# Rated Age Mortality for Lifetime Medical Claims

## CLRS 2020

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# Today's speakers

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# Agenda

- Intro
- Estimating Claimant Mortality
- Modeling Lifetime Medical claims

# Intro

- Situations that require analysis of lifetime medical claims
  - Runoff book of Permanent Total Workers Compensation claims
  - Unlimited Personal Injury Protection (PIP)
- Features of this situation
  - Payments are likely to continue for remainder of claimant’s life
  - Often the claims adjuster, care manager, or doctor will include a ‘rated age’
- Data required
  - Claimant age and rated age (if available)
  - Claimant gender
  - Historical annual medical payments
  - Reinsurance structure, if applicable

# Estimating Claimant Mortality

# Life and Casualty Intersect

## Structured Settlement Annuity (SSA) Overview

- Mortality is a key risk for SSAs
  - When annuitants live longer, they continue to receive life contingent benefits for a longer period of time
  - A higher mortality assumption implies a shorter life, and fewer life contingent benefit payments
  - A lower mortality assumption implies a longer life, and more life contingent benefit payments

- In the Life insurance industry, companies typically do not receive updates on the impairment of the annuitant after issue (except notification of death), which results in uncertainty that increases with the duration of the contract.
  - I was quite interested (oh, let's be honest…envious!) to see that Jon's data included updated views on rated ages!
  - This difference in life vs casualty may be quite important when considering ways to use SSA data from the life industry

# Life and Casualty Intersect

## Structured Settlement Annuity (SSA) Overview (cont'd)

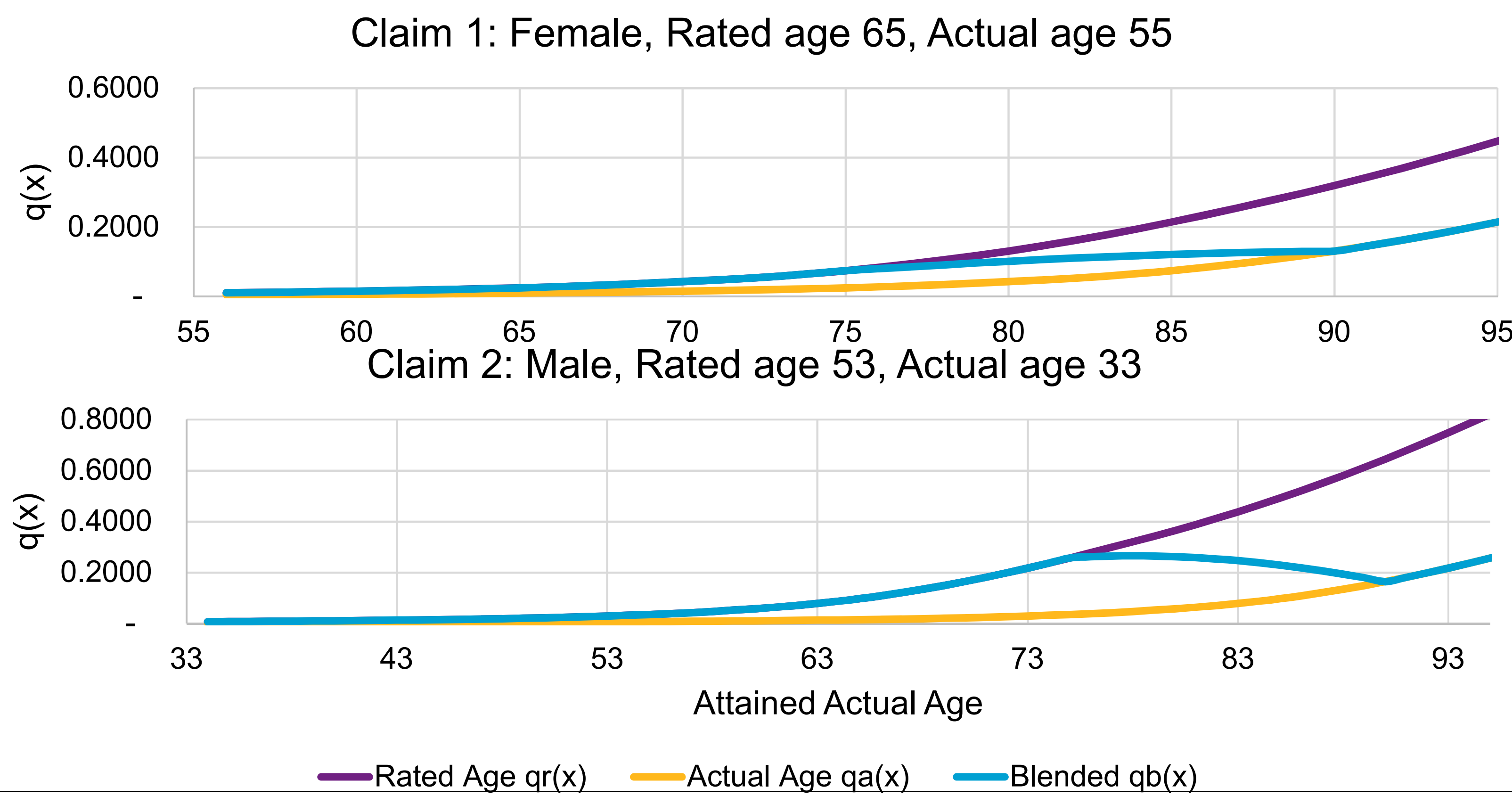
- The risk of volatility surrounding structured settlement mortality experience is a significant issue:
  - The causes and degrees of impairment vary widely and there is limited experience especially in the later durations.
  - The original underwriting may not have been appropriate and/or sufficient documentation is not available to make that determination. This issue is more prevalent with older business.
  - Medical advances since issue may significantly increase life expectancy.
  - It takes time for evidence to emerge that the mortality experience is worse than expected (i.e., annuitants are living longer).
  - Industry and company experience is very limited, particularly in durations 20-25+.

