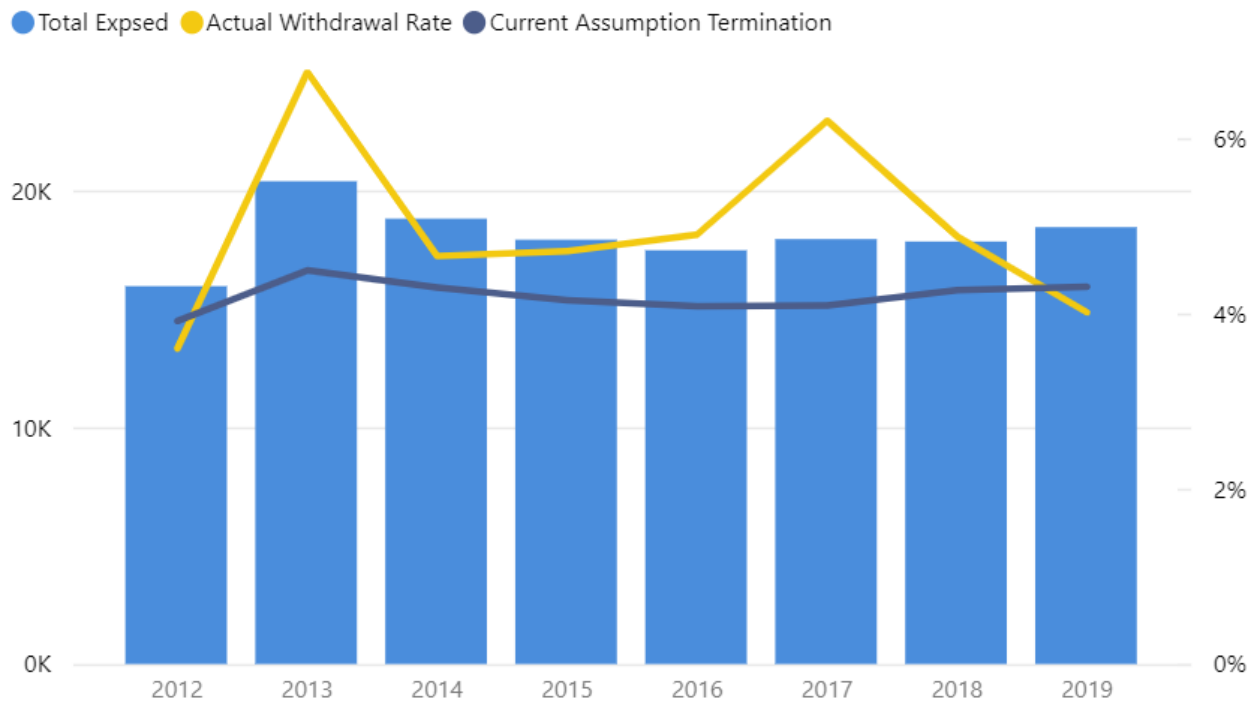
The following table shows the experience results for withdrawal by year, for the age range (20 to 79), and service range (0 to 37 years). Based on the current assumptions, the overall expected rate of withdrawal averaged 4.25% whereas the actual rate was at 4.16%.

| Plan Year | Actual Withdrawals | Expected Withdrawals | Total Exposed | Actual Withdrawal Rate | Current Assumption Termination | Ratio Act/Exp Term |
|--------------|--------------------|----------------------|----------------|------------------------|--------------------------------|--------------------|
| 2012 | 574 | 624.0 | 15,955 | 3.60% | 3.91% | 0.92 |
| 2013 | 1,377 | 915.5 | 20,387 | 6.75% | 4.49% | 1.50 |
| 2014 | 875 | 807.9 | 18,806 | 4.65% | 4.30% | 1.08 |
| 2015 | 844 | 743.5 | 17,918 | 4.71% | 4.15% | 1.14 |
| 2016 | 856 | 713.1 | 17,471 | 4.90% | 4.08% | 1.20 |
| 2017 | 1,112 | 733.7 | 17,942 | 6.20% | 4.09% | 1.52 |
| 2018 | 870 | 761.2 | 17,841 | 4.88% | 4.27% | 1.14 |
| 2019 | 740 | 793.6 | 18,446 | 4.01% | 4.30% | 0.93 |
| 2020 | 218 | 854.9 | 19,415 | 1.12% | 4.40% | 0.26 |
| 2021 | 213 | 896.8 | 20,464 | 1.04% | 4.38% | 0.24 |
| Total | 7,679 | 7,844.2 | 184,645 | 4.16% | 4.25% | 0.98 |

The rate of termination during 2020 and 2021 may be artificially low due to members with a LOA status code. A record with a LOA status code is included as an exposure and not a decrement. Note that from 2016 – 2019, between 4% and 13% of the records with a status code of LOA were changed to a rehire. Hence, between 87% and 96% of the LOA records are eventually coded as withdrawal, retired, disabled or death. Excluding these two years, the actual rate of termination of 5.01% exceeded the assumed rate of 4.21% for an A/E ratio of 1.19 as shown in the following tables.

| Plan Year | Actual Withdrawals | Expected Withdrawals | Total Exposed | Actual Withdrawal Rate | Current Assumption Termination | Ratio Act/Exp Term |
|--------------|--------------------|----------------------|----------------|------------------------|--------------------------------|--------------------|
| 2012 | 574 | 624.0 | 15,955 | 3.60% | 3.91% | 0.92 |
| 2013 | 1,377 | 915.5 | 20,387 | 6.75% | 4.49% | 1.50 |
| 2014 | 875 | 807.9 | 18,806 | 4.65% | 4.30% | 1.08 |
| 2015 | 844 | 743.5 | 17,918 | 4.71% | 4.15% | 1.14 |
| 2016 | 856 | 713.1 | 17,471 | 4.90% | 4.08% | 1.20 |
| 2017 | 1,112 | 733.7 | 17,942 | 6.20% | 4.09% | 1.52 |
| 2018 | 870 | 761.2 | 17,841 | 4.88% | 4.27% | 1.14 |
| 2019 | 740 | 793.6 | 18,446 | 4.01% | 4.30% | 0.93 |
| Total | 7,248 | 6,092.5 | 144,766 | 5.01% | 4.21% | 1.19 |

Exposure Distribution w/ Withdrawal Rate - Actual and Expected; by Year



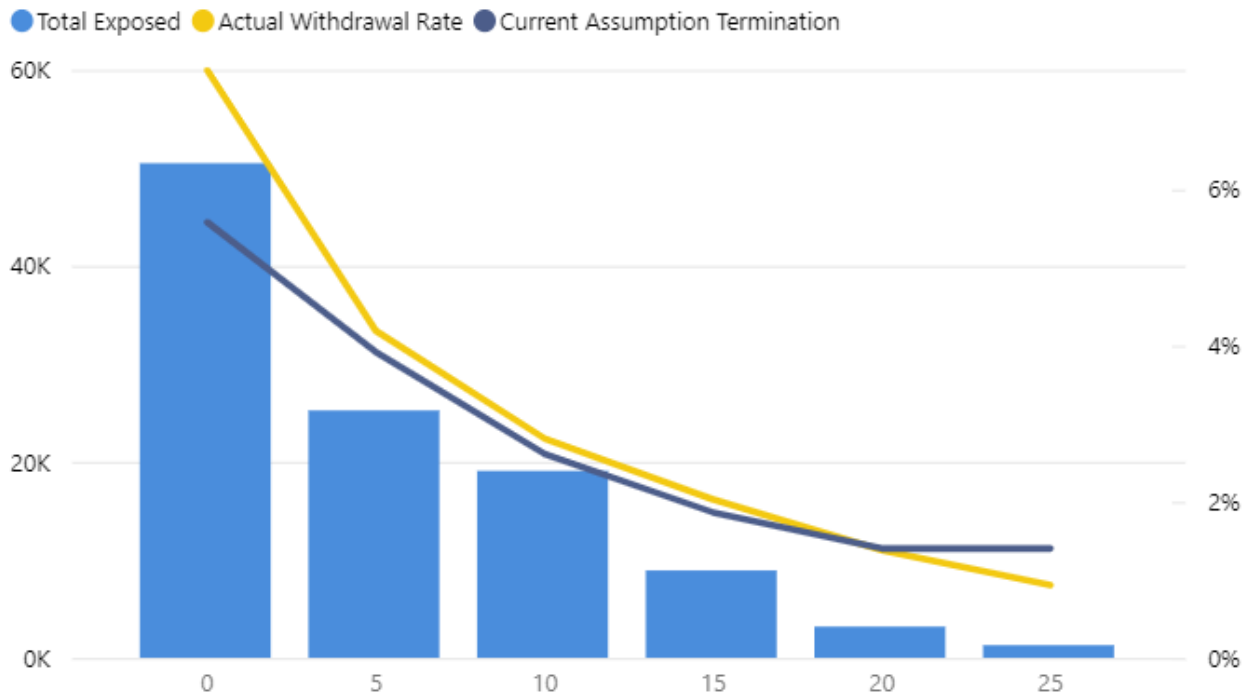
Specific observations on the results through 2019:

- The actual rate of withdrawal exceeded 6% in 2013 and 2017.
- From 2013 to 2018, the actual rate exceeded the assumption.
- For male members, the actual experience of 4.95% was slightly lower than the current expected rate of 5.17%.
- For female members, the actual experience of 5.03% was 30% higher than the expected rate of 3.87%.

The following charts show the results by service (0 to 29 years) in the experience study period through 2017, prior to the addition of new data.

| Service | Actual Withdrawals | Expected Withdrawals | Total Exposed | Actual Withdrawal Rate | Current Assumption Termination | Ratio Act/Exp Term |
|--------------|--------------------|----------------------|----------------|------------------------|--------------------------------|--------------------|
| 0 | 834 | 534.8 | 8,423 | 9.90% | 6.35% | 1.56 |
| 1 | 899 | 669.3 | 11,291 | 7.96% | 5.93% | 1.34 |
| 2 | 746 | 593.6 | 10,670 | 6.99% | 5.56% | 1.26 |
| 3 | 622 | 488.4 | 9,360 | 6.65% | 5.22% | 1.27 |
| 4 | 702 | 531.0 | 10,730 | 6.54% | 4.95% | 1.32 |
| 5 | 288 | 231.2 | 5,053 | 5.70% | 4.58% | 1.25 |
| 6 | 258 | 234.5 | 5,536 | 4.66% | 4.24% | 1.10 |
| 7 | 181 | 196.6 | 5,063 | 3.57% | 3.88% | 0.92 |
| 8 | 200 | 182.6 | 5,142 | 3.89% | 3.55% | 1.10 |
| 9 | 131 | 143.9 | 4,451 | 2.94% | 3.23% | 0.91 |
| 10 | 146 | 130.9 | 4,415 | 3.31% | 2.96% | 1.12 |
| 11 | 121 | 107.9 | 3,946 | 3.07% | 2.73% | 1.12 |
| 12 | 106 | 105.5 | 4,085 | 2.59% | 2.58% | 1.01 |
| 13 | 89 | 80.4 | 3,295 | 2.70% | 2.44% | 1.11 |
| 14 | 74 | 74.1 | 3,337 | 2.22% | 2.22% | 1.00 |
| 15 | 49 | 55.1 | 2,622 | 1.87% | 2.10% | 0.89 |
| 16 | 49 | 42.9 | 2,259 | 2.17% | 1.90% | 1.14 |
| 17 | 35 | 30.4 | 1,689 | 2.07% | 1.80% | 1.15 |
| 18 | 26 | 23.2 | 1,365 | 1.90% | 1.70% | 1.12 |
| 19 | 22 | 14.7 | 983 | 2.24% | 1.50% | 1.49 |
| 20 | 13 | 10.9 | 777 | 1.67% | 1.40% | 1.20 |
| 21 | 16 | 9.1 | 652 | 2.45% | 1.40% | 1.75 |
| 22 | 4 | 9.7 | 690 | 0.58% | 1.40% | 0.41 |
| 23 | 4 | 7.6 | 542 | 0.74% | 1.40% | 0.53 |
| 24 | 7 | 7.4 | 526 | 1.33% | 1.40% | 0.95 |
| 25 | 5 | 4.8 | 341 | 1.47% | 1.40% | 1.05 |
| 26 | 3 | 4.4 | 316 | 0.95% | 1.40% | 0.68 |
| 27 | 1 | 3.8 | 269 | 0.37% | 1.40% | 0.27 |
| 28 | 1 | 2.9 | 207 | 0.48% | 1.40% | 0.35 |
| 29 | 2 | 2.2 | 155 | 1.29% | 1.40% | 0.92 |
| Total | 5,634 | 4,533.7 | 108,190 | 5.21% | 4.19% | 1.24 |

Exposure Distribution w/ Withdrawal Rate - Actual and Expected; by Service



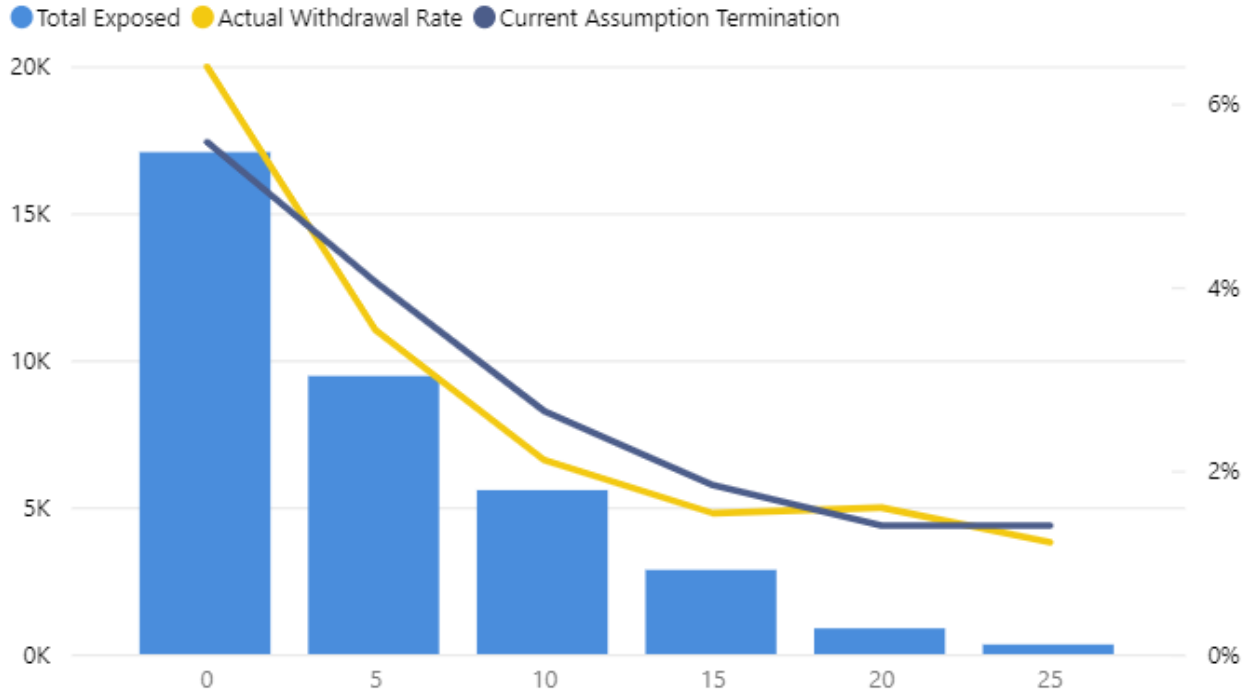
Specific observations:

- For short-service members with up to five years of service, the actual rate of withdrawal was the same for female and male members combined (7.37%), but due to different expectations, the A/E ratios were different (1.49 for females, 1.04 for males).
- For members with between 6 and 29 years of service, the actual rate of withdrawal for males and females combined was slightly higher than assumed (A/E ratio of 1.04), but the A/E ratio was 1.13 for females, and 0.82 for males.

The following chart shows the results for the two-year period July 1, 2017 – June 30, 2019 (2018 and 2019) by service (0 to 29 years).

| Service | Actual Withdrawals | Expected Withdrawals | Total Exposed | Actual Withdrawal Rate | Current Assumption Termination | Ratio Act/Exp Term |
|--------------|--------------------|----------------------|---------------|------------------------|--------------------------------|--------------------|
| 0 | 170 | 141.0 | 2,239 | 7.59% | 6.30% | ▲ 1.21 |
| 1 | 369 | 292.4 | 4,915 | 7.51% | 5.95% | ▲ 1.26 |
| 2 | 242 | 218.9 | 3,905 | 6.20% | 5.60% | ▲ 1.11 |
| 3 | 158 | 155.1 | 3,027 | 5.22% | 5.12% | ● 1.02 |
| 4 | 155 | 145.2 | 2,988 | 5.19% | 4.86% | ● 1.07 |
| 5 | 107 | 130.8 | 2,815 | 3.80% | 4.65% | ▲ 0.82 |
| 6 | 103 | 101.9 | 2,391 | 4.31% | 4.26% | ● 1.01 |
| 7 | 39 | 55.7 | 1,454 | 2.68% | 3.83% | ▲ 0.70 |
| 8 | 47 | 49.7 | 1,406 | 3.34% | 3.54% | ● 0.95 |
| 9 | 38 | 45.5 | 1,396 | 2.72% | 3.26% | ▲ 0.84 |
| 10 | 34 | 39.8 | 1,329 | 2.56% | 2.99% | ▲ 0.86 |
| 11 | 30 | 33.9 | 1,232 | 2.44% | 2.75% | ▲ 0.88 |
| 12 | 27 | 29.0 | 1,105 | 2.44% | 2.62% | ● 0.93 |
| 13 | 16 | 25.8 | 1,048 | 1.53% | 2.46% | ▲ 0.62 |
| 14 | 11 | 19.3 | 865 | 1.27% | 2.23% | ▲ 0.57 |
| 15 | 12 | 15.6 | 744 | 1.61% | 2.10% | ▲ 0.77 |
| 16 | 12 | 11.9 | 626 | 1.92% | 1.90% | ● 1.01 |
| 17 | 8 | 10.8 | 598 | 1.34% | 1.80% | ▲ 0.74 |
| 18 | 4 | 8.5 | 502 | 0.80% | 1.70% | ◆ 0.47 |
| 19 | 8 | 6.0 | 397 | 2.02% | 1.50% | ▲ 1.34 |
| 20 | 4 | 4.0 | 285 | 1.40% | 1.40% | ● 1.00 |
| 21 | 2 | 3.1 | 224 | 0.89% | 1.40% | ▲ 0.64 |
| 22 | 2 | 2.0 | 143 | 1.40% | 1.40% | ● 1.00 |
| 23 | 3 | 1.8 | 129 | 2.33% | 1.40% | ◆ 1.66 |
| 24 | 3 | 1.3 | 96 | 3.13% | 1.40% | ◆ 2.23 |
| 25 | 2 | 1.5 | 110 | 1.82% | 1.40% | ▲ 1.30 |
| 26 | 0 | 1.0 | 72 | 0.00% | 1.40% | ◆ 0.00 |
| 27 | 1 | 0.8 | 55 | 1.82% | 1.40% | ▲ 1.30 |
| 28 | 1 | 0.7 | 53 | 1.89% | 1.40% | ▲ 1.35 |
| 29 | 0 | 0.5 | 38 | 0.00% | 1.40% | ◆ 0.00 |
| Total | 1,608 | 1,553.4 | 36,187 | 4.44% | 4.29% | ● 1.04 |

Exposure Distribution w/ Withdrawal Rate - Actual and Expected; by Service



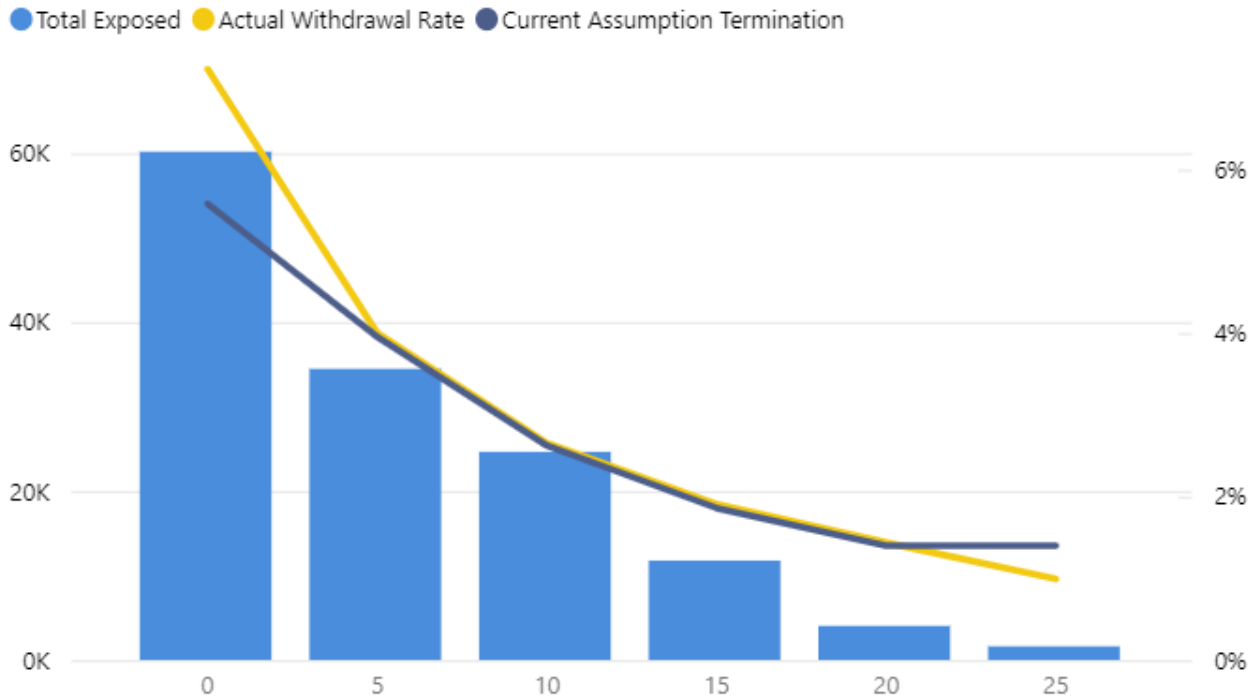
Specific observations for the 2-year period 2018-2019:

- Overall, the level of withdrawal in 2019 was lower than in all prior years except for 2012.
- For short-service members with up to five years of service, the actual rate of withdrawal was higher than assumed for female members (A/E ratio of 1.20), but lower than assumed for male members (A/E ratio of 0.93).
- For members with between 6 and 29 years of service, the actual rate of withdrawal was lower than assumed (A/E ratio of 0.87 for both females and males).

The following charts show the combined results for 2012 – 2019, by service (0 to 29 years), for the age range of 25 to 59.

| Service | Actual Withdrawals | Expected Withdrawals | Total Exposed | Actual Withdrawal Rate | Current Assumption Termination | Ratio Act/Exp Term |
|--------------|--------------------|----------------------|----------------|------------------------|--------------------------------|--------------------|
| 0 | 857 | 601.8 | 9,521 | 9.00% | 6.32% | ▲ 1.42 |
| 1 | 1,121 | 864.6 | 14,590 | 7.68% | 5.93% | ▲ 1.30 |
| 2 | 883 | 731.7 | 13,136 | 6.72% | 5.57% | ▲ 1.21 |
| 3 | 715 | 568.8 | 10,946 | 6.53% | 5.20% | ▲ 1.26 |
| 4 | 777 | 590.6 | 11,969 | 6.49% | 4.93% | ▲ 1.32 |
| 5 | 387 | 357.3 | 7,769 | 4.98% | 4.60% | ● 1.08 |
| 6 | 358 | 334.1 | 7,871 | 4.55% | 4.24% | ● 1.07 |
| 7 | 219 | 250.9 | 6,479 | 3.38% | 3.87% | ▲ 0.87 |
| 8 | 246 | 231.0 | 6,508 | 3.78% | 3.55% | ● 1.07 |
| 9 | 169 | 188.9 | 5,830 | 2.90% | 3.24% | ▲ 0.89 |
| 10 | 180 | 170.5 | 5,738 | 3.14% | 2.97% | ● 1.06 |
| 11 | 151 | 141.7 | 5,173 | 2.92% | 2.74% | ● 1.07 |
| 12 | 133 | 134.3 | 5,186 | 2.56% | 2.59% | ● 0.99 |
| 13 | 105 | 106.1 | 4,341 | 2.42% | 2.44% | ● 0.99 |
| 14 | 85 | 93.3 | 4,199 | 2.02% | 2.22% | ● 0.91 |
| 15 | 61 | 70.6 | 3,360 | 1.82% | 2.10% | ▲ 0.86 |
| 16 | 61 | 54.7 | 2,880 | 2.12% | 1.90% | ▲ 1.11 |
| 17 | 43 | 41.1 | 2,284 | 1.88% | 1.80% | ● 1.05 |
| 18 | 30 | 31.7 | 1,865 | 1.61% | 1.70% | ● 0.95 |
| 19 | 30 | 20.7 | 1,378 | 2.18% | 1.50% | ▲ 1.45 |
| 20 | 17 | 14.8 | 1,059 | 1.61% | 1.40% | ▲ 1.15 |
| 21 | 18 | 12.2 | 873 | 2.06% | 1.40% | ▲ 1.47 |
| 22 | 6 | 11.6 | 827 | 0.73% | 1.40% | ▲ 0.52 |
| 23 | 7 | 9.3 | 666 | 1.05% | 1.40% | ▲ 0.75 |
| 24 | 10 | 8.6 | 615 | 1.63% | 1.40% | ▲ 1.16 |
| 25 | 7 | 6.3 | 451 | 1.55% | 1.40% | ▲ 1.11 |
| 26 | 3 | 5.4 | 388 | 0.77% | 1.40% | ▲ 0.55 |
| 27 | 2 | 4.5 | 324 | 0.62% | 1.40% | ◆ 0.44 |
| 28 | 2 | 3.6 | 260 | 0.77% | 1.40% | ▲ 0.55 |
| 29 | 2 | 2.7 | 193 | 1.04% | 1.40% | ▲ 0.74 |
| Total | 6,685 | 5,663.5 | 136,679 | 4.89% | 4.14% | ▲ 1.18 |

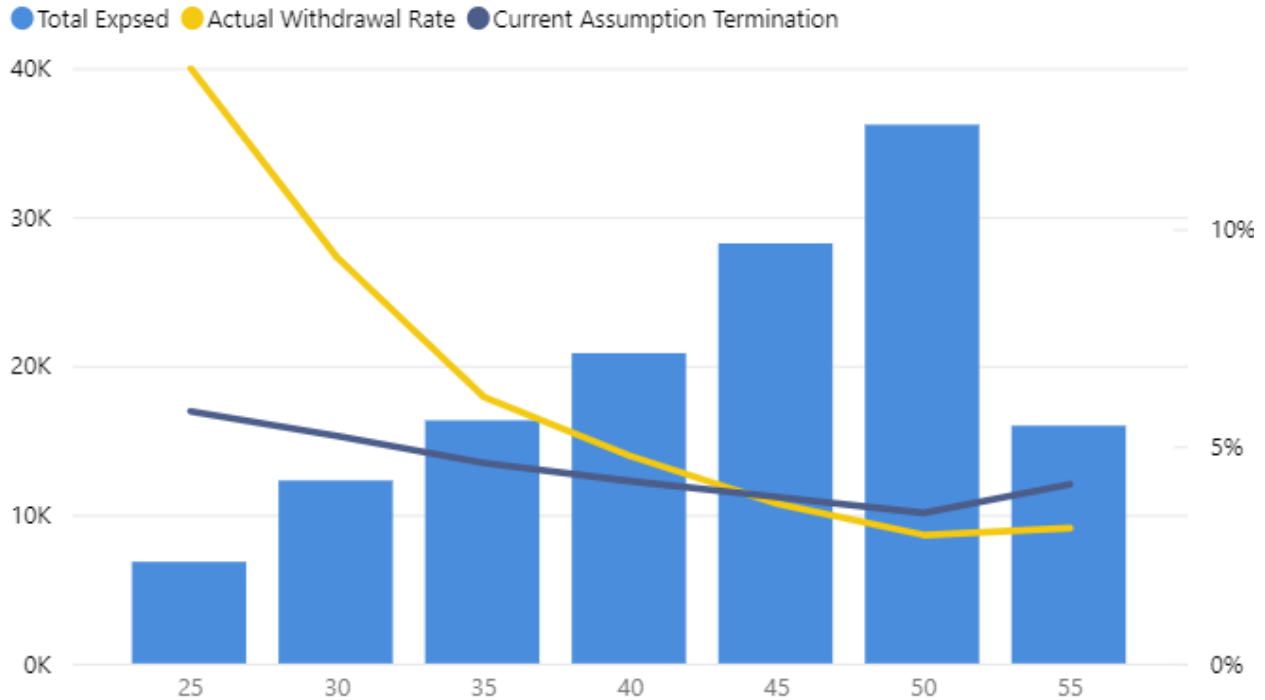
Exposure Distribution w/ Withdrawal Rate - Actual and Expected; by Service



The following charts show the combined results for 2012 – 2019, by age, using the same ranges for service (0 to 29 years) and age (25 to 59).

| Age | Actual Withdrawals | Expected Withdrawals | Total Exposed | Actual Withdrawal Rate | Current Assumption Termination | Ratio Act/Exp Term |
|--------------|--------------------|----------------------|----------------|------------------------|--------------------------------|--------------------|
| 25 | 150 | 50.3 | 829 | 18.09% | 6.07% | 2.98 |
| 26 | 185 | 64.4 | 1,089 | 16.99% | 5.91% | 2.87 |
| 27 | 187 | 80.2 | 1,382 | 13.53% | 5.81% | 2.33 |
| 28 | 189 | 93.5 | 1,620 | 11.67% | 5.77% | 2.02 |
| 29 | 225 | 107.8 | 1,908 | 11.79% | 5.65% | 2.09 |
| 30 | 232 | 119.4 | 2,153 | 10.78% | 5.54% | 1.94 |
| 31 | 238 | 124.1 | 2,305 | 10.33% | 5.39% | 1.92 |
| 32 | 207 | 128.2 | 2,453 | 8.44% | 5.23% | 1.61 |
| 33 | 220 | 132.7 | 2,593 | 8.48% | 5.12% | 1.66 |
| 34 | 251 | 138.6 | 2,785 | 9.01% | 4.98% | 1.81 |
| 35 | 212 | 140.1 | 2,896 | 7.32% | 4.84% | 1.51 |
| 36 | 188 | 145.0 | 3,076 | 6.11% | 4.72% | 1.30 |
| 37 | 196 | 150.0 | 3,256 | 6.02% | 4.61% | 1.31 |
| 38 | 205 | 156.9 | 3,458 | 5.93% | 4.54% | 1.31 |
| 39 | 201 | 162.2 | 3,643 | 5.52% | 4.45% | 1.24 |
| 40 | 185 | 164.8 | 3,788 | 4.88% | 4.35% | 1.12 |
| 41 | 204 | 171.4 | 4,013 | 5.08% | 4.27% | 1.19 |
| 42 | 198 | 172.2 | 4,104 | 4.82% | 4.20% | 1.15 |
| 43 | 204 | 179.9 | 4,343 | 4.70% | 4.14% | 1.13 |
| 44 | 204 | 186.5 | 4,597 | 4.44% | 4.06% | 1.09 |
| 45 | 184 | 195.9 | 4,912 | 3.75% | 3.99% | 0.94 |
| 46 | 226 | 208.1 | 5,314 | 4.25% | 3.92% | 1.09 |
| 47 | 207 | 217.4 | 5,660 | 3.66% | 3.84% | 0.95 |
| 48 | 209 | 227.1 | 6,015 | 3.47% | 3.78% | 0.92 |
| 49 | 211 | 233.5 | 6,321 | 3.34% | 3.69% | 0.90 |
| 50 | 205 | 241.3 | 6,672 | 3.07% | 3.62% | 0.85 |
| 51 | 210 | 249.7 | 7,022 | 2.99% | 3.56% | 0.84 |
| 52 | 225 | 251.6 | 7,260 | 3.10% | 3.47% | 0.89 |
| 53 | 213 | 255.7 | 7,549 | 2.82% | 3.39% | 0.83 |
| 54 | 216 | 255.8 | 7,688 | 2.81% | 3.33% | 0.84 |
| 55 | 172 | 212.3 | 5,763 | 2.98% | 3.68% | 0.81 |
| 56 | 124 | 203.5 | 5,581 | 2.22% | 3.65% | 0.61 |
| 57 | 64 | 89.3 | 1,710 | 3.74% | 5.22% | 0.72 |
| 58 | 74 | 82.6 | 1,567 | 4.72% | 5.27% | 0.90 |
| 59 | 64 | 71.3 | 1,354 | 4.73% | 5.26% | 0.90 |
| Total | 6,685 | 5,663.5 | 136,679 | 4.89% | 4.14% | 1.18 |

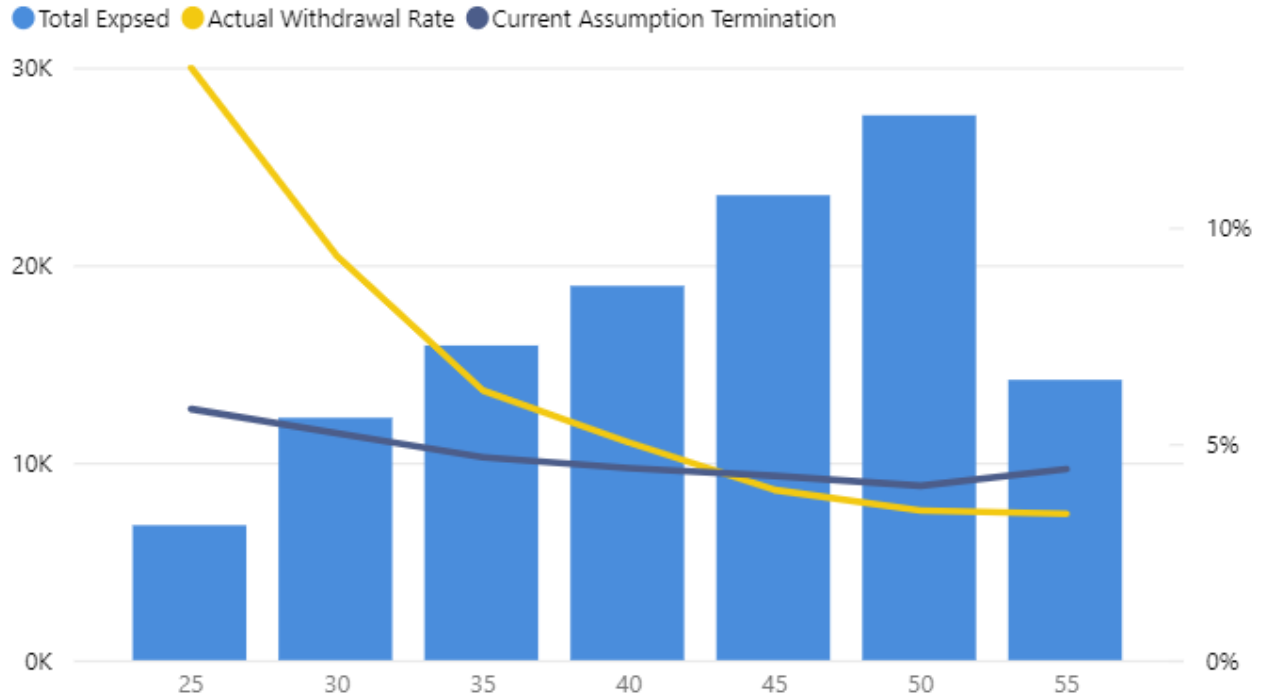
Exposure Distribution w/ Withdrawal Rate - Actual and Expected; by Age



Specific observations for the period 2012 - 2019:

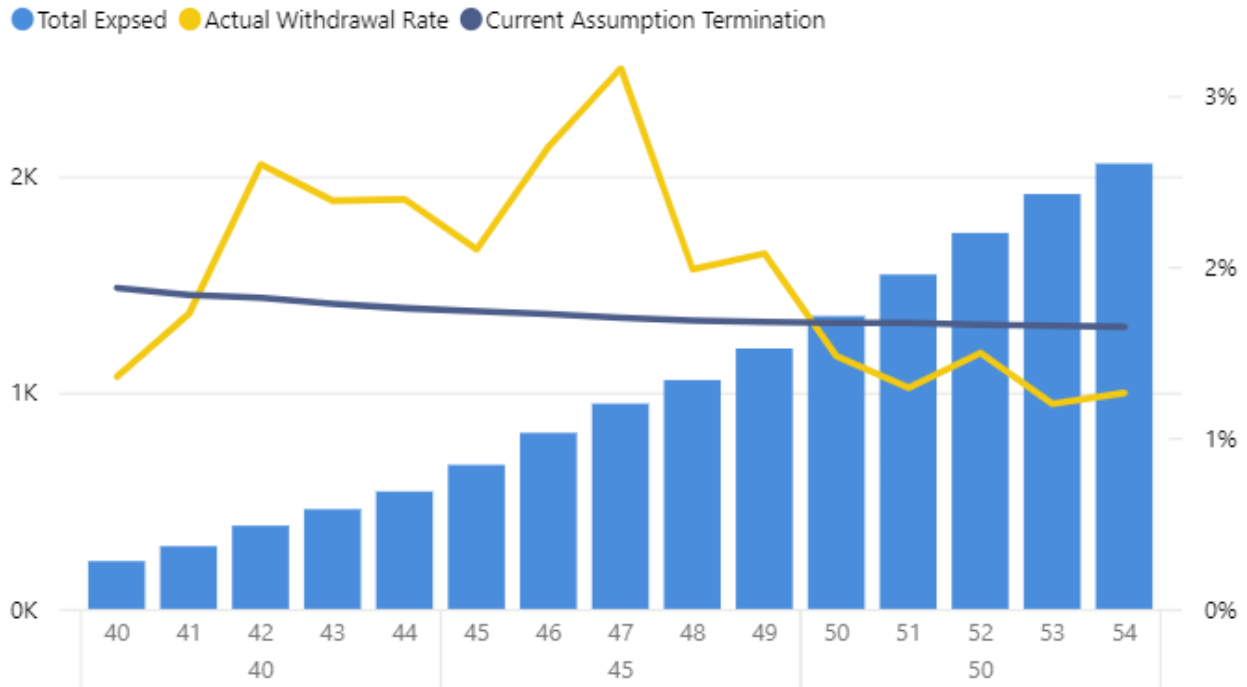
- Rates of withdrawal are similar between males and females for service periods of up to 14 years. For the age range 25 to 59, the actual rates of withdrawal for females and males are 5.33% and 5.42%, respectively.
- The rates of withdrawal vary by age. Younger members have higher rates of withdrawal, as shown in the following chart.

Exposure Distribution w/ Withdrawal Rate - Actual and Expected; by Age



- While actual rates of withdrawal vary somewhat by length of service, data scarcity is likely to produce larger variations on a percentage basis, especially when the length of service is 15 years or more.
- At these service periods, rates of withdrawal also seem to vary by age as depicted in the following chart.

Exposure Distribution w/ Withdrawal Rate - Actual and Expected; by Age



Summary

We find that female and male rates of withdrawal are similar by service, and that within these service ranges, rates vary age.

In subsequent analyses, we will develop the experience on a salary-weighted basis as lower paid members may exhibit higher rates of termination but would have less impact on the liability.