# Three Simplified Views of Substandard Mortality

- Actual Age
  - Assume mortality rates and life expectancy of an unimpaired life
  - At the time the underwriting is performed, actual age mortality would produce a longer life expectancy than the underwriter believes is reasonable
- Rated Age
  - The rated age is assigned by the underwriter at the time that the contract is issued
  - The rated age reflects the underwriter's view on the life expectancy of the annuitant given the degree and type of impairment at issue (and is also dependent on the underlying mortality table assumption used in the life expectancy calculation)
  - Results in higher mortality rates and lower life expectancy than Actual Age mortality
- Blended Age
  - The basic idea is that a blended age approach falls in between Actual Age and Rated Age mortality
  - Tends to be closer to Rated Age mortality at the time of issue, and Actual Age mortality at the end of the mortality table (such as age 100 or 110)
  - There can be different ways to accomplish this – Jon has used one example today based on blending the mortality rates:
    - For attained years 75 and prior, give 100% weight to the rated age mortality
    - For attained age 90 and subsequent, give 100% weight to the mortality associated with the actual age
    - For ages 75-90, give linearly increasing weight from the rated age to the actual mortality

# Mortality Curve

- Use the rated age with a life table to calculate $q_r(x)$, the probability of death at each age
  - If the claims adjuster provides a life expectancy, perform a reverse lookup from the life table to estimate the rated age
- Repeat to create $q_a(x)$, the probability of death at age given the actual age
- Blend $q_r(x)$ and $q_a(x)$ to get $q_b(x)$



# 2005-2017 Structured Settlement Mortality Experience Report

Published by the SOA in January 2020

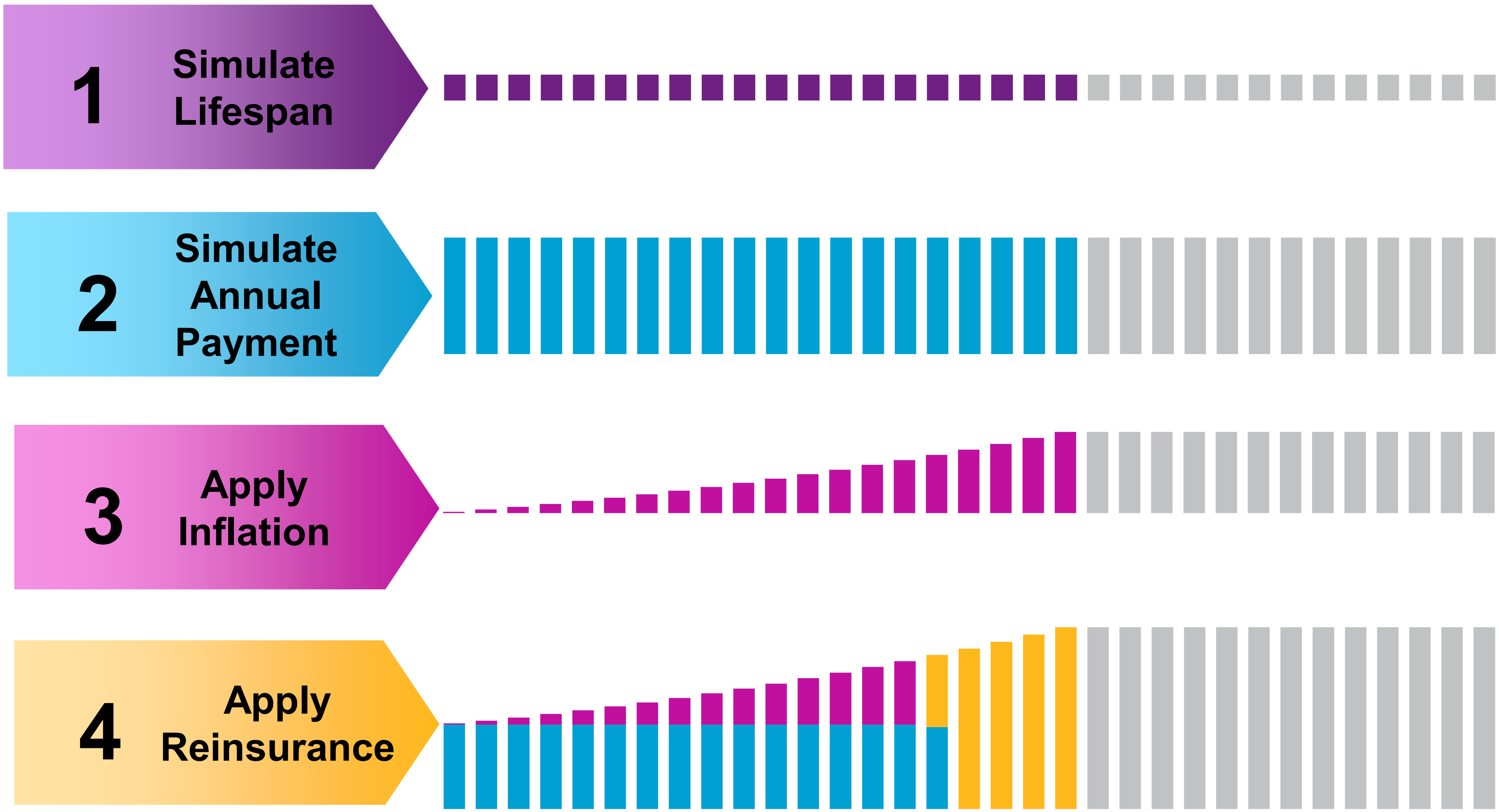
- https://www.soa.org/resources/research-reports/2020/2005-17-structured-settlement-mortality/
- This link includes both a report and pivot tables with the full set of underlying data
- Be sure to consider other slices of data (particularly duration) when evaluating a methodology or table

**Table 19**

| A/E RATIO BY EXPECTED BASIS | | | | | |
|---|---|---|---|---|---|
| Expected Bases | | Actual Deaths 13,475 Expected Deaths | A/E Ratio | Actual Death Amount ('000) $2,734,619 Expected Death Amount ('000) | A/E Ratio |
| 1983 IAM | True Age | 4,382 | 307.5% | $610,785 | 447.7% |
| 2000 Annuity | True Age | 3,513 | 383.6% | $489,297 | 558.9% |
| 2012 IAM Period with G2 Scale | True Age | 2,697 | 499.5% | $378,878 | 721.8% |
| SSA 2011 (midpoint) | True Age | 5,549 | 242.8% | $805,158 | 339.6% |
| Expected Bases | | Expected Deaths | A/E Ratio | Expected Death Amount ('000) | A/E Ratio |
| 1983 IAM | Rated Age | 13,479 | 100.0% | $3,695,921 | 74.0% |
| 2000 Annuity | Rated Age | 11,117 | 121.2% | $2,762,692 | 99.0% |
| 2012 IAM Period with G2 Scale | Rated Age | 8,998 | 149.8% | $2,269,434 | 120.5% |
| SSA 2011 (midpoint) | Rated Age | 16,136 | 83.5% | $4,008,886 | 68.2% |
| Expected Bases | | Expected Deaths | A/E Ratio | Expected Death Amount ('000) | A/E Ratio |
| 1983 IAM plus 1983 IAM CED | | 17,334 | 77.7% | $4,170,641 | 65.6% |