Retirement

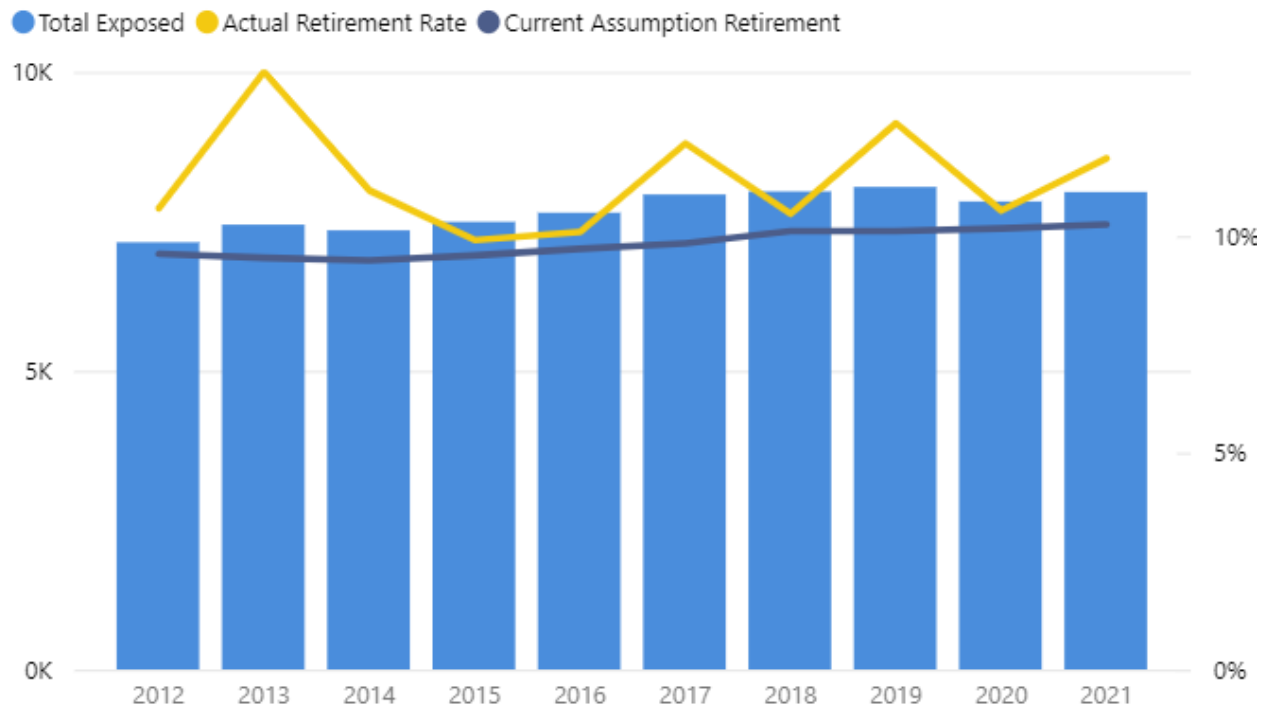
The current retirement assumption varies by age and eligibility for unreduced retirement with higher rates occurring at first eligibility. Furthermore, higher rates of retirement are assumed for members who had the option to elect an improved program.

Since Tier 6 became effective on April 1, 2012, and required 10 years of service for vesting, there is little to no retirement experience associated with these plans. Chapter 56 Laws of 2022 changed the vesting requirements for the Tier 6 plans and the Ch 504/09 – 55/27 [Mandatory]] plan to five years of service. Since the vesting requirement was 10 years during the study period, we used the 10-year requirement in this report.

The following table shows the retirement experience of all the plans by year, for the age range (55 to 79) and service range (5 to 47 years). Based on the current assumptions, the overall expected rate of retirement averaged 9.84% during this period, whereas the actual rate was 11.32% for an A/E ratio of 1.15.

| Plan Year | Actual Retirements | Expected Retirements | Total Exposed | Actual Retirement Rate | Current Assumption Retirement | Ratio Act/Exp Ret |
|--------------|--------------------|----------------------|---------------|------------------------|-------------------------------|-------------------|
| 2012 | 760 | 685.1 | 7,148 | 10.63% | 9.58% | ▲ 1.11 |
| 2013 | 1,026 | 706.7 | 7,443 | 13.78% | 9.49% | ▲ 1.45 |
| 2014 | 812 | 693.4 | 7,348 | 11.05% | 9.44% | ▲ 1.17 |
| 2015 | 742 | 715.1 | 7,490 | 9.91% | 9.55% | ● 1.04 |
| 2016 | 771 | 741.5 | 7,643 | 10.09% | 9.70% | ● 1.04 |
| 2017 | 964 | 781.1 | 7,948 | 12.13% | 9.83% | ▲ 1.23 |
| 2018 | 841 | 809.0 | 7,999 | 10.51% | 10.11% | ● 1.04 |
| 2019 | 1,017 | 816.6 | 8,074 | 12.60% | 10.11% | ▲ 1.25 |
| 2020 | 829 | 796.5 | 7,831 | 10.59% | 10.17% | ● 1.04 |
| 2021 | 942 | 819.8 | 7,989 | 11.79% | 10.26% | ▲ 1.15 |
| Total | 8,704 | 7,564.7 | 76,913 | 11.32% | 9.84% | ▲ 1.15 |

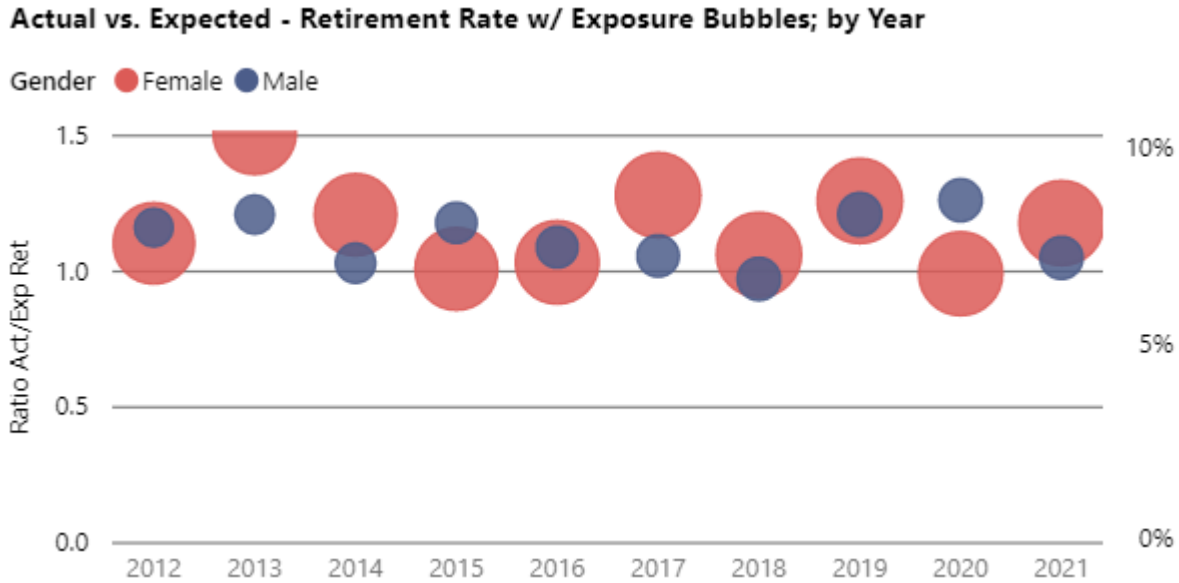
Exposure Distribution w/ Retirement Rate - Actual and Expected; by Year



The rate of retirement during 2020 and 2021 may be slightly lower than shown in this report due to the treatment of members with a LOA status code. While the percentage of members with a LOA code who have a retired status code in the following two years is approximately 2%, the number of retirements not captured in each of these two years could be roughly 400. Excluding these two years, the A/E ratio of 1.17 in years 2012 – 2019 is very similar to the results with these years included (2012 – 2021).

Specific observations:

- The actual rate of retirement was nearly 14% in 2013, which was the year with the largest withdrawal rate.
- The actual rate of retirement exceeded the assumption every year.
- Relative to the current assumption, the experience did not appear to vary significantly by gender. The female A/E ratio was 1.16; the male A/E ratio was 1.12, as shown in the following bubble chart.



We will review the experience for only the following four plan codes because data was limited for other plan codes:

1. Tier IV (plan code F) – normal retirement age is 62; retirement age with reduced benefits is 55; it uses mandated plan retirement rates.
2. Chapter 96 Age 57 Plan (Plan Codes I and M) – normal retirement age is 57; it uses mandated plan retirement rates.
3. Chapter 19 55/25 Plan (Plan Code K) – normal retirement is age 55 with 25 years of service; it uses elected improved plan retirement rates.
4. Chapter 19 and Chapter 504 55/27 Plan (Plan Codes P and Q) – normal retirement age is 55 with 27 years of service; it uses mandated plan retirement rates.
 - a. Chapter 504 allows reduced retirement at age 55 with 10 years of service.

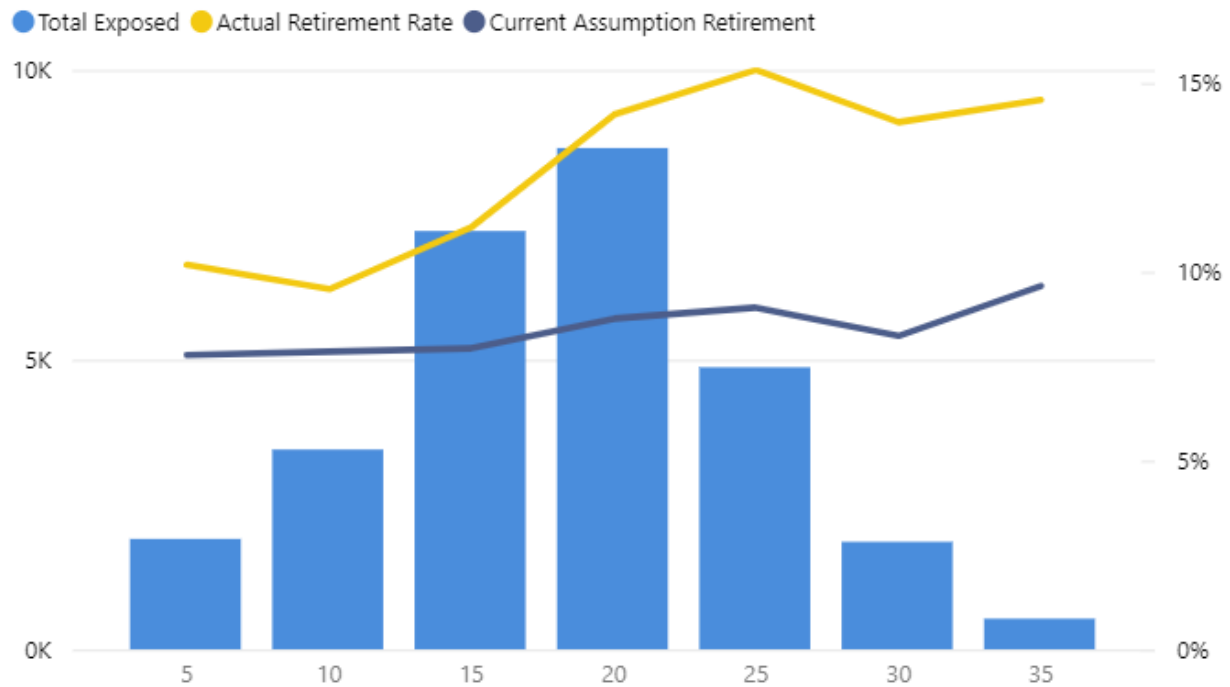
Basic Tier IV Plan

The following charts display the experience of Basic Tier IV Plan, by service (0 to 39), during 2012 – 2019.

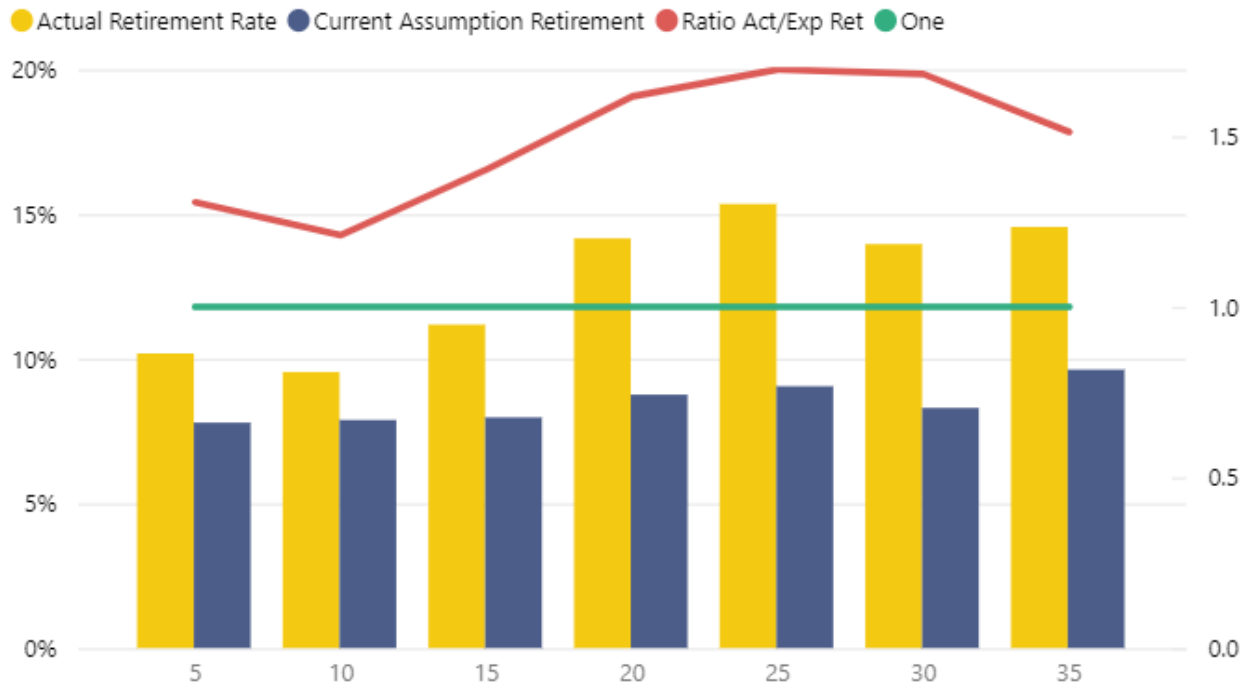
| Service | Actual Retirements | Expected Retirements | Total Exposed | Actual Retirement Rate | Current Assumption Retirement | Ratio Act/Exp Ret |
|---------|--------------------|----------------------|---------------|------------------------|-------------------------------|-------------------|
| 5 | 187 | 332.2 | 2,228 | 8.39% | 14.91% | ▲ 0.56 |
| 6 | 180 | 244.0 | 2,497 | 7.21% | 9.77% | ▲ 0.74 |
| 7 | 198 | 235.8 | 2,388 | 8.29% | 9.87% | ▲ 0.84 |
| 8 | 225 | 270.8 | 2,723 | 8.26% | 9.95% | ▲ 0.83 |
| 9 | 253 | 286.0 | 2,849 | 8.88% | 10.04% | ▲ 0.88 |
| 10 | 365 | 307.8 | 3,119 | 11.70% | 9.87% | ▲ 1.19 |
| 11 | 359 | 308.7 | 3,150 | 11.40% | 9.80% | ▲ 1.16 |
| 12 | 332 | 342.7 | 3,452 | 9.62% | 9.93% | ● 0.97 |
| 13 | 335 | 320.3 | 3,287 | 10.19% | 9.75% | ● 1.05 |
| 14 | 348 | 354.4 | 3,568 | 9.75% | 9.93% | ● 0.98 |
| 15 | 357 | 314.1 | 3,288 | 10.86% | 9.55% | ▲ 1.14 |
| 16 | 353 | 294.8 | 3,154 | 11.19% | 9.35% | ▲ 1.20 |
| 17 | 304 | 258.8 | 2,850 | 10.67% | 9.08% | ▲ 1.17 |
| 18 | 298 | 247.5 | 2,765 | 10.78% | 8.95% | ▲ 1.20 |
| 19 | 249 | 204.7 | 2,278 | 10.93% | 8.99% | ▲ 1.22 |
| 20 | 307 | 187.3 | 2,111 | 14.54% | 8.87% | ◆ 1.64 |
| 21 | 271 | 163.4 | 1,828 | 14.82% | 8.94% | ◆ 1.66 |
| 22 | 268 | 171.4 | 1,942 | 13.80% | 8.83% | ◆ 1.56 |
| 23 | 262 | 151.7 | 1,683 | 15.57% | 9.02% | ◆ 1.73 |
| 24 | 226 | 140.9 | 1,602 | 14.11% | 8.79% | ◆ 1.60 |

| | | | | | | | |
|--------------|--------------|----------------|---------------|---------------|--------------|----------|-------------|
| 25 | 171 | 115.0 | 1,270 | 13.46% | 9.06% | ▲ | 1.49 |
| 26 | 197 | 115.3 | 1,242 | 15.86% | 9.28% | ◆ | 1.71 |
| 27 | 160 | 90.8 | 1,021 | 15.67% | 8.90% | ◆ | 1.76 |
| 28 | 120 | 67.7 | 744 | 16.13% | 9.10% | ◆ | 1.77 |
| 29 | 99 | 51.7 | 590 | 16.78% | 8.75% | ◆ | 1.92 |
| 30 | 60 | 42.3 | 505 | 11.88% | 8.37% | ▲ | 1.42 |
| 31 | 54 | 34.6 | 435 | 12.41% | 7.94% | ◆ | 1.56 |
| 32 | 53 | 31.3 | 397 | 13.35% | 7.89% | ◆ | 1.69 |
| 33 | 41 | 25.4 | 288 | 14.24% | 8.81% | ◆ | 1.62 |
| 34 | 51 | 20.4 | 230 | 22.17% | 8.89% | ◆ | 2.50 |
| 35 | 20 | 15.4 | 179 | 11.17% | 8.60% | ▲ | 1.30 |
| 36 | 20 | 15.4 | 157 | 12.74% | 9.79% | ▲ | 1.30 |
| 37 | 18 | 8.8 | 94 | 19.15% | 9.38% | ◆ | 2.04 |
| 38 | 13 | 6.3 | 58 | 22.41% | 10.84% | ◆ | 2.07 |
| 39 | 6 | 5.1 | 41 | 14.63% | 12.32% | ▲ | 1.19 |
| Total | 3,638 | 2,398.8 | 28,474 | 12.78% | 8.42% | ◆ | 1.52 |

Exposure Distribution w/ Retirement Rate - Actual and Expected; by Service



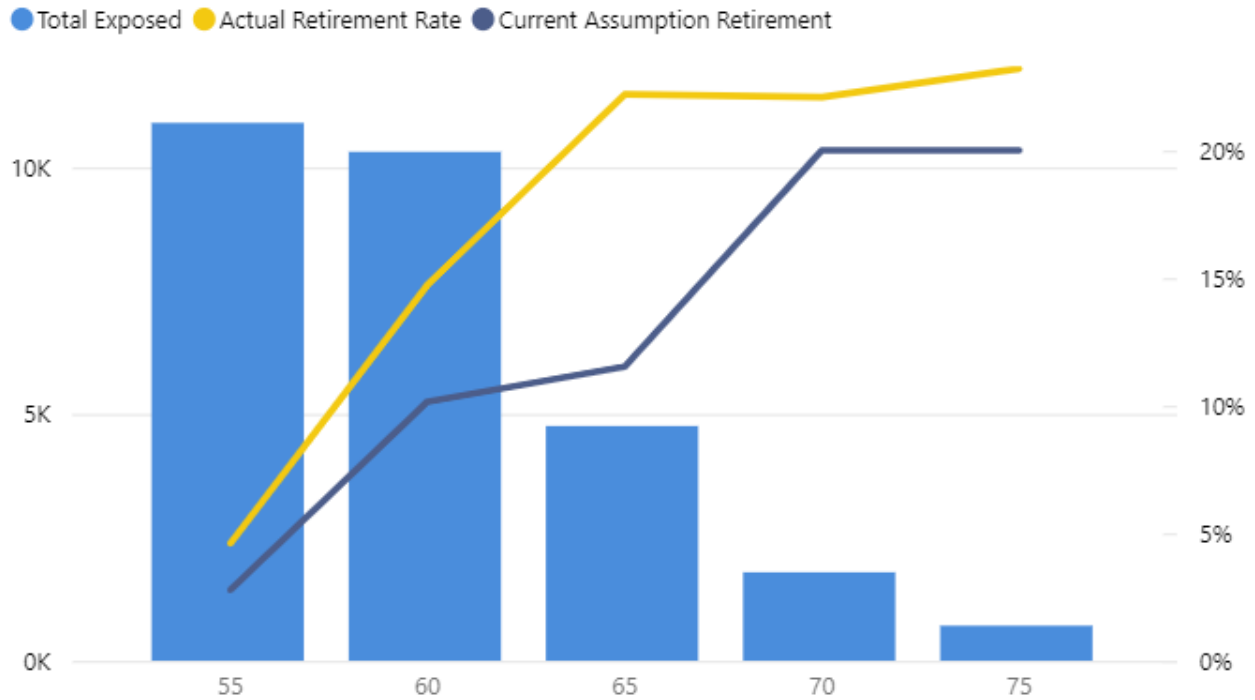
Retirement Rate - Actual, Expected, and Ratio; by Service



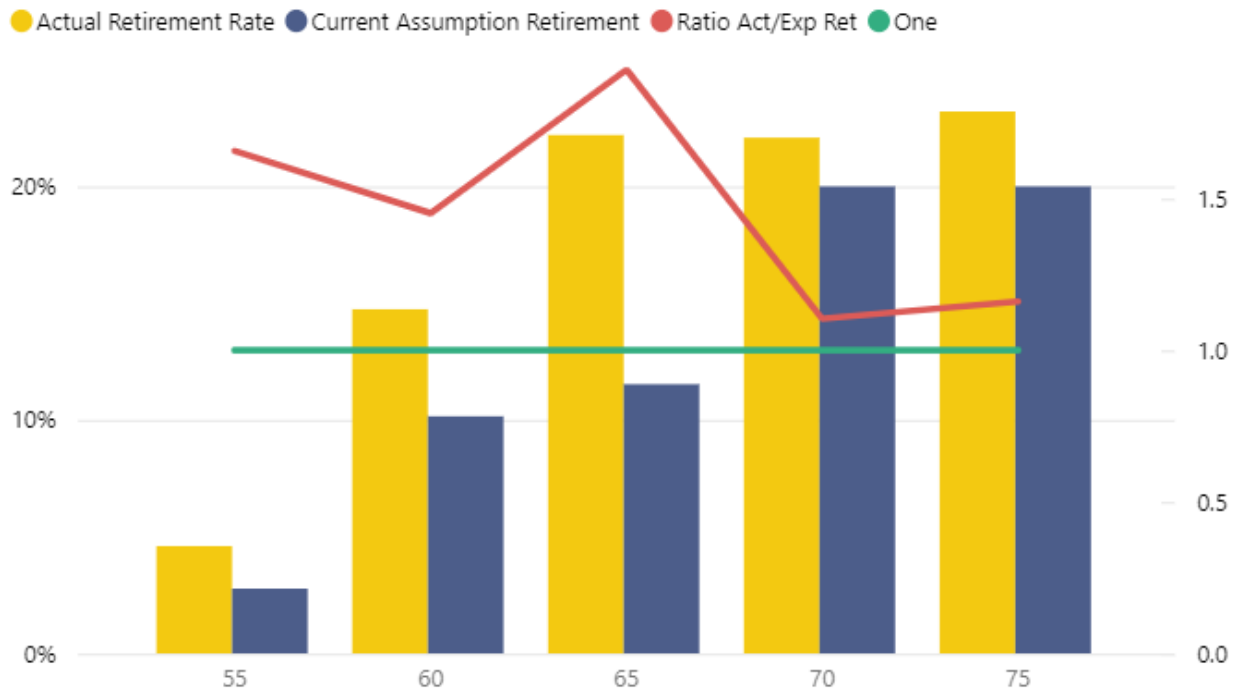
The following charts display the experience of Tier IV, by age, during the period 2012 – 2019.

| Age | Actual Retirements | Expected Retirements | Total Exposed | Actual Retirement Rate | Current Assumption Retirement | Ratio Act/Exp Ret |
|--------------|--------------------|----------------------|---------------|------------------------|-------------------------------|-------------------|
| 55 | 98 | 49.1 | 1,965 | 4.99% | 2.50% | 1.99 |
| 56 | 86 | 51.1 | 2,045 | 4.21% | 2.50% | 1.68 |
| 57 | 89 | 54.7 | 2,187 | 4.07% | 2.50% | 1.63 |
| 58 | 104 | 57.9 | 2,316 | 4.49% | 2.50% | 1.80 |
| 59 | 124 | 89.5 | 2,387 | 5.19% | 3.75% | 1.39 |
| 60 | 122 | 119.8 | 2,396 | 5.09% | 5.00% | 1.02 |
| 61 | 290 | 149.4 | 2,390 | 12.13% | 6.25% | 1.94 |
| 62 | 543 | 446.0 | 2,230 | 24.35% | 20.00% | 1.22 |
| 63 | 303 | 175.3 | 1,742 | 17.39% | 10.07% | 1.73 |
| 64 | 262 | 156.7 | 1,555 | 16.85% | 10.07% | 1.67 |
| 65 | 301 | 212.2 | 1,410 | 21.35% | 15.05% | 1.42 |
| 66 | 290 | 114.3 | 1,139 | 25.46% | 10.04% | 2.54 |
| 67 | 195 | 88.5 | 879 | 22.18% | 10.06% | 2.20 |
| 68 | 161 | 73.6 | 732 | 21.99% | 10.05% | 2.19 |
| 69 | 109 | 59.9 | 597 | 18.26% | 10.03% | 1.82 |
| 70 | 112 | 107.4 | 537 | 20.86% | 20.00% | 1.04 |
| 71 | 110 | 86.6 | 433 | 25.40% | 20.00% | 1.27 |
| 72 | 74 | 66.6 | 333 | 22.22% | 20.00% | 1.11 |
| 73 | 61 | 54.8 | 274 | 22.26% | 20.00% | 1.11 |
| 74 | 39 | 43.2 | 216 | 18.06% | 20.00% | 0.90 |
| 75 | 41 | 40.4 | 202 | 20.30% | 20.00% | 1.01 |
| 76 | 49 | 35.6 | 178 | 27.53% | 20.00% | 1.38 |
| 77 | 31 | 27.4 | 137 | 22.63% | 20.00% | 1.13 |
| 78 | 27 | 21.4 | 107 | 25.23% | 20.00% | 1.26 |
| 79 | 17 | 17.4 | 87 | 19.54% | 20.00% | 0.98 |
| Total | 3,638 | 2,398.8 | 28,474 | 12.78% | 8.42% | 1.52 |

Exposure Distribution w/ Retirement Rate - Actual and Expected; by Age



Retirement Rate - Actual, Expected, and Ratio; by Age



Specific observations:

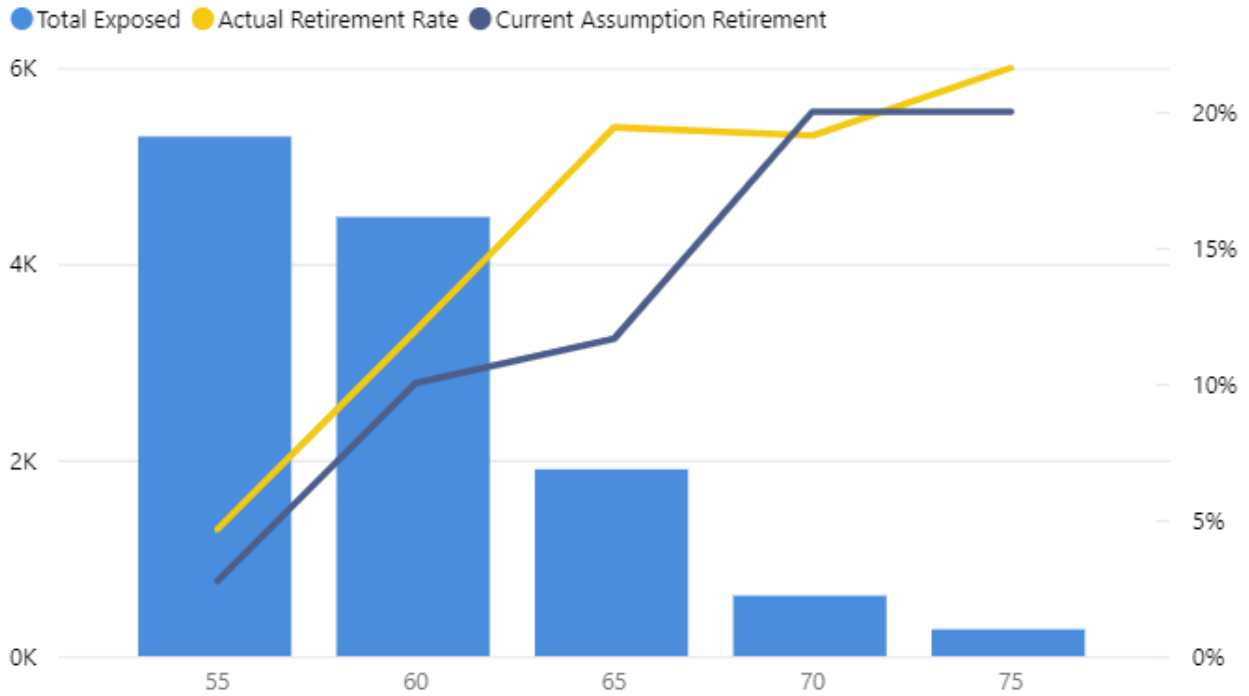
- Overall, actual retirements exceeded the assumption by 52% (A/E ratio of 1.52).
- Actual experience was higher across all service periods and nearly all ages.
- The largest difference between the current experience and the expectation was at age 66.
- The rates of retirement for members who have accrued at least 20 years of service (A/E ratio of 1.65) are higher than for those who have not (A/E ratio of 1.34).
 - This is probably due to the benefit formula that applies a 2% multiplier to all years of service once 20 years are accrued.
- During reduced retirement periods (ages 55 to 61), the actual rates of retirement were higher than assumed (A/E ratio of 1.60). The rates of retirement of members with less than 20 years of service (5.46% for an A/E ratio of 1.52) were smaller than the rates of retirement of members with at least 20 years of service but no more than 30 years of service (6.15% for an A/E ratio of 1.66).

The following charts show the retirement experience split by members with less than 20 years of service, and members with at least 20 years of service. Members under age 62 are not eligible for unreduced retirement benefits. Please note that due to rounding there may be some members with an assigned retirement age of 61 who actually retired when they first attained age 62. We will review potential adjustments in subsequent analyses.

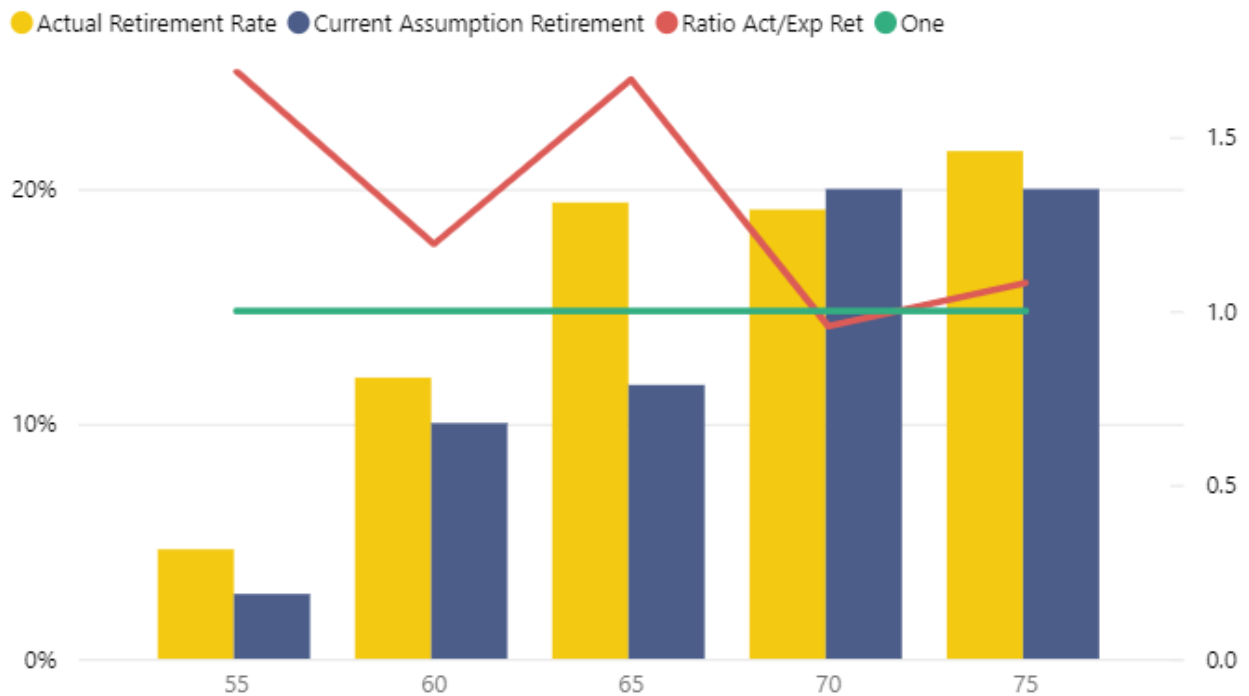
The following charts show the retirement experience of members with less than 20 years of service.

| Age | Actual Retirements | Expected Retirements | Total Exposed | Actual Retirement Rate | Current Assumption Retirement | Ratio Act/Exp Ret |
|--------------|--------------------|----------------------|---------------|------------------------|-------------------------------|-------------------|
| 55 | 52 | 25.6 | 1,025 | 5.07% | 2.50% | 2.03 |
| 56 | 49 | 25.6 | 1,025 | 4.78% | 2.50% | 1.91 |
| 57 | 49 | 26.6 | 1,063 | 4.61% | 2.50% | 1.84 |
| 58 | 38 | 27.0 | 1,081 | 3.52% | 2.50% | 1.41 |
| 59 | 59 | 41.4 | 1,105 | 5.34% | 3.75% | 1.42 |
| 60 | 46 | 54.5 | 1,090 | 4.22% | 5.00% | 0.84 |
| 61 | 113 | 65.8 | 1,052 | 10.74% | 6.25% | 1.72 |
| 62 | 178 | 186.4 | 932 | 19.10% | 20.00% | 0.95 |
| 63 | 92 | 75.5 | 743 | 12.38% | 10.15% | 1.22 |
| 64 | 107 | 67.3 | 661 | 16.19% | 10.17% | 1.59 |
| 65 | 104 | 88.7 | 587 | 17.72% | 15.12% | 1.17 |
| 66 | 100 | 46.6 | 462 | 21.65% | 10.09% | 2.15 |
| 67 | 71 | 35.4 | 349 | 20.34% | 10.16% | 2.00 |
| 68 | 58 | 29.1 | 287 | 20.21% | 10.14% | 1.99 |
| 69 | 37 | 22.2 | 220 | 16.82% | 10.09% | 1.67 |
| 70 | 42 | 39.0 | 195 | 21.54% | 20.00% | 1.08 |
| 71 | 32 | 26.4 | 132 | 24.24% | 20.00% | 1.21 |
| 72 | 20 | 23.4 | 117 | 17.09% | 20.00% | 0.85 |
| 73 | 14 | 18.6 | 93 | 15.05% | 20.00% | 0.75 |
| 74 | 10 | 16.0 | 80 | 12.50% | 20.00% | 0.63 |
| 75 | 15 | 17.0 | 85 | 17.65% | 20.00% | 0.88 |
| 76 | 15 | 13.8 | 69 | 21.74% | 20.00% | 1.09 |
| 77 | 12 | 10.8 | 54 | 22.22% | 20.00% | 1.11 |
| 78 | 9 | 8.0 | 40 | 22.50% | 20.00% | 1.13 |
| 79 | 8 | 5.0 | 25 | 32.00% | 20.00% | 1.60 |
| Total | 1,330 | 995.7 | 12,572 | 10.58% | 7.92% | 1.34 |

Exposure Distribution w/ Retirement Rate - Actual and Expected; by Age



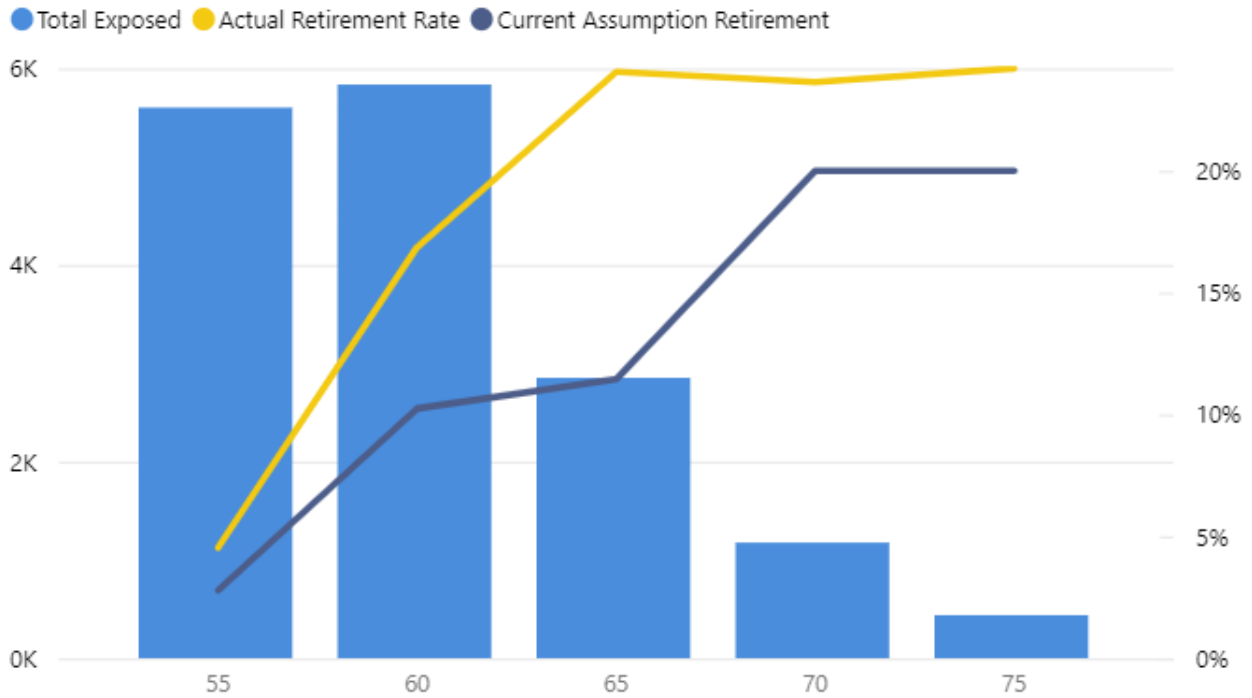
Retirement Rate - Actual, Expected, and Ratio; by Age



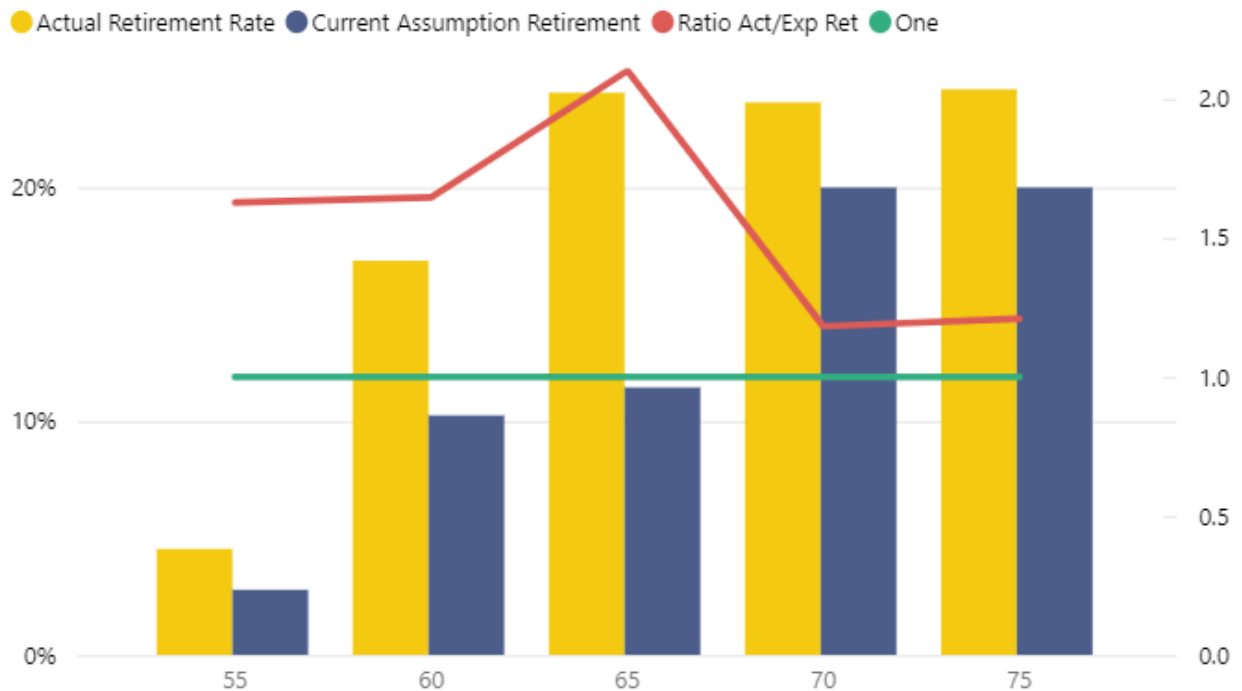
The following charts show the retirement experience of members with at least 20 years of service.