# Modeling Lifetime Medical Claims

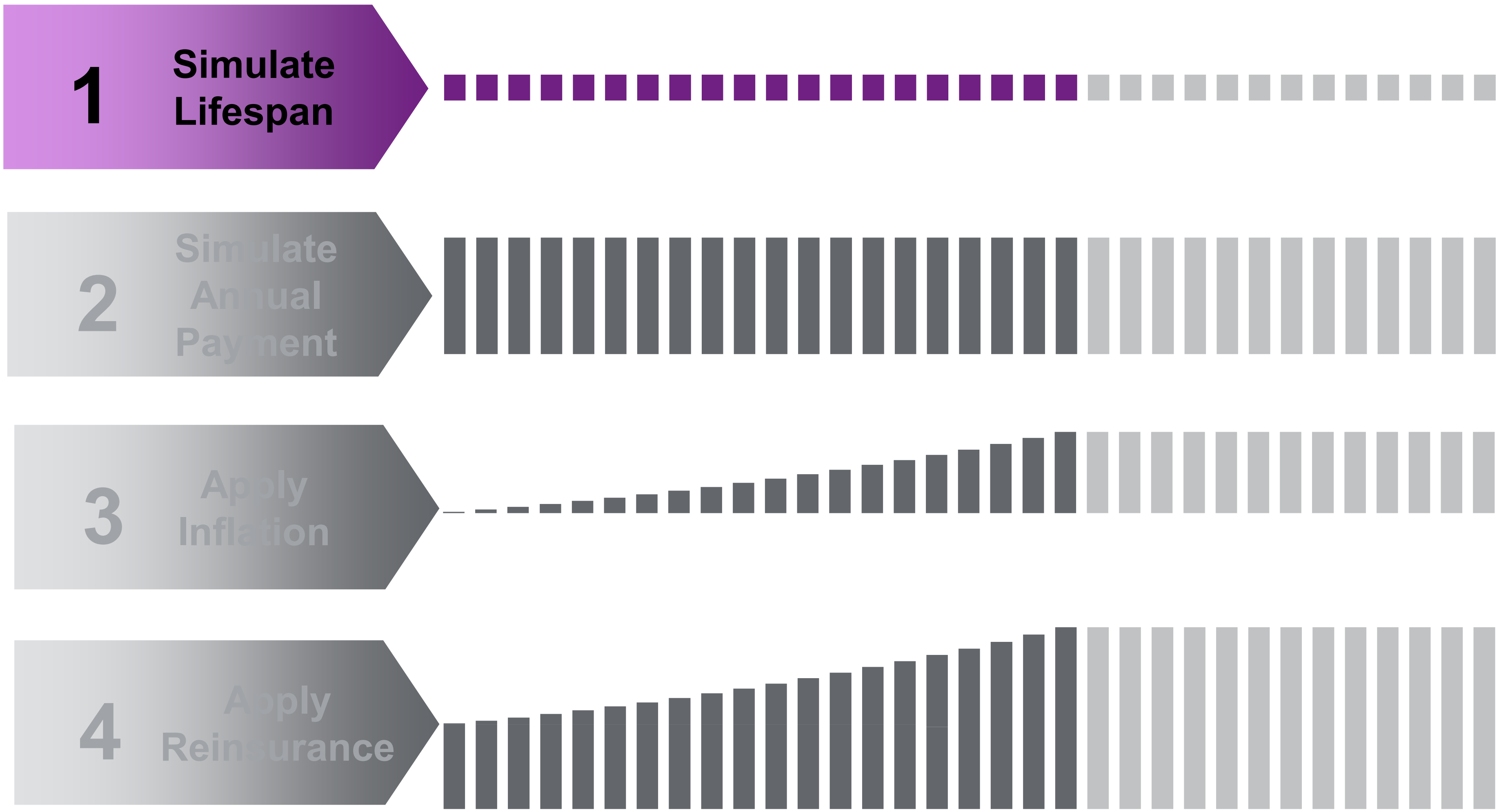
# Lifetime Medical Claims - Four Modeling Steps



# Two sample claims

| Attribute | Claim 1 | Claim 2 |
|---|---|---|
| Gender | Female | Male |
| Actual Age | 55 | 33 |
| Rated Age | 65 | 53 |
| Average Annual Medical Payments | $150,000 | $300,000 |
| CV of Medical Payments | 25% | 25% |
| Payments since inception | $500,000 | $2,300,000 |
| Reinsurance | 100% of $5M xs $5M | 100% of $5M xs $5M |