| Age | Actual Retirements | Expected Retirements | Total Exposed | Actual Retirement Rate | Current Assumption Retirement | Ratio Act/Exp Ret |
|--------------|--------------------|----------------------|---------------|------------------------|-------------------------------|-------------------|
| 55 | 46 | 23.5 | 940 | 4.89% | 2.50% | 1.96 |
| 56 | 37 | 25.5 | 1,020 | 3.63% | 2.50% | 1.45 |
| 57 | 40 | 28.1 | 1,124 | 3.56% | 2.50% | 1.42 |
| 58 | 66 | 30.9 | 1,235 | 5.34% | 2.50% | 2.14 |
| 59 | 65 | 48.1 | 1,282 | 5.07% | 3.75% | 1.35 |
| 60 | 76 | 65.3 | 1,306 | 5.82% | 5.00% | 1.16 |
| 61 | 177 | 83.6 | 1,338 | 13.23% | 6.25% | 2.12 |
| 62 | 365 | 259.6 | 1,298 | 28.12% | 20.00% | 1.41 |
| 63 | 211 | 99.9 | 999 | 21.12% | 10.00% | 2.11 |
| 64 | 155 | 89.4 | 894 | 17.34% | 10.00% | 1.73 |
| 65 | 197 | 123.4 | 823 | 23.94% | 15.00% | 1.60 |
| 66 | 190 | 67.7 | 677 | 28.06% | 10.00% | 2.81 |
| 67 | 124 | 53.0 | 530 | 23.40% | 10.00% | 2.34 |
| 68 | 103 | 44.5 | 445 | 23.15% | 10.00% | 2.31 |
| 69 | 72 | 37.7 | 377 | 19.10% | 10.00% | 1.91 |
| 70 | 70 | 68.4 | 342 | 20.47% | 20.00% | 1.02 |
| 71 | 78 | 60.2 | 301 | 25.91% | 20.00% | 1.30 |
| 72 | 54 | 43.2 | 216 | 25.00% | 20.00% | 1.25 |
| 73 | 47 | 36.2 | 181 | 25.97% | 20.00% | 1.30 |
| 74 | 29 | 27.2 | 136 | 21.32% | 20.00% | 1.07 |
| 75 | 26 | 23.4 | 117 | 22.22% | 20.00% | 1.11 |
| 76 | 34 | 21.8 | 109 | 31.19% | 20.00% | 1.56 |
| 77 | 19 | 16.6 | 83 | 22.89% | 20.00% | 1.14 |
| 78 | 18 | 13.4 | 67 | 26.87% | 20.00% | 1.34 |
| 79 | 9 | 12.4 | 62 | 14.52% | 20.00% | 0.73 |
| Total | 2,308 | 1,403.0 | 15,902 | 14.51% | 8.82% | 1.65 |

Exposure Distribution w/ Retirement Rate - Actual and Expected; by Age



Retirement Rate - Actual, Expected, and Ratio; by Age

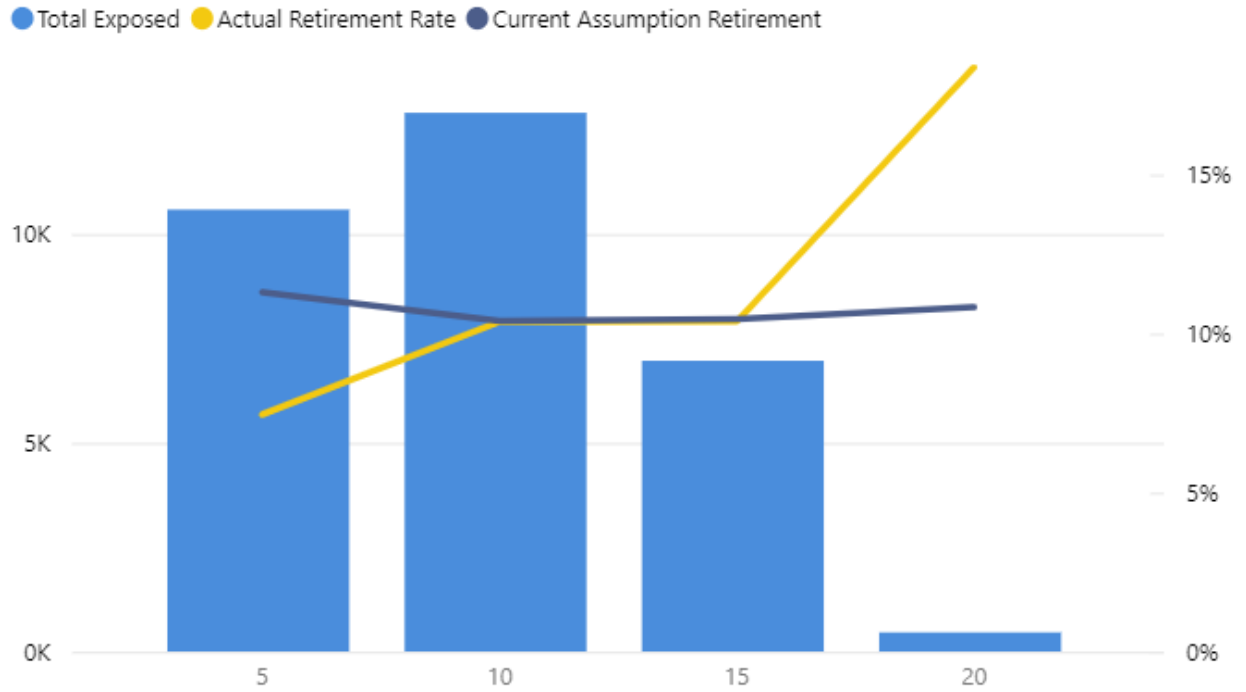


Age 57 Plan

The following charts display the experience of the Age 57 Plans (plan selections Ch96 – 57/10 Mandated and Ch96 – Tier IV Mandated), by service (0 - 24 years), for the age range (57 – 79), during the period 2012 – 2019.

| Service | Actual Retirements | Expected Retirements | Total Exposed | Actual Retirement Rate | Current Assumption Retirement | Ratio Act/Exp Ret |
|--------------|--------------------|----------------------|---------------|------------------------|-------------------------------|-------------------|
| 5 | 138 | 295.8 | 1,852 | 7.45% | 15.97% | 0.47 |
| 6 | 132 | 211.1 | 2,077 | 6.36% | 10.16% | 0.63 |
| 7 | 158 | 207.5 | 2,014 | 7.85% | 10.30% | 0.76 |
| 8 | 162 | 236.2 | 2,280 | 7.11% | 10.36% | 0.69 |
| 9 | 199 | 244.9 | 2,363 | 8.42% | 10.37% | 0.81 |
| 10 | 286 | 261.4 | 2,531 | 11.30% | 10.33% | 1.09 |
| 11 | 284 | 259.2 | 2,493 | 11.39% | 10.40% | 1.10 |
| 12 | 257 | 283.8 | 2,710 | 9.48% | 10.47% | 0.91 |
| 13 | 254 | 255.8 | 2,499 | 10.16% | 10.24% | 0.99 |
| 14 | 258 | 281.1 | 2,671 | 9.66% | 10.53% | 0.92 |
| 15 | 242 | 237.7 | 2,292 | 10.56% | 10.37% | 1.02 |
| 16 | 194 | 191.0 | 1,828 | 10.61% | 10.45% | 1.02 |
| 17 | 144 | 145.2 | 1,387 | 10.38% | 10.47% | 0.99 |
| 18 | 95 | 98.3 | 931 | 10.20% | 10.56% | 0.97 |
| 19 | 48 | 56.0 | 527 | 9.11% | 10.62% | 0.86 |
| 20 | 47 | 26.9 | 241 | 19.50% | 11.16% | 1.75 |
| 21 | 20 | 12.9 | 123 | 16.26% | 10.52% | 1.55 |
| 22 | 6 | 4.9 | 48 | 12.50% | 10.25% | 1.22 |
| 23 | 4 | 2.7 | 26 | 15.38% | 10.21% | 1.51 |
| 24 | 7 | 2.1 | 19 | 36.84% | 10.95% | 3.37 |
| Total | 2,935 | 3,314.5 | 30,912 | 9.49% | 10.72% | 0.89 |

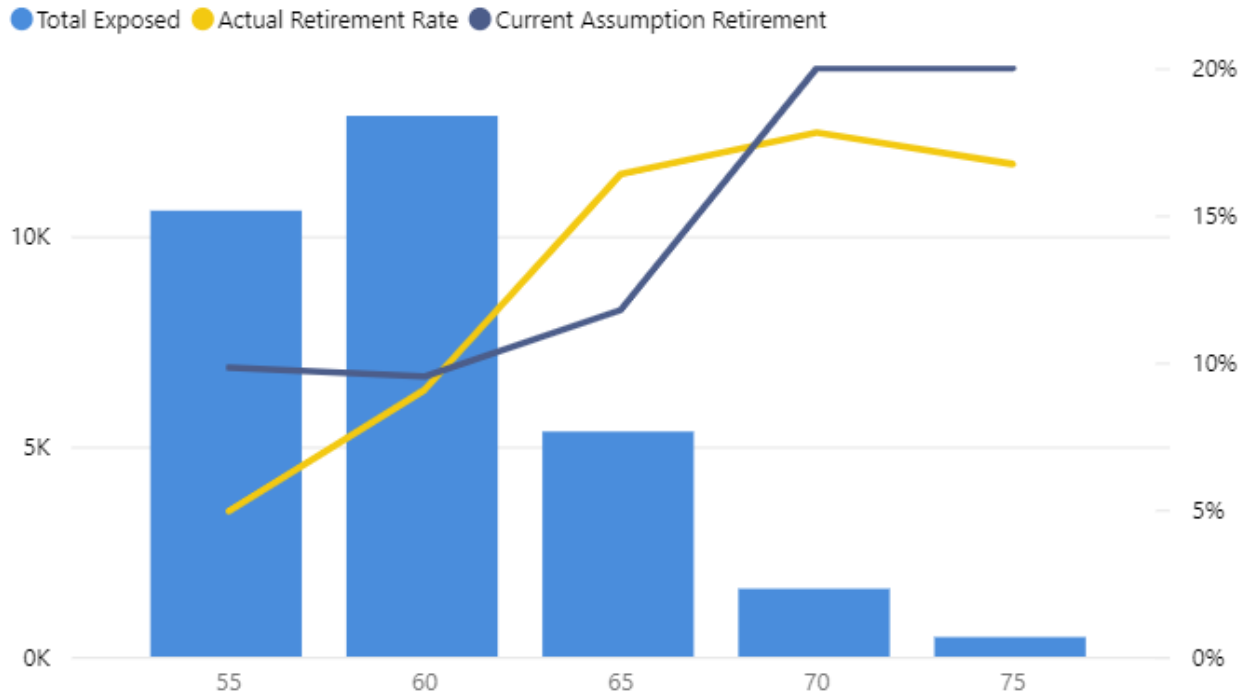
Exposure Distribution w/ Retirement Rate - Actual and Expected; by Service



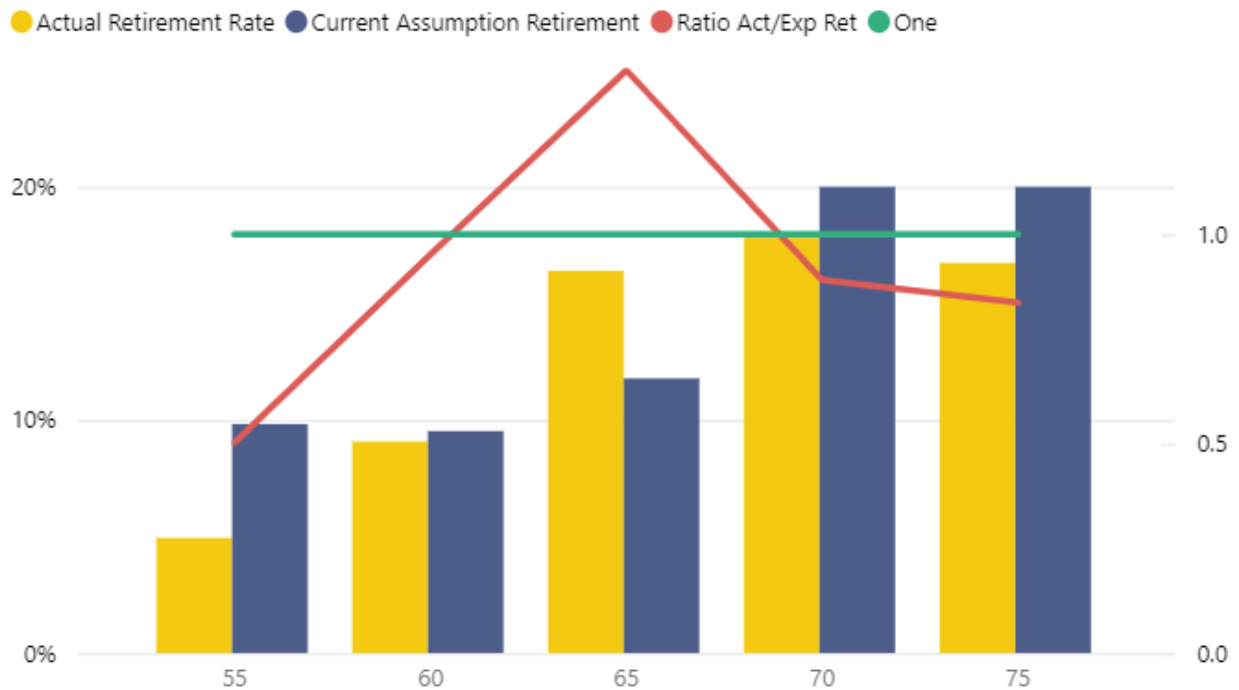
The following charts display the experience of the Age 57 Plans, by age, for the service range (5 – 24), during the period 2012 – 2019.

| Age | Actual Retirements | Expected Retirements | Total Exposed | Actual Retirement Rate | Current Assumption Retirement | Ratio Act/Exp Ret |
|--------------|--------------------|----------------------|---------------|------------------------|-------------------------------|-------------------|
| 57 | 204 | 547.6 | 3,651 | 5.59% | 15.00% | 0.37 |
| 58 | 164 | 252.1 | 3,544 | 4.63% | 7.11% | 0.65 |
| 59 | 156 | 242.3 | 3,415 | 4.57% | 7.09% | 0.64 |
| 60 | 133 | 224.7 | 3,197 | 4.16% | 7.03% | 0.59 |
| 61 | 228 | 304.6 | 2,968 | 7.68% | 10.26% | 0.75 |
| 62 | 384 | 278.3 | 2,628 | 14.61% | 10.59% | 1.38 |
| 63 | 215 | 221.2 | 2,160 | 9.95% | 10.24% | 0.97 |
| 64 | 207 | 196.1 | 1,911 | 10.83% | 10.26% | 1.06 |
| 65 | 256 | 246.7 | 1,613 | 15.87% | 15.29% | 1.04 |
| 66 | 248 | 132.1 | 1,293 | 19.18% | 10.22% | 1.88 |
| 67 | 140 | 100.6 | 976 | 14.34% | 10.31% | 1.39 |
| 68 | 133 | 84.3 | 818 | 16.26% | 10.30% | 1.58 |
| 69 | 101 | 67.2 | 655 | 15.42% | 10.26% | 1.50 |
| 70 | 96 | 103.8 | 519 | 18.50% | 20.00% | 0.92 |
| 71 | 67 | 78.6 | 393 | 17.05% | 20.00% | 0.85 |
| 72 | 60 | 59.2 | 296 | 20.27% | 20.00% | 1.01 |
| 73 | 36 | 45.8 | 229 | 15.72% | 20.00% | 0.79 |
| 74 | 29 | 36.0 | 180 | 16.11% | 20.00% | 0.81 |
| 75 | 24 | 30.0 | 150 | 16.00% | 20.00% | 0.80 |
| 76 | 16 | 22.6 | 113 | 14.16% | 20.00% | 0.71 |
| 77 | 14 | 17.0 | 85 | 16.47% | 20.00% | 0.82 |
| 78 | 12 | 13.6 | 68 | 17.65% | 20.00% | 0.88 |
| 79 | 12 | 10.0 | 50 | 24.00% | 20.00% | 1.20 |
| Total | 2,935 | 3,314.5 | 30,912 | 9.49% | 10.72% | 0.89 |

Exposure Distribution w/ Retirement Rate - Actual and Expected; by Age



Retirement Rate - Actual, Expected, and Ratio; by Age



Specific observations:

- Overall, the number of retirements was less than expected (A/E ratio of 0.89)
- Due to when these plans were adopted, there was nearly no retirement experience for members with 20 or more years of service.
 - Based on the limited data available, the rates of retirement of members with at least 20 years of service were higher than the rates of retirement of members with shorter service periods (A/E ratio of 1.56 when all service periods are selected).
- Under the current assumptions, higher first eligibility rates apply when members are first eligible for retirement, which includes members in their fifth year of service after attaining age 57. However, the actual rate of retirement of these members was smaller than expected (A/E ratio of 0.37 for members attaining age 57, and 0.47 for members in their fifth year of service).
 - Please note that due to rounding there were members with an assigned retirement age of 56 who retired when they first attained age 57. We will review potential adjustments in subsequent analyses. However, even with adjustments, the actual number of retirements is expected to be much smaller than expected.
- There were more retirements than expected for ages 62 – 69 (A/E ratio of 1.27); the largest variance occurred at age 66.

Age 55 and 25 Plan

The following chart displays the experience of the age 55 and 25 plans, by age, for members with service greater than or equal to 25 years, during the period 2012 – 2019.

| Age | Actual Retirements | Expected Retirements | Total Exposed | Actual Retirement Rate | Current Assumption Retirement | Ratio Act/Exp Ret |
|--------------|--------------------|----------------------|---------------|------------------------|-------------------------------|-------------------|
| 55 | 2 | 4.2 | 12 | 16.67% | 35.00% | 0.48 |
| 56 | 1 | 2.0 | 13 | 7.69% | 15.54% | 0.50 |
| 57 | 0 | 2.7 | 17 | 0.00% | 16.06% | 0.00 |
| 58 | 2 | 3.1 | 22 | 9.09% | 14.09% | 0.65 |
| 59 | 4 | 3.0 | 21 | 19.05% | 14.19% | 1.34 |
| 60 | 3 | 1.6 | 13 | 23.08% | 12.00% | 1.92 |
| 61 | 0 | 2.3 | 15 | 0.00% | 15.07% | 0.00 |
| 62 | 4 | 2.6 | 13 | 30.77% | 20.00% | 1.54 |
| 63 | 0 | 1.4 | 9 | 0.00% | 15.00% | 0.00 |
| 64 | 2 | 1.2 | 8 | 25.00% | 15.00% | 1.67 |
| 65 | 1 | 0.8 | 4 | 25.00% | 20.00% | 1.25 |
| 66 | 1 | 0.3 | 2 | 50.00% | 15.00% | 3.33 |
| 67 | 1 | 0.2 | 1 | 100.00% | 15.00% | 6.67 |
| Total | 21 | 25.3 | 150 | 14.00% | 16.83% | 0.83 |

The following chart displays the experience of the age 55 and 25 plans, by age, for members with service under 25 years, for an age range (62 – 75), during the period 2012 – 2019.

| Age | Actual Retirements | Expected Retirements | Total Exposed | Actual Retirement Rate | Current Assumption Retirement | Ratio Act/Exp Ret |
|--------------|--------------------|----------------------|---------------|------------------------|-------------------------------|-------------------|
| 62 | 2 | 9.0 | 18 | 11.11% | 50.00% | 0.22 |
| 63 | 2 | 3.1 | 19 | 10.53% | 16.05% | 0.66 |
| 64 | 5 | 1.7 | 11 | 45.45% | 15.00% | 3.03 |
| 65 | 0 | 1.2 | 6 | 0.00% | 20.00% | 0.00 |
| 66 | 3 | 0.9 | 6 | 50.00% | 15.00% | 3.33 |
| 67 | 0 | 0.6 | 4 | 0.00% | 15.00% | 0.00 |
| 68 | 0 | 0.3 | 2 | 0.00% | 15.00% | 0.00 |
| 69 | 0 | 0.3 | 2 | 0.00% | 15.00% | 0.00 |
| 70 | 0 | 0.2 | 1 | 0.00% | 15.00% | 0.00 |
| 71 | 0 | 0.5 | 3 | 0.00% | 15.00% | 0.00 |
| 72 | 0 | 0.2 | 1 | 0.00% | 15.00% | 0.00 |
| 74 | 0 | 0.2 | 1 | 0.00% | 15.00% | 0.00 |
| Total | 12 | 17.9 | 74 | 16.22% | 24.19% | 0.67 |

Specific observations:

- The number of exposures was very small for this group. Due to statistical volatility, larger differences between actual experience and expectations may occur when the comparisons are made by individual age and by service periods.
- The current assumption uses the elected improved plan rates of retirement. The actual experience was somewhat lower than expected for members with at least 25 years of service (A/E ratio of 0.83), and much less than expected for members with when service was less than 25 years of service (A/E ratio of 0.67).

Age 55 and 27 Plan

The following charts display the experience of the age 55 and 27 plans (plan selections Ch 19/08 – 55/27 Mandated and Ch 504/09 – 55/27 Mandated), by age (62 to 75) for service periods (5 to 22 years), during the period 2012 – 2021. Due to so few exposures and retirements for these plans, we included retirements during 2020 and 2021. Also, since no members would have been able to attain 27 years of service during the study period, the experience was limited to ages 62 and older.

| Age | Actual Retirements | Expected Retirements | Total Exposed | Actual Retirement Rate | Current Assumption Retirement | Ratio Act/Exp Ret |
|--------------|--------------------|----------------------|---------------|------------------------|-------------------------------|-------------------|
| 62 | 3 | 4.6 | 23 | 13.04% | 20.00% | ▲ 0.65 |
| 63 | 2 | 2.8 | 25 | 8.00% | 11.00% | ▲ 0.73 |
| 64 | 1 | 2.3 | 21 | 4.76% | 10.71% | ◆ 0.44 |
| 65 | 4 | 3.7 | 24 | 16.67% | 15.21% | ● 1.10 |
| 66 | 5 | 1.9 | 19 | 26.32% | 9.74% | ◆ 2.70 |
| 67 | 1 | 1.3 | 13 | 7.69% | 10.00% | ▲ 0.77 |
| 68 | 4 | 0.9 | 8 | 50.00% | 10.63% | ◆ 4.71 |
| 69 | 2 | 0.9 | 8 | 25.00% | 11.25% | ◆ 2.22 |
| 70 | 1 | 1.0 | 6 | 16.67% | 16.67% | ● 1.00 |
| 71 | 1 | 0.6 | 3 | 33.33% | 20.00% | ◆ 1.67 |
| 72 | 0 | 0.6 | 3 | 0.00% | 20.00% | ◆ 0.00 |
| 73 | 0 | 0.6 | 3 | 0.00% | 20.00% | ◆ 0.00 |
| 74 | 0 | 0.2 | 1 | 0.00% | 20.00% | ◆ 0.00 |
| 75 | 0 | 0.4 | 2 | 0.00% | 20.00% | ◆ 0.00 |
| Total | 24 | 21.6 | 159 | 15.09% | 13.55% | ▲ 1.11 |

Specific observations:

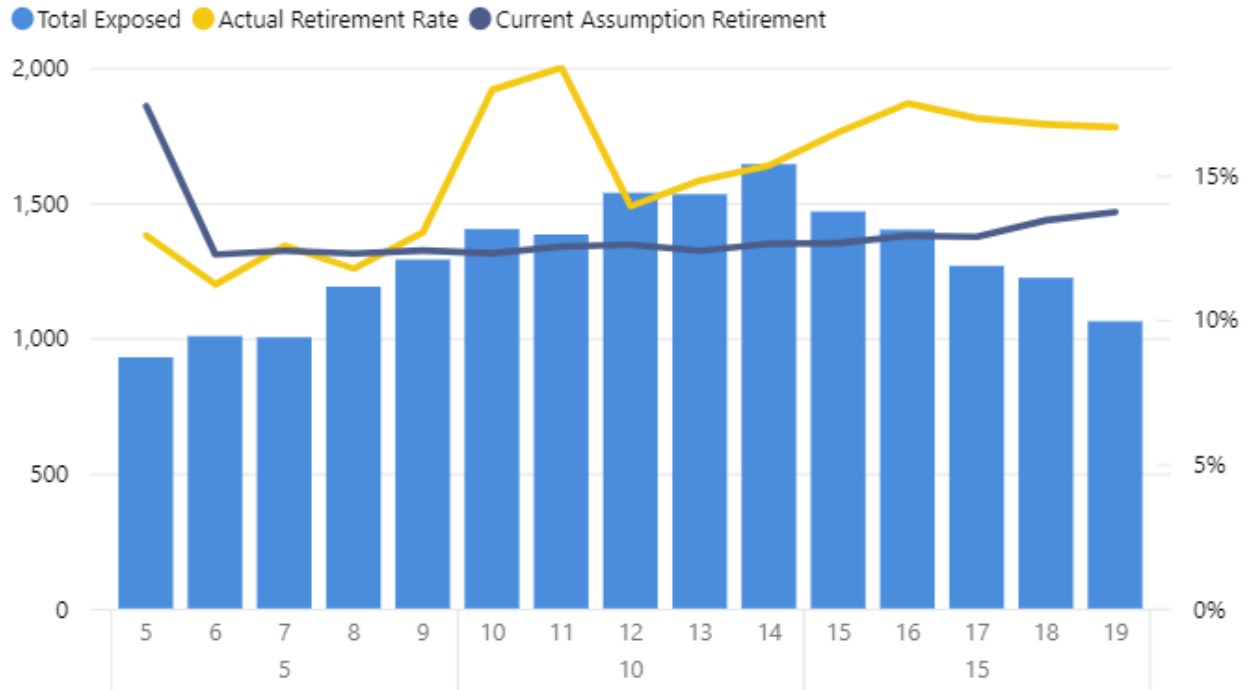
- Due to when these plans were adopted, there was no experience for members among retirements for those with 27 or more years of service. In essence, members retiring under this plan code are retiring under the Basic Tier IV plan.

All Plans Up to 20 Years of Service

Upon examining the experience of each plan, we believe that all of them can be reviewed in the aggregate for ages 62 and older. The following charts display the experience of Tier 3 and 4 members with less than 20 years of service, by service, during the period 2012 – 2019.

| Service | Actual Retirements | Expected Retirements | Total Exposed | Actual Retirement Rate | Current Assumption Retirement | Ratio Act/Exp Ret |
|--------------|--------------------|----------------------|---------------|------------------------|-------------------------------|-------------------|
| 5 | 120 | 161.6 | 929 | 12.92% | 17.40% | ▲ 0.74 |
| 6 | 113 | 123.5 | 1,007 | 11.22% | 12.26% | ● 0.92 |
| 7 | 126 | 124.3 | 1,003 | 12.56% | 12.39% | ● 1.01 |
| 8 | 140 | 146.3 | 1,190 | 11.76% | 12.29% | ● 0.96 |
| 9 | 168 | 159.9 | 1,290 | 13.02% | 12.39% | ● 1.05 |
| 10 | 252 | 172.5 | 1,403 | 17.96% | 12.30% | ▲ 1.46 |
| 11 | 259 | 173.4 | 1,383 | 18.73% | 12.53% | ▲ 1.49 |
| 12 | 214 | 193.7 | 1,537 | 13.92% | 12.60% | ▲ 1.11 |
| 13 | 227 | 189.8 | 1,532 | 14.82% | 12.39% | ▲ 1.20 |
| 14 | 252 | 207.5 | 1,643 | 15.34% | 12.63% | ▲ 1.21 |
| 15 | 242 | 185.7 | 1,468 | 16.49% | 12.65% | ▲ 1.30 |
| 16 | 245 | 180.7 | 1,401 | 17.49% | 12.90% | ▲ 1.36 |
| 17 | 215 | 163.1 | 1,267 | 16.97% | 12.87% | ▲ 1.32 |
| 18 | 205 | 164.4 | 1,223 | 16.76% | 13.44% | ▲ 1.25 |
| 19 | 177 | 145.8 | 1,062 | 16.67% | 13.72% | ▲ 1.21 |
| Total | 2,955 | 2,491.9 | 19,338 | 15.28% | 12.89% | ▲ 1.19 |

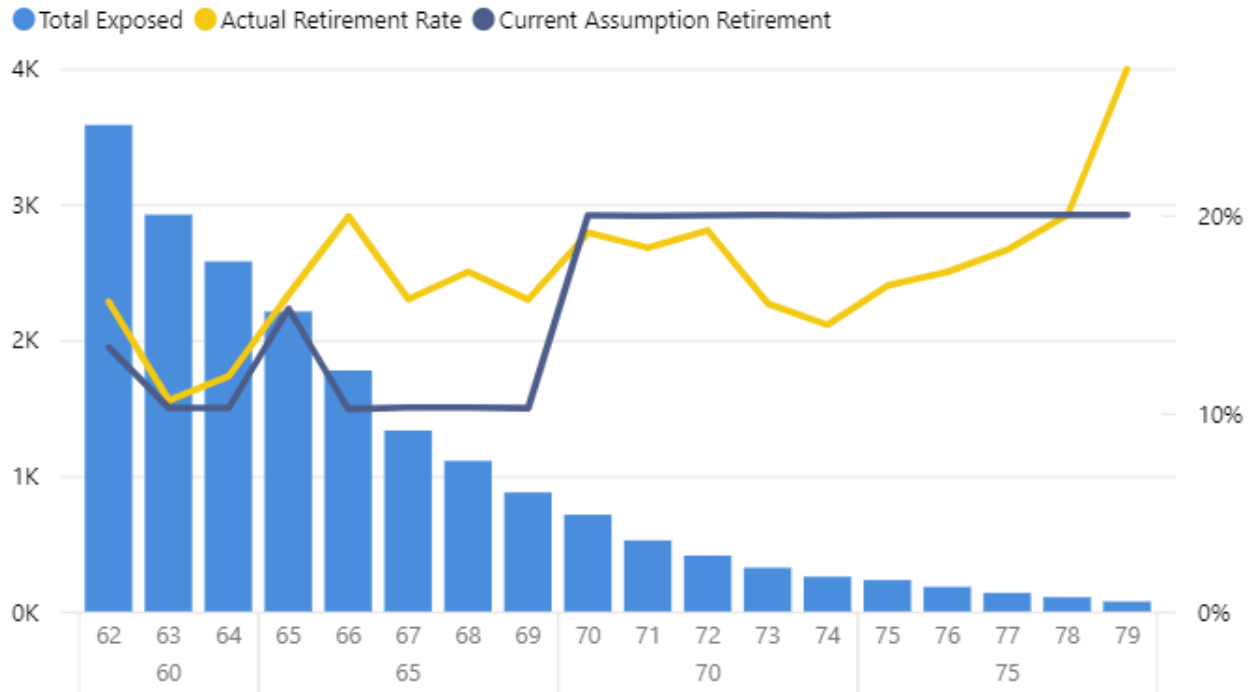
Exposure Distribution w/ Retirement Rate - Actual and Expected; by Service



The following charts display the experience of Tier 3 and 4 members with less than 20 years of service, by age, during the period 2012 – 2019.

| Age | Actual Retirements | Expected Retirements | Total Exposed | Actual Retirement Rate | Current Assumption Retirement | Ratio Act/Exp Ret |
|--------------|--------------------|----------------------|---------------|------------------------|-------------------------------|-------------------|
| 62 | 560 | 477.4 | 3,583 | 15.63% | 13.32% | ▲ 1.17 |
| 63 | 311 | 300.0 | 2,923 | 10.64% | 10.27% | ● 1.04 |
| 64 | 306 | 264.8 | 2,578 | 11.87% | 10.27% | ▲ 1.16 |
| 65 | 353 | 337.4 | 2,209 | 15.98% | 15.27% | ● 1.05 |
| 66 | 354 | 181.2 | 1,775 | 19.94% | 10.21% | ◆ 1.95 |
| 67 | 210 | 137.2 | 1,333 | 15.75% | 10.29% | ◆ 1.53 |
| 68 | 190 | 114.1 | 1,109 | 17.13% | 10.29% | ◆ 1.67 |
| 69 | 138 | 90.0 | 877 | 15.74% | 10.26% | ◆ 1.53 |
| 70 | 136 | 142.3 | 712 | 19.10% | 19.99% | ● 0.96 |
| 71 | 96 | 104.4 | 523 | 18.36% | 19.96% | ● 0.92 |
| 72 | 79 | 82.1 | 411 | 19.22% | 19.98% | ● 0.96 |
| 73 | 50 | 64.4 | 322 | 15.53% | 20.00% | ▲ 0.78 |
| 74 | 37 | 51.1 | 256 | 14.45% | 19.98% | ▲ 0.72 |
| 75 | 38 | 46.2 | 231 | 16.45% | 20.00% | ▲ 0.82 |
| 76 | 31 | 36.2 | 181 | 17.13% | 20.00% | ▲ 0.86 |
| 77 | 25 | 27.4 | 137 | 18.25% | 20.00% | ● 0.91 |
| 78 | 21 | 21.0 | 105 | 20.00% | 20.00% | ● 1.00 |
| 79 | 20 | 14.6 | 73 | 27.40% | 20.00% | ▲ 1.37 |
| Total | 2,955 | 2,491.8 | 19,338 | 15.28% | 12.89% | ▲ 1.19 |

Exposure Distribution w/ Retirement Rate - Actual and Expected; by Age



Specific observations:

- Actual retirement rates are smaller than expected when the length of service is shorter than 10 years (A/E ratio of 0.93).
- Actual retirement rates are greater than expected for ages 62 – 69 (A/E ratio of 1.27); the difference peaks at age 66. Excluding members with less than 10 years of service, the A/E ratio increases further to 1.40.

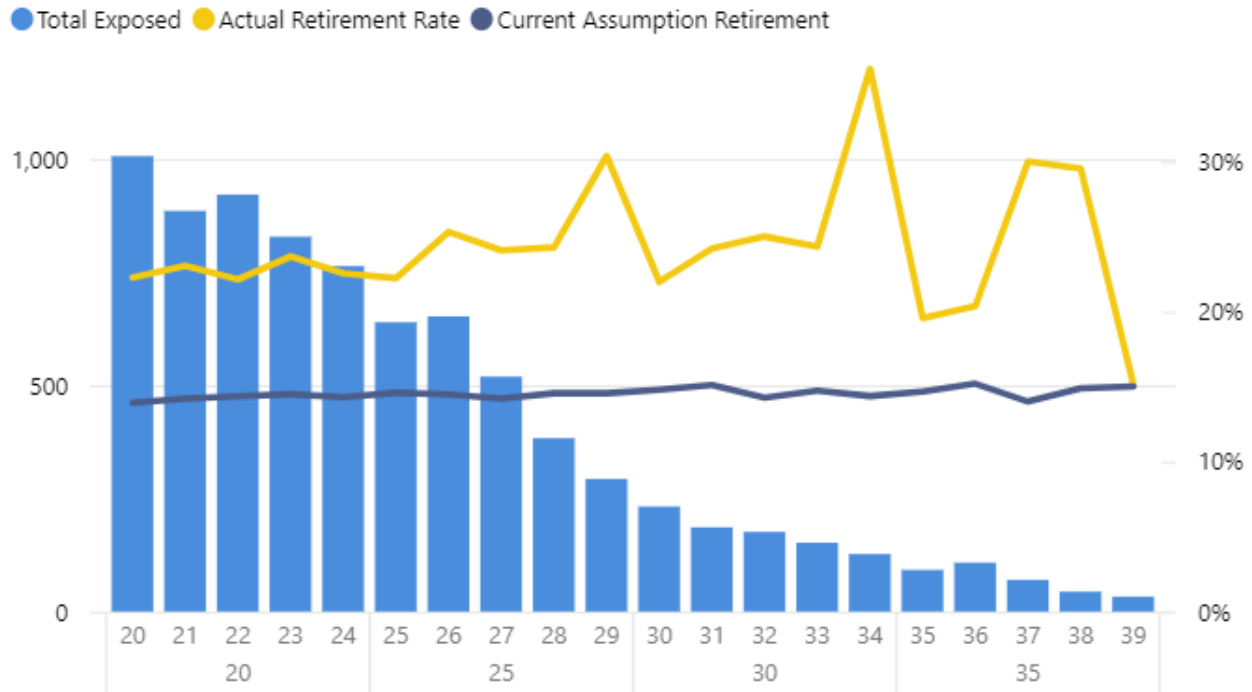
All Plans 20 or More Years of Service

In this section we combine the experience of all the Tier 3 and Tier 4 plans, for members at least 62 years old, with service of at least 20 years.

The following charts display the experience of Tier 3 and 4 members by service, for the service range of 20 to 39 years, during the period 2012 – 2019.

| Service | Actual Retirements | Expected Retirements | Total Exposed | Actual Retirement Rate | Current Assumption Retirement | Ratio Act/Exp Ret |
|--------------|--------------------|----------------------|---------------|------------------------|-------------------------------|-------------------|
| 20 | 224 | 140.1 | 1,006 | 22.27% | 13.93% | ◆ 1.60 |
| 21 | 204 | 125.7 | 885 | 23.05% | 14.20% | ◆ 1.62 |
| 22 | 204 | 132.3 | 921 | 22.15% | 14.36% | ◆ 1.54 |
| 23 | 196 | 120.0 | 828 | 23.67% | 14.49% | ◆ 1.63 |
| 24 | 172 | 109.0 | 763 | 22.54% | 14.29% | ◆ 1.58 |
| 25 | 142 | 93.2 | 639 | 22.22% | 14.59% | ◆ 1.52 |
| 26 | 165 | 94.4 | 652 | 25.31% | 14.48% | ◆ 1.75 |
| 27 | 125 | 73.7 | 519 | 24.08% | 14.20% | ◆ 1.70 |
| 28 | 93 | 55.7 | 383 | 24.28% | 14.56% | ◆ 1.67 |
| 29 | 89 | 42.6 | 293 | 30.38% | 14.56% | ◆ 2.09 |
| 30 | 51 | 34.3 | 232 | 21.98% | 14.78% | ▲ 1.49 |
| 31 | 45 | 28.1 | 186 | 24.19% | 15.11% | ◆ 1.60 |
| 32 | 44 | 25.1 | 176 | 25.00% | 14.26% | ◆ 1.75 |
| 33 | 37 | 22.4 | 152 | 24.34% | 14.74% | ◆ 1.65 |
| 34 | 46 | 18.3 | 127 | 36.22% | 14.37% | ◆ 2.52 |
| 35 | 18 | 13.5 | 92 | 19.57% | 14.67% | ▲ 1.33 |
| 36 | 22 | 16.4 | 108 | 20.37% | 15.19% | ▲ 1.34 |
| 37 | 21 | 9.8 | 70 | 30.00% | 14.00% | ◆ 2.14 |
| 38 | 13 | 6.6 | 44 | 29.55% | 14.89% | ◆ 1.98 |
| 39 | 5 | 5.0 | 33 | 15.15% | 15.00% | ● 1.01 |
| Total | 1,916 | 1,166.1 | 8,109 | 23.63% | 14.38% | ◆ 1.64 |

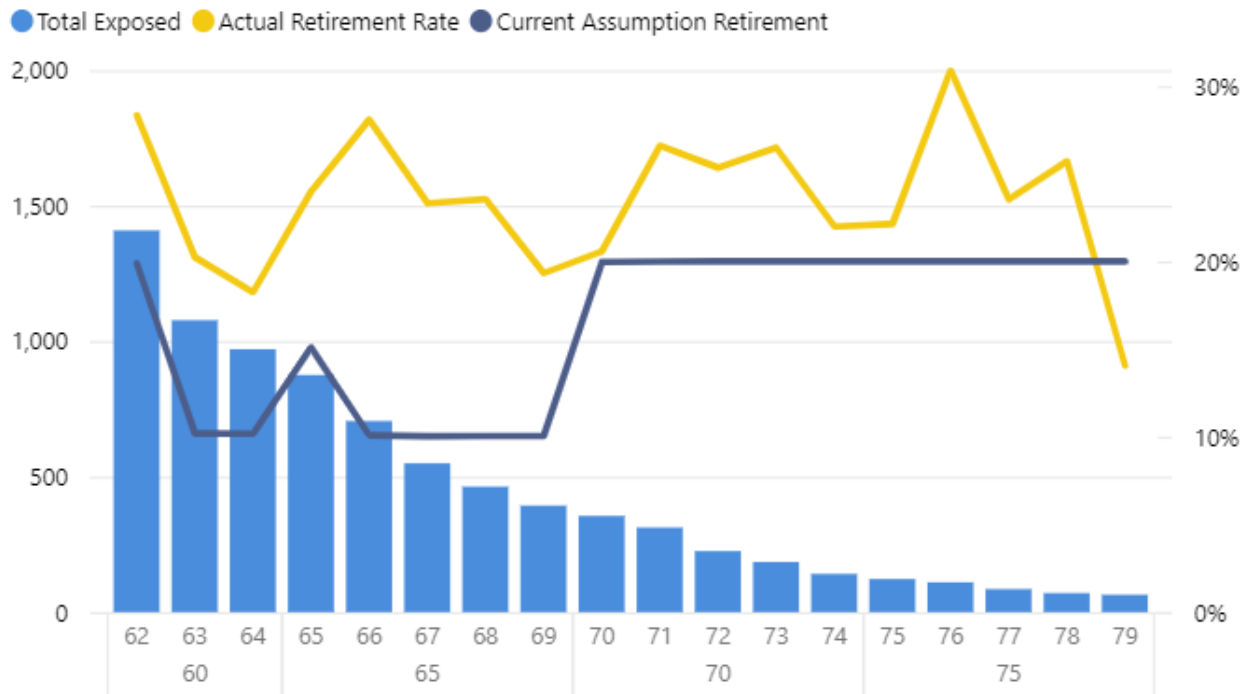
Exposure Distribution w/ Retirement Rate - Actual and Expected; by Service



The following charts display the experience by age, for the service range of 20 to 39 years, during the period 2012 – 2019.

| Age | Actual Retirements | Expected Retirements | Total Exposed | Actual Retirement Rate | Current Assumption Retirement | Ratio Act/Exp Ret |
|--------------|--------------------|----------------------|---------------|------------------------|-------------------------------|-------------------|
| 62 | 399 | 280.0 | 1,408 | 28.34% | 19.89% | ▲ 1.42 |
| 63 | 218 | 109.8 | 1,077 | 20.24% | 10.19% | ◆ 1.99 |
| 64 | 177 | 98.7 | 970 | 18.25% | 10.17% | ◆ 1.79 |
| 65 | 210 | 132.0 | 875 | 24.00% | 15.09% | ◆ 1.59 |
| 66 | 198 | 71.1 | 705 | 28.09% | 10.08% | ◆ 2.79 |
| 67 | 128 | 55.1 | 549 | 23.32% | 10.03% | ◆ 2.33 |
| 68 | 109 | 46.5 | 463 | 23.54% | 10.03% | ◆ 2.35 |
| 69 | 76 | 39.4 | 393 | 19.34% | 10.04% | ◆ 1.93 |
| 70 | 73 | 70.8 | 355 | 20.56% | 19.96% | ● 1.03 |
| 71 | 83 | 62.3 | 312 | 26.60% | 19.98% | ▲ 1.33 |
| 72 | 57 | 45.0 | 225 | 25.33% | 20.00% | ▲ 1.27 |
| 73 | 49 | 37.0 | 185 | 26.49% | 20.00% | ▲ 1.32 |
| 74 | 31 | 28.2 | 141 | 21.99% | 20.00% | ● 1.10 |
| 75 | 27 | 24.4 | 122 | 22.13% | 20.00% | ▲ 1.11 |
| 76 | 34 | 22.0 | 110 | 30.91% | 20.00% | ◆ 1.55 |
| 77 | 20 | 17.0 | 85 | 23.53% | 20.00% | ▲ 1.18 |
| 78 | 18 | 14.0 | 70 | 25.71% | 20.00% | ▲ 1.29 |
| 79 | 9 | 12.8 | 64 | 14.06% | 20.00% | ▲ 0.70 |
| Total | 1,916 | 1,166.1 | 8,109 | 23.63% | 14.38% | ◆ 1.64 |

Exposure Distribution w/ Retirement Rate - Actual and Expected; by Age



Specific observations:

- Overall, the rate of retirement of members with at least 20 years of service are higher (actual rate of 23.63%) than the rates of retirement of members of the same age but with shorter periods of service (actual rate of 15.28%).
- Actual rates of retirement for members with 20 or more years of service exceeded the assumption at essentially all ages (A/E ratio of 1.64), particularly in the range 62 – 69 (A/E ratio of 1.82).

Disability

Current ordinary disability assumptions vary by age and gender but do not apply during the 10-year eligibility service period. Furthermore, an additional rate applies to accidental disability during all service periods. Both ordinary and accidental disability benefits are equal to 1/60 times the final average salary for each year of service accrued but no less than 1/3 of the member's final average salary. The benefit is payable during the lifetime of the member, whether or not optional forms of payment are selected. For members who have accrued at least 20 years of service, the service retirement benefit is greater than the disability retirement benefit if the member has met the conditions for an unreduced retirement benefit.

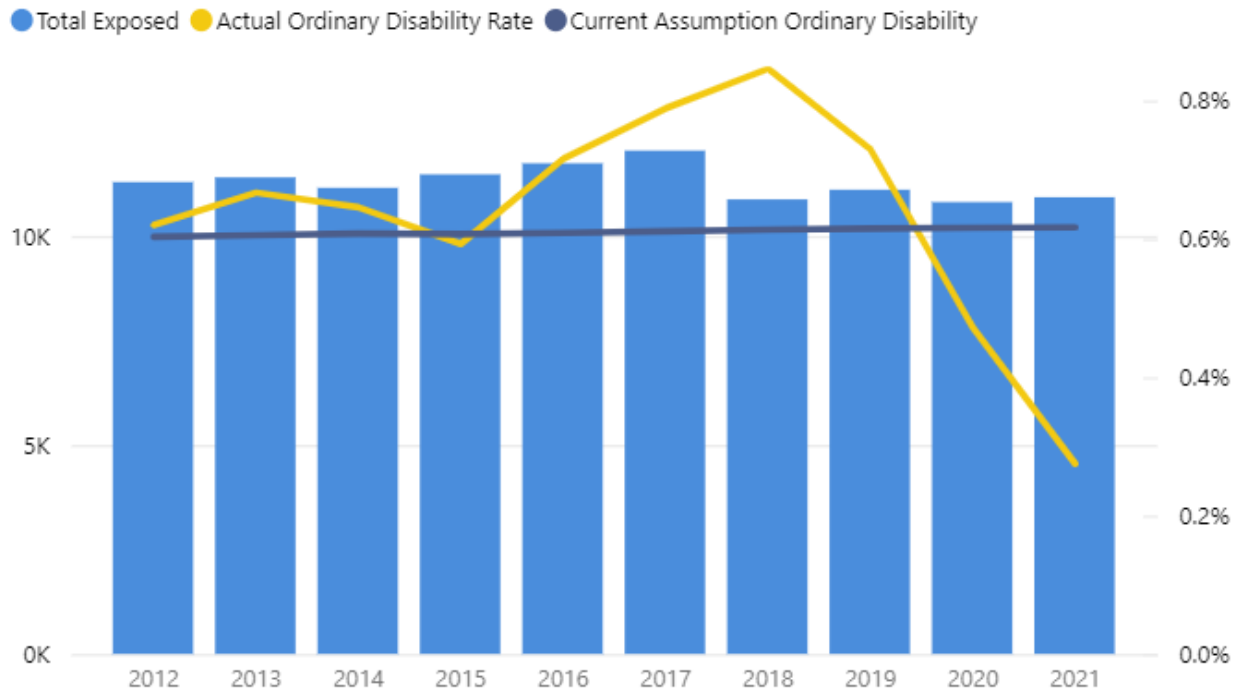
Ordinary Disability

In performing the experience analysis, it is necessary to reassign disability retirement codes retroactively to reflect the eventual approval of a disability retirement. Members with a disability code in a given year had all inactive status codes in prior years changed to a disability status code. We made adjustments as far back as 2012. Rates of disability during the 2012 – 2019 period were much higher than in the last two years of the study period, 2020 – 2021. It is difficult to determine how future years would impact the experience during the study period, but we believe that this type of retroactive adjustment will be required in subsequent iterations of this study. The consequence will be a restatement of the number of disability retirements experienced during this study period, specifically 2019 – 2021.

The following tables show the experience of ordinary disability retirement for all plans, by year, for males and females combined, based on the age the range 30 to 79, for the service range 10 to 50 years.

| Plan Year | Actual Ordinary Disabilities | Expected Ordinary Disabilities | Total Exposed | Actual Ordinary Disability Rate | Current Assumption Ordinary Disability | Ratio Act/Exp Ordinary Disability |
|--------------|------------------------------|--------------------------------|----------------|---------------------------------|--|-----------------------------------|
| 2012 | 70 | 68.1 | 11,290 | 0.6200% | 0.6031% | 1.03 |
| 2013 | 76 | 69.0 | 11,402 | 0.6665% | 0.6055% | 1.10 |
| 2014 | 72 | 67.8 | 11,152 | 0.6456% | 0.6076% | 1.06 |
| 2015 | 68 | 69.6 | 11,474 | 0.5926% | 0.6069% | 0.98 |
| 2016 | 84 | 71.4 | 11,739 | 0.7156% | 0.6086% | 1.18 |
| 2017 | 95 | 73.6 | 12,043 | 0.7888% | 0.6111% | 1.29 |
| 2018 | 92 | 66.7 | 10,876 | 0.8459% | 0.6133% | 1.38 |
| 2019 | 81 | 68.3 | 11,107 | 0.7293% | 0.6149% | 1.19 |
| 2020 | 51 | 66.6 | 10,811 | 0.4717% | 0.6159% | 0.77 |
| 2021 | 30 | 67.4 | 10,928 | 0.2745% | 0.6167% | 0.45 |
| Total | 719 | 688.5 | 112,822 | 0.6373% | 0.6103% | 1.04 |

Exposure Distribution w/ Ordinary Disability Rate - Actual and Expected; by Year



Due to scarcity of data in the most recent years, the following charts show results only through 2019.

The following tables show the experience results for ordinary disability retirement for all the plans, by year, for BERS for the age range 30 to 69, and the service range of 10 to 29 years, for male and female members separately. There number of ordinary disability cases after 30 years of service was negligible, so these cases were excluded from these charts. Based on the current assumptions, the actual rate of disability retirements was very similar to what was expected for males (A/E ratio of 0.99) but greater than expected for females (A/E ratio of 1.22) from 2012 - 2019.

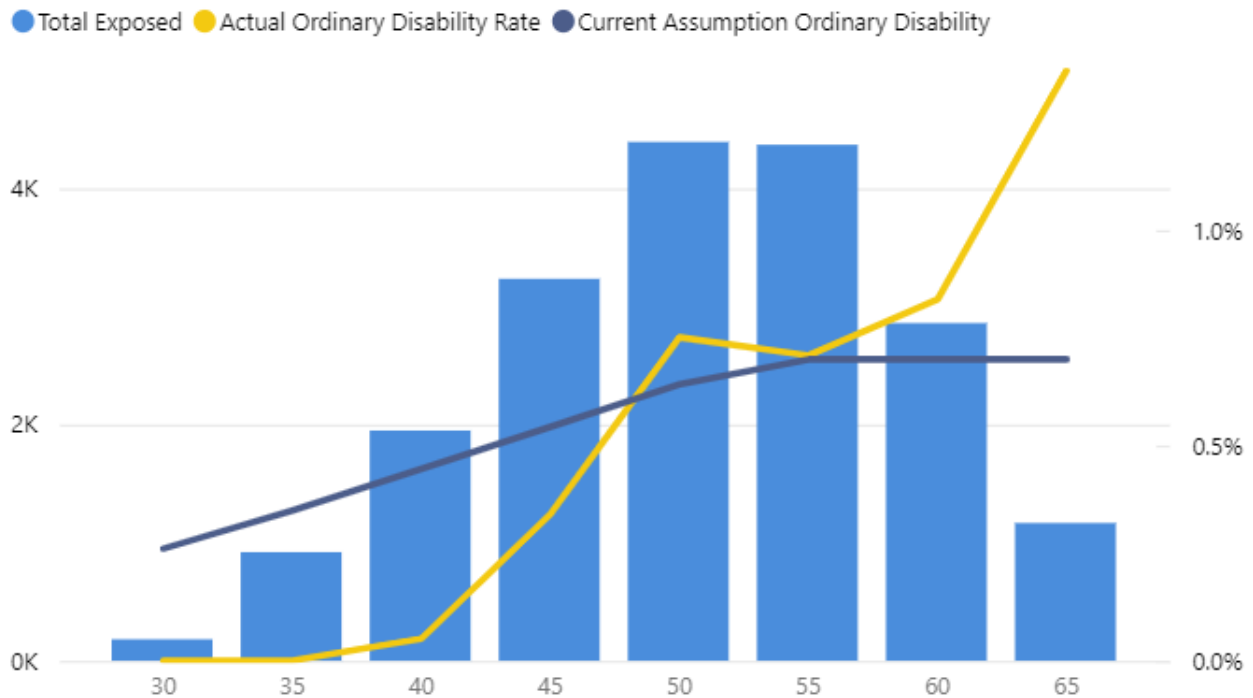
Males

The following tables are for male members.

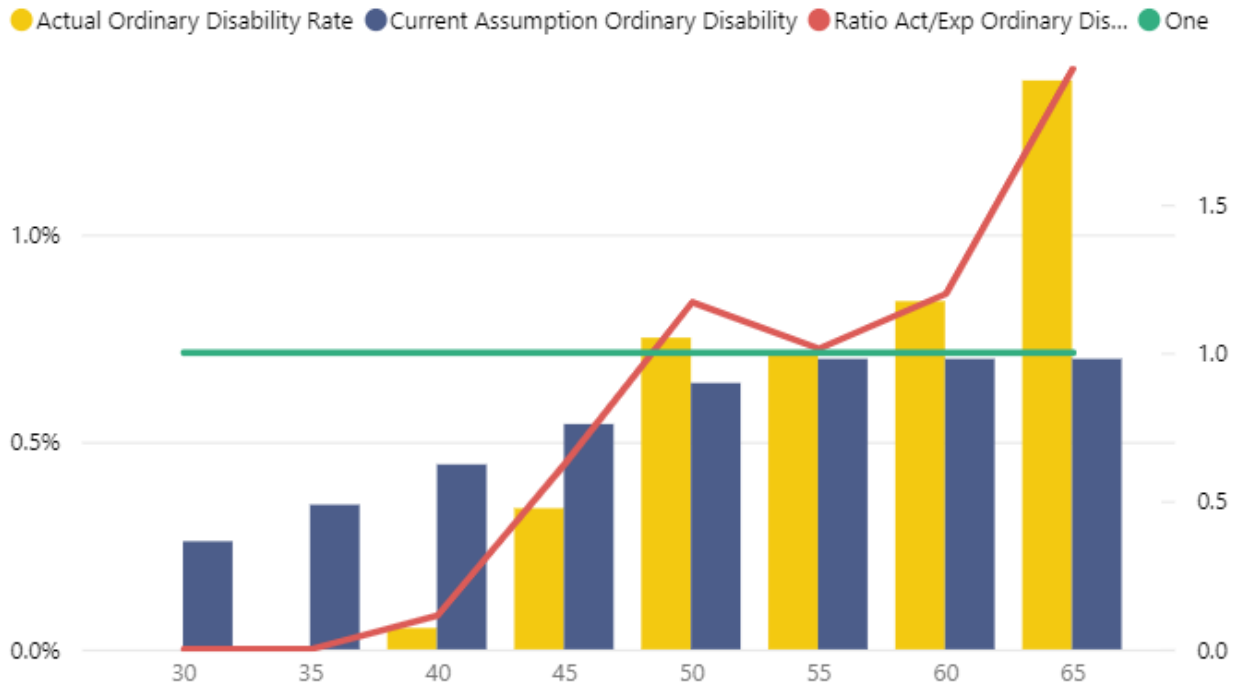
| Age | Actual Ordinary Disabilities | Expected Ordinary Disabilities | Total Exposed | Actual Ordinary Disability Rate | Current Assumption Ordinary Disability | Ratio Act/Exp Ordinary Disability |
|-----|------------------------------|--------------------------------|---------------|---------------------------------|--|-----------------------------------|
| 30 | 0 | 0.0 | 7 | 0.0000% | 0.2000% | 0.00 |
| 31 | 0 | 0.0 | 14 | 0.0000% | 0.2200% | 0.00 |
| 32 | 0 | 0.1 | 29 | 0.0000% | 0.2400% | 0.00 |
| 33 | 0 | 0.1 | 51 | 0.0000% | 0.2600% | 0.00 |
| 34 | 0 | 0.2 | 81 | 0.0000% | 0.2800% | 0.00 |
| 35 | 0 | 0.3 | 106 | 0.0000% | 0.3000% | 0.00 |
| 36 | 0 | 0.5 | 143 | 0.0000% | 0.3200% | 0.00 |
| 37 | 0 | 0.6 | 184 | 0.0000% | 0.3400% | 0.00 |
| 38 | 0 | 0.8 | 225 | 0.0000% | 0.3600% | 0.00 |
| 39 | 0 | 1.0 | 262 | 0.0000% | 0.3800% | 0.00 |
| 40 | 1 | 1.1 | 287 | 0.3484% | 0.4000% | 0.87 |
| 41 | 0 | 1.4 | 333 | 0.0000% | 0.4200% | 0.00 |
| 42 | 0 | 1.7 | 381 | 0.0000% | 0.4400% | 0.00 |
| 43 | 0 | 2.0 | 445 | 0.0000% | 0.4600% | 0.00 |
| 44 | 0 | 2.4 | 504 | 0.0000% | 0.4800% | 0.00 |
| 45 | 2 | 2.8 | 552 | 0.3623% | 0.5000% | 0.72 |
| 46 | 3 | 3.1 | 591 | 0.5076% | 0.5200% | 0.98 |
| 47 | 2 | 3.5 | 646 | 0.3096% | 0.5400% | 0.57 |
| 48 | 2 | 4.0 | 720 | 0.2778% | 0.5600% | 0.50 |
| 49 | 2 | 4.2 | 726 | 0.2755% | 0.5800% | 0.47 |
| 50 | 5 | 4.8 | 793 | 0.6305% | 0.6000% | 1.05 |

| | | | | | | | |
|--------------|------------|--------------|---------------|----------------|----------------|---|-------------|
| 51 | 4 | 5.2 | 838 | 0.4773% | 0.6200% | ▲ | 0.77 |
| 52 | 5 | 5.6 | 881 | 0.5675% | 0.6400% | ▲ | 0.89 |
| 53 | 8 | 6.2 | 935 | 0.8556% | 0.6600% | ▲ | 1.30 |
| 54 | 11 | 6.4 | 947 | 1.1616% | 0.6800% | ◆ | 1.71 |
| 55 | 5 | 6.4 | 913 | 0.5476% | 0.7000% | ▲ | 0.78 |
| 56 | 3 | 6.3 | 896 | 0.3348% | 0.7000% | ◆ | 0.48 |
| 57 | 11 | 6.2 | 882 | 1.2472% | 0.7000% | ◆ | 1.78 |
| 58 | 4 | 6.0 | 858 | 0.4662% | 0.7000% | ▲ | 0.67 |
| 59 | 8 | 5.7 | 821 | 0.9744% | 0.7000% | ▲ | 1.39 |
| 60 | 5 | 5.2 | 738 | 0.6775% | 0.7000% | ● | 0.97 |
| 61 | 5 | 4.8 | 679 | 0.7364% | 0.7000% | ● | 1.05 |
| 62 | 5 | 4.2 | 595 | 0.8403% | 0.7000% | ▲ | 1.20 |
| 63 | 5 | 3.2 | 462 | 1.0823% | 0.7000% | ◆ | 1.55 |
| 64 | 4 | 2.7 | 386 | 1.0363% | 0.7000% | ▲ | 1.48 |
| 65 | 7 | 2.3 | 333 | 2.1021% | 0.7000% | ◆ | 3.00 |
| 66 | 2 | 1.9 | 274 | 0.7299% | 0.7000% | ● | 1.04 |
| 67 | 5 | 1.6 | 228 | 2.1930% | 0.7000% | ◆ | 3.13 |
| 68 | 0 | 1.2 | 178 | 0.0000% | 0.7000% | ◆ | 0.00 |
| 69 | 2 | 1.1 | 154 | 1.2987% | 0.7000% | ◆ | 1.86 |
| Total | 116 | 116.9 | 19,078 | 0.6080% | 0.6128% | ● | 0.99 |

Exposure Distribution w/ Ordinary Disability Rate - Actual and Expected; by Age



Ordinary Disability Rate - Actual, Expected, and Ratio; by Age



Specific observations for male members:

- The disability rates were much smaller for members under 50 years old (A/E ratio of 0.40) versus those aged 50 and older (A/E ratio of 1.20).

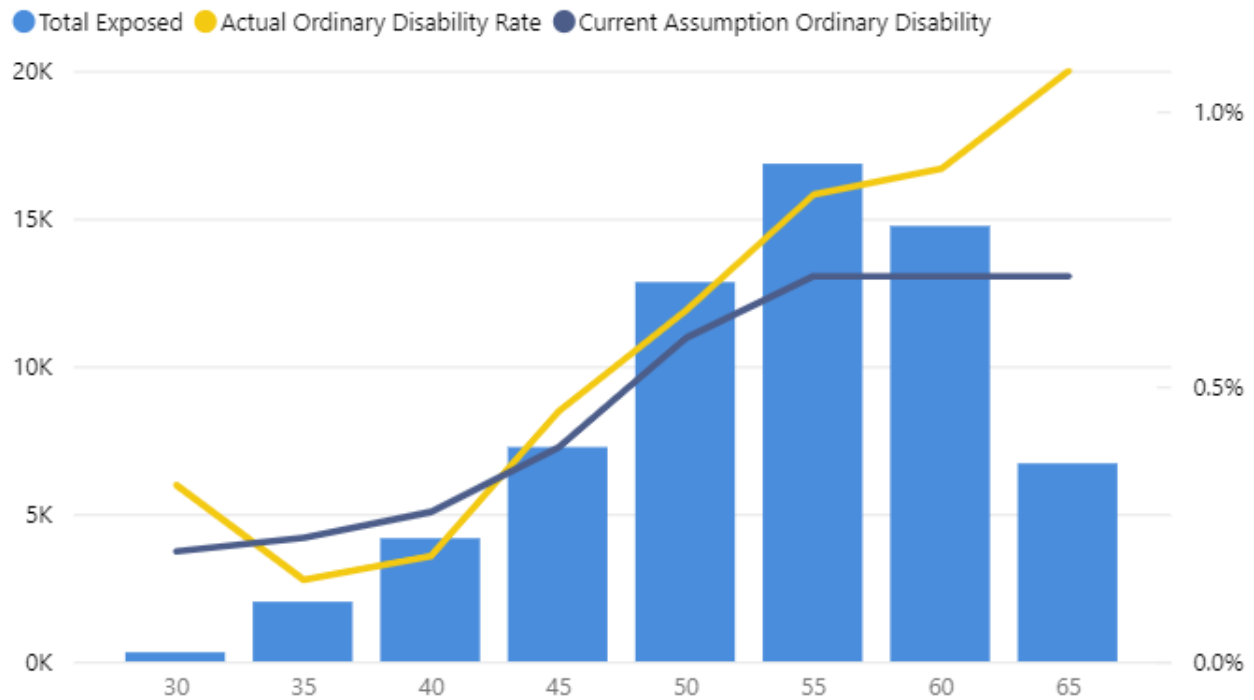
Females

The following tables are for female members.

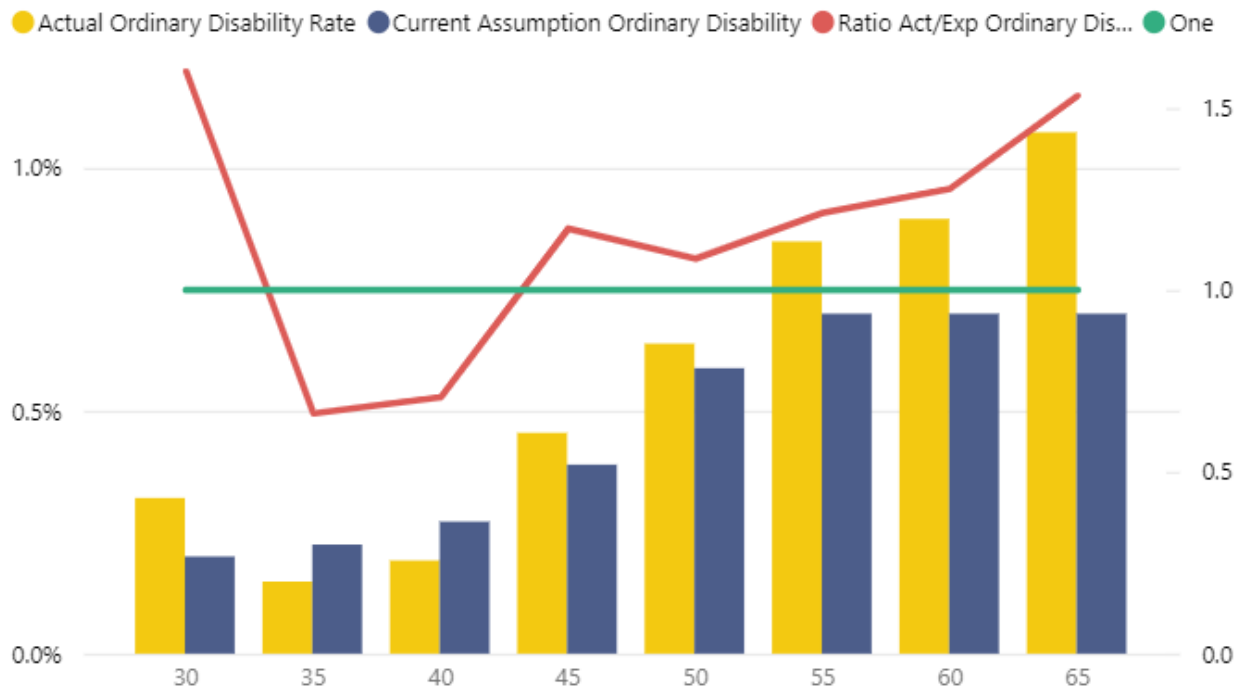
| Age | Actual Ordinary Disabilities | Expected Ordinary Disabilities | Total Exposed | Actual Ordinary Disability Rate | Current Assumption Ordinary Disability | Ratio Act/Exp Ordinary Disability |
|-----|------------------------------|--------------------------------|---------------|---------------------------------|--|-----------------------------------|
| 30 | 0 | 0.0 | 15 | 0.0000% | 0.2000% | 0.00 |
| 31 | 0 | 0.1 | 29 | 0.0000% | 0.2000% | 0.00 |
| 32 | 0 | 0.1 | 50 | 0.0000% | 0.2000% | 0.00 |
| 33 | 0 | 0.2 | 79 | 0.0000% | 0.2000% | 0.00 |
| 34 | 1 | 0.3 | 139 | 0.7194% | 0.2000% | 3.60 |
| 35 | 1 | 0.4 | 224 | 0.4464% | 0.2000% | 2.23 |
| 36 | 0 | 0.6 | 306 | 0.0000% | 0.2100% | 0.00 |
| 37 | 0 | 0.9 | 405 | 0.0000% | 0.2200% | 0.00 |
| 38 | 2 | 1.2 | 500 | 0.4000% | 0.2300% | 1.74 |
| 39 | 0 | 1.4 | 587 | 0.0000% | 0.2400% | 0.00 |
| 40 | 3 | 1.7 | 683 | 0.4392% | 0.2500% | 1.76 |
| 41 | 3 | 2.0 | 752 | 0.3989% | 0.2600% | 1.53 |
| 42 | 2 | 2.2 | 826 | 0.2421% | 0.2700% | 0.90 |
| 43 | 0 | 2.6 | 917 | 0.0000% | 0.2800% | 0.00 |
| 44 | 0 | 2.9 | 994 | 0.0000% | 0.2900% | 0.00 |
| 45 | 6 | 3.4 | 1,123 | 0.5343% | 0.3000% | 1.78 |
| 46 | 5 | 4.4 | 1,303 | 0.3837% | 0.3400% | 1.13 |
| 47 | 3 | 5.4 | 1,434 | 0.2092% | 0.3800% | 0.55 |
| 48 | 12 | 6.7 | 1,588 | 0.7557% | 0.4200% | 1.80 |
| 49 | 7 | 8.3 | 1,810 | 0.3867% | 0.4600% | 0.84 |
| 50 | 12 | 10.3 | 2,064 | 0.5814% | 0.5000% | 1.16 |

| | | | | | | | |
|--------------|------------|--------------|---------------|----------------|----------------|----------|-------------|
| 51 | 16 | 12.6 | 2,326 | 0.6879% | 0.5400% | ▲ | 1.27 |
| 52 | 9 | 14.8 | 2,556 | 0.3521% | 0.5800% | ▲ | 0.61 |
| 53 | 18 | 17.6 | 2,838 | 0.6342% | 0.6200% | ● | 1.02 |
| 54 | 27 | 20.2 | 3,061 | 0.8821% | 0.6600% | ▲ | 1.34 |
| 55 | 35 | 22.8 | 3,254 | 1.0756% | 0.7000% | ◆ | 1.54 |
| 56 | 21 | 23.4 | 3,342 | 0.6284% | 0.7000% | ▲ | 0.90 |
| 57 | 25 | 23.6 | 3,365 | 0.7429% | 0.7000% | ● | 1.06 |
| 58 | 25 | 24.0 | 3,429 | 0.7291% | 0.7000% | ● | 1.04 |
| 59 | 37 | 24.2 | 3,460 | 1.0694% | 0.7000% | ◆ | 1.53 |
| 60 | 27 | 24.2 | 3,455 | 0.7815% | 0.7000% | ▲ | 1.12 |
| 61 | 41 | 23.9 | 3,414 | 1.2009% | 0.7000% | ◆ | 1.72 |
| 62 | 25 | 21.8 | 3,114 | 0.8028% | 0.7000% | ▲ | 1.15 |
| 63 | 23 | 17.5 | 2,501 | 0.9196% | 0.7000% | ▲ | 1.31 |
| 64 | 16 | 15.8 | 2,261 | 0.7077% | 0.7000% | ● | 1.01 |
| 65 | 22 | 14.0 | 2,002 | 1.0989% | 0.7000% | ◆ | 1.57 |
| 66 | 15 | 11.3 | 1,620 | 0.9259% | 0.7000% | ▲ | 1.32 |
| 67 | 17 | 8.6 | 1,230 | 1.3821% | 0.7000% | ◆ | 1.97 |
| 68 | 10 | 7.2 | 1,023 | 0.9775% | 0.7000% | ▲ | 1.40 |
| 69 | 8 | 5.8 | 832 | 0.9615% | 0.7000% | ▲ | 1.37 |
| Total | 474 | 388.4 | 64,911 | 0.7302% | 0.5983% | ▲ | 1.22 |

Exposure Distribution w/ Ordinary Disability Rate - Actual and Expected; by Age



Ordinary Disability Rate - Actual, Expected, and Ratio; by Age



Specific observations for female members:

- Similarly, to the experience of male members, the rates of disability were smaller than expected for members under 45 years old (A/E ratio of 0.73), and greater than expected for members 45 years old and older (A/E ratio of 1.24).

Specific observations for both male and female members:

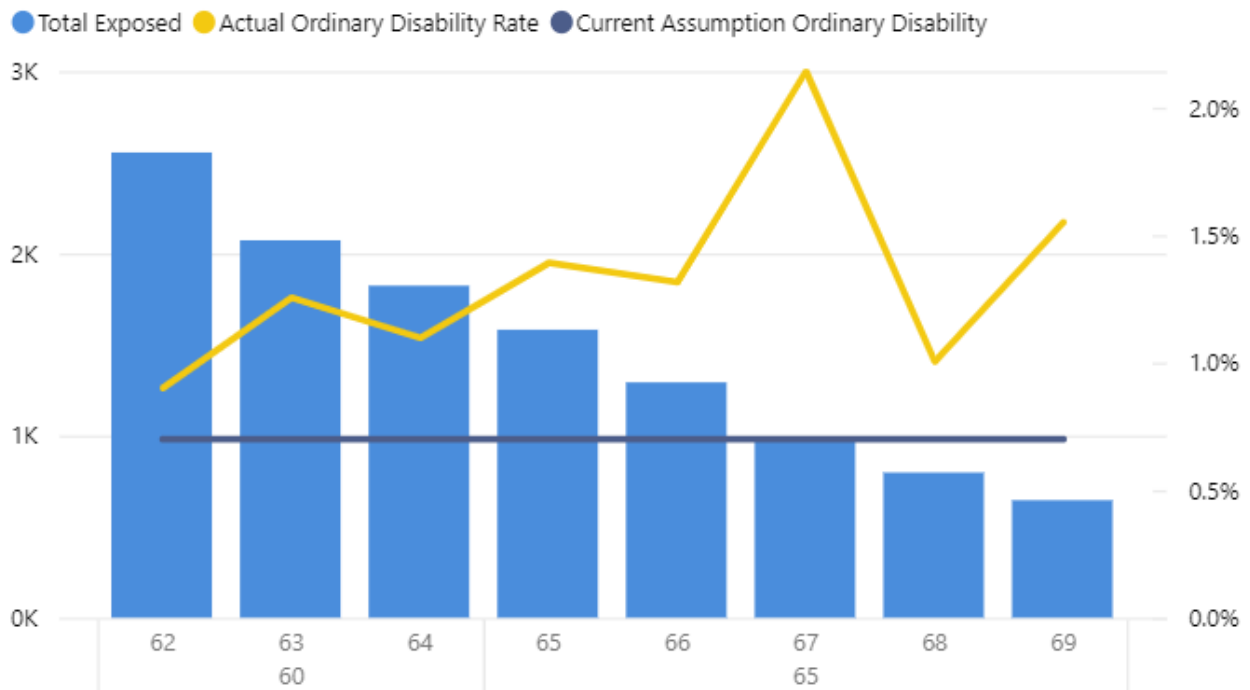
- The number of actual disabilities is influenced by whether the member had accrued 20 years of service. For members with service periods between 20 and 29 years the A/E ratio was 0.78 for males and 0.88 for females. This finding is consistent with the fact that the disability benefit is smaller than the member’s accrued benefit with 20 years of service.
- This issue was pronounced in the rates experienced for ages 62 and older. For members with at least 20 years of service, the A/E ratios are even lower (0.39 for males, 0.46 for females).
- For members with less than 20 years of service, 62 years and older, the actual experience exceeded expectations (A/E ratio of 2.30 for males, 1.71 for females).
- While the rates of disability vary by gender, the overall observations compared to expectations are consistent for each gender.

Age 62 and older

The following charts show the results of members aged 62 and older, with fewer than 20 years of service, for male and female members combined.

| Age | Actual Ordinary Disabilities | Expected Ordinary Disabilities | Total Exposed | Actual Ordinary Disability Rate | Current Assumption Ordinary Disability | Ratio Act/Exp Ordinary Disability |
|--------------|------------------------------|--------------------------------|---------------|---------------------------------|--|-----------------------------------|
| 62 | 23 | 17.9 | 2,554 | 0.9005% | 0.7000% | ▲ 1.29 |
| 63 | 26 | 14.5 | 2,072 | 1.2548% | 0.7000% | ◆ 1.79 |
| 64 | 20 | 12.8 | 1,823 | 1.0971% | 0.7000% | ◆ 1.57 |
| 65 | 22 | 11.1 | 1,581 | 1.3915% | 0.7000% | ◆ 1.99 |
| 66 | 17 | 9.0 | 1,292 | 1.3158% | 0.7000% | ◆ 1.88 |
| 67 | 21 | 6.9 | 980 | 2.1429% | 0.7000% | ◆ 3.06 |
| 68 | 8 | 5.6 | 797 | 1.0038% | 0.7000% | ▲ 1.43 |
| 69 | 10 | 4.5 | 645 | 1.5504% | 0.7000% | ◆ 2.21 |
| Total | 147 | 82.2 | 11,744 | 1.2517% | 0.7000% | ◆ 1.79 |

Exposure Distribution w/ Ordinary Disability Rate - Actual and Expected; by Age

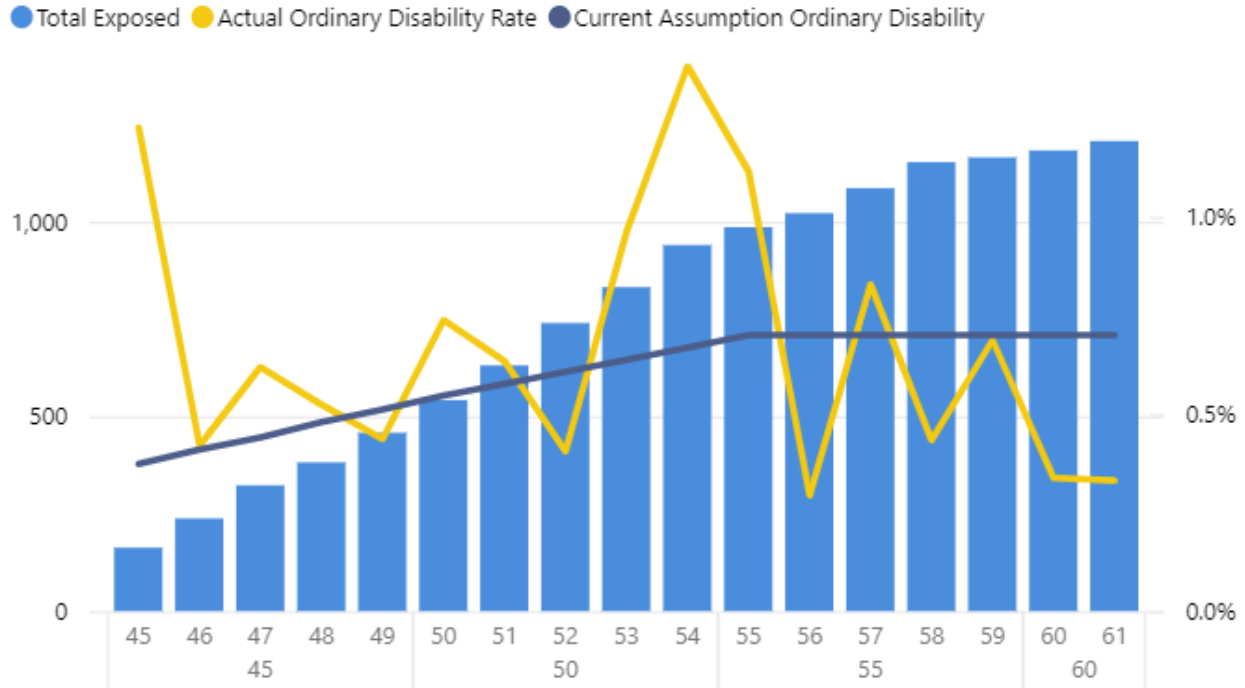


Service Greater than 20 Years and Less than Age 62

The following tables display the experience for members by age (45 to 61), with at least 20 years of service but less than 30 years, for males and females combined.

| Age | Actual Ordinary Disabilities | Expected Ordinary Disabilities | Total Exposed | Actual Ordinary Disability Rate | Current Assumption Ordinary Disability | Ratio Act/Exp Ordinary Disability |
|--------------|------------------------------|--------------------------------|---------------|---------------------------------|--|-----------------------------------|
| 45 | 2 | 0.6 | 163 | 1.2270% | 0.3736% | 3.28 |
| 46 | 1 | 1.0 | 238 | 0.4202% | 0.4103% | 1.02 |
| 47 | 2 | 1.4 | 323 | 0.6192% | 0.4404% | 1.41 |
| 48 | 2 | 1.8 | 382 | 0.5236% | 0.4790% | 1.09 |
| 49 | 2 | 2.3 | 458 | 0.4367% | 0.5119% | 0.85 |
| 50 | 4 | 3.0 | 542 | 0.7380% | 0.5465% | 1.35 |
| 51 | 4 | 3.6 | 631 | 0.6339% | 0.5766% | 1.10 |
| 52 | 3 | 4.5 | 740 | 0.4054% | 0.6073% | 0.67 |
| 53 | 8 | 5.3 | 832 | 0.9615% | 0.6377% | 1.51 |
| 54 | 13 | 6.3 | 940 | 1.3830% | 0.6687% | 2.07 |
| 55 | 11 | 6.9 | 986 | 1.1156% | 0.7000% | 1.59 |
| 56 | 3 | 7.2 | 1,022 | 0.2935% | 0.7000% | 0.42 |
| 57 | 9 | 7.6 | 1,086 | 0.8287% | 0.7000% | 1.18 |
| 58 | 5 | 8.1 | 1,153 | 0.4337% | 0.7000% | 0.62 |
| 59 | 8 | 8.2 | 1,165 | 0.6867% | 0.7000% | 0.98 |
| 60 | 4 | 8.3 | 1,183 | 0.3381% | 0.7000% | 0.48 |
| 61 | 4 | 8.4 | 1,207 | 0.3314% | 0.7000% | 0.47 |
| Total | 85 | 84.5 | 13,051 | 0.6513% | 0.6473% | 1.01 |

Exposure Distribution w/ Ordinary Disability Rate - Actual and Expected; by Age



Specific observations:

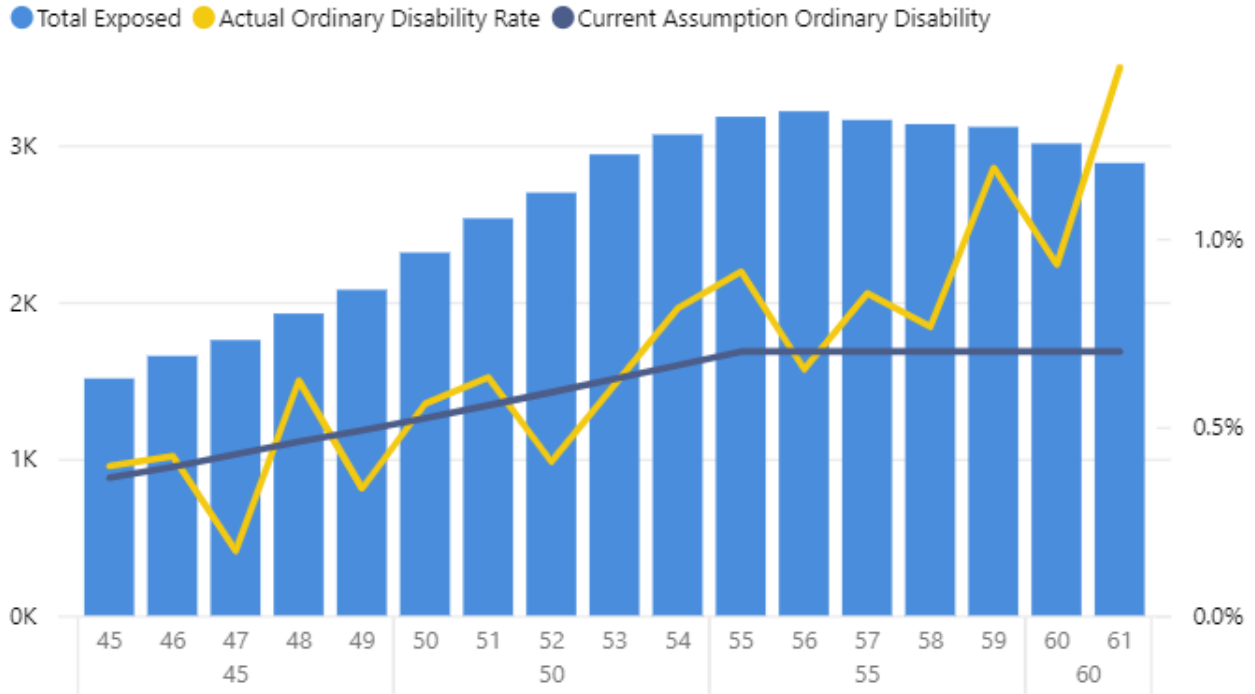
- Overall, for these ages, the number of actual ordinary disability retirements is consistent with expectations (A/E ratio of 1.01).
- The actual rate of disability retirements is highest for members in their early 50s; it declines somewhat lower when members become eligible for early retirement in their late 50s.