# Simulate Lifespan

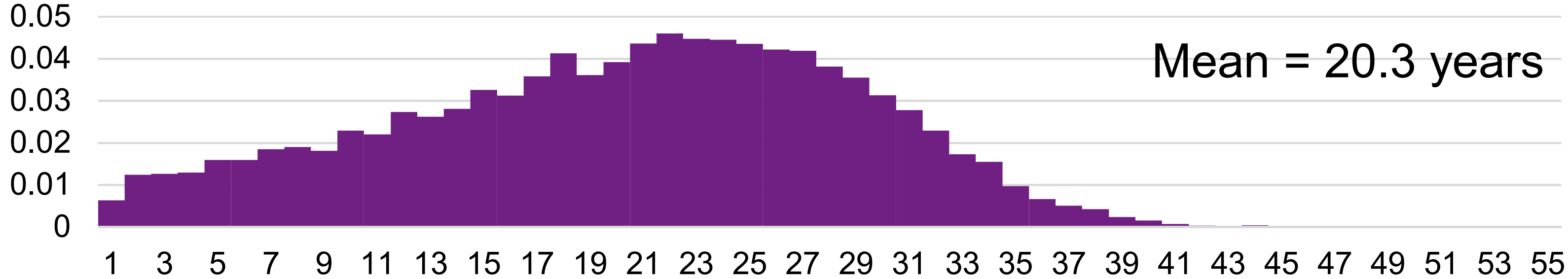


# How to Simulate Lifespan

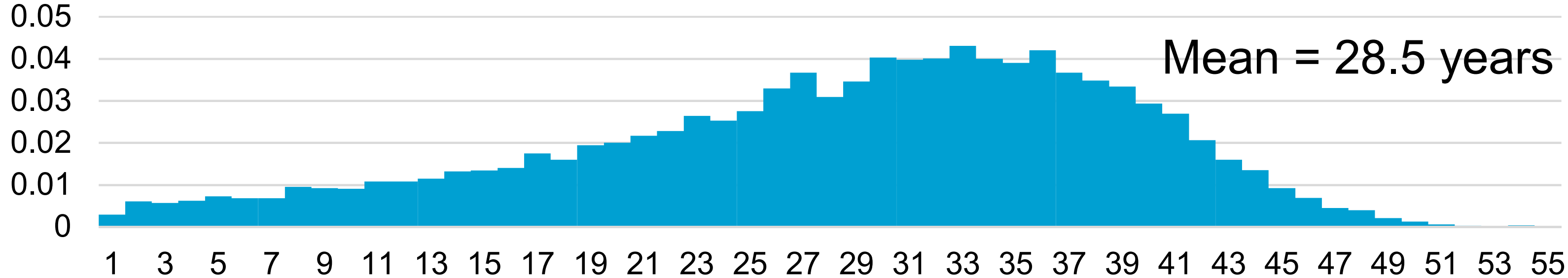
- Simulating the future lifespan is a relatively simple task once you have determined the mortality assumptions
- For each simulation
  - Draw a random uniform number
  - If it is less than q(x), the claimant does not survive the year
    - No more random numbers are required for this simulation
  - If it is greater than q(x), then the claimant survives that year
    - Continue drawing random numbers as long as they exceed q(x)
    - The number of draws is the number of future years the claimant survives
- Repeat the simulations 10,000 times