Service Less than 20 Years and Less than Age 62

The following tables display the results by age, for members with fewer than 20 years of service under age 62, for males and females combined.

| Age | Actual Ordinary Disabilities | Expected Ordinary Disabilities | Total Exposed | Actual Ordinary Disability Rate | Current Assumption Ordinary Disability | Ratio Act/Exp Ordinary Disability |
|--------------|------------------------------|--------------------------------|---------------|---------------------------------|--|-----------------------------------|
| 45 | 6 | 5.5 | 1,512 | 0.3968% | 0.3651% | 1.09 |
| 46 | 7 | 6.5 | 1,656 | 0.4227% | 0.3941% | 1.07 |
| 47 | 3 | 7.5 | 1,757 | 0.1707% | 0.4277% | 0.40 |
| 48 | 12 | 8.9 | 1,926 | 0.6231% | 0.4606% | 1.35 |
| 49 | 7 | 10.2 | 2,078 | 0.3369% | 0.4905% | 0.69 |
| 50 | 13 | 12.1 | 2,315 | 0.5616% | 0.5234% | 1.07 |
| 51 | 16 | 14.1 | 2,533 | 0.6317% | 0.5573% | 1.13 |
| 52 | 11 | 16.0 | 2,697 | 0.4079% | 0.5921% | 0.69 |
| 53 | 18 | 18.5 | 2,941 | 0.6120% | 0.6277% | 0.98 |
| 54 | 25 | 20.4 | 3,068 | 0.8149% | 0.6635% | 1.23 |
| 55 | 29 | 22.3 | 3,181 | 0.9117% | 0.7000% | 1.30 |
| 56 | 21 | 22.5 | 3,216 | 0.6530% | 0.7000% | 0.93 |
| 57 | 27 | 22.1 | 3,161 | 0.8542% | 0.7000% | 1.22 |
| 58 | 24 | 21.9 | 3,134 | 0.7658% | 0.7000% | 1.09 |
| 59 | 37 | 21.8 | 3,116 | 1.1874% | 0.7000% | 1.70 |
| 60 | 28 | 21.1 | 3,010 | 0.9302% | 0.7000% | 1.33 |
| 61 | 42 | 20.2 | 2,886 | 1.4553% | 0.7000% | 2.08 |
| Total | 326 | 271.6 | 44,187 | 0.7378% | 0.6146% | 1.20 |

Exposure Distribution w/ Ordinary Disability Rate - Actual and Expected; by Age



Specific observations:

- Overall, for these ages, the number of actual ordinary disability retirements is greater than expected (A/E ratio of 1.20).

Summary

Retirement eligibility and the change in the benefit accrual rate upon completion of 20 years of service have a significant impact on the members who apply for a disability retirement. Consequently, it may be desirable to use disability rates to account for these two variables.

Accidental Disability

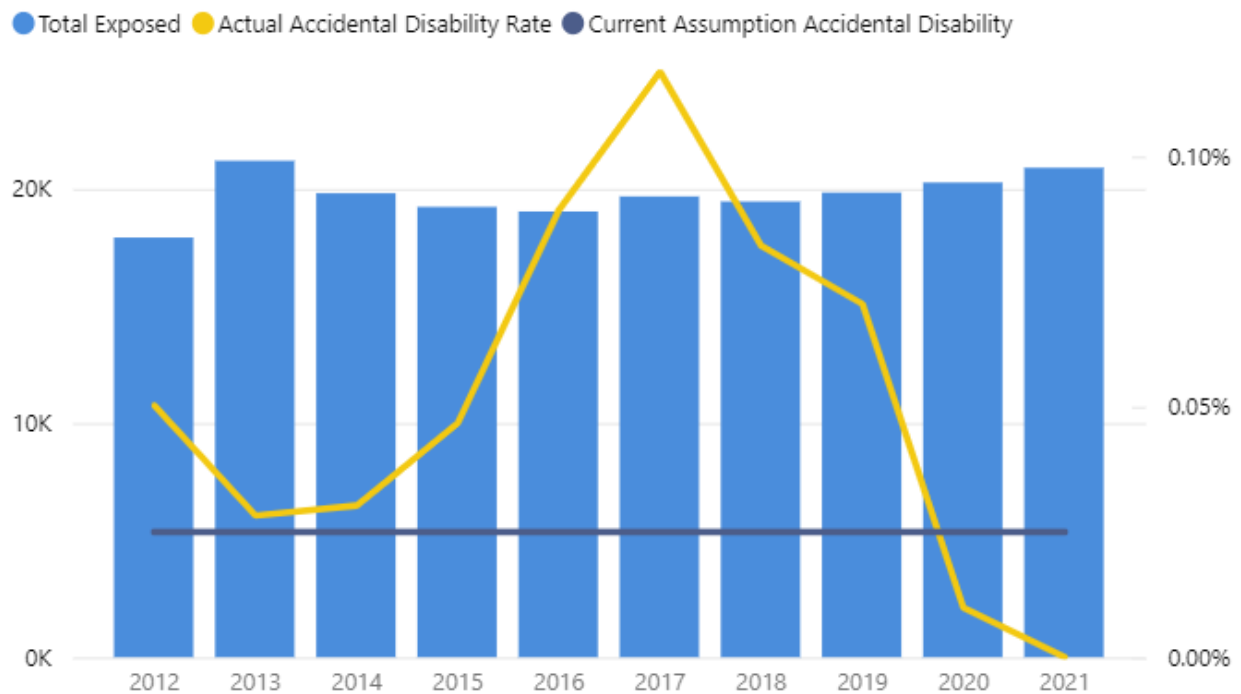
As noted in the section of ordinary disability, it is necessary to reassign disability retirement codes retroactively to reflect the eventual approval of a disability retirement. Members with a disability code in a given year had all inactive status codes in prior years changed to a disability status code. Rates of accidental disability were highest between 2016 – 2019 and there were only four recorded for the two-year period 2020 - 2021.

| Plan Year | Actual Accidental Disabilities | Expected Accidental Disabilities | Total Exposed | Actual Accidental Disability Rate | Current Assumption Accidental Disability | Ratio Act/Exp Accidental Disability |
|--------------|--------------------------------|----------------------------------|----------------|-----------------------------------|--|-------------------------------------|
| 2012 | 10 | 6.0 | 23,147 | 0.0432% | 0.0261% | 1.65 |
| 2013 | 7 | 7.3 | 27,881 | 0.0251% | 0.0262% | 0.96 |
| 2014 | 7 | 6.9 | 26,201 | 0.0267% | 0.0262% | 1.02 |
| 2015 | 11 | 6.7 | 25,470 | 0.0432% | 0.0262% | 1.65 |
| 2016 | 18 | 6.6 | 25,184 | 0.0715% | 0.0262% | 2.73 |
| 2017 | 28 | 6.8 | 25,957 | 0.1079% | 0.0262% | 4.12 |
| 2018 | 20 | 6.8 | 25,874 | 0.0773% | 0.0262% | 2.95 |
| 2019 | 14 | 7.0 | 26,536 | 0.0528% | 0.0263% | 2.01 |
| 2020 | 4 | 7.2 | 27,264 | 0.0147% | 0.0263% | 0.56 |
| 2021 | 0 | 7.4 | 28,111 | 0.0000% | 0.0263% | 0.00 |
| Total | 119 | 68.6 | 261,625 | 0.0455% | 0.0262% | 1.73 |

The following tables show the experience results for accidental disability retirement for all the plans, by year, for the age range (20 to 79) and service range (0 to 47 years), for females.

| Plan Year | Actual Accidental Disabilities | Expected Accidental Disabilities | Total Exposed | Actual Accidental Disability Rate | Current Assumption Accidental Disability | Ratio Act/Exp Accidental Disability |
|--------------|--------------------------------|----------------------------------|----------------|-----------------------------------|--|-------------------------------------|
| 2012 | 9 | 4.5 | 17,923 | 0.0502% | 0.0250% | 2.01 |
| 2013 | 6 | 5.3 | 21,202 | 0.0283% | 0.0250% | 1.13 |
| 2014 | 6 | 5.0 | 19,817 | 0.0303% | 0.0250% | 1.21 |
| 2015 | 9 | 4.8 | 19,233 | 0.0468% | 0.0250% | 1.87 |
| 2016 | 17 | 4.8 | 19,037 | 0.0893% | 0.0250% | 3.57 |
| 2017 | 23 | 4.9 | 19,680 | 0.1169% | 0.0250% | 4.67 |
| 2018 | 16 | 4.9 | 19,462 | 0.0822% | 0.0250% | 3.29 |
| 2019 | 14 | 5.0 | 19,845 | 0.0705% | 0.0250% | 2.82 |
| 2020 | 2 | 5.1 | 20,274 | 0.0099% | 0.0250% | 0.39 |
| 2021 | 0 | 5.2 | 20,905 | 0.0000% | 0.0250% | 0.00 |
| Total | 102 | 49.3 | 197,378 | 0.0517% | 0.0250% | 2.07 |

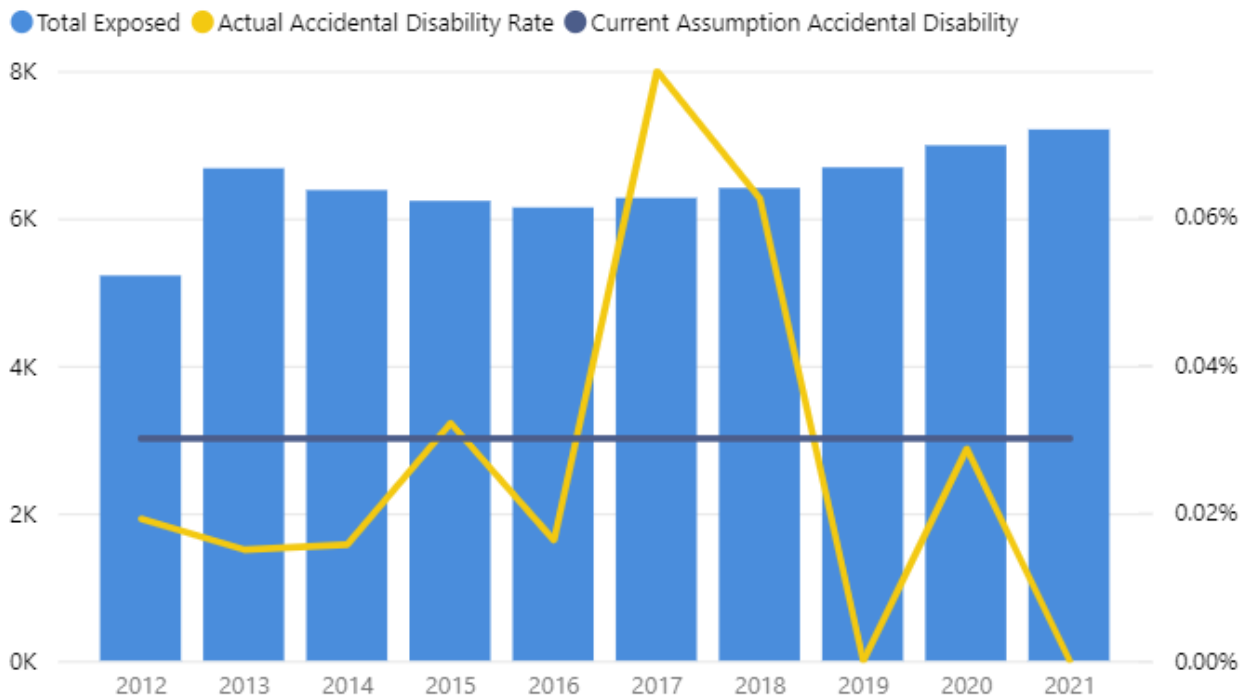
Exposure Distribution w/ Accidental Disability Rate - Actual and Expected; by Year



The following tables show the experience of accidental disability retirements for males, by year, for the age range (20 to 79) and service range (0 to 47 years), during 2012 - 2019.

| Plan Year | Actual Accidental Disabilities | Expected Accidental Disabilities | Total Exposed | Actual Accidental Disability Rate | Current Assumption Accidental Disability | Ratio Act/Exp Accidental Disability |
|--------------|--------------------------------|----------------------------------|---------------|-----------------------------------|--|-------------------------------------|
| 2012 | 1 | 1.6 | 5,224 | 0.0191% | 0.0300% | 0.64 |
| 2013 | 1 | 2.0 | 6,679 | 0.0150% | 0.0300% | 0.50 |
| 2014 | 1 | 1.9 | 6,384 | 0.0157% | 0.0300% | 0.52 |
| 2015 | 2 | 1.9 | 6,237 | 0.0321% | 0.0300% | 1.07 |
| 2016 | 1 | 1.8 | 6,147 | 0.0163% | 0.0300% | 0.54 |
| 2017 | 5 | 1.9 | 6,277 | 0.0797% | 0.0300% | 2.66 |
| 2018 | 4 | 1.9 | 6,412 | 0.0624% | 0.0300% | 2.08 |
| 2019 | 0 | 2.0 | 6,691 | 0.0000% | 0.0300% | 0.00 |
| 2020 | 2 | 2.1 | 6,990 | 0.0286% | 0.0300% | 0.95 |
| 2021 | 0 | 2.2 | 7,206 | 0.0000% | 0.0300% | 0.00 |
| Total | 17 | 19.3 | 64,247 | 0.0265% | 0.0300% | 0.88 |

Exposure Distribution w/ Accidental Disability Rate - Actual and Expected; by Year



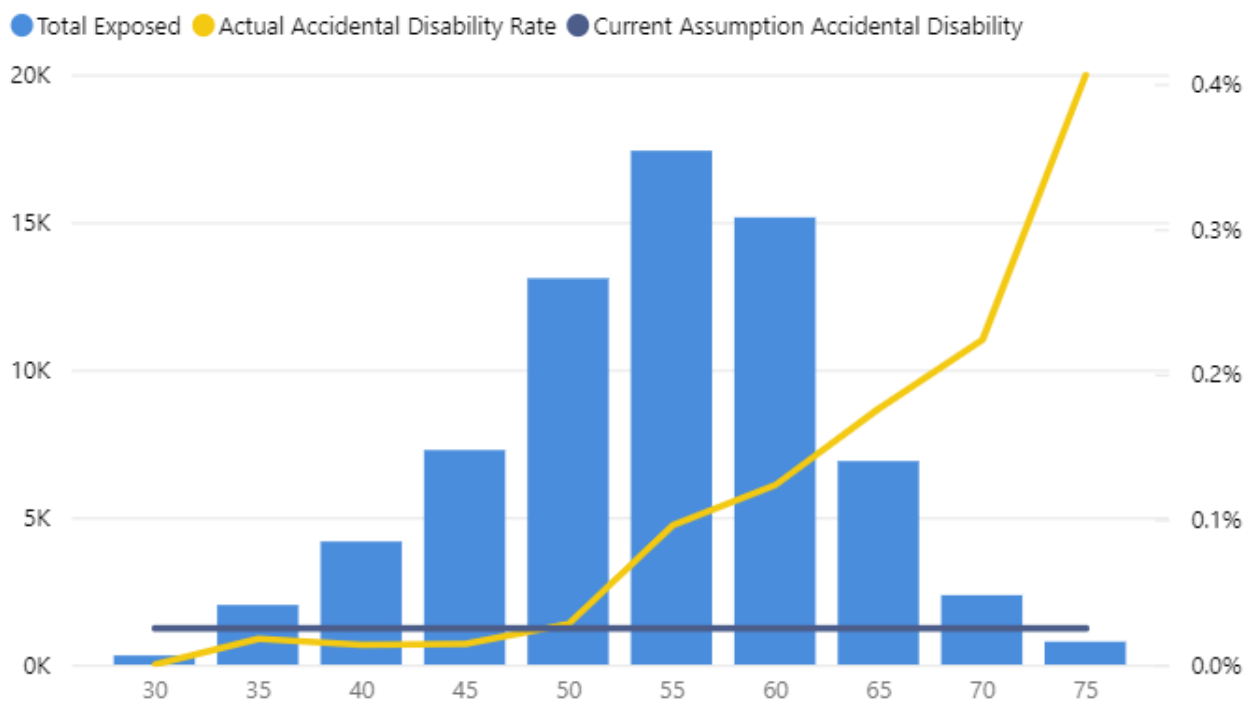
Specific observations:

- The small number of accidental disability retirements produces high year-to-year variations, especially for male members.
- The normal retirement benefit is greater than the accidental disability benefit when a member completes 35 years of service. There are no cases of accidental disability retirements for members with at least 35 years of service; there is one case of accidental disability retirement for members with 30 years of service or more. These findings are similar to the findings of ordinary disability benefits.

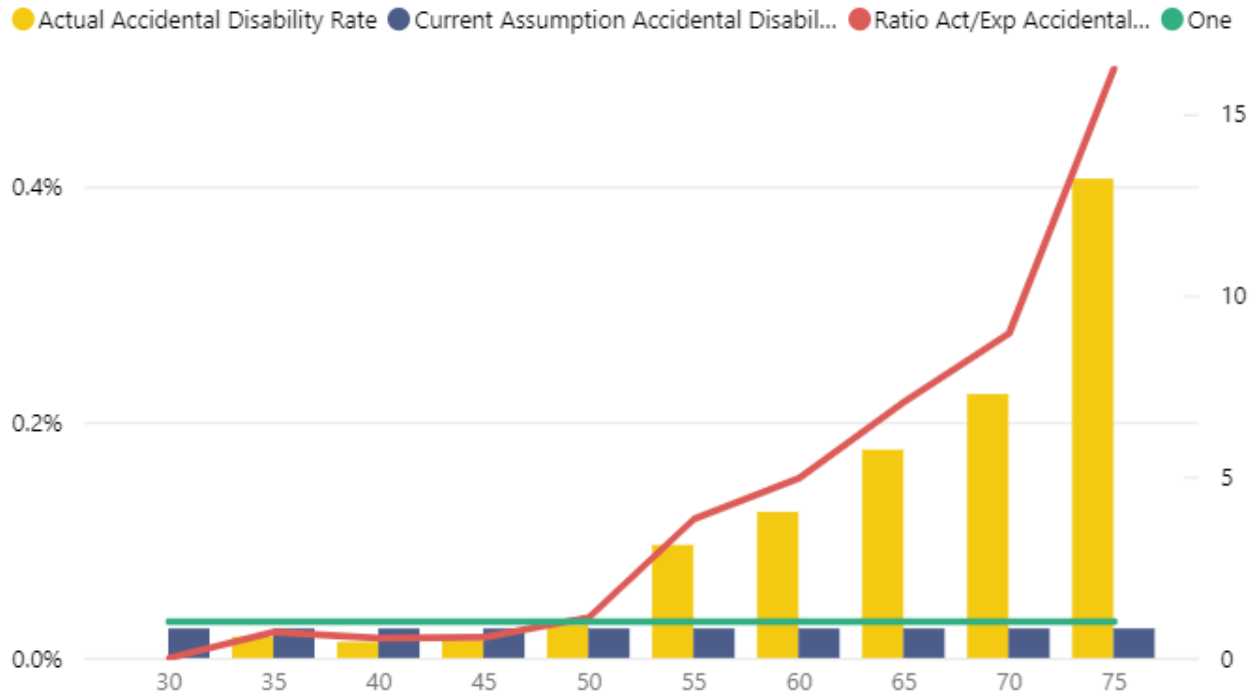
Females

The following tables display the results for females by age, for the age range (30 to 79) and the service range (0 to 34), during 2012 - 2019.

Exposure Distribution w/ Accidental Disability Rate - Actual and Expected; by Age



Accidental Disability Rate - Actual, Expected, and Ratio; by Age



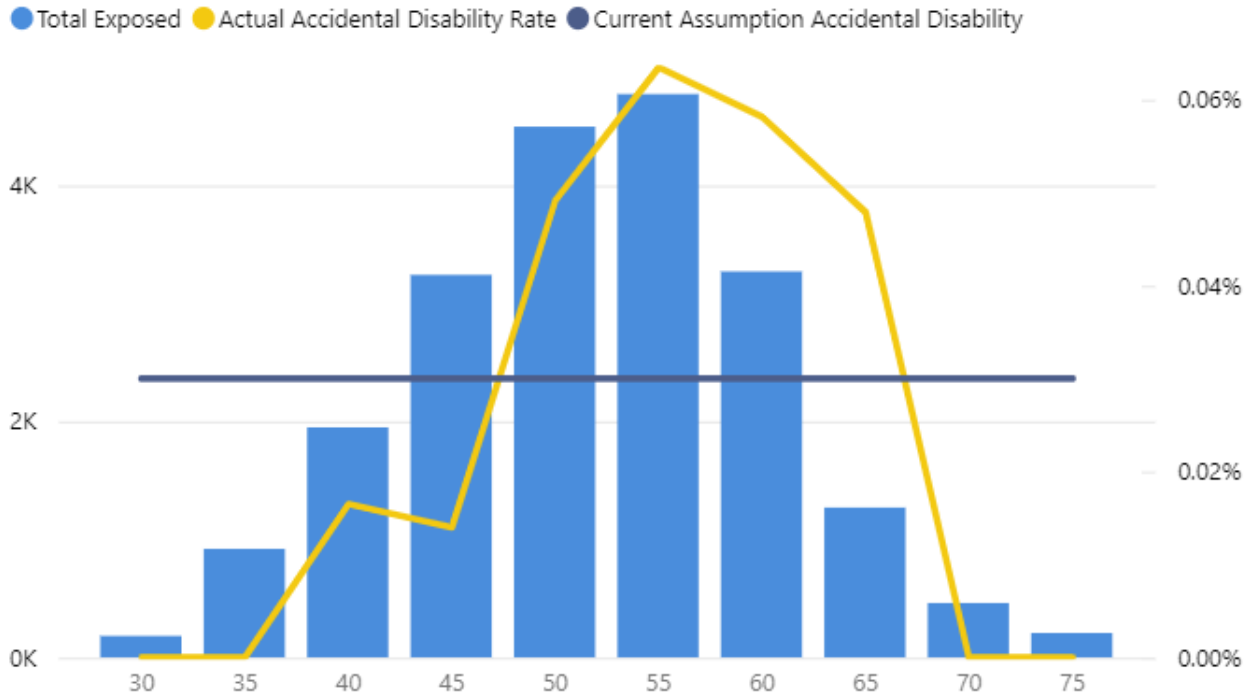
Specific observations:

- Overall, the actual number of accidental disability retirements was more than doubled what was expected for females (A/E ratio of 2.66).
- For members under 55 years old, the rate of accidental disability is 0.0179% versus the assumed rate of 0.025% for an A/E ratio of 0.72.
- For members older than 55 years, the rate of accidental disability is 0.1276%, the assumption is 0.025%, and the A/E ratio is 5.10.

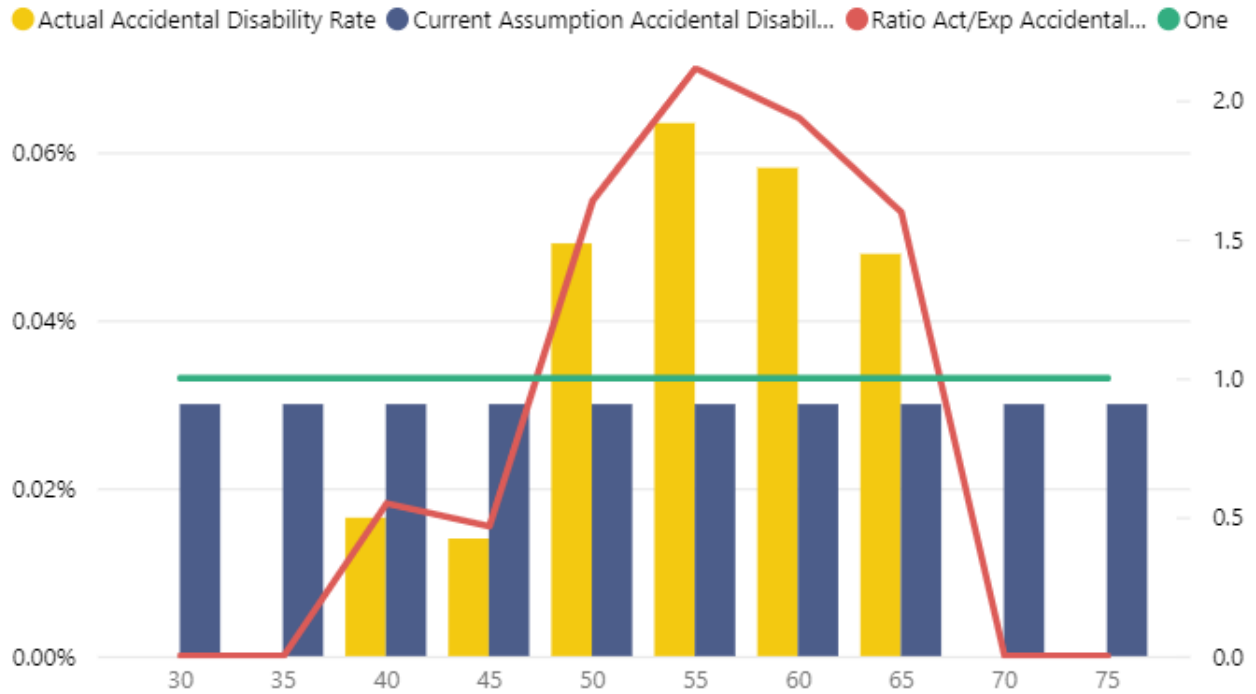
Males

The following tables display the results by age for males, for the age range of 30 to 79 and the service range 0 to 34, during 2012 - 2019.

Exposure Distribution w/ Accidental Disability Rate - Actual and Expected; by Age



Accidental Disability Rate - Actual, Expected, and Ratio; by Age



Specific observations:

- Overall, the actual number of accidental disability retirements was very similar to what was expected for male members (A/E ratio of 1.07).
- For members under 55 years old, the rate of accidental disability is 0.0196%, the assumption is 0.030%, and the A/E ratio is 0.65.
- For members older than 55 years, the rate of accidental disability is 0.0556%, the assumption is 0.030%, and the A/E ratio is 1.85.

Pre-retirement Death

Plan codes excluded in the analysis of other contingencies are part of the analysis of pre-retirement death.

Mortality assumptions involve two components: a base table and a mortality improvement scale. The mortality improvement scale adjusts the mortality rates of the base table to reflect that generally rates of mortality are anticipated to improve over time.

The Society of Actuaries (SOA) has published mortality improvement scales (MP scales) each year from 2014 to 2021. In the last several actuarial valuations, OA has used the mortality improvement scale that coincides with the valuation date. For example, OA used the MP-2020 scale in its June 30, 2020 lag actuarial valuation. In this analysis, we used the most recent improvement scale (MP-2021) published by the SOA as of the date of this analysis. Please note that the SOA did not publish a MP-2022 scale.

In this study the base table corresponds to the year 2012; expected mortality rates in future years are obtained from the base table and the MP-2021 scale. For example, the 2017 (July 1, 2016 – June 30, 2017) mortality rates are derived from the base table (2012) adjusted with four years of improvements. This method links mortality rates across the years and, consequently, allows mortality comparisons from one year to another.

The SOA MP-2021 improvement scale is based on data through 2019 (before the onset of Covid) from the Social Security Administration (SSA). Even though the aggregate (for all ages) long-term trend has been towards mortality improvements, this is not always the case for each age. Therefore, there are situations where the expected mortality rate in a later year is higher than the base rate.

There is much discussion in the actuarial profession and among retirement systems about the development of mortality tables and the treatment of excess deaths due to the Covid pandemic which occurred in 2020 – 2022. The purpose of this analysis is to share our observations about the experience during the study period. In subsequent analyses, we will recommend changes to mortality assumptions as appropriate.

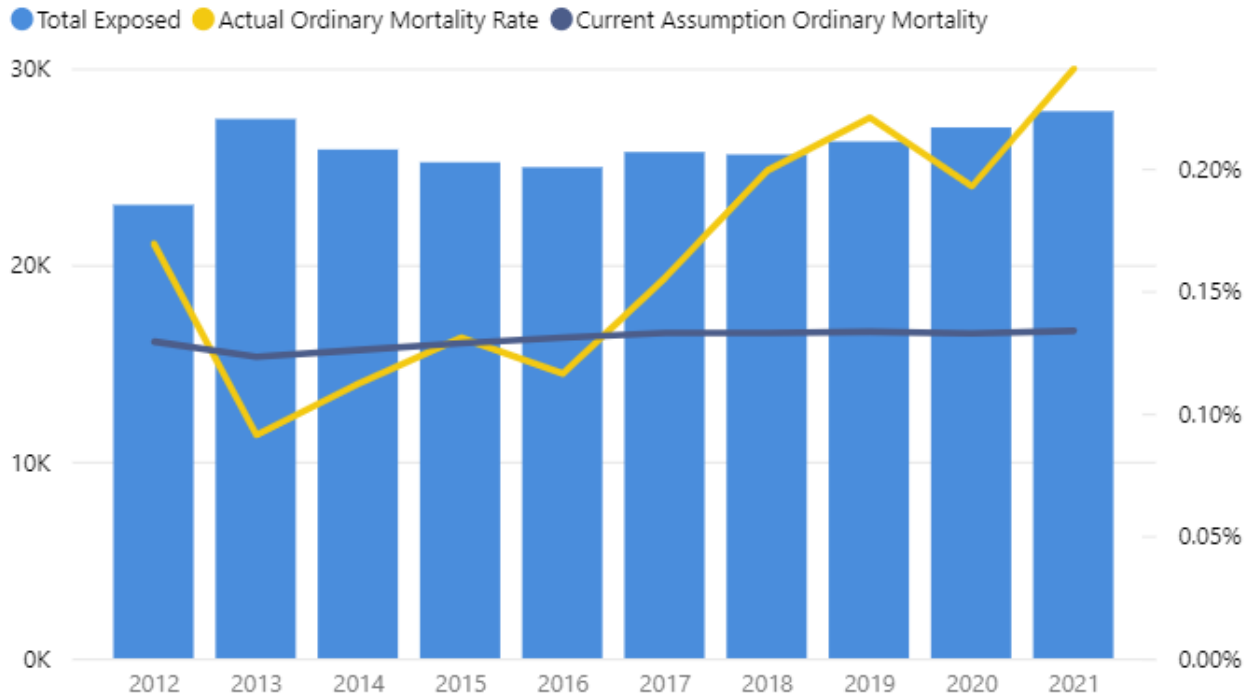
Please note that the charts by age are based on 5-year brackets. For example, the age bracket 45 should be interpreted as the interval 45 – 49.

Ordinary Death

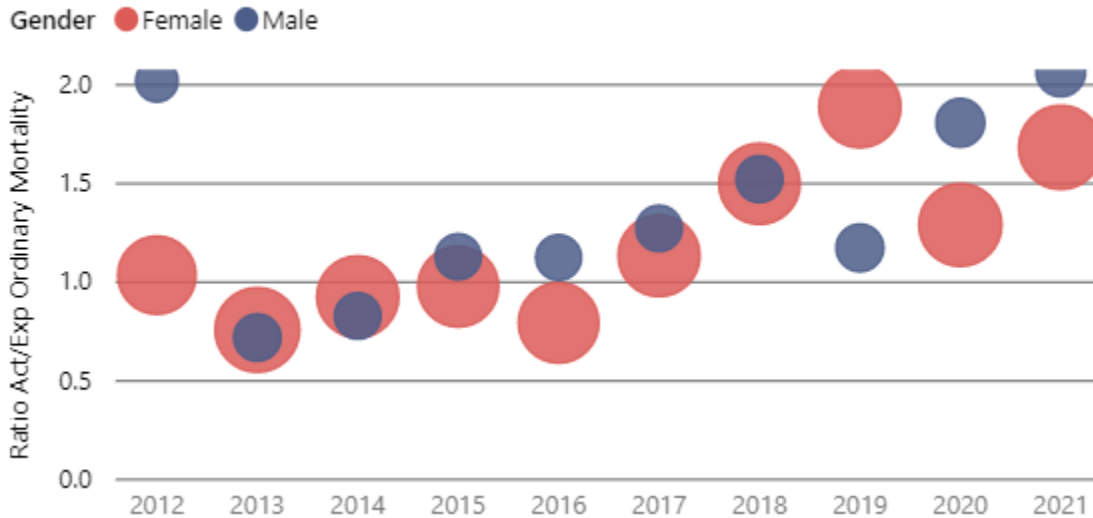
The following charts show the results of ordinary death by year, for males and females combined, for the age range (25 to 74) and service range (0 to 49), during the period 2012 – 2021.

| Plan Year | Actual Ordinary Deaths | Expected Ordinary Deaths | Total Exposed | Actual Ordinary Mortality Rate | Current Assumption Ordinary Mortality | Ratio Act/Exp Ordinary Mortality |
|--------------|------------------------|--------------------------|----------------|--------------------------------|---------------------------------------|----------------------------------|
| 2012 | 39 | 29.8 | 23,053 | 0.1692% | 0.1293% | 1.31 |
| 2013 | 25 | 33.7 | 27,423 | 0.0912% | 0.1231% | 0.74 |
| 2014 | 29 | 32.6 | 25,870 | 0.1121% | 0.1258% | 0.89 |
| 2015 | 33 | 32.4 | 25,218 | 0.1309% | 0.1286% | 1.02 |
| 2016 | 29 | 32.7 | 24,967 | 0.1162% | 0.1309% | 0.89 |
| 2017 | 40 | 34.2 | 25,739 | 0.1554% | 0.1329% | 1.17 |
| 2018 | 51 | 34.0 | 25,614 | 0.1991% | 0.1328% | 1.50 |
| 2019 | 58 | 35.0 | 26,277 | 0.2207% | 0.1333% | 1.66 |
| 2020 | 52 | 35.8 | 26,990 | 0.1927% | 0.1326% | 1.45 |
| 2021 | 67 | 37.2 | 27,816 | 0.2409% | 0.1337% | 1.80 |
| Total | 423 | 337.4 | 258,967 | 0.1633% | 0.1303% | 1.25 |

Exposure Distribution w/ Ordinary Mortality Rate - Actual and Expected; by Year



Actual vs. Expected - Ordinary Mortality Rate w/ Exposure Bubbles; by Year



Specific observations:

- Actual deaths were greater than expected during the study period (A/E ratio of 1.25).
- 2020 – 2021 were years with some of the largest number of actual deaths (A/E ratio of 1.63).
- The rates of death among males (A/E ratio of 1.37) were greater than among females (1.20)

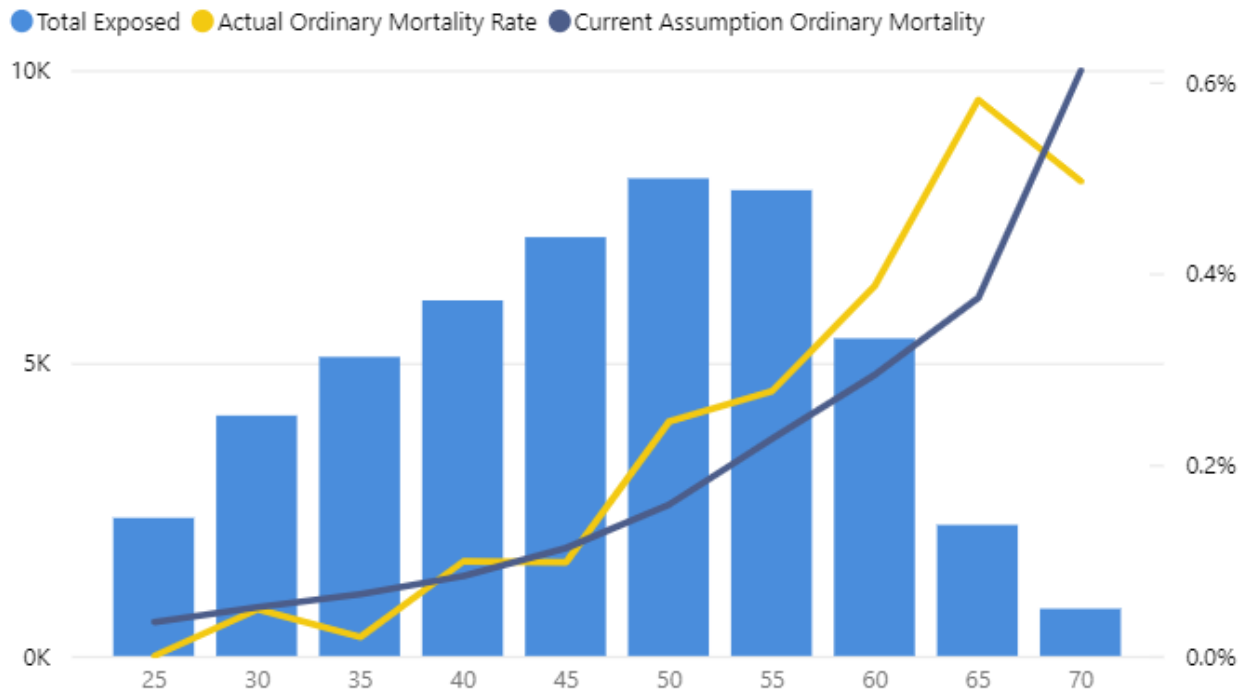
Since there were more deaths than expected during 2020 – 2021 due to the Covid pandemic, we excluded these years in the following analysis.

Males

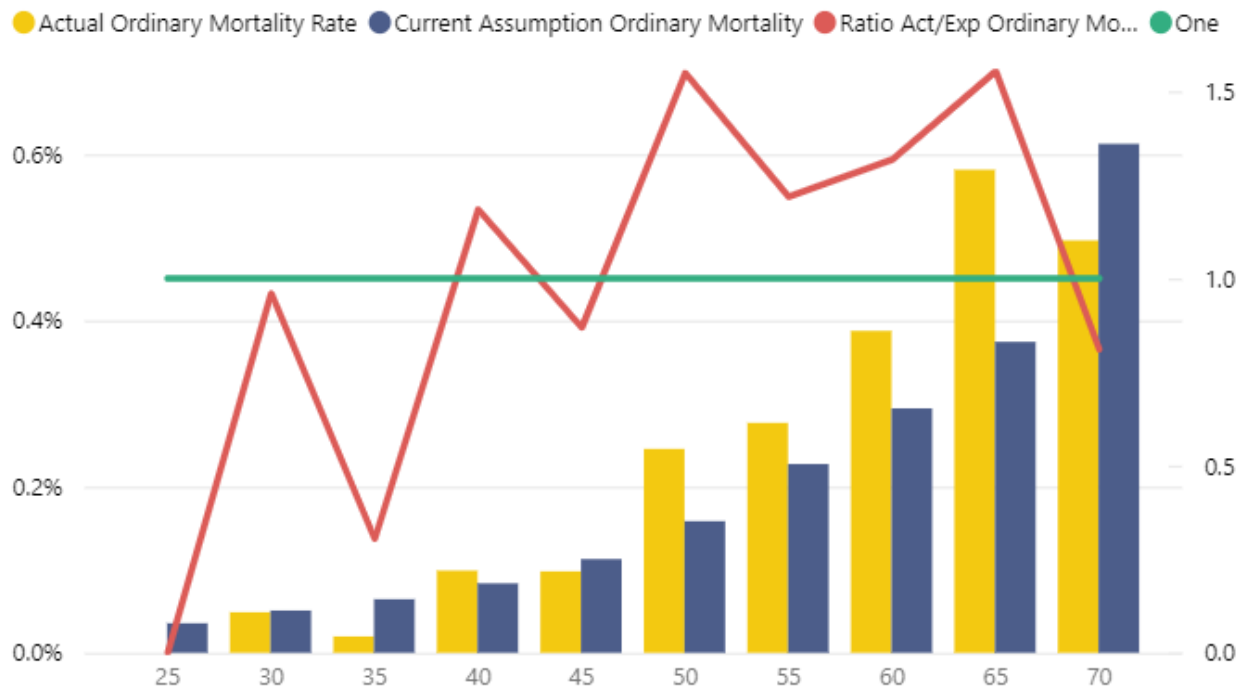
The following tables show the experience of ordinary death by age, for males, for the age range (25 to 74) and service range (0 to 49), during the period 2012 – 2019.

| Age (bins) | Actual Ordinary Deaths | Expected Ordinary Deaths | Total Exposed | Actual Ordinary Mortality Rate | Current Assumption Ordinary Mortality | Ratio Act/Exp Ordinary Mortality |
|--------------|------------------------|--------------------------|---------------|--------------------------------|---------------------------------------|----------------------------------|
| 25 | 0 | 0.8 | 2,357 | 0.0000% | 0.0355% | 0.00 |
| 30 | 2 | 2.1 | 4,103 | 0.0487% | 0.0508% | 0.96 |
| 35 | 1 | 3.3 | 5,104 | 0.0196% | 0.0645% | 0.30 |
| 40 | 6 | 5.1 | 6,069 | 0.0989% | 0.0835% | 1.18 |
| 45 | 7 | 8.1 | 7,148 | 0.0979% | 0.1127% | 0.87 |
| 50 | 20 | 12.9 | 8,152 | 0.2453% | 0.1584% | 1.55 |
| 55 | 22 | 18.1 | 7,951 | 0.2767% | 0.2271% | 1.22 |
| 60 | 21 | 15.9 | 5,420 | 0.3875% | 0.2941% | 1.32 |
| 65 | 13 | 8.4 | 2,236 | 0.5814% | 0.3742% | 1.55 |
| 70 | 4 | 4.9 | 806 | 0.4963% | 0.6125% | 0.81 |
| Total | 96 | 79.5 | 49,346 | 0.1945% | 0.1612% | 1.21 |

Exposure Distribution w/ Ordinary Mortality Rate - Actual and Expected; by Age



Ordinary Mortality Rate - Actual, Expected, and Ratio; by Age



Specific observations:

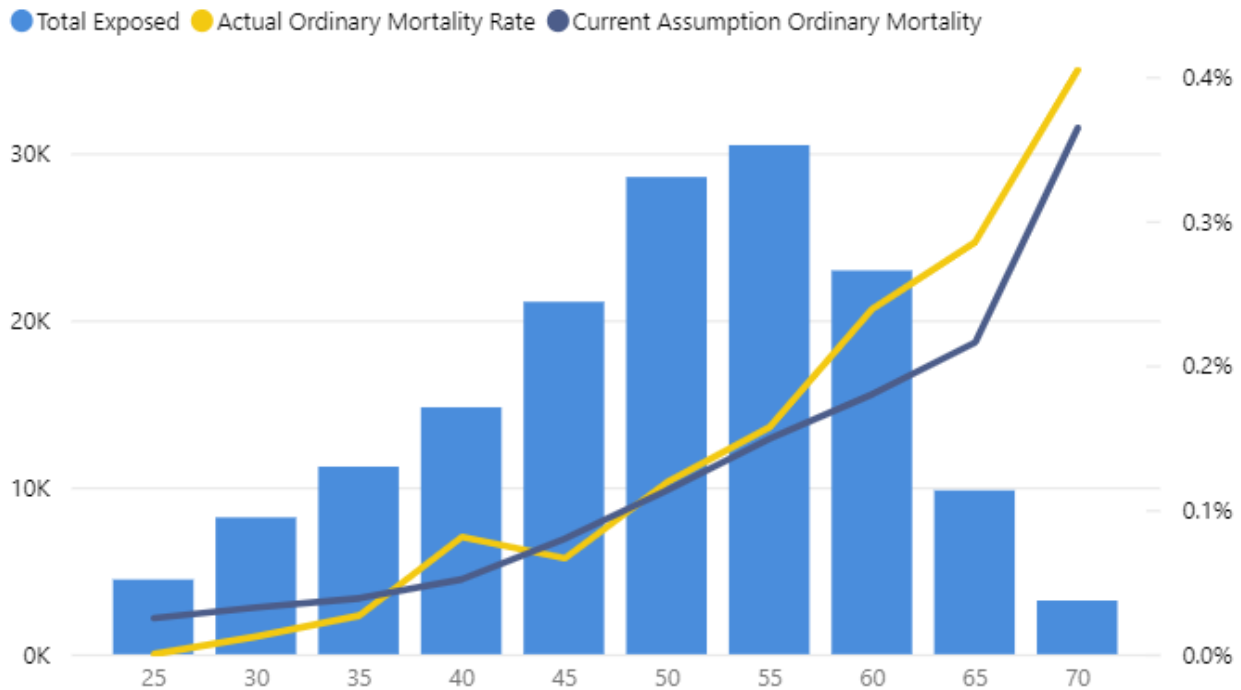
- Actual deaths were greater than expected (A/E ratio of 1.21).
- The difference was largest at older ages (A/E ratio of 1.33 for ages 50 - 74).

Females

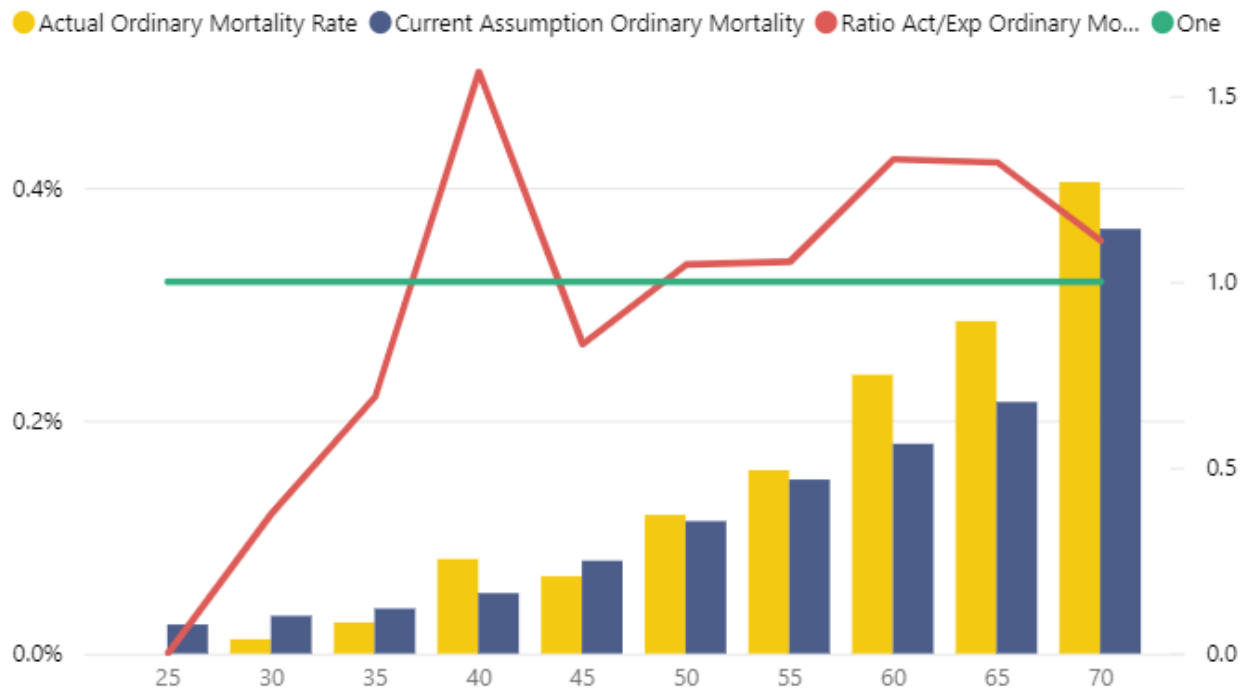
The following tables show the experience of ordinary death by age, for females, for the age range (25 to 74) and service range (0 to 49), during the period 2012 – 2019.

| Age (bins) | Actual Ordinary Deaths | Expected Ordinary Deaths | Total Exposed | Actual Ordinary Mortality Rate | Current Assumption Ordinary Mortality | Ratio Act/Exp Ordinary Mortality |
|--------------|------------------------|--------------------------|----------------|--------------------------------|---------------------------------------|----------------------------------|
| 25 | 0 | 1.1 | 4,472 | 0.0000% | 0.0249% | 0.00 |
| 30 | 1 | 2.7 | 8,187 | 0.0122% | 0.0324% | 0.38 |
| 35 | 3 | 4.3 | 11,229 | 0.0267% | 0.0386% | 0.69 |
| 40 | 12 | 7.7 | 14,781 | 0.0812% | 0.0518% | 1.57 |
| 45 | 14 | 16.8 | 21,100 | 0.0664% | 0.0797% | 0.83 |
| 50 | 34 | 32.5 | 28,570 | 0.1190% | 0.1137% | 1.05 |
| 55 | 48 | 45.5 | 30,481 | 0.1575% | 0.1494% | 1.05 |
| 60 | 55 | 41.4 | 22,974 | 0.2394% | 0.1801% | 1.33 |
| 65 | 28 | 21.2 | 9,810 | 0.2854% | 0.2160% | 1.32 |
| 70 | 13 | 11.7 | 3,211 | 0.4049% | 0.3646% | 1.11 |
| Total | 208 | 184.9 | 154,815 | 0.1344% | 0.1194% | 1.13 |

Exposure Distribution w/ Ordinary Mortality Rate - Actual and Expected; by Age



Ordinary Mortality Rate - Actual, Expected, and Ratio; by Age



Specific observations:

- Actual deaths were greater than expected (A/E ratio of 1.13).
- The difference was largest at older ages (A/E ratio of 1.29 for ages 60 - 74).

Postretirement Mortality

In addition to gender, the post-retirement mortality assumption varies by type of inactive member:

- 1) Service Retirees
- 2) Disabled Retirees
- 3) Contingent Beneficiaries

The MEST contains all retirees on one page and beneficiaries on another page. On the retiree page, the experience can be examined by status to review disabled retirees versus service retirees. Service retirees include members who have commenced their pension benefit from a terminated vested status. Vested members prior to commencement are included in the MEST but are essentially excluded in the analysis below.

Analogous to the pre-retirement death assumption, the mortality assumption involves two components: a base table and a mortality improvement scale. The mortality improvement scale adjusts the mortality rates of the base table to reflect that generally rates of mortality are anticipated to improve over time. The same mortality improvement scale applies to the post-retirement mortality base table that applies to the pre-retirement death base table. In this study the base table corresponds to the year 2012.

Many mortality studies have found that greater benefits are positively correlated with smaller mortality rates and longer life expectancy. Accordingly, the OA utilizes adjustment factors to convert post-retirement mortality weighted by headcounts to post-retirement mortality weighted by benefit amounts. The adjustment factors used by the OA are:

| Post-Retirement Mortality Adjustment Factor To Convert from Headcount-Weighted to Amount-Weighted | | |
|--|-------|---------|
| | Males | Females |
| Service Retiree | 0.980 | 0.980 |
| Disabled Retiree | 0.980 | 0.980 |
| Contingent Beneficiary | 0.890 | 0.951 |

We examined the implications of using both types of weights in the post-retirement mortality analysis. Pure mortality is the same as post-retirement mortality weighted by headcounts; pure mortality multiplied by the adjustment factor is post-retirement mortality weighted by benefit amount. The benefit amount weighting approach was not applied to the experience prior to 2015 because the historical database did not contain benefit amounts prior to 2015.

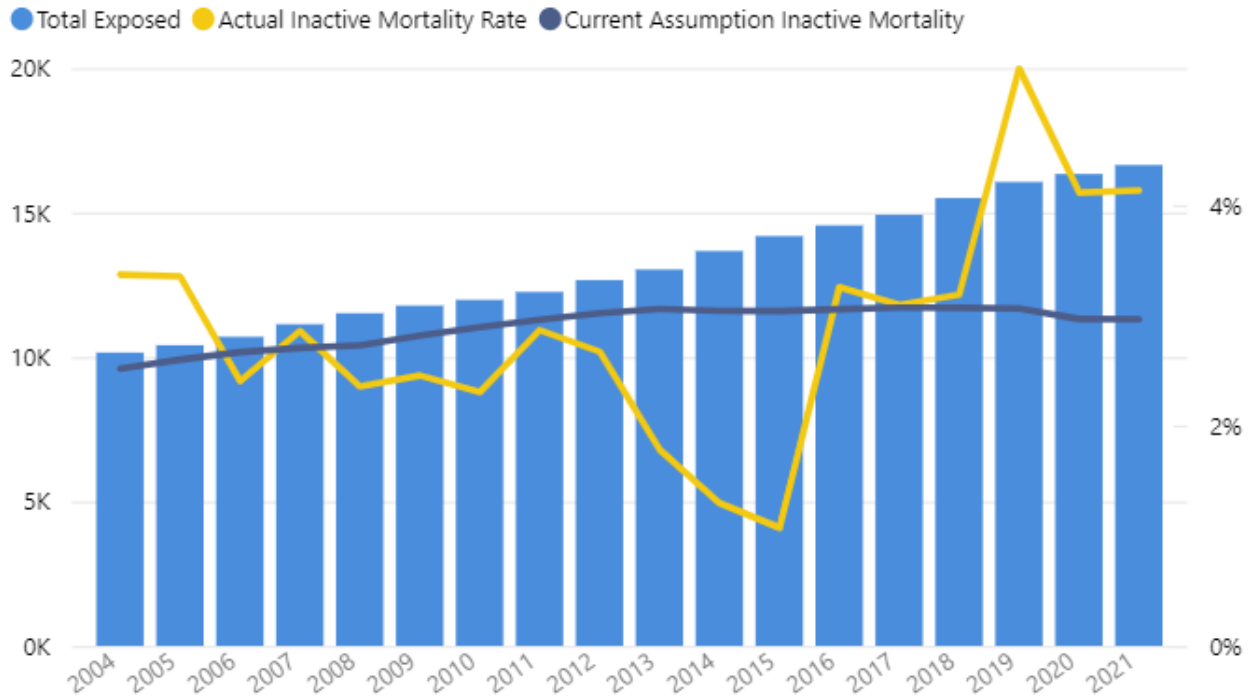
There is much discussion in the actuarial profession and among retirement systems about the development of mortality tables and treatment of excess deaths due to Covid that occurred in 2020 – 2022. The purpose of this analysis is to share our observations about the experience during the study period. In subsequent analyses, we will recommend changes to mortality assumptions as appropriate.

The charts by age are based on 5-year age brackets. For example, the age bracket 45 should be interpreted as the interval 45-49.

Postretirement Mortality – All Retirees

We noticed significant changes in the mortality experience of the retirees over time. During 2013 – 2015, the number of deaths decreased significantly. This was followed by a large spike in 2019. The following graph shows the experience on a headcount basis from 2004 – 2021.

Exposure Distribution w/ Inactive Mortality Rate - Actual and Expected; by Year



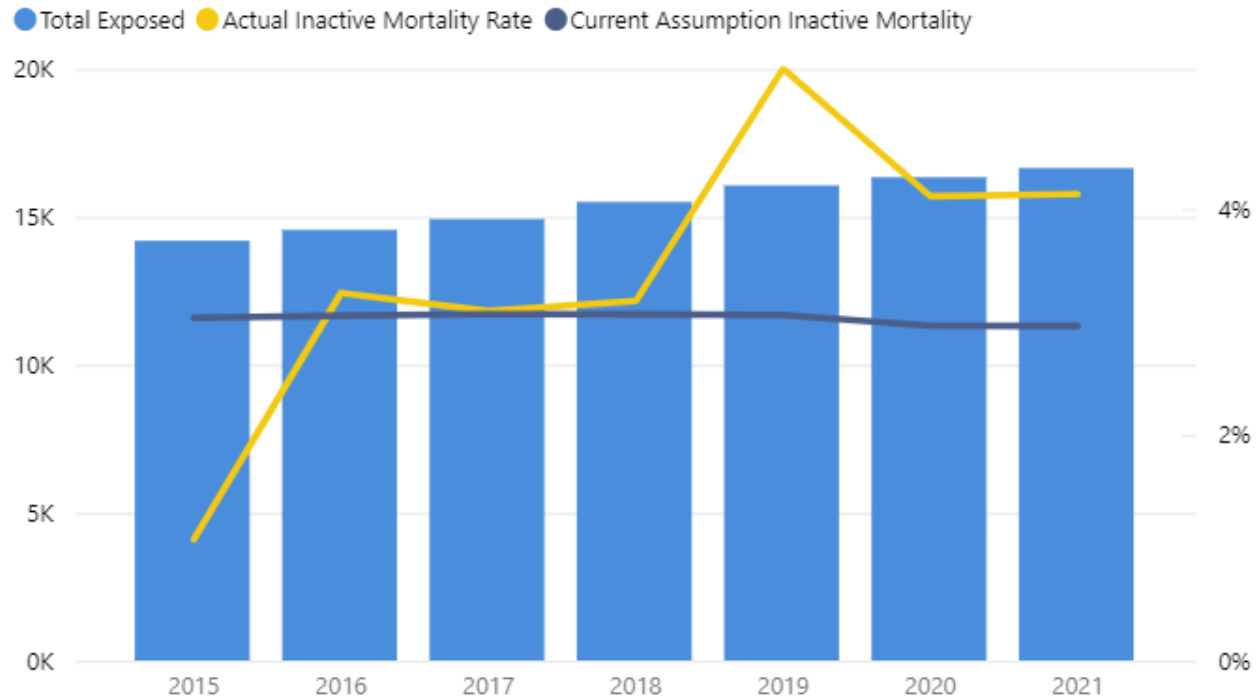
We don't know what generated these anomalous results; one potential cause is problems with the data. In the prior experience study report, it was noted that mortality data prior to 2016 was unreliable. Our analysis is based on the reported data without any adjustments.

Postretirement Mortality – Service Retirees

The following charts show postretirement mortality experience on a headcount-weighted basis by year and by age, for males and females combined, for the age range (55 to 99) during the period 2015 – 2021.

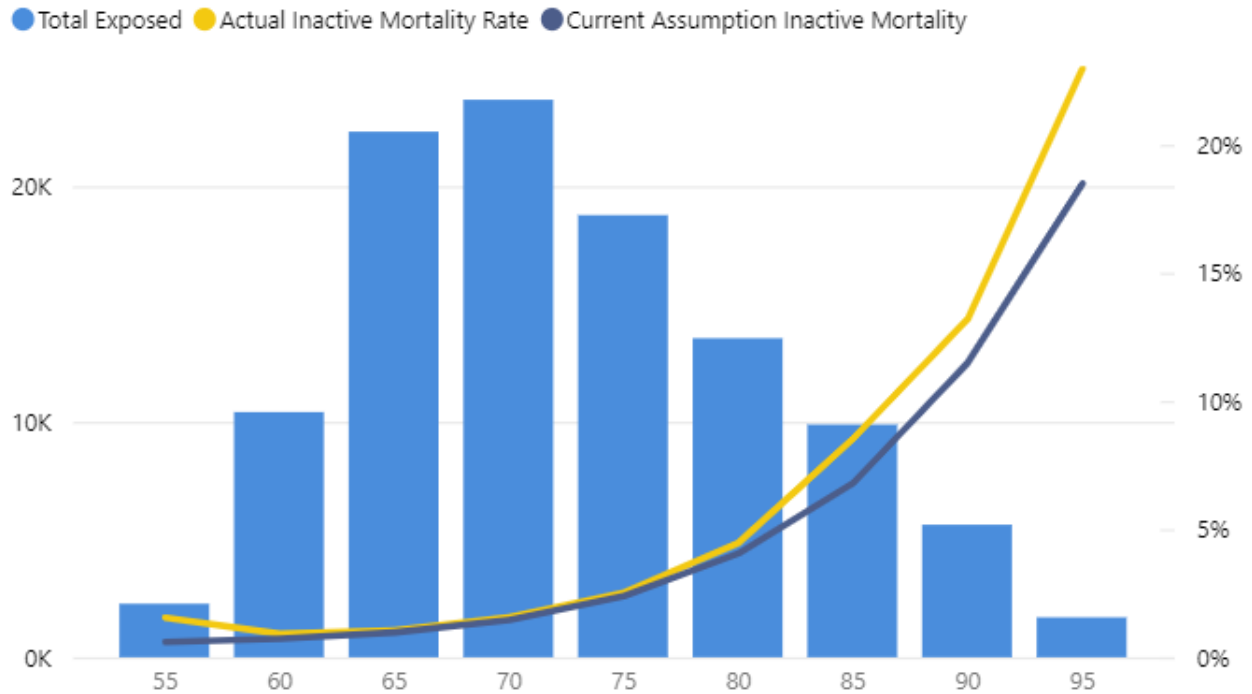
| Plan Year | Actual Inactive Deaths | Expected Inactive Deaths | Total Exposed | Actual Inactive Mortality Rate | Current Assumption Inactive Mortality | Ratio Act/Exp Inactive Mortality |
|--------------|------------------------|--------------------------|----------------|--------------------------------|---------------------------------------|----------------------------------|
| 2015 | 152 | 430.9 | 14,185 | 1.0716% | 3.0374% | 0.35 |
| 2016 | 474 | 444.5 | 14,554 | 3.2568% | 3.0544% | 1.07 |
| 2017 | 462 | 458.1 | 14,920 | 3.0965% | 3.0705% | 1.01 |
| 2018 | 494 | 475.5 | 15,501 | 3.1869% | 3.0675% | 1.04 |
| 2019 | 842 | 491.4 | 16,057 | 5.2438% | 3.0606% | 1.71 |
| 2020 | 672 | 484.5 | 16,333 | 4.1144% | 2.9664% | 1.39 |
| 2021 | 688 | 493.4 | 16,644 | 4.1336% | 2.9642% | 1.39 |
| Total | 3,784 | 3,278.3 | 108,194 | 3.4974% | 3.0300% | 1.15 |

Exposure Distribution w/ Inactive Mortality Rate - Actual and Expected; by Year

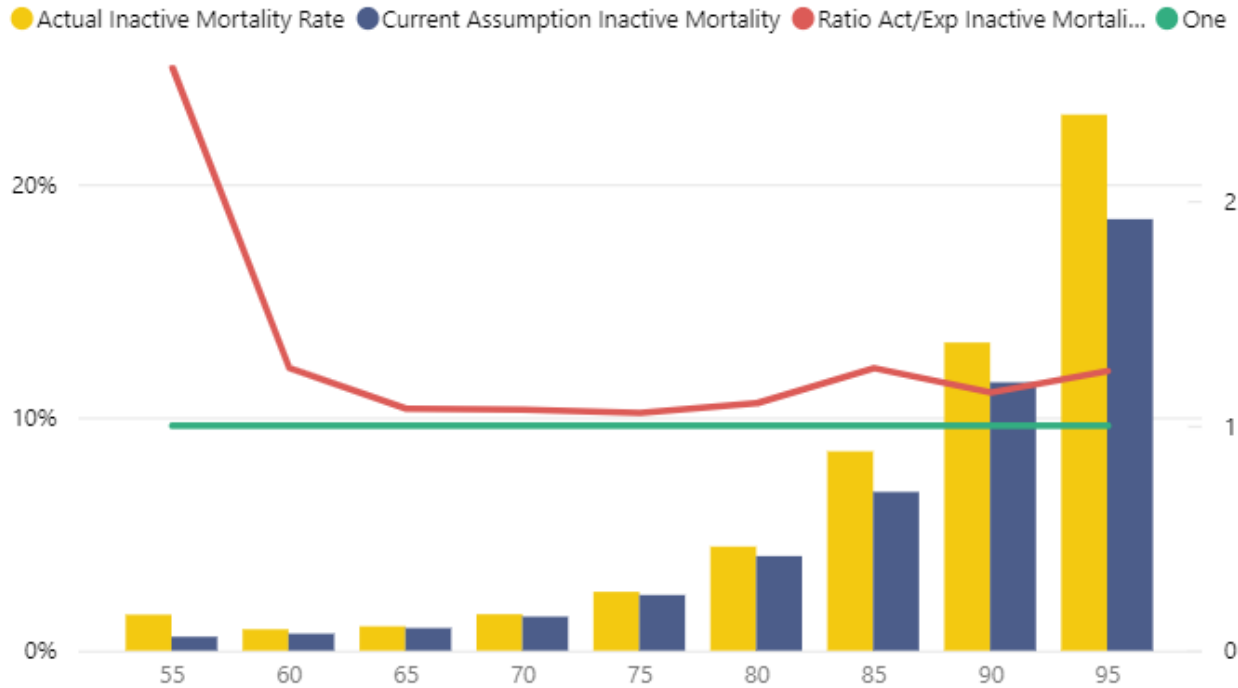


| Age (bins) | Actual Inactive Deaths | Expected Inactive Deaths | Total Exposed | Actual Inactive Mortality Rate | Current Assumption Inactive Mortality | Ratio Act/Exp Inactive Mortality |
|--------------|------------------------|--------------------------|----------------|--------------------------------|---------------------------------------|----------------------------------|
| 55 | 35 | 13.5 | 2,272 | 1.5405% | 0.5941% | 2.59 |
| 60 | 95 | 75.6 | 10,411 | 0.9125% | 0.7263% | 1.26 |
| 65 | 232 | 215.8 | 22,318 | 1.0395% | 0.9670% | 1.08 |
| 70 | 369 | 344.6 | 23,673 | 1.5587% | 1.4557% | 1.07 |
| 75 | 473 | 447.6 | 18,773 | 2.5196% | 2.3842% | 1.06 |
| 80 | 604 | 548.9 | 13,547 | 4.4586% | 4.0517% | 1.10 |
| 85 | 844 | 672.2 | 9,881 | 8.5416% | 6.8027% | 1.26 |
| 90 | 743 | 647.0 | 5,626 | 13.2065% | 11.5000% | 1.15 |
| 95 | 389 | 313.1 | 1,693 | 22.9770% | 18.4966% | 1.24 |
| Total | 3,784 | 3,278.3 | 108,194 | 3.4974% | 3.0300% | 1.15 |

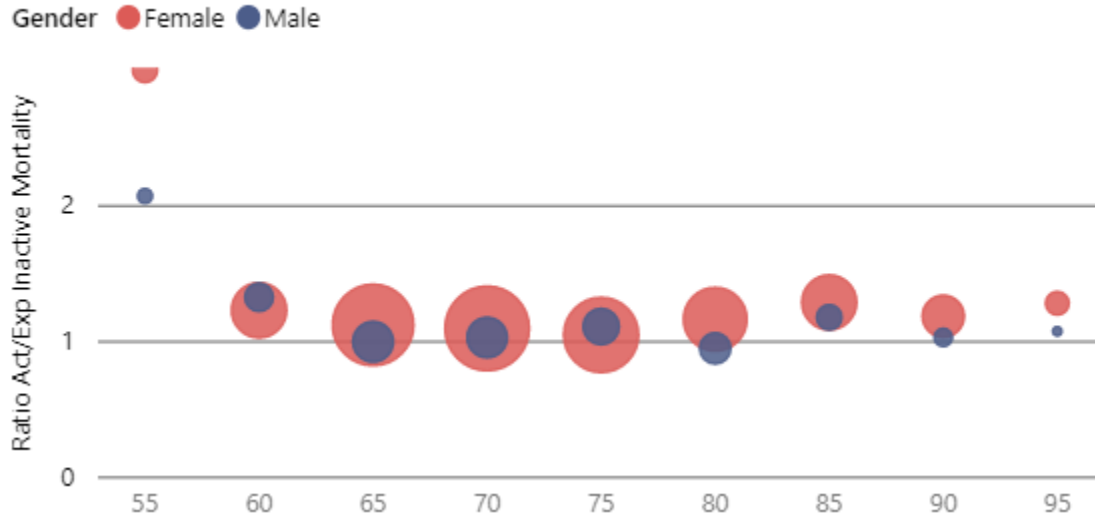
Exposure Distribution w/ Inactive Mortality Rate - Actual and Expected; by Age



Inactive Mortality Rate - Actual, Expected, and Ratio; by Age



Actual vs. Expected - Inactive Mortality Rate w/ Exposure Bubbles; by Age

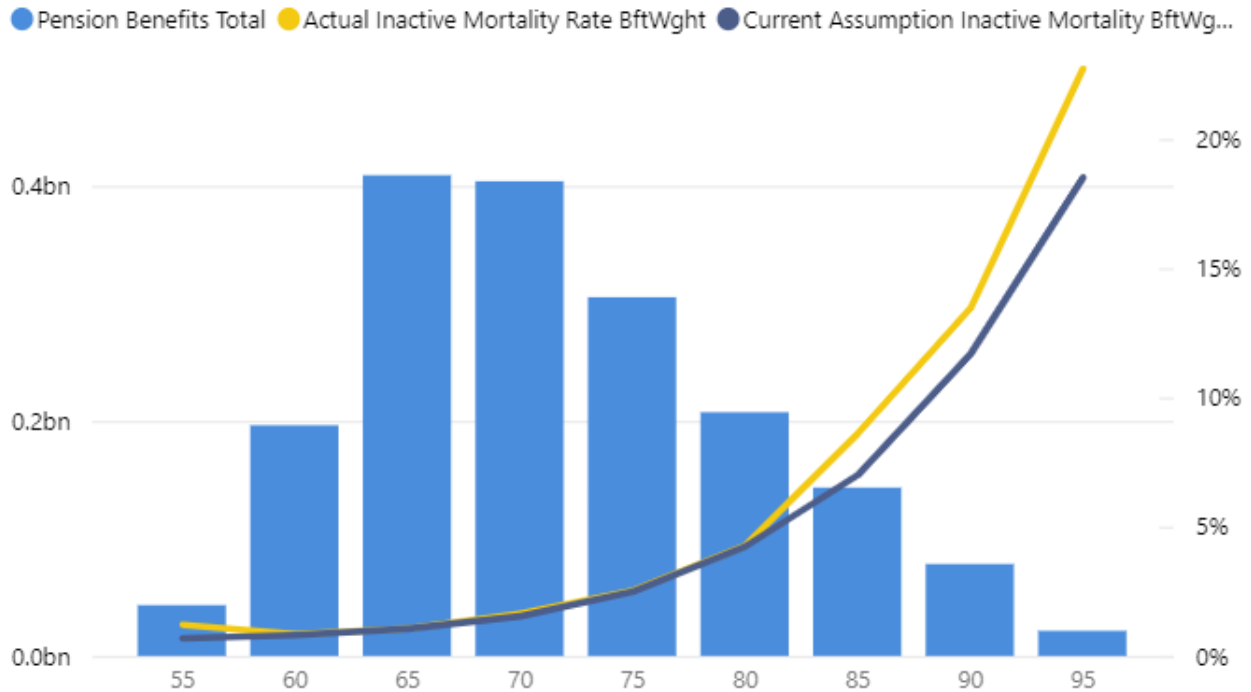


The following charts show postretirement mortality experience on an amount-weighted basis by year and by age, for males and females combined, for the age range (55 to 99), during the period 2015 – 2021.

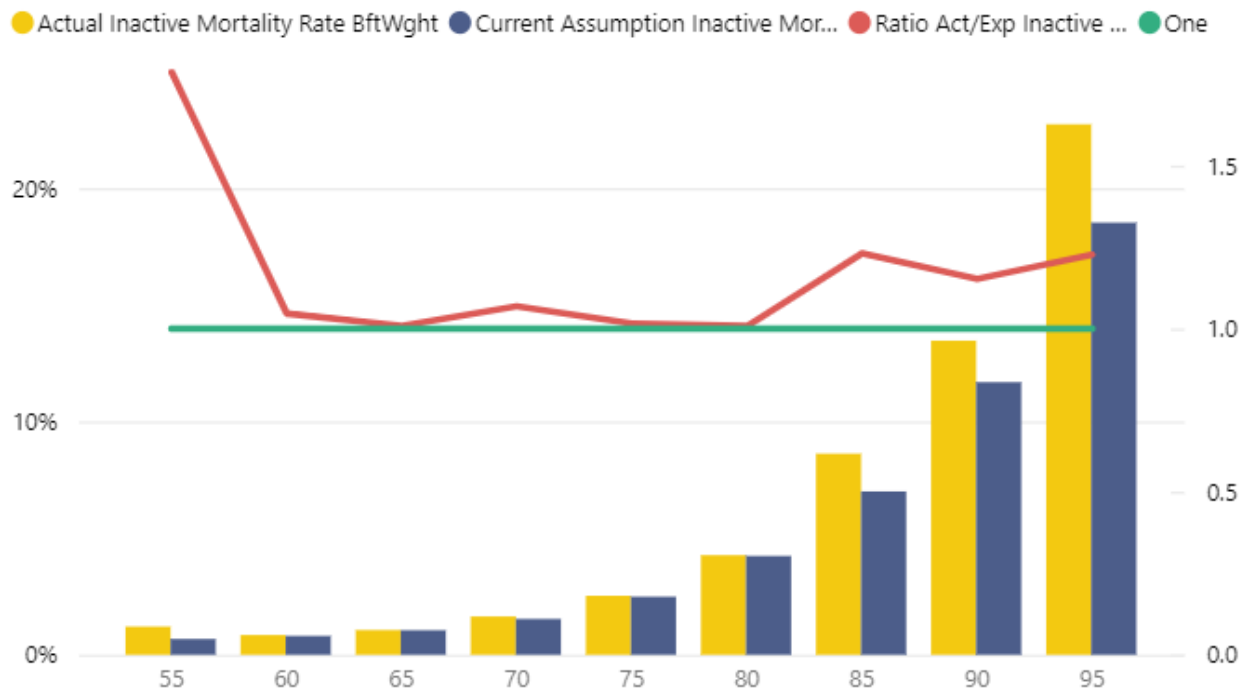
| Plan Year | Actual Svc. Retiree Benefits Released | Expected Inactive Benefits Released | Pension Benefits Total | Actual Inactive Mortality Rate BftWght | Current Assumption Inactive Mortality BftWght | Ratio Act/Exp Inactive Mortality BftWght |
|--------------|---------------------------------------|-------------------------------------|------------------------|--|---|--|
| 2015 | 2,149K | 6,530K | 226,693K | 0.9480% | 2.8804% | 0.33 |
| 2016 | 7,082K | 6,877K | 237,652K | 2.9799% | 2.8937% | 1.03 |
| 2017 | 7,045K | 7,123K | 245,019K | 2.8754% | 2.9071% | 0.99 |
| 2018 | 7,388K | 7,470K | 256,008K | 2.8859% | 2.9178% | 0.99 |
| 2019 | 12,778K | 7,825K | 270,852K | 4.7178% | 2.8890% | 1.63 |
| 2020 | 10,312K | 7,781K | 279,148K | 3.6942% | 2.7873% | 1.33 |
| 2021 | 10,669K | 8,254K | 291,976K | 3.6540% | 2.8268% | 1.29 |
| Total | 57,423K | 51,858K | 1,807,348K | 3.1772% | 2.8693% | 1.11 |

| Age (bins) | Actual Inactive Benefits Released | Expected Inactive Benefits Released | Pension Benefits Total | Actual Inactive Mortality Rate BftWght | Current Assumption Inactive Mortality BftWght | Ratio Act/Exp Inactive Mortality BftWght |
|--------------|-----------------------------------|-------------------------------------|------------------------|--|---|--|
| 55 | 521K | 291K | 43,173K | 1.2071% | 0.6749% | 1.79 |
| 60 | 1,657K | 1,584K | 196,200K | 0.8448% | 0.8072% | 1.05 |
| 65 | 4,334K | 4,296K | 408,909K | 1.0598% | 1.0506% | 1.01 |
| 70 | 6,624K | 6,200K | 403,819K | 1.6404% | 1.5353% | 1.07 |
| 75 | 7,714K | 7,593K | 305,174K | 2.5277% | 2.4882% | 1.02 |
| 80 | 8,847K | 8,779K | 207,325K | 4.2673% | 4.2343% | 1.01 |
| 85 | 12,344K | 10,025K | 143,204K | 8.6198% | 7.0004% | 1.23 |
| 90 | 10,527K | 9,135K | 78,193K | 13.4631% | 11.6831% | 1.15 |
| 95 | 4,855K | 3,955K | 21,350K | 22.7380% | 18.5224% | 1.23 |
| Total | 57,423K | 51,858K | 1,807,348K | 3.1772% | 2.8693% | 1.11 |

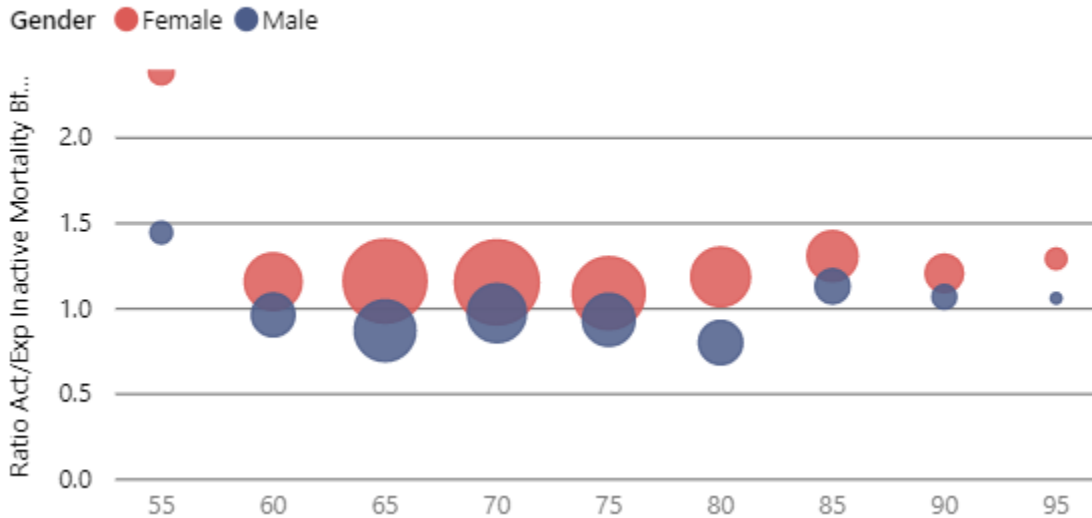
Pension Benefit Distribution w/ Inactive Mortality Rate - Actual and Expected; by Age



Inactive Mortality Rate - Actual, Expected, and Ratio; by Age



Actual vs. Expected - Inactive Mortality Rate w/ Benefit Bubbles; by Age



Specific observations:

- From 2015 - 2021, the actual number of deaths was greater than expected on a headcount basis (A/E ratio of 1.15) and a benefit basis (A/E ratio of 1.11).
- The largest difference between the number of actual and expected deaths occurred during 2020 – 2021 (A/E ratio of 1.31 on a benefits basis).
- During 2019, actual deaths exceeded the assumption by 71% on a headcount basis (A/E ratio of 1.71) and 63% on a benefits basis (A/E ratio 1.63). We don't know whether a potential data clean-up triggered the recording of a significant number of deaths during this year.
- For males, the rate of mortality on an amount-weighted basis was 83.1% of the rate of mortality on a headcount-weighted basis, versus the ratio on an expected basis of 91.4%. The assumed percentage is 98%. The actual weighting of benefits will result in a difference from the assumed percentage.
- For females, the rate of mortality on an amount-weighted basis was 91.6% of the rate of mortality on a headcount-weighted basis, versus the ratio on an expected basis of 90.0%. The assumed percentage is 98%. The actual weighting of benefits will result in a difference from the assumed percentage.
- The mortality rates of members retiring directly from active service are lower than the mortality rates of members commencing a pension benefit from vested status, although the number of deaths of the latter is minimal.