# Year of Death Frequency – Claim 1

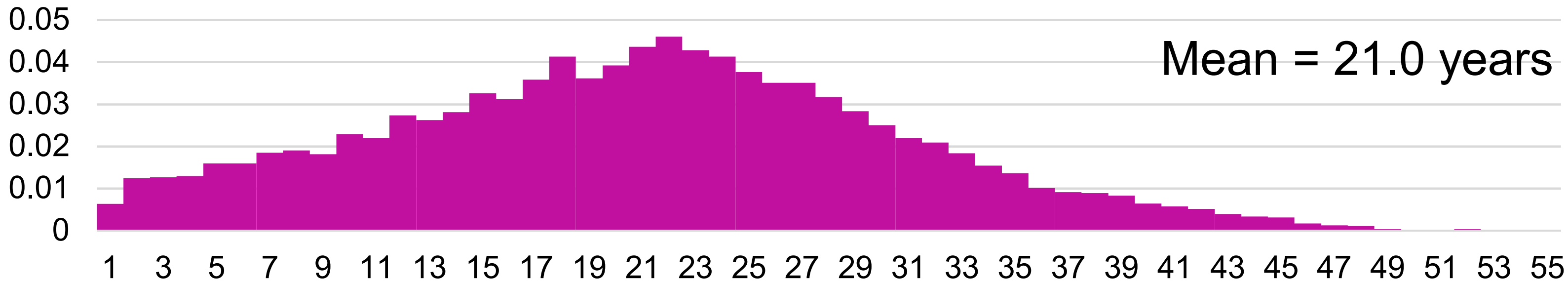
q(x) from rated age of 65



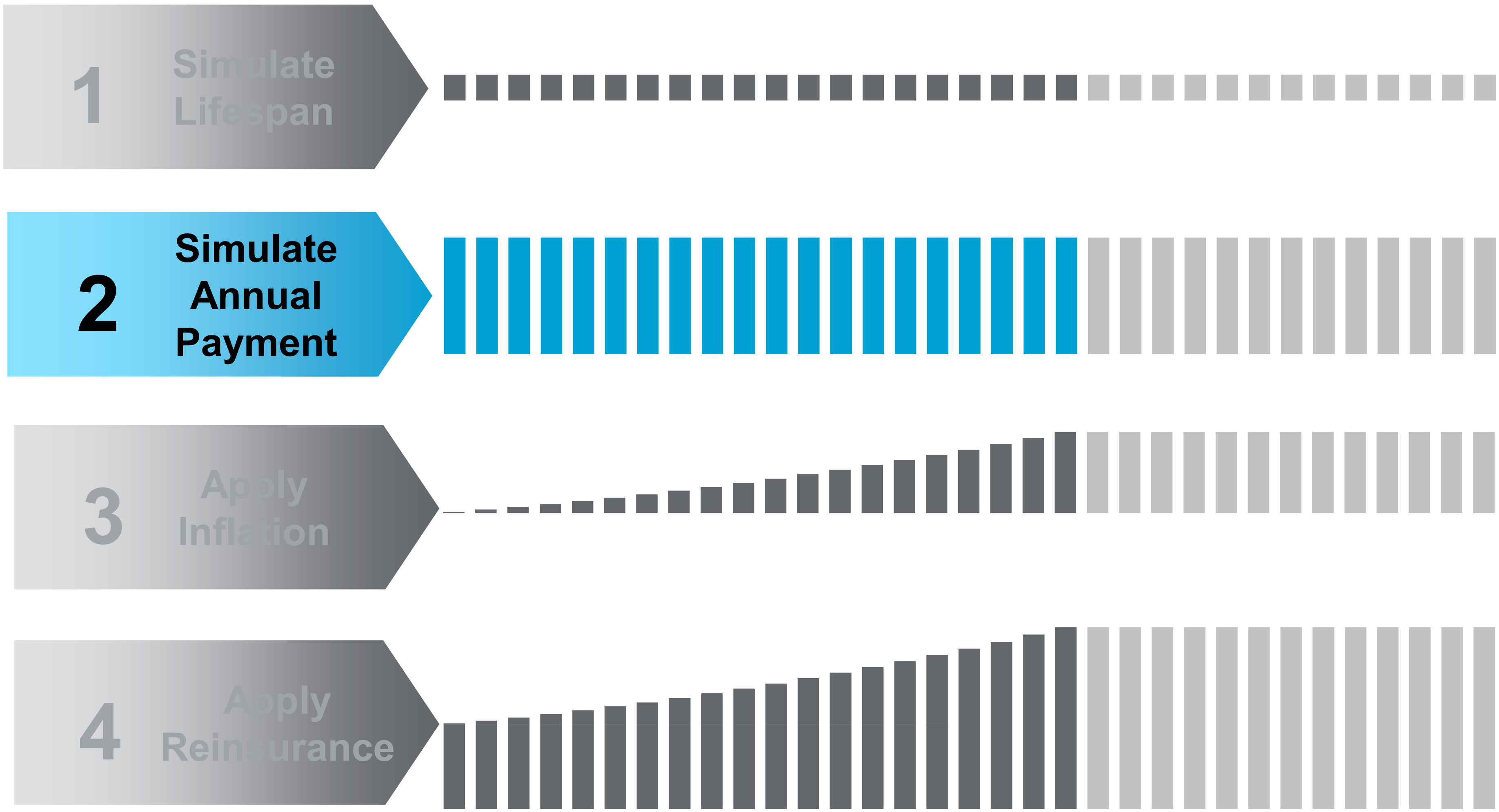

q(x) from actual age of 55




q(x) from blend



# Lifetime Medical Claims - Four Modeling Steps



# Simulate Annual Payment

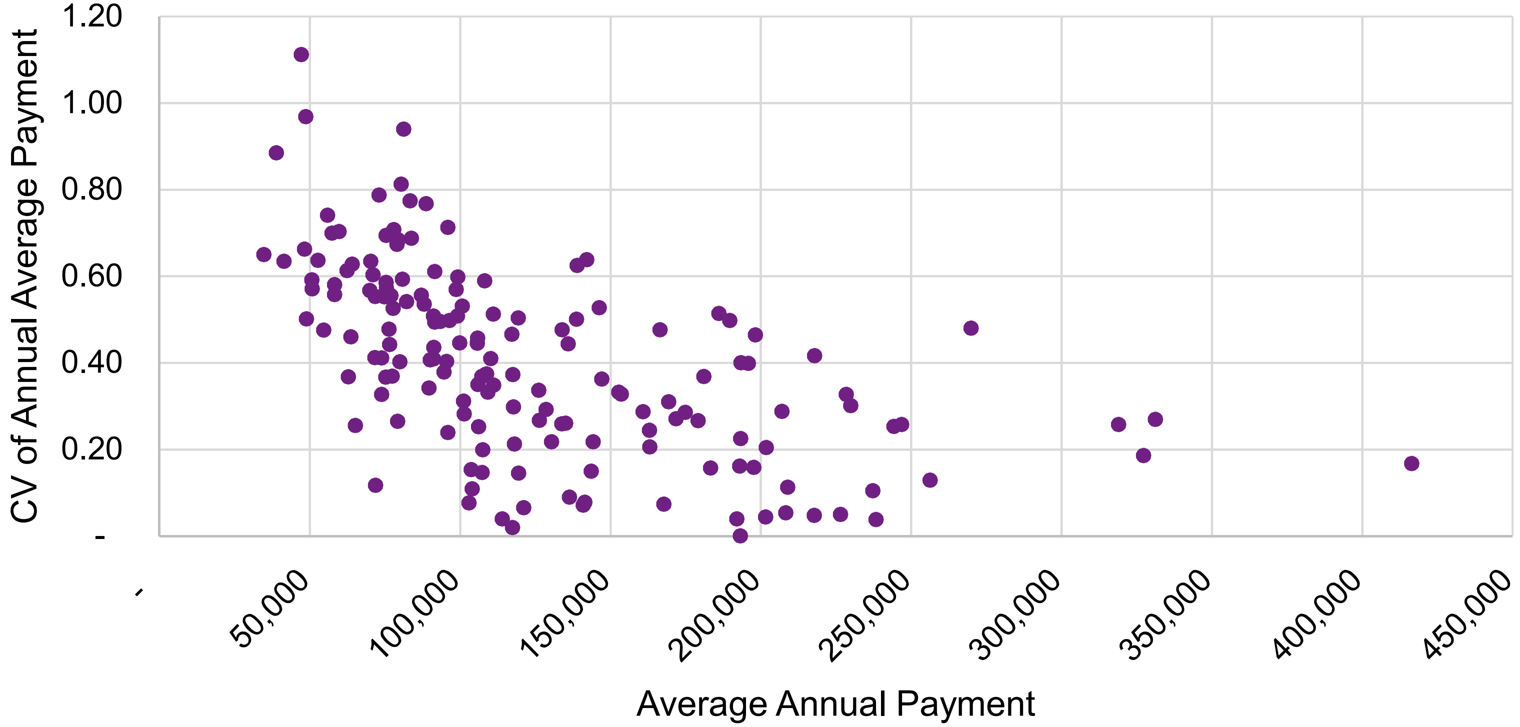
## Estimating the Mean

- If you have a forward-looking cost estimate from a care manager or claims adjuster, you can incorporate this information, especially if it differs from historical costs
- If you have historical annual medical costs by claim
  - Adjust historical average to current inflation level
  - Select a mean current-level cost by claim
    - Can be based on recent n-year average
    - Judgmental adjustments are possible based on qualitative data