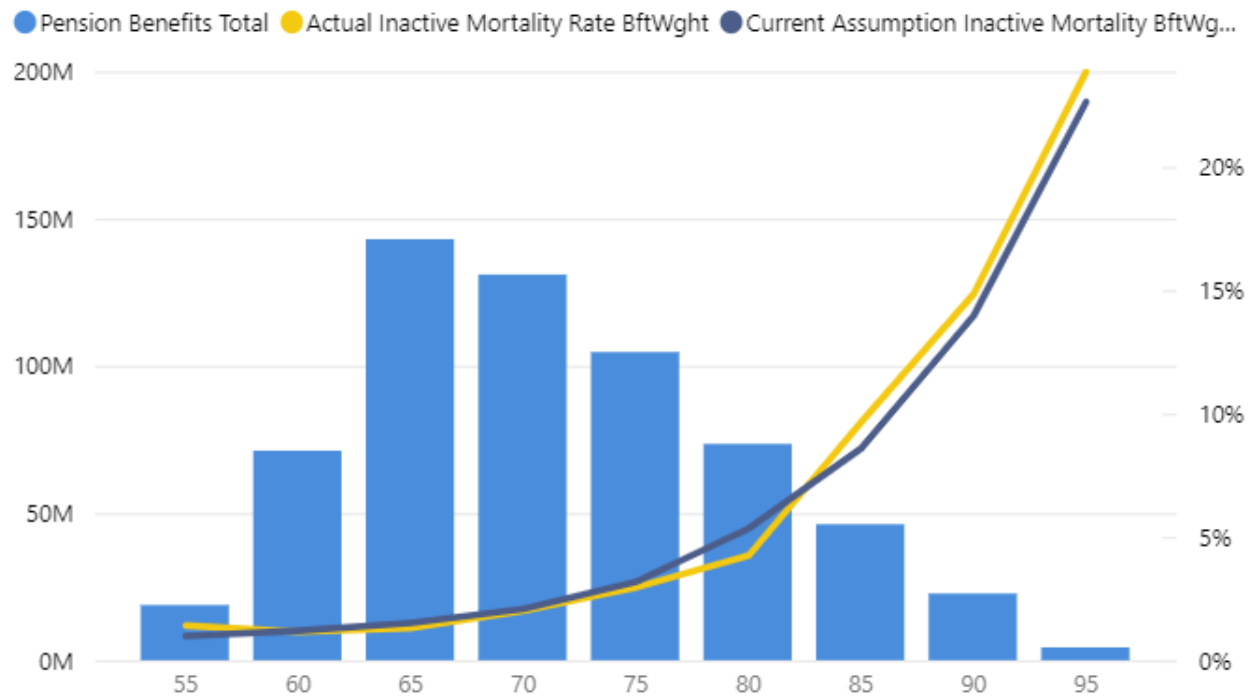
Although data reliability and the relatively high rates of mortality during 2020 and 2021 could be questionable, the following analysis is based on data from the period 2015 – 2021.

Service Retirees - Males

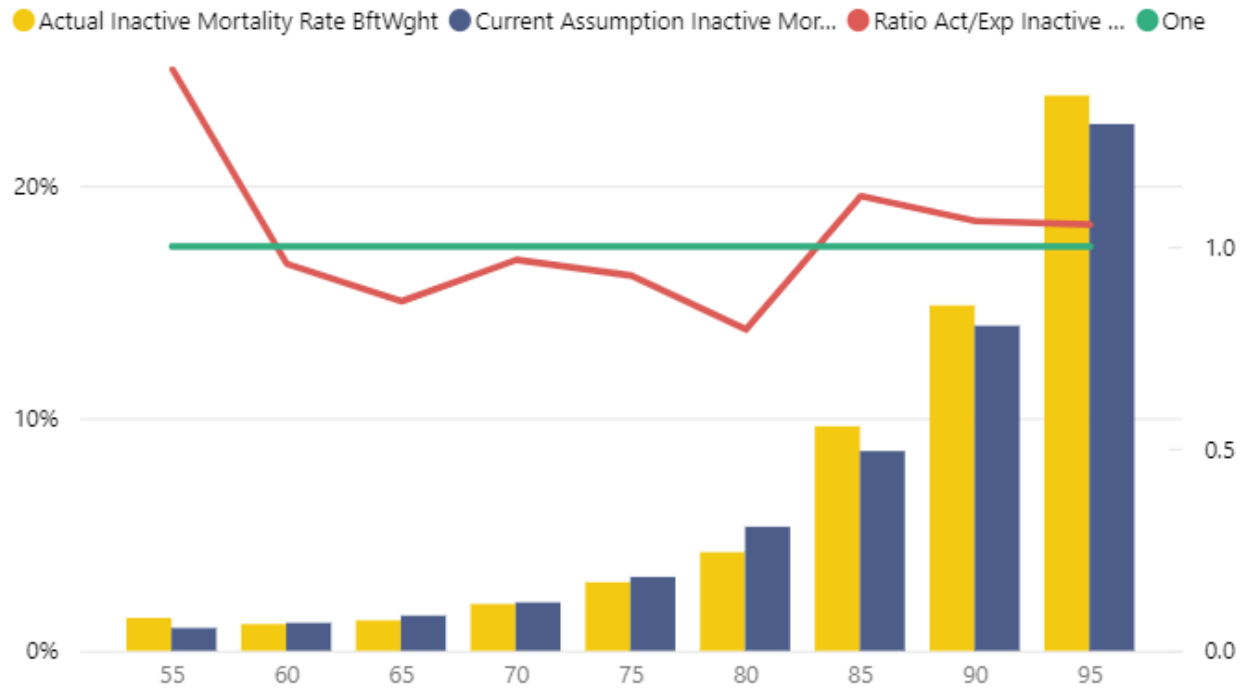
The following charts show postretirement mortality experience on an amount-weighted basis by age, for males, for the age range (55 to 99), during the period 2015 – 2021.

| Age (bins) | Actual Inactive Benefits Released | Expected Inactive Benefits Released | Pension Benefits Total | Actual Inactive Mortality Rate BftWght | Current Assumption Inactive Mortality BftWght | Ratio Act/Exp Inactive Mortality BftWght |
|--------------|-----------------------------------|-------------------------------------|------------------------|--|---|--|
| 55 | 263K | 183K | 18,736K | 1.4057% | 0.9770% | ▲ 1.44 |
| 60 | 815K | 852K | 71,166K | 1.1453% | 1.1973% | ● 0.96 |
| 65 | 1,864K | 2,157K | 143,010K | 1.3032% | 1.5085% | ▲ 0.86 |
| 70 | 2,629K | 2,719K | 131,004K | 2.0069% | 2.0752% | ● 0.97 |
| 75 | 3,081K | 3,320K | 104,676K | 2.9433% | 3.1719% | ● 0.93 |
| 80 | 3,112K | 3,916K | 73,473K | 4.2350% | 5.3299% | ▲ 0.79 |
| 85 | 4,455K | 3,962K | 46,180K | 9.6462% | 8.5797% | ▲ 1.12 |
| 90 | 3,364K | 3,166K | 22,665K | 14.8401% | 13.9663% | ● 1.06 |
| 95 | 1,043K | 990K | 4,372K | 23.8642% | 22.6389% | ● 1.05 |
| Total | 20,626K | 21,265K | 615,282K | 3.3522% | 3.4561% | ● 0.97 |

Pension Benefit Distribution w/ Inactive Mortality Rate - Actual and Expected; by Age



Inactive Mortality Rate - Actual, Expected, and Ratio; by Age



Specific observations:

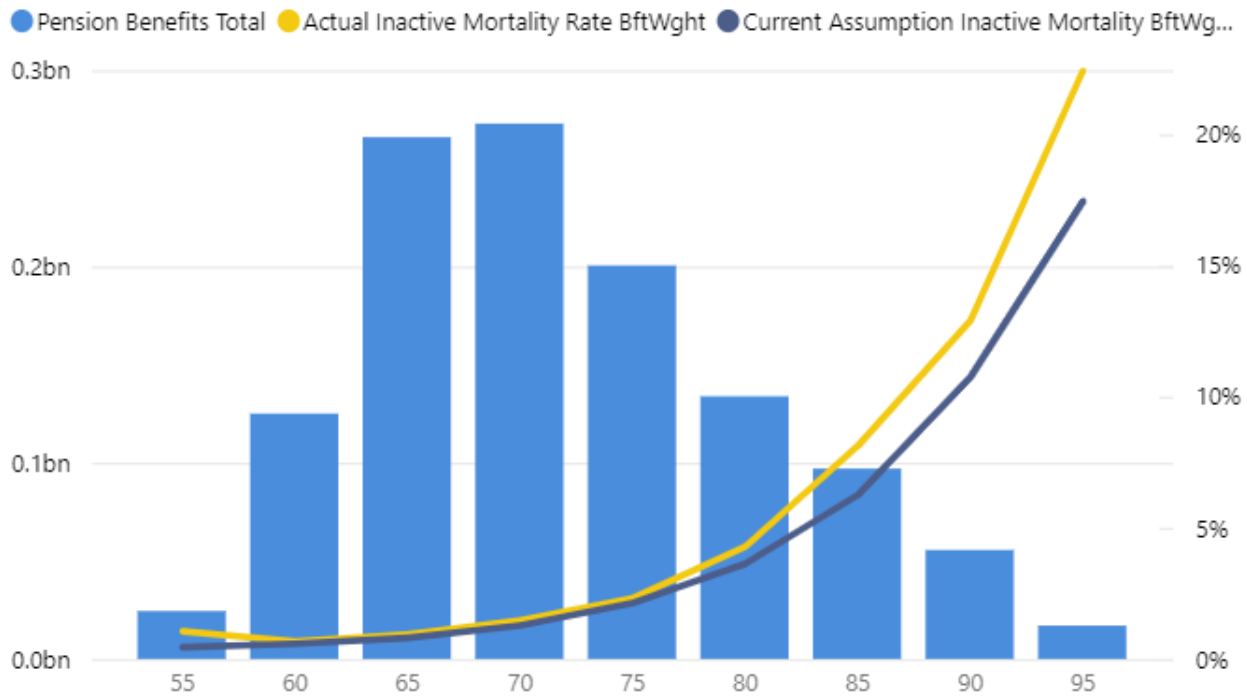
- From 2015 - 2021, the actual number of male deaths was greater than expected on a headcount basis (A/E ratio of 1.07), but less than expected on a benefit basis (A/E ratio of 0.97).
- From 2016 - 2018, the A/E ratios were 0.84 and 0.79, respectively.

Service Retirees - Females

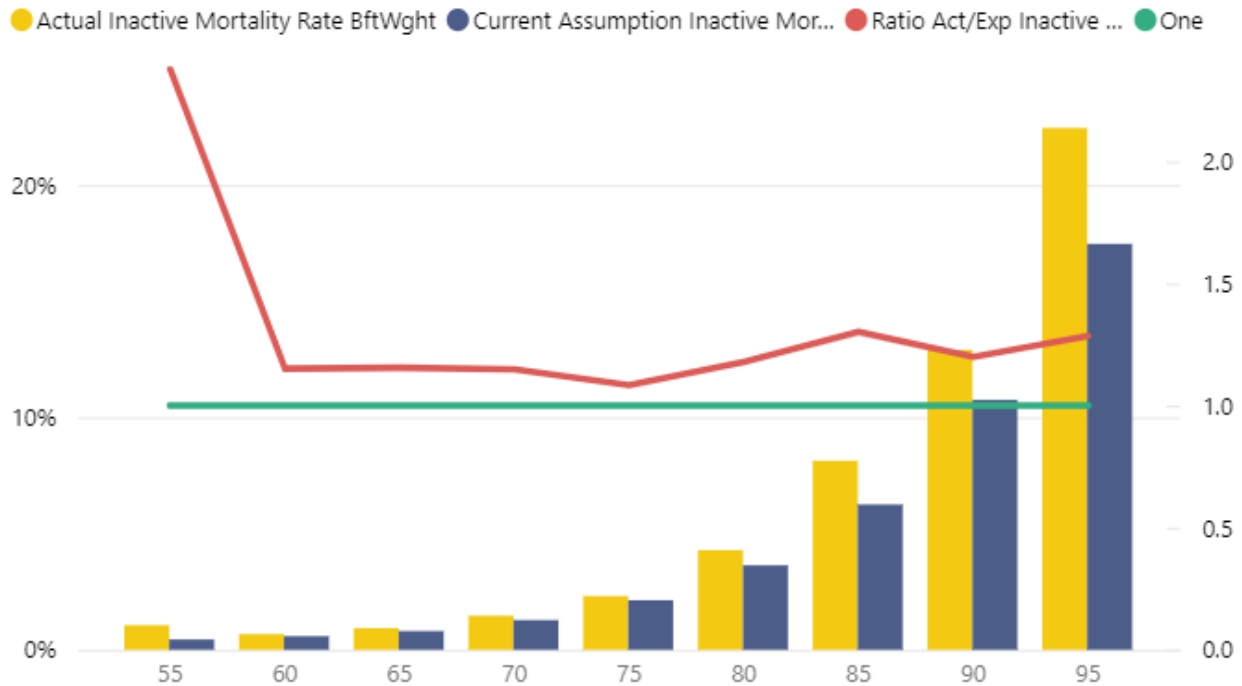
The following charts show postretirement mortality experience on an amount-weighted basis by age, for males, for the age range (55 to 99), during the period 2015 – 2021.

| Age (bins) | Actual Inactive Benefits Released | Expected Inactive Benefits Released | Pension Benefits Total | Actual Inactive Mortality Rate BftWght | Current Assumption Inactive Mortality BftWght | Ratio Act/Exp Inactive Mortality BftWght |
|--------------|-----------------------------------|-------------------------------------|------------------------|--|---|--|
| 55 | 258K | 108K | 24,437K | 1.0549% | 0.4433% | 2.38 |
| 60 | 842K | 732K | 125,034K | 0.6737% | 0.5852% | 1.15 |
| 65 | 2,470K | 2,139K | 265,899K | 0.9289% | 0.8044% | 1.15 |
| 70 | 3,995K | 3,481K | 272,816K | 1.4644% | 1.2761% | 1.15 |
| 75 | 4,633K | 4,273K | 200,498K | 2.3108% | 2.1314% | 1.08 |
| 80 | 5,736K | 4,863K | 133,852K | 4.2850% | 3.6330% | 1.18 |
| 85 | 7,889K | 6,063K | 97,024K | 8.1313% | 6.2488% | 1.30 |
| 90 | 7,164K | 5,970K | 55,528K | 12.9011% | 10.7511% | 1.20 |
| 95 | 3,811K | 2,965K | 16,978K | 22.4480% | 17.4622% | 1.29 |
| Total | 36,798K | 30,594K | 1,192,066K | 3.0869% | 2.5665% | 1.20 |

Pension Benefit Distribution w/ Inactive Mortality Rate - Actual and Expected; by Age



Inactive Mortality Rate - Actual, Expected, and Ratio; by Age



Specific observations:

- From 2015 - 2021, the actual number of female deaths was greater than expected on a headcount basis (A/E ratio of 1.18) and a benefit basis (A/E ratio of 1.20).
- From 2016 - 2018, A/E ratios were 1.10 and 1.15, respectively.

Postretirement Mortality – Disability Retirees

The following charts show postretirement mortality experience on a headcount-weighted basis and amount-weighted basis by year and by age, for males and females combined, for the age range (45 to 94), during the period 2015 – 2021.

| Plan Year | Actual Inactive Deaths | Expected Inactive Deaths | Total Exposed | Actual Inactive Mortality Rate | Current Assumption Inactive Mortality | Ratio Act/Exp Inactive Mortality |
|--------------|------------------------|--------------------------|---------------|--------------------------------|---------------------------------------|----------------------------------|
| 2015 | 11 | 28.4 | 1,043 | 1.0547% | 2.7208% | 0.39 |
| 2016 | 34 | 30.2 | 1,098 | 3.0965% | 2.7532% | 1.12 |
| 2017 | 36 | 32.8 | 1,175 | 3.0638% | 2.7875% | 1.10 |
| 2018 | 37 | 35.5 | 1,276 | 2.8997% | 2.7816% | 1.04 |
| 2019 | 76 | 38.4 | 1,362 | 5.5800% | 2.8195% | 1.98 |
| 2020 | 68 | 39.5 | 1,396 | 4.8711% | 2.8293% | 1.72 |
| 2021 | 57 | 39.0 | 1,385 | 4.1155% | 2.8194% | 1.46 |
| Total | 319 | 243.8 | 8,735 | 3.6520% | 2.7911% | 1.31 |

| Plan Year | Actual Inactive Benefits Released | Expected Inactive Benefits Released | Pension Benefits Total | Actual Inactive Mortality Rate BftWght | Current Assumption Inactive Mortality BftWght | Ratio Act/Exp Inactive Mortality BftWght |
|--------------|-----------------------------------|-------------------------------------|------------------------|--|---|--|
| 2015 | 336K | 376K | 13,824K | 2.4321% | 2.7201% | 0.89 |
| 2016 | 477K | 411K | 15,073K | 3.1620% | 2.7298% | 1.16 |
| 2017 | 454K | 442K | 15,912K | 2.8550% | 2.7797% | 1.03 |
| 2018 | 605K | 470K | 16,963K | 3.5692% | 2.7727% | 1.29 |
| 2019 | 1,255K | 511K | 18,178K | 6.9066% | 2.8120% | 2.46 |
| 2020 | 878K | 529K | 18,649K | 4.7054% | 2.8356% | 1.66 |
| 2021 | 1,047K | 529K | 18,724K | 5.5935% | 2.8269% | 1.98 |
| Total | 5,053K | 3,269K | 117,323K | 4.3068% | 2.7867% | 1.55 |

Specific observations:

- From 2015 - 2021, the actual number of deaths was greater than expected on both a headcount basis (A/E ratio of 1.31) and a benefit basis (A/E ratio of 1.55).
- From 2016 - 2018, A/E ratios were 1.09 and 1.16, respectively.
- For males, the rate of mortality on an amount-weighted basis was 100.9% of the rate of mortality on a headcount-weighted basis, versus the ratio on an expected basis of 100.1%. The assumed percentage is 100%. The actual weighting of benefits will result in a difference from the assumed percentage.
- For females, the rate of mortality on an amount-weighted basis was 122.9% of the rate of mortality on a headcount-weighted basis, versus the ratio on an expected basis of 96.2%. The assumed percentage is 96%. The actual weighting of benefits will result in a

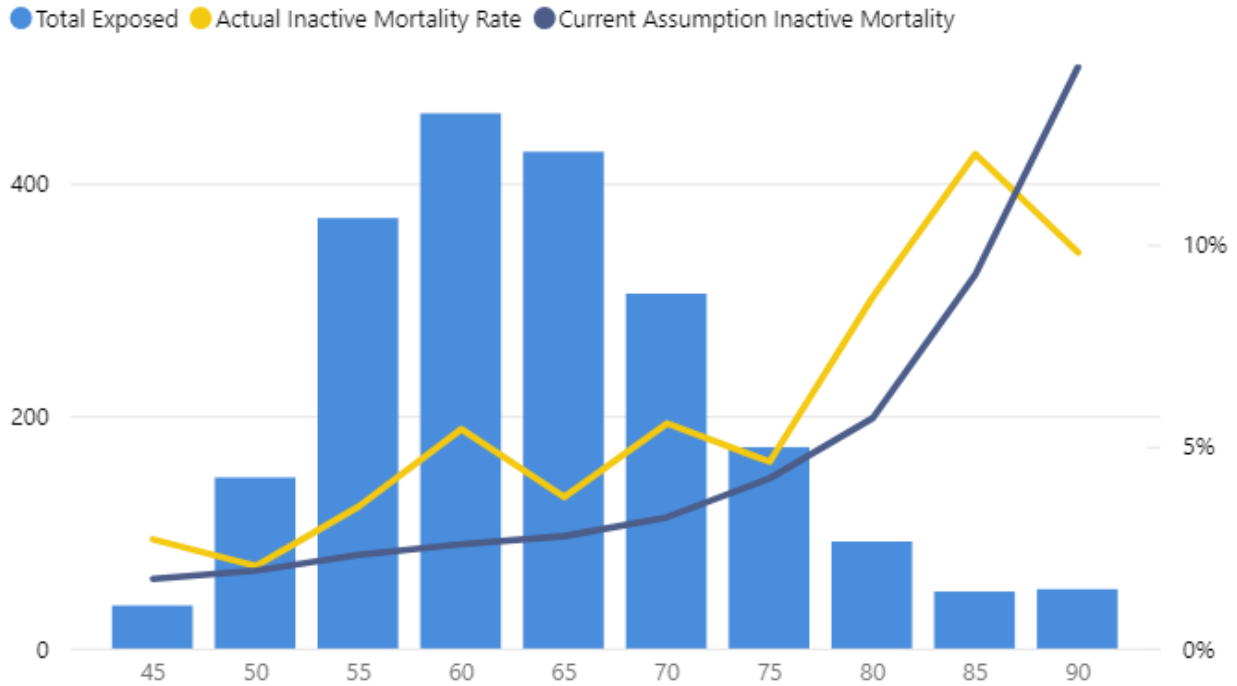
difference from the assumed percentage. This unexpected result indicates that members with higher benefits had significantly higher rates of mortality than members with lower benefits.

Disabled Retirees - Males

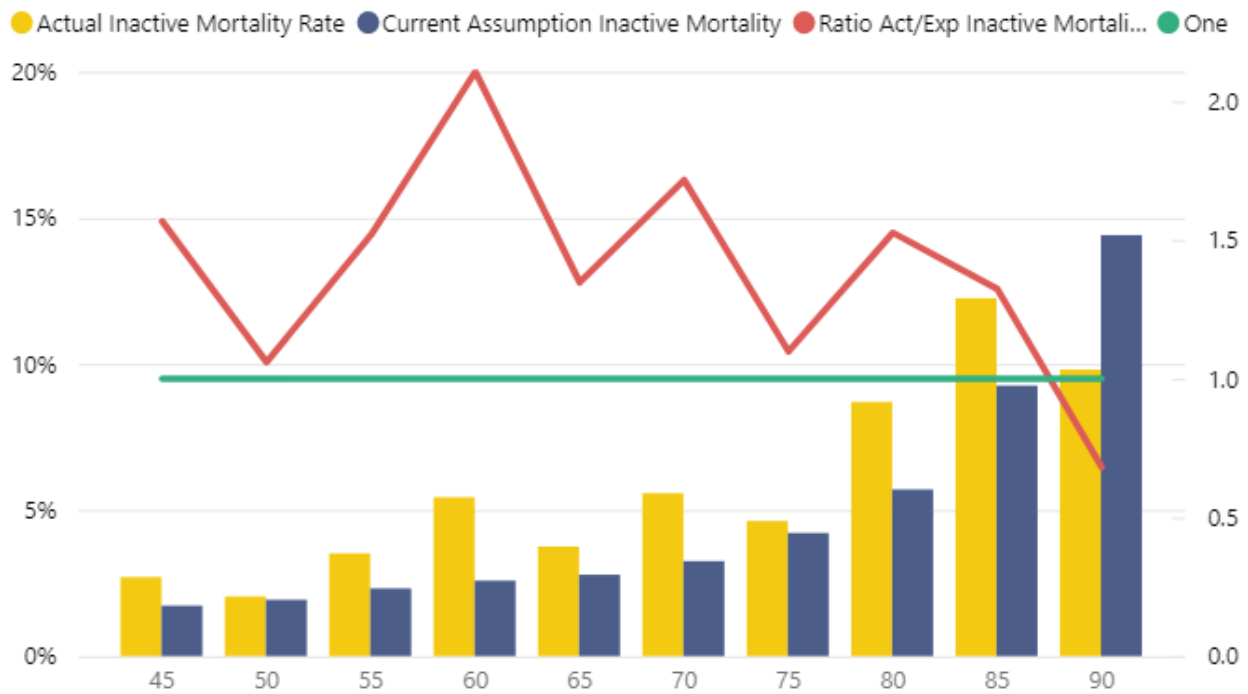
The following charts show postretirement mortality experience on a headcount-weighted basis by age, for males, for the age range (45 to 94), during the period 2015 – 2021.

| Age (bins) | Actual Inactive Deaths | Expected Inactive Deaths | Total Exposed | Actual Inactive Mortality Rate | Current Assumption Inactive Mortality | Ratio Act/Exp Inactive Mortality |
|--------------|------------------------|--------------------------|---------------|--------------------------------|---------------------------------------|----------------------------------|
| 45 | 1 | 0.6 | 37 | 2.7027% | 1.7249% | 1.57 |
| 50 | 3 | 2.8 | 147 | 2.0408% | 1.9262% | 1.06 |
| 55 | 13 | 8.6 | 370 | 3.5135% | 2.3154% | 1.52 |
| 60 | 25 | 11.9 | 460 | 5.4348% | 2.5802% | 2.11 |
| 65 | 16 | 11.9 | 427 | 3.7471% | 2.7819% | 1.35 |
| 70 | 17 | 9.9 | 305 | 5.5738% | 3.2492% | 1.72 |
| 75 | 8 | 7.3 | 173 | 4.6243% | 4.2119% | 1.10 |
| 80 | 8 | 5.2 | 92 | 8.6957% | 5.7000% | 1.53 |
| 85 | 6 | 4.5 | 49 | 12.2449% | 9.2559% | 1.32 |
| 90 | 5 | 7.3 | 51 | 9.8039% | 14.4043% | 0.68 |
| Total | 102 | 70.1 | 2,111 | 4.8318% | 3.3210% | 1.45 |

Exposure Distribution w/ Inactive Mortality Rate - Actual and Expected; by Age



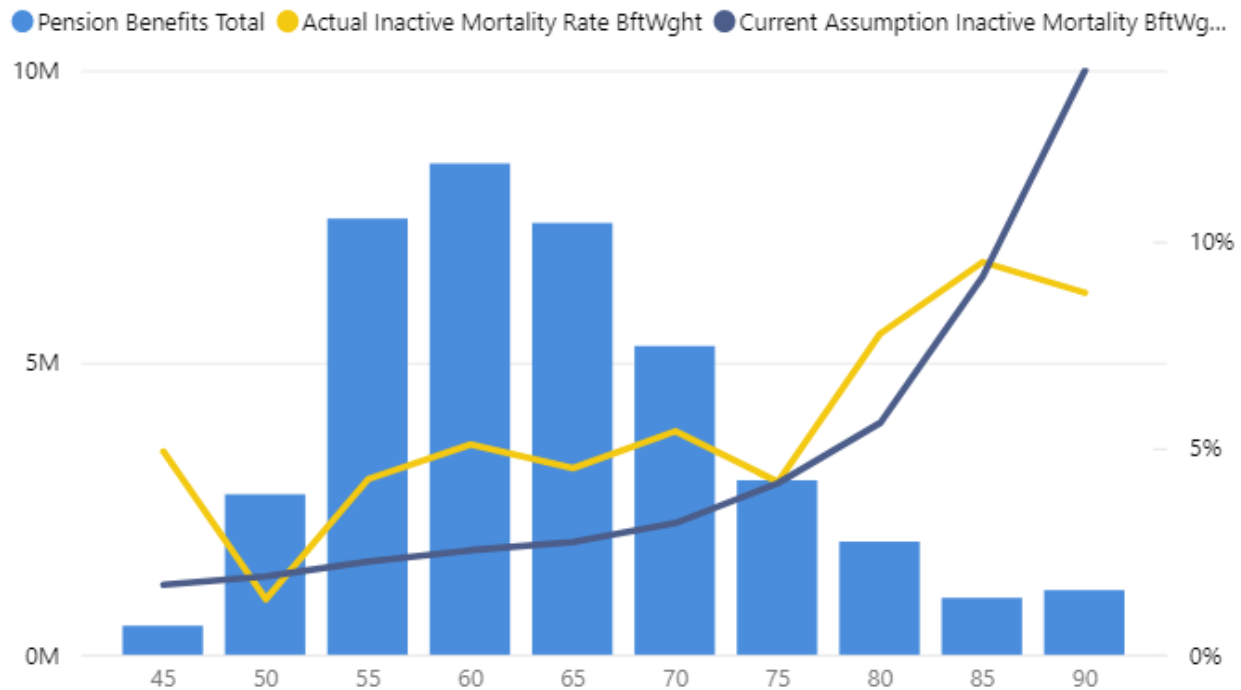
Inactive Mortality Rate - Actual, Expected, and Ratio; by Age



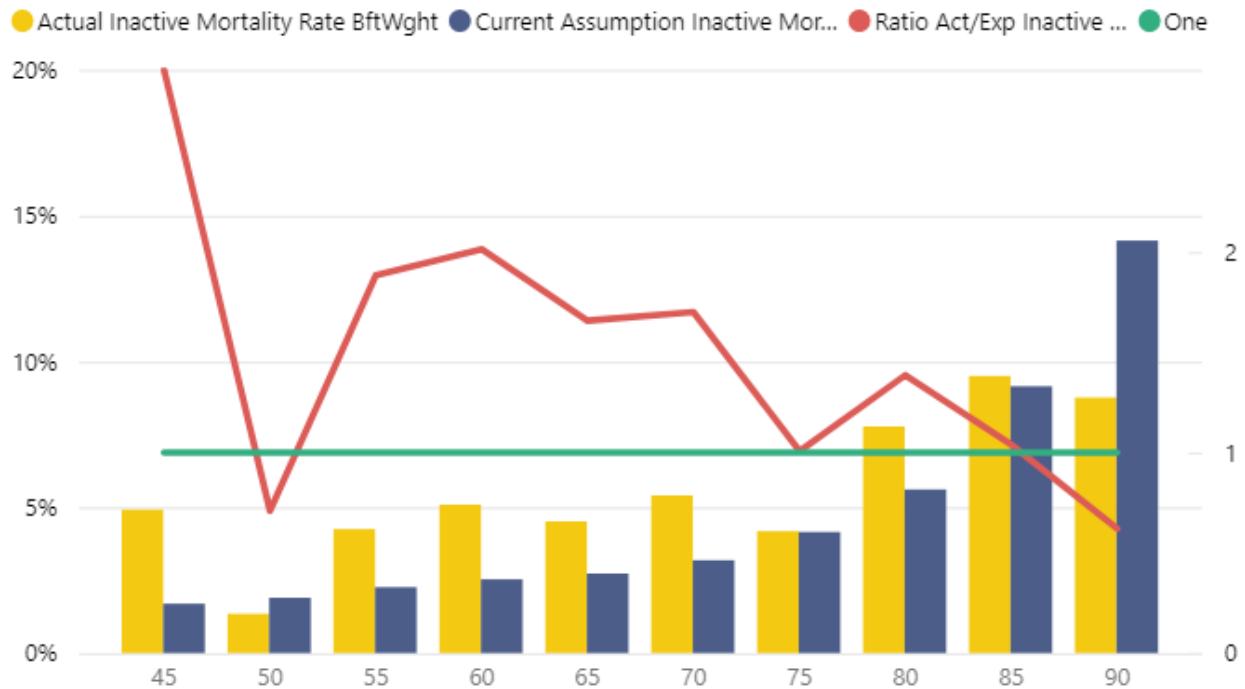
The following charts show postretirement mortality experience on an amount-weighted basis by age, for males, for the age range (45 to 94), during the period 2015 – 2021.

| Age (bins) | Actual Inactive Benefits Released | Expected Inactive Benefits Released | Pension Benefits Total | Actual Inactive Mortality Rate BftWght | Current Assumption Inactive Mortality BftWght | Ratio Act/Exp Inactive Mortality BftWght |
|--------------|-----------------------------------|-------------------------------------|------------------------|--|---|--|
| 45 | 24K | 8K | 496K | 4.9180% | 1.6915% | 2.91 |
| 50 | 37K | 52K | 2,744K | 1.3443% | 1.8946% | 0.71 |
| 55 | 317K | 168K | 7,462K | 4.2501% | 2.2573% | 1.88 |
| 60 | 428K | 212K | 8,405K | 5.0877% | 2.5282% | 2.01 |
| 65 | 334K | 201K | 7,387K | 4.5156% | 2.7256% | 1.66 |
| 70 | 286K | 168K | 5,283K | 5.4084% | 3.1827% | 1.70 |
| 75 | 125K | 124K | 2,985K | 4.1779% | 4.1502% | 1.01 |
| 80 | 150K | 109K | 1,935K | 7.7703% | 5.6088% | 1.39 |
| 85 | 92K | 89K | 973K | 9.5006% | 9.1479% | 1.04 |
| 90 | 97K | 156K | 1,104K | 8.7597% | 14.1443% | 0.62 |
| Total | 1,890K | 1,288K | 38,775K | 4.8733% | 3.3228% | 1.47 |

Pension Benefit Distribution w/ Inactive Mortality Rate - Actual and Expected; by Age



Inactive Mortality Rate - Actual, Expected, and Ratio; by Age



Specific observations:

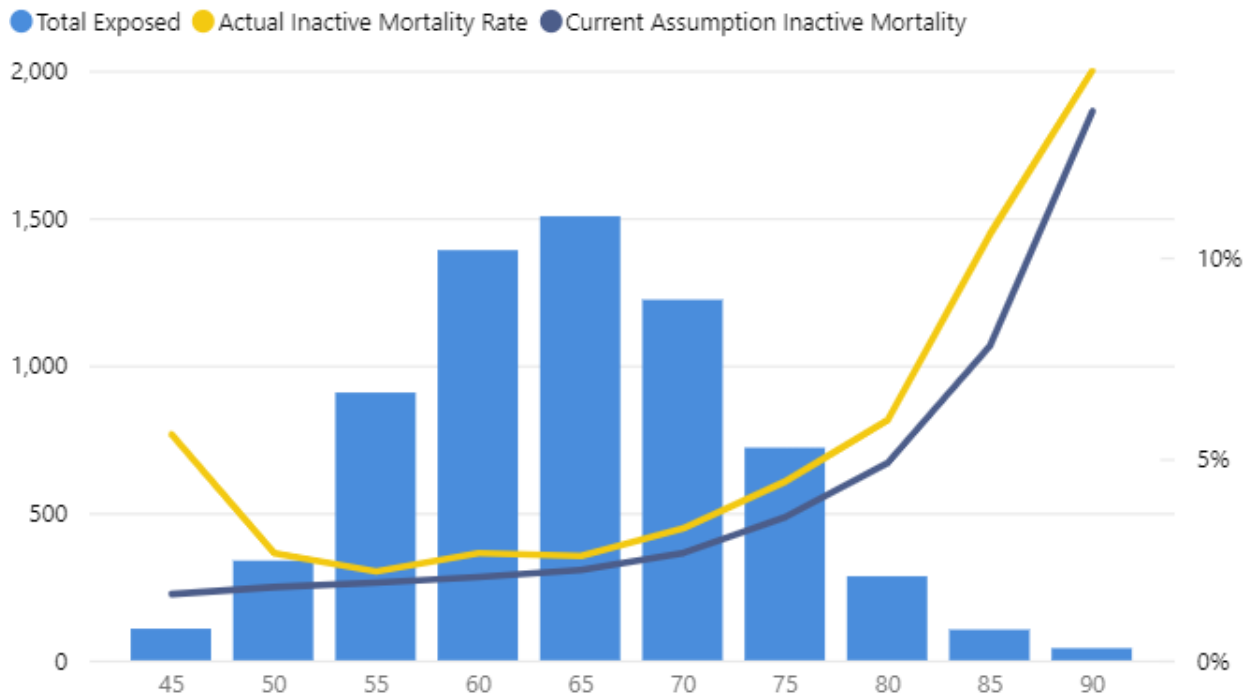
- The mortality experience of male disabled members is not credible as there were only 102 deaths during the study period.
- From 2015 - 2021, the actual number of deaths was greater than expected on both a headcount basis (A/E ratio of 1.45) and a benefit basis (A/E ratio of 1.47).

Disabled Retirees - Females

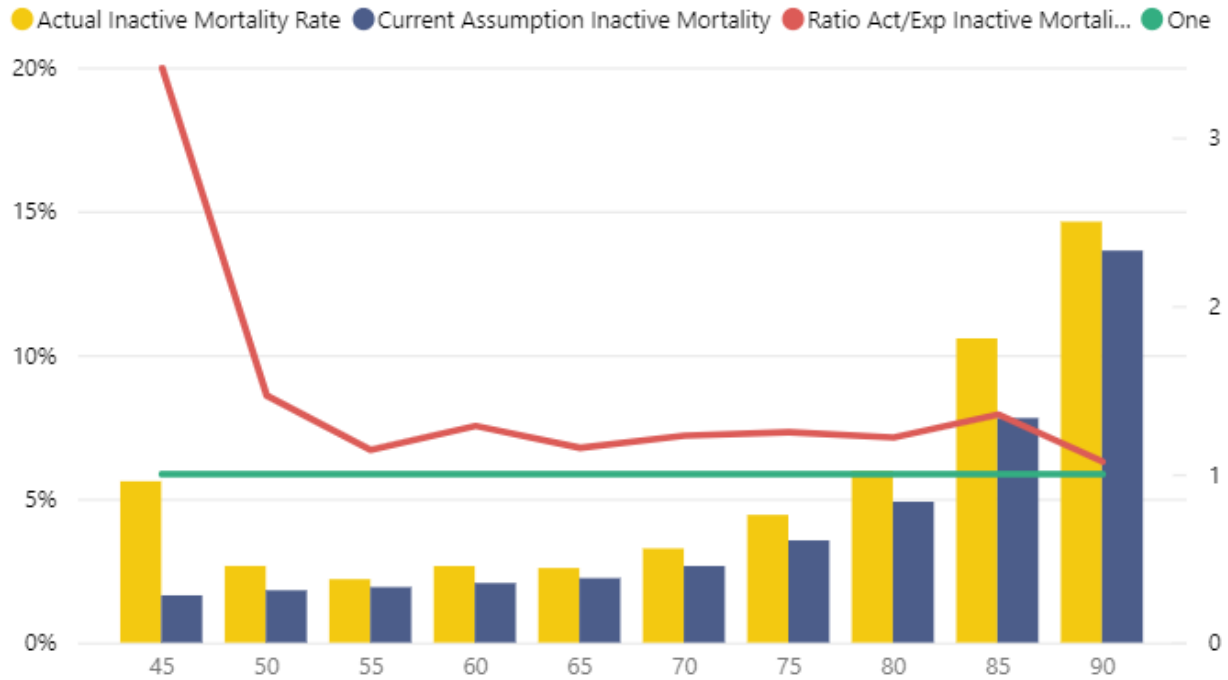
The following charts show the postretirement mortality experience on a headcount-weighted basis of by age, for females, for the age range (45 to 94), during the period 2015 – 2021.

| Age (bins) | Actual Inactive Deaths | Expected Inactive Deaths | Total Exposed | Actual Inactive Mortality Rate | Current Assumption Inactive Mortality | Ratio Act/Exp Inactive Mortality |
|--------------|------------------------|--------------------------|---------------|--------------------------------|---------------------------------------|----------------------------------|
| 45 | 6 | 1.8 | 107 | 5.6075% | 1.6414% | 3.42 |
| 50 | 9 | 6.1 | 338 | 2.6627% | 1.8152% | 1.47 |
| 55 | 20 | 17.5 | 908 | 2.2026% | 1.9264% | 1.14 |
| 60 | 37 | 28.8 | 1,391 | 2.6600% | 2.0681% | 1.29 |
| 65 | 39 | 33.7 | 1,506 | 2.5896% | 2.2392% | 1.16 |
| 70 | 40 | 32.6 | 1,223 | 3.2706% | 2.6615% | 1.23 |
| 75 | 32 | 25.6 | 721 | 4.4383% | 3.5523% | 1.25 |
| 80 | 17 | 14.0 | 285 | 5.9649% | 4.8953% | 1.22 |
| 85 | 11 | 8.1 | 104 | 10.5769% | 7.8074% | 1.35 |
| 90 | 6 | 5.6 | 41 | 14.6341% | 13.6287% | 1.07 |
| Total | 217 | 173.7 | 6,624 | 3.2760% | 2.6222% | 1.25 |

Exposure Distribution w/ Inactive Mortality Rate - Actual and Expected; by Age



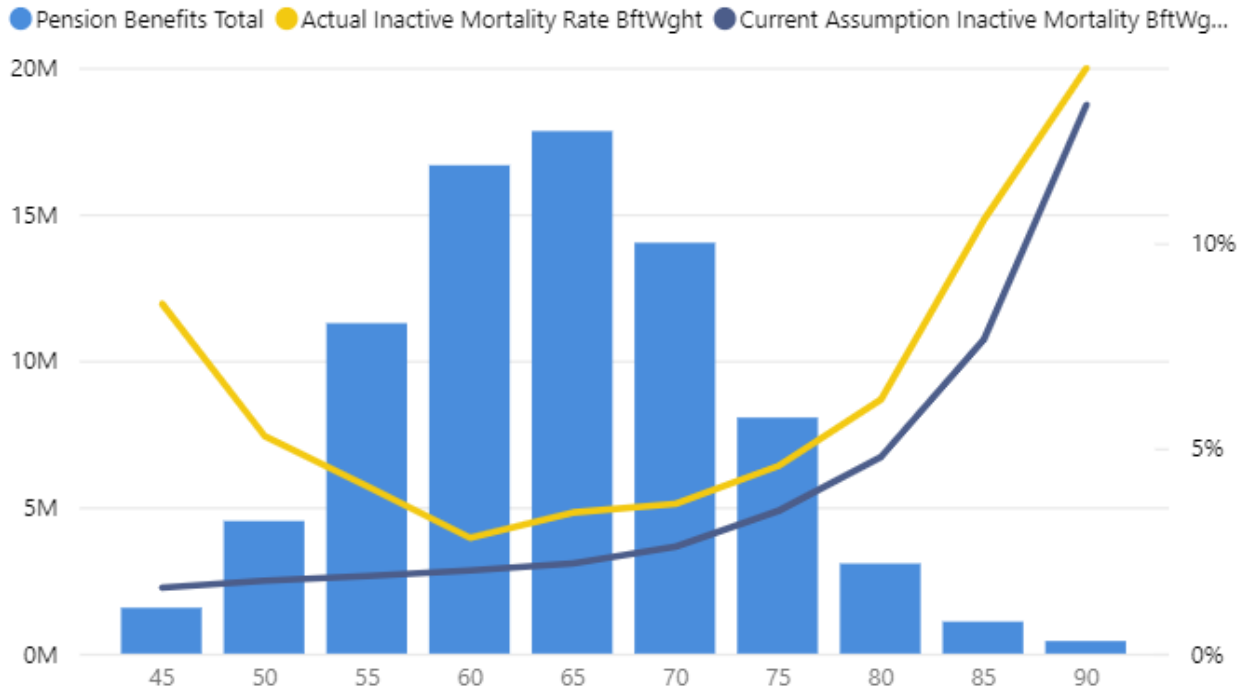
Inactive Mortality Rate - Actual, Expected, and Ratio; by Age



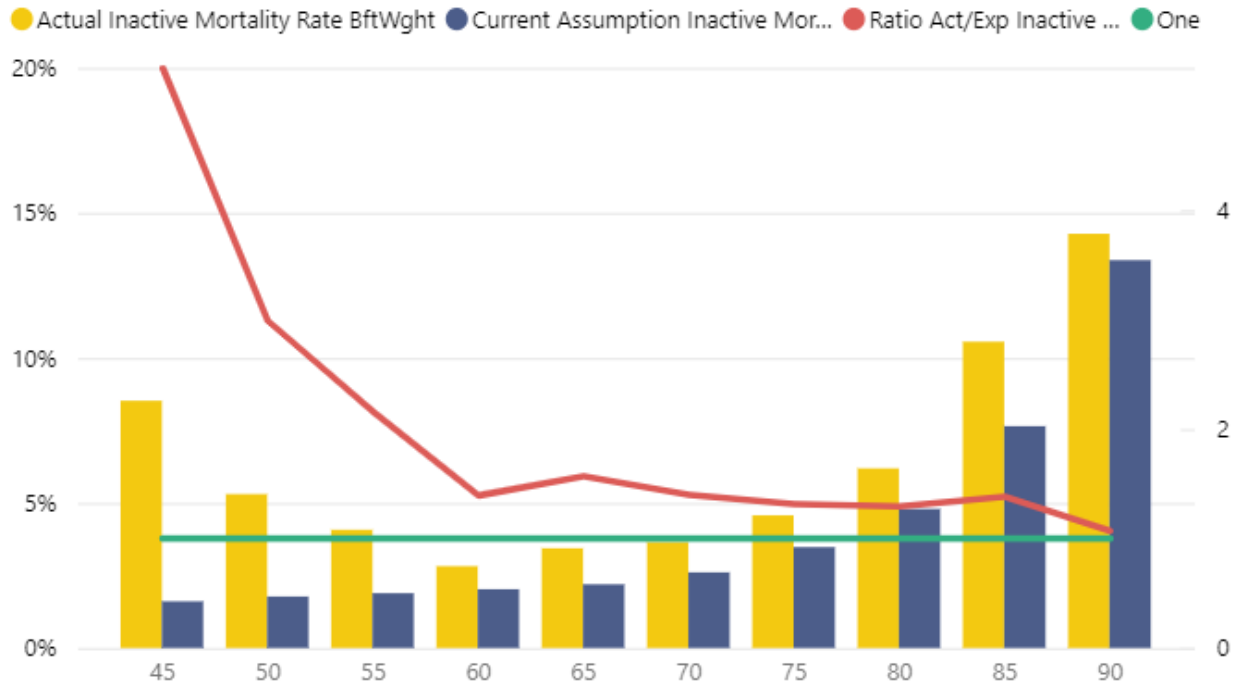
The following charts show postretirement mortality experience on an amount-weighted basis by age, for females, for the age range (45 to 94), during the period 2015 – 2021.

| Age (bins) | Actual Inactive Benefits Released | Expected Inactive Benefits Released | Pension Benefits Total | Actual Inactive Mortality Rate BftWght | Current Assumption Inactive Mortality BftWght | Ratio Act/Exp Inactive Mortality BftWght |
|--------------|-----------------------------------|-------------------------------------|------------------------|--|---|--|
| 45 | 133K | 25K | 1,564K | 8.5230% | 1.6080% | 5.30 |
| 50 | 240K | 80K | 4,527K | 5.3034% | 1.7741% | 2.99 |
| 55 | 460K | 213K | 11,278K | 4.0747% | 1.8881% | 2.16 |
| 60 | 470K | 338K | 16,669K | 2.8209% | 2.0259% | 1.39 |
| 65 | 613K | 391K | 17,836K | 3.4382% | 2.1937% | 1.57 |
| 70 | 512K | 366K | 14,024K | 3.6494% | 2.6066% | 1.40 |
| 75 | 368K | 280K | 8,055K | 4.5715% | 3.4758% | 1.32 |
| 80 | 190K | 147K | 3,074K | 6.1914% | 4.7915% | 1.29 |
| 85 | 115K | 84K | 1,092K | 10.5577% | 7.6466% | 1.38 |
| 90 | 61K | 57K | 428K | 14.2772% | 13.3670% | 1.07 |
| Total | 3,163K | 1,981K | 78,548K | 4.0271% | 2.5220% | 1.60 |

Pension Benefit Distribution w/ Inactive Mortality Rate - Actual and Expected; by Age



Inactive Mortality Rate - Actual, Expected, and Ratio; by Age



Specific observations:

- Although there were more deaths among female disabled members than male disabled members, the volume of experience data is still not credible.
- From 2015 - 2021, the actual number of deaths was greater than expected on both a headcount basis (A/E ratio of 1.25) and a benefit basis (A/E ratio of 1.60).

Postretirement Mortality – Contingent Beneficiaries

The following charts show the postretirement mortality experience on a headcount-weighted basis and amount-weighted basis by year and by age, for males and females combined, for the age range (60 to 104), during the period 2015 – 2021.

| Age Bene (bins) | Actual Beneficiary Deaths | Expected Beneficiary Deaths | Total Exposed | Actual Beneficiary Mortality Rate | Current Assumption Beneficiary Mortality | Ratio Act/Exp Beneficiary Mortality |
|-----------------|---------------------------|-----------------------------|---------------|-----------------------------------|--|-------------------------------------|
| 60 | 5 | 4.0 | 388 | 1.2887% | 1.0346% | ▲ 1.25 |
| 65 | 7 | 7.3 | 537 | 1.3035% | 1.3613% | ● 0.96 |
| 70 | 29 | 13.7 | 705 | 4.1135% | 1.9447% | ◆ 2.12 |
| 75 | 31 | 25.7 | 818 | 3.7897% | 3.1440% | ▲ 1.21 |
| 80 | 39 | 45.5 | 888 | 4.3919% | 5.1266% | ▲ 0.86 |
| 85 | 83 | 70.9 | 824 | 10.0728% | 8.5997% | ▲ 1.17 |
| 90 | 90 | 80.4 | 564 | 15.9574% | 14.2536% | ▲ 1.12 |
| 95 | 59 | 41.7 | 200 | 29.5000% | 20.8693% | ▲ 1.41 |
| 100 | 11 | 6.4 | 27 | 40.7407% | 23.8276% | ◆ 1.71 |
| Total | 354 | 295.7 | 4,951 | 7.1501% | 5.9726% | ▲ 1.20 |

| Age Bene (bins) | Actual Beneficiary Benefits Released | Expected Beneficiary Benefits Released | Pension Benefits Total | Actual Beneficiary Mortality Rate BftWght | Current Assumption Beneficiary Mortality BftWght | Ratio Act/Exp Beneficiary Mortality BftWght |
|-----------------|--------------------------------------|--|------------------------|---|--|---|
| 60 | 57K | 56K | 5,795K | 0.9792% | 0.9579% | ● 1.02 |
| 65 | 102K | 114K | 9,089K | 1.1208% | 1.2531% | ▲ 0.89 |
| 70 | 631K | 225K | 12,518K | 5.0418% | 1.7948% | ◆ 2.81 |
| 75 | 605K | 489K | 16,964K | 3.5656% | 2.8851% | ▲ 1.24 |
| 80 | 767K | 881K | 18,670K | 4.1060% | 4.7208% | ▲ 0.87 |
| 85 | 1,828K | 1,288K | 16,098K | 11.3576% | 7.9995% | ▲ 1.42 |
| 90 | 1,714K | 1,361K | 10,190K | 16.8189% | 13.3568% | ▲ 1.26 |
| 95 | 1,025K | 632K | 3,236K | 31.6904% | 19.5301% | ◆ 1.62 |
| 100 | 182K | 96K | 424K | 42.9582% | 22.6790% | ◆ 1.89 |
| Total | 6,911K | 5,142K | 92,983K | 7.4325% | 5.5298% | ▲ 1.34 |

Specific observations:

- From 2015 - 2021, the actual number of deaths was greater than expected on both a headcount basis (A/E ratio of 1.20) and on a benefit basis (A/E ratio of 1.34).
- There was no spike in mortality during 2019 as was seen for the retiree population.

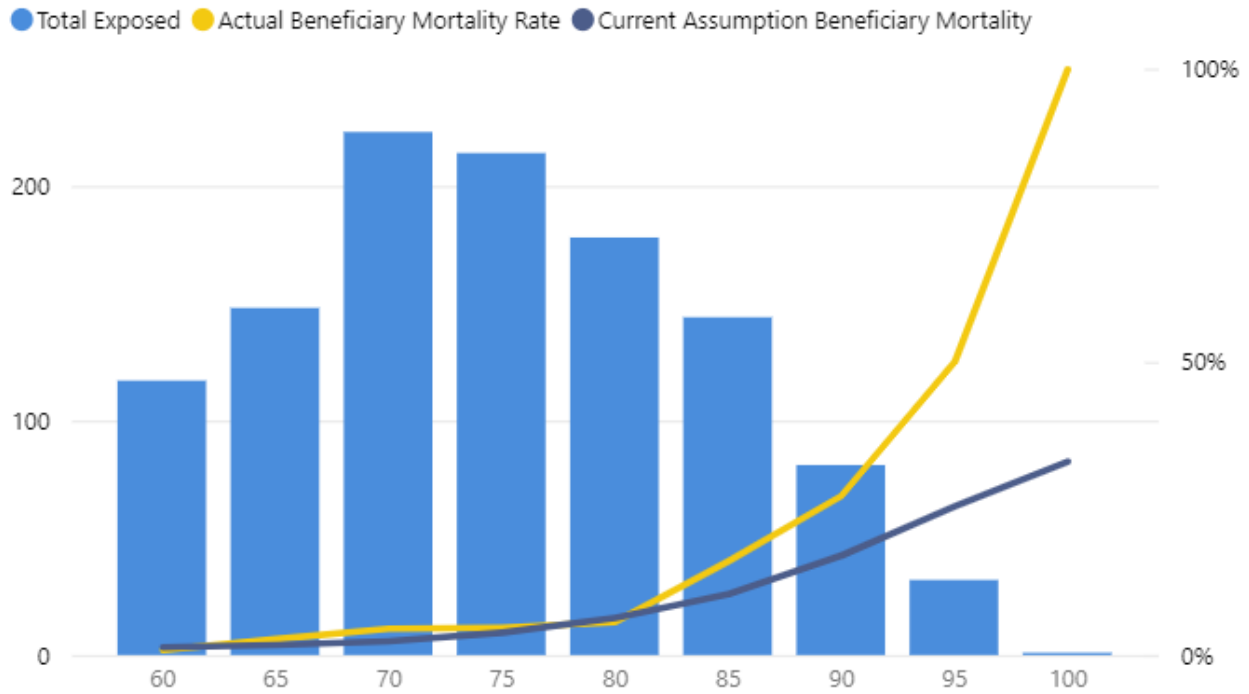
- Members with higher benefits had higher rates of mortality than members with lower benefits, which is consistent with results for disabled retirees.
- The rates of mortality of contingent beneficiaries were higher than the rates of mortality of service retirees at ages 70 to 99; contingent beneficiary experience is limited.

Contingent Beneficiaries – Males

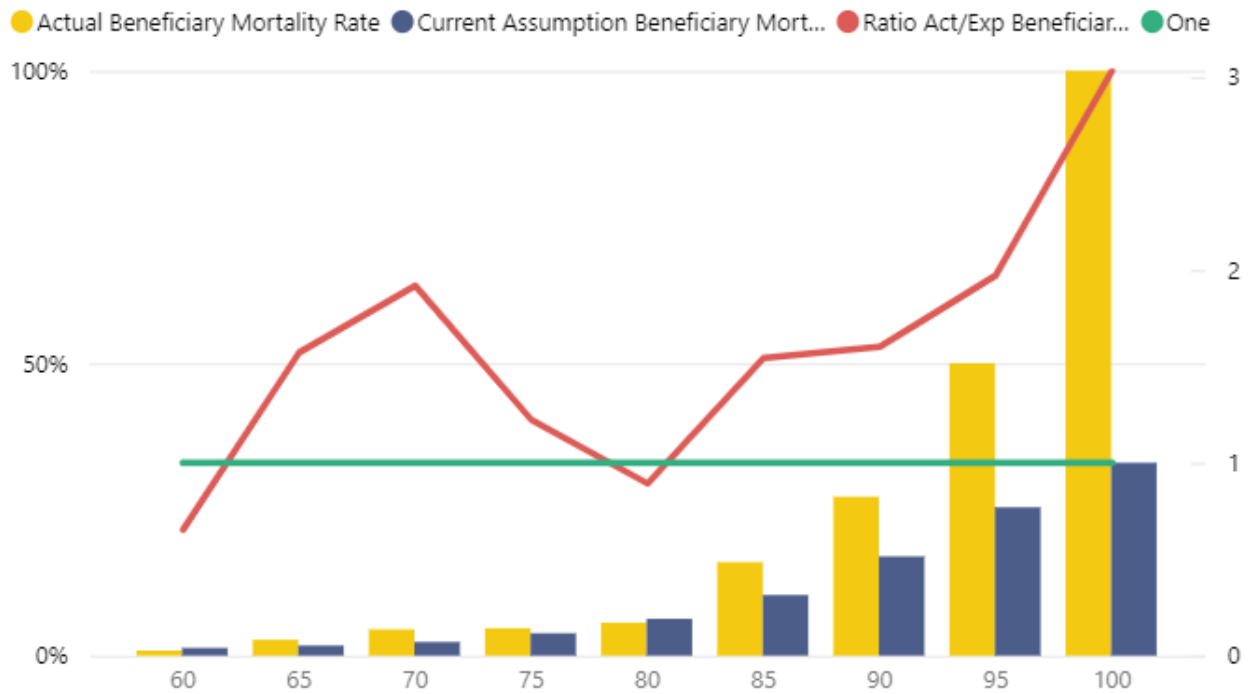
The following charts show postretirement mortality experience on a headcount-weighted basis by age, for males, for the age range (60 to 104), during the period 2015 – 2021.

| Age Bene (bins) | Actual Beneficiary Deaths | Expected Beneficiary Deaths | Total Exposed | Actual Beneficiary Mortality Rate | Current Assumption Beneficiary Mortality | Ratio Act/Exp Beneficiary Mortality |
|-----------------|---------------------------|-----------------------------|---------------|-----------------------------------|--|-------------------------------------|
| 60 | 1 | 1.5 | 117 | 0.8547% | 1.3102% | ▲ 0.65 |
| 65 | 4 | 2.5 | 148 | 2.7027% | 1.7202% | ◆ 1.57 |
| 70 | 10 | 5.2 | 223 | 4.4843% | 2.3373% | ◆ 1.92 |
| 75 | 10 | 8.2 | 214 | 4.6729% | 3.8199% | ▲ 1.22 |
| 80 | 10 | 11.2 | 178 | 5.6180% | 6.2954% | ▲ 0.89 |
| 85 | 23 | 14.9 | 144 | 15.9722% | 10.3534% | ◆ 1.54 |
| 90 | 22 | 13.7 | 81 | 27.1605% | 16.9690% | ◆ 1.60 |
| 95 | 16 | 8.1 | 32 | 50.0000% | 25.3558% | ◆ 1.97 |
| 100 | 1 | 0.3 | 1 | 100.0000% | 32.9732% | ◆ 3.03 |
| Total | 97 | 65.8 | 1,138 | 8.5237% | 5.7793% | ▲ 1.47 |

Exposure Distribution w/ Beneficiary Mortality Rate - Actual and Expected; by Age



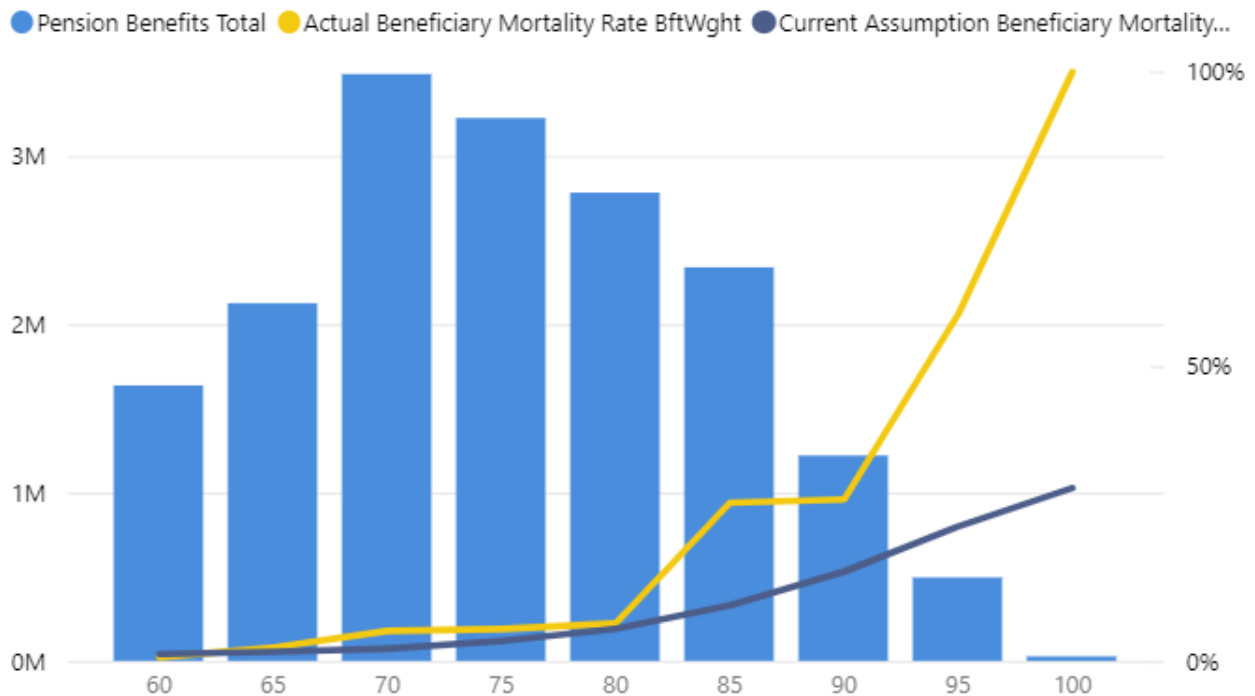
Beneficiary Mortality Rate - Actual, Expected, and Ratio; by Age



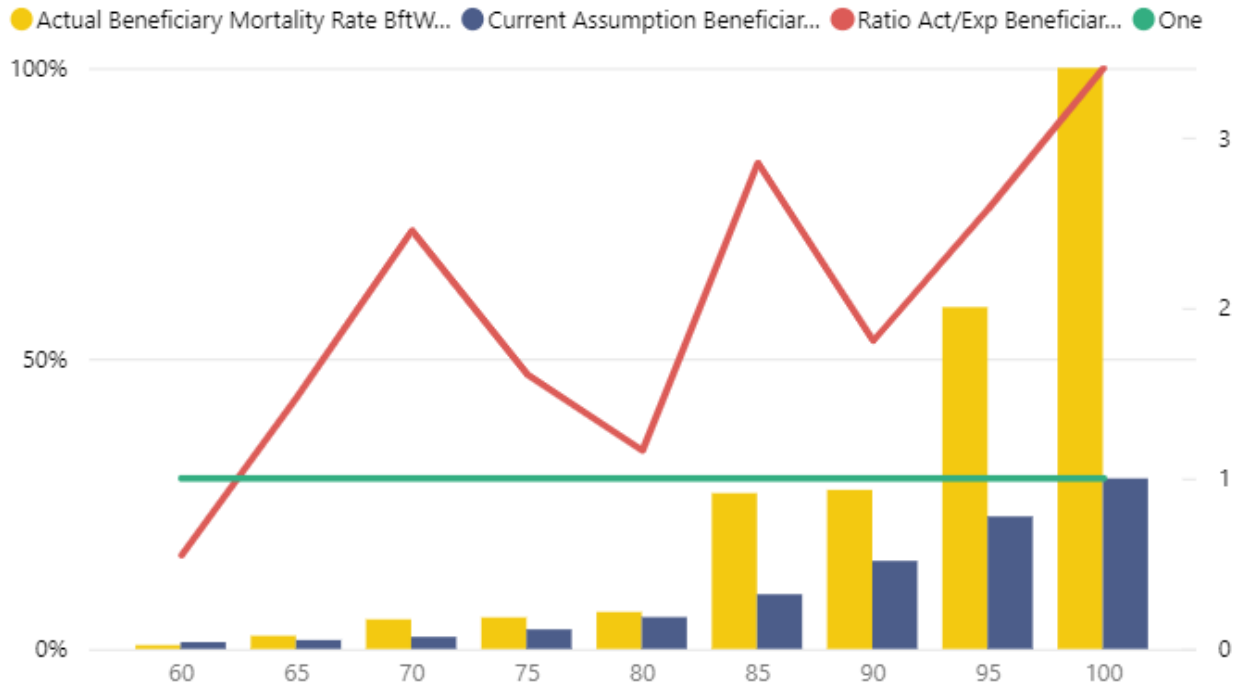
The following charts show postretirement mortality experience on an amount-weighted basis by age, for males, for the age range (60 to 104), during the period 2015 – 2021.

| Age Bene (bins) | Actual Beneficiary Benefits Released | Expected Beneficiary Benefits Released | Pension Benefits Total | Actual Beneficiary Mortality Rate BftWght | Current Assumption Beneficiary Mortality BftWght | Ratio Act/Exp Beneficiary Mortality BftWght |
|-----------------|--------------------------------------|--|------------------------|---|--|---|
| 60 | 11K | 19K | 1,635K | 0.6441% | 1.1733% | 0.55 |
| 65 | 48K | 33K | 2,123K | 2.2627% | 1.5328% | 1.48 |
| 70 | 177K | 72K | 3,484K | 5.0881% | 2.0737% | 2.45 |
| 75 | 175K | 108K | 3,223K | 5.4178% | 3.3656% | 1.61 |
| 80 | 177K | 152K | 2,780K | 6.3683% | 5.4720% | 1.16 |
| 85 | 626K | 220K | 2,337K | 26.8062% | 9.4030% | 2.85 |
| 90 | 334K | 185K | 1,219K | 27.3731% | 15.1521% | 1.81 |
| 95 | 291K | 113K | 495K | 58.8313% | 22.8004% | 2.58 |
| 100 | 27K | 8K | 27K | 100.0000% | 29.3462% | 3.41 |
| Total | 1,866K | 910K | 17,325K | 10.7694% | 5.2517% | 2.05 |

Pension Benefit Distribution w/ Beneficiary Mortality Rate - Actual and Expected; by Age



Beneficiary Mortality Rate - Actual, Expected, and Ratio; by Age



Specific observations:

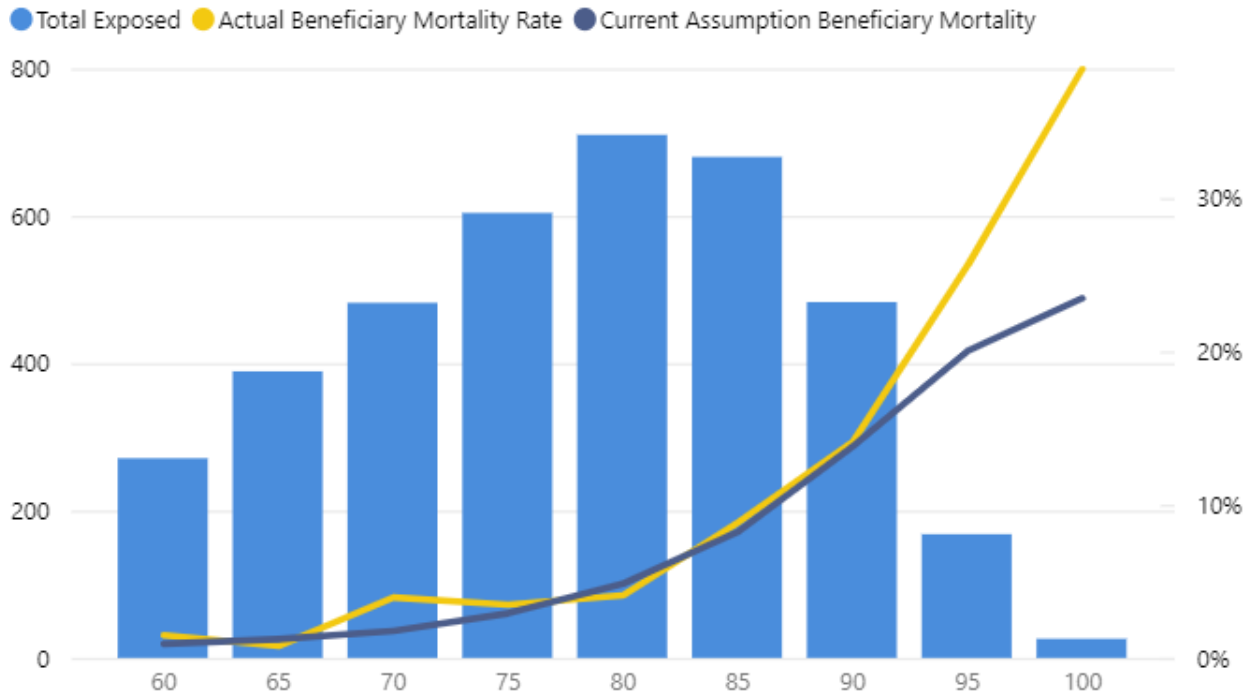
- The mortality experience of male contingent beneficiaries is not credible as there were only 97 deaths during the study period.
- From 2015 - 2021, the actual number of deaths was greater than expected on both a headcount basis (A/E ratio of 1.47) and a benefit basis (A/E ratio of 2.05).

Contingent Beneficiaries - Females

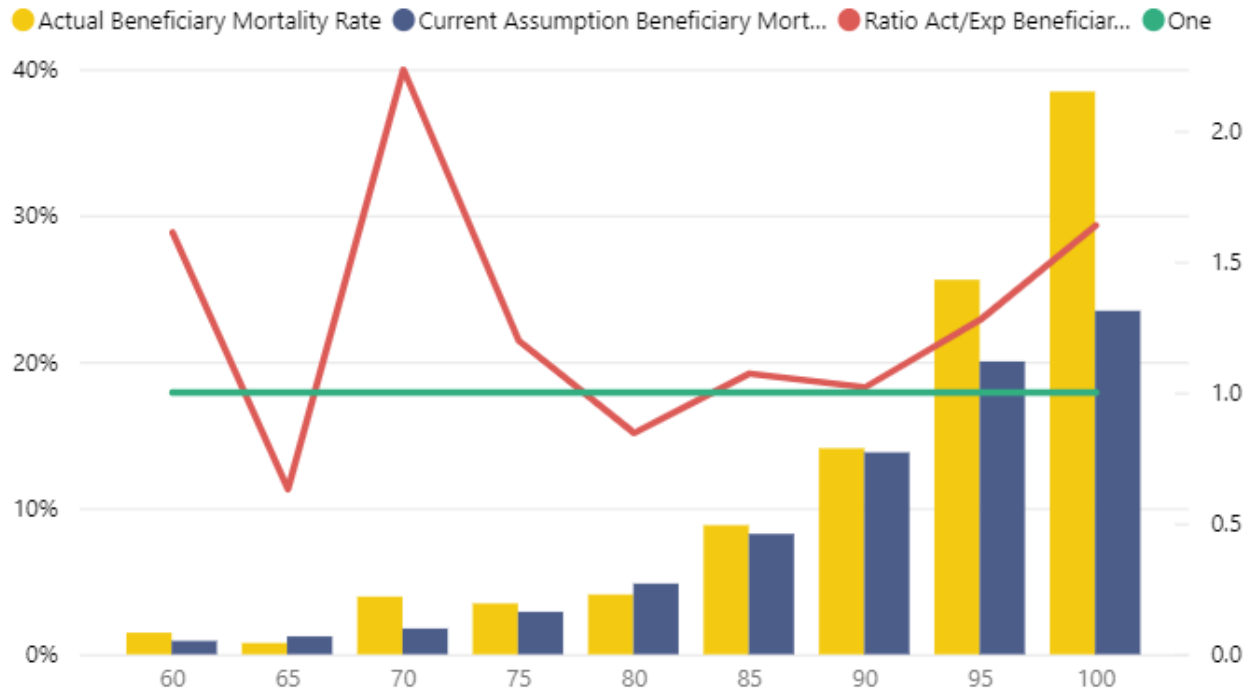
The following charts show postretirement mortality experience on a headcount-weighted basis by age, for females, for the age range (60 to 104), during the period 2015 – 2021.

| Age Bene (bins) | Actual Beneficiary Deaths | Expected Beneficiary Deaths | Total Exposed | Actual Beneficiary Mortality Rate | Current Assumption Beneficiary Mortality | Ratio Act/Exp Beneficiary Mortality |
|-----------------|---------------------------|-----------------------------|---------------|-----------------------------------|--|-------------------------------------|
| 60 | 4 | 2.5 | 271 | 1.4760% | 0.9156% | 1.61 |
| 65 | 3 | 4.8 | 389 | 0.7712% | 1.2248% | 0.63 |
| 70 | 19 | 8.5 | 482 | 3.9419% | 1.7630% | 2.24 |
| 75 | 21 | 17.5 | 604 | 3.4768% | 2.9046% | 1.20 |
| 80 | 29 | 34.3 | 710 | 4.0845% | 4.8336% | 0.85 |
| 85 | 60 | 56.0 | 680 | 8.8235% | 8.2283% | 1.07 |
| 90 | 68 | 66.6 | 483 | 14.0787% | 13.7982% | 1.02 |
| 95 | 43 | 33.6 | 168 | 25.5952% | 20.0148% | 1.28 |
| 100 | 10 | 6.1 | 26 | 38.4615% | 23.4758% | 1.64 |
| Total | 257 | 229.9 | 3,813 | 6.7401% | 6.0302% | 1.12 |

Exposure Distribution w/ Beneficiary Mortality Rate - Actual and Expected; by Age



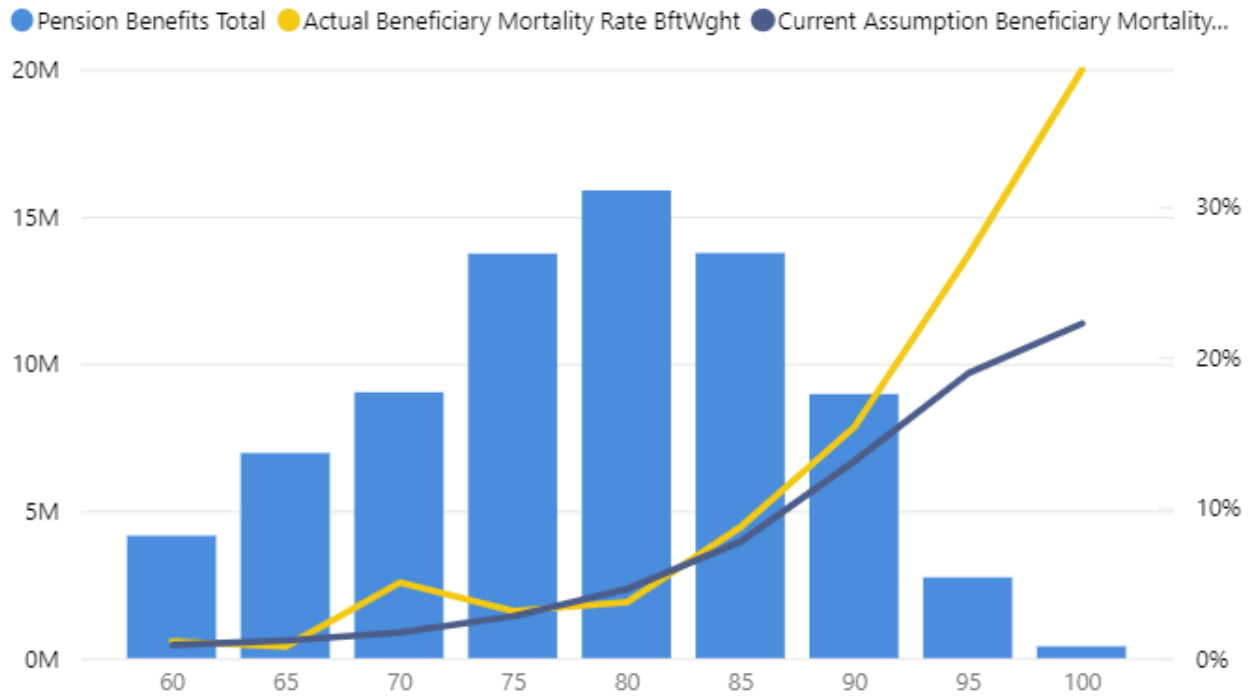
Beneficiary Mortality Rate - Actual, Expected, and Ratio; by Age



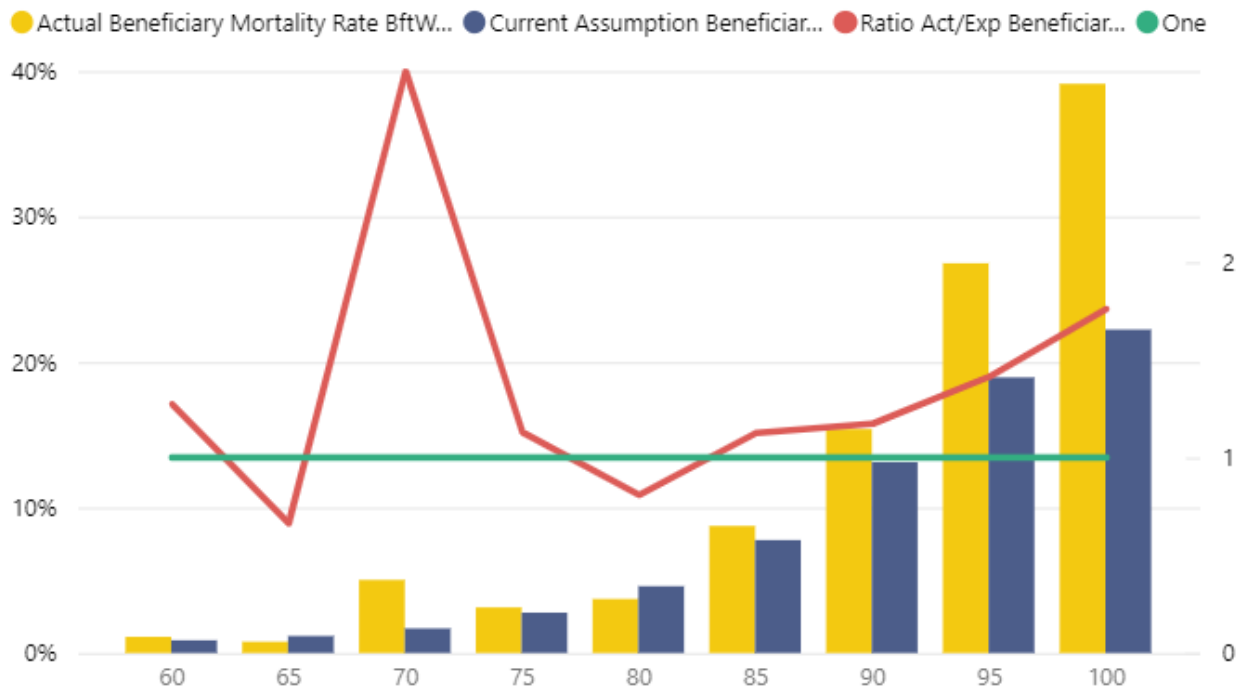
The following charts show postretirement mortality experience on an amount-weighted basis by age, for females, for the age range (60 to 104), during the period 2015 – 2021.

| Age Bene (bins) | Actual Beneficiary Benefits Released | Expected Beneficiary Benefits Released | Pension Benefits Total | Actual Beneficiary Mortality Rate BftWght | Current Assumption Beneficiary Mortality BftWght | Ratio Act/Exp Beneficiary Mortality BftWght |
|-----------------|--------------------------------------|--|------------------------|---|--|---|
| 60 | 46K | 36K | 4,159K | 1.1110% | 0.8732% | ▲ 1.27 |
| 65 | 54K | 81K | 6,966K | 0.7727% | 1.1679% | ▲ 0.66 |
| 70 | 454K | 152K | 9,033K | 5.0239% | 1.6872% | ◆ 2.98 |
| 75 | 430K | 381K | 13,741K | 3.1311% | 2.7724% | ▲ 1.13 |
| 80 | 590K | 729K | 15,890K | 3.7102% | 4.5893% | ▲ 0.81 |
| 85 | 1,202K | 1,068K | 13,761K | 8.7341% | 7.7612% | ▲ 1.13 |
| 90 | 1,380K | 1,176K | 8,970K | 15.3841% | 13.1127% | ▲ 1.17 |
| 95 | 734K | 519K | 2,740K | 26.7869% | 18.9393% | ▲ 1.41 |
| 100 | 156K | 88K | 397K | 39.1223% | 22.2307% | ◆ 1.76 |
| Total | 5,045K | 4,232K | 75,658K | 6.6683% | 5.5935% | ▲ 1.19 |

Pension Benefit Distribution w/ Beneficiary Mortality Rate - Actual and Expected; by Age



Beneficiary Mortality Rate - Actual, Expected, and Ratio; by Age



Specific observations:

Part I Experience Study Report – TRS and BERS
 New York City Retirement Systems

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- From 2015 - 2021, the actual number of deaths was greater than expected on both a headcount basis (A/E ratio of 1.12) and a benefit basis (A/E ratio of 1.19).