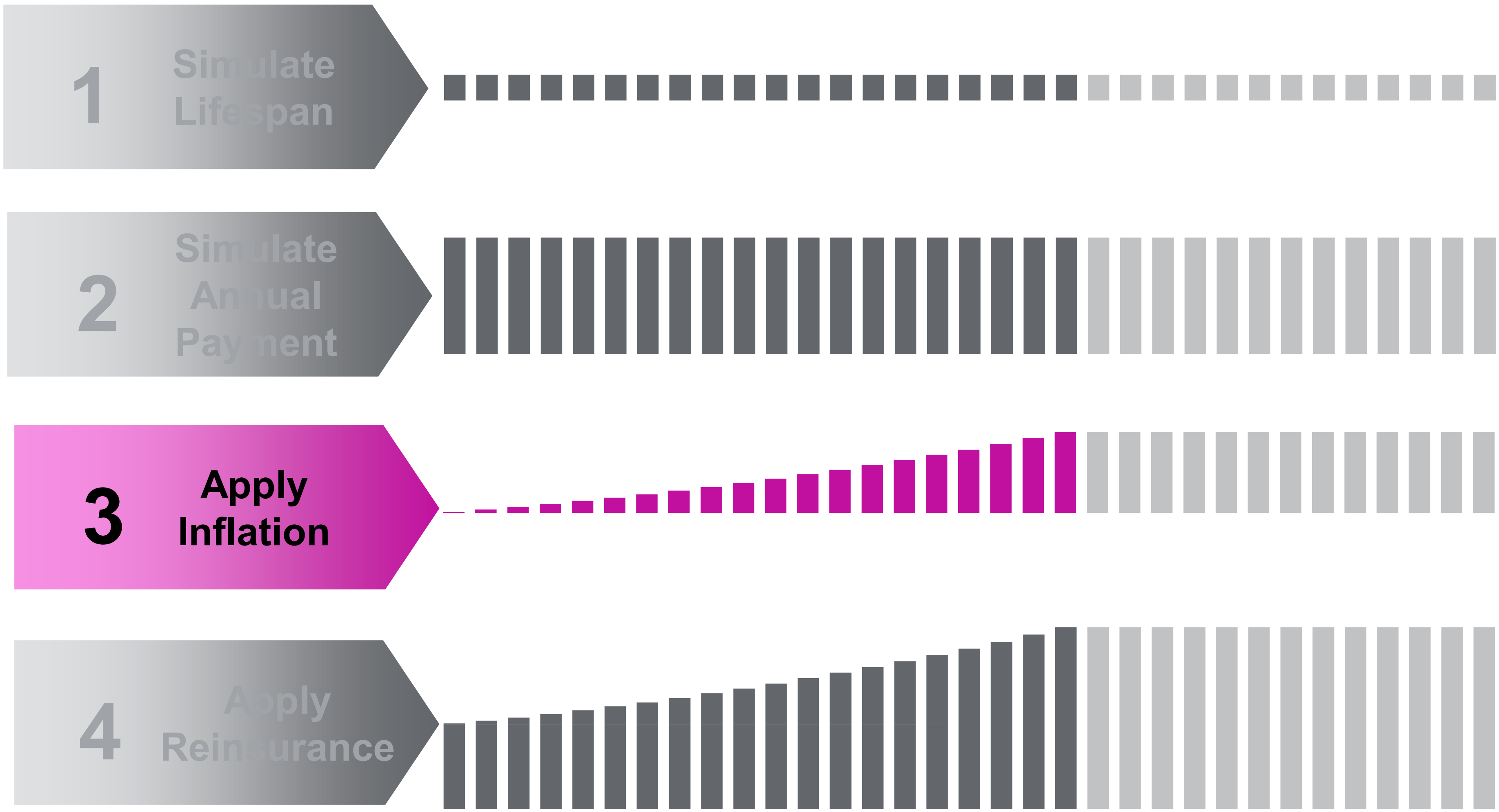
# Simulate Annual Payment

## Estimating the Variance

- Coefficient of Variation (CV) can be measured directly from historical payment stream
- If you have a large cohort of claims, you can measure and select the CV by size
  - Larger claims are likely to have a smaller CV as the claimant is generally in a facility with relatively stable costs
  - Smaller claims require a larger CV to cover the possibility of a claimant moving from family care to a more expensive facility

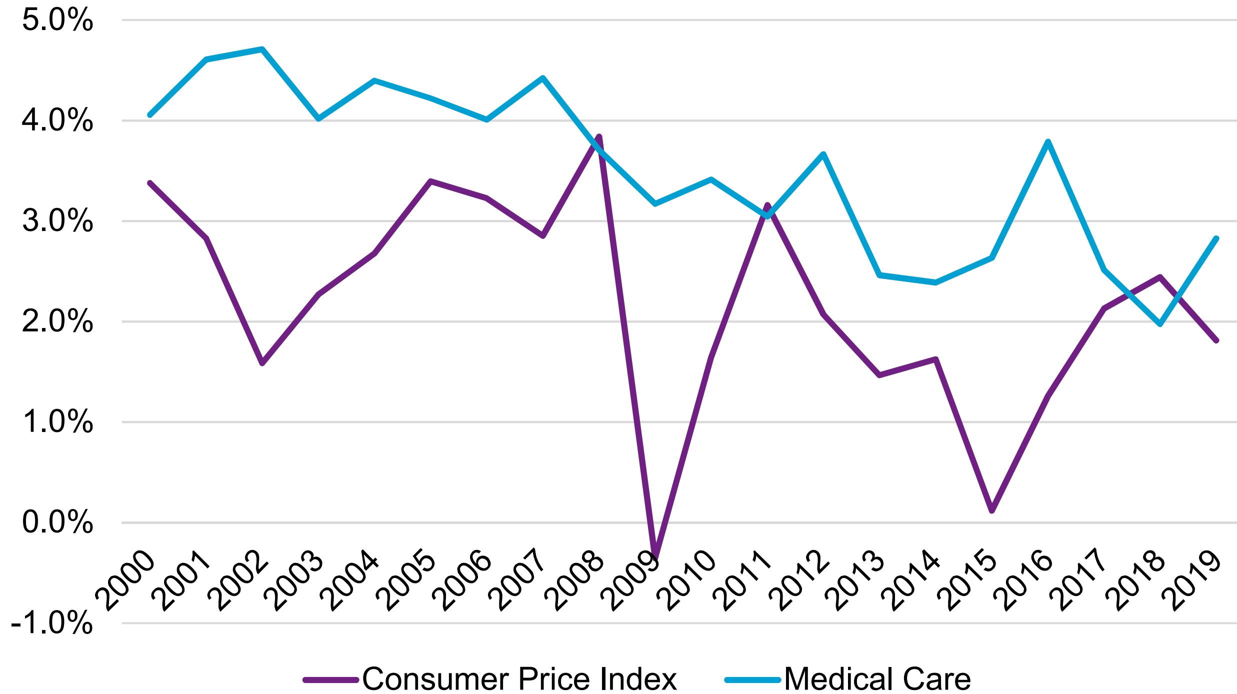


# Lifetime Medical Claims - Four Modeling Steps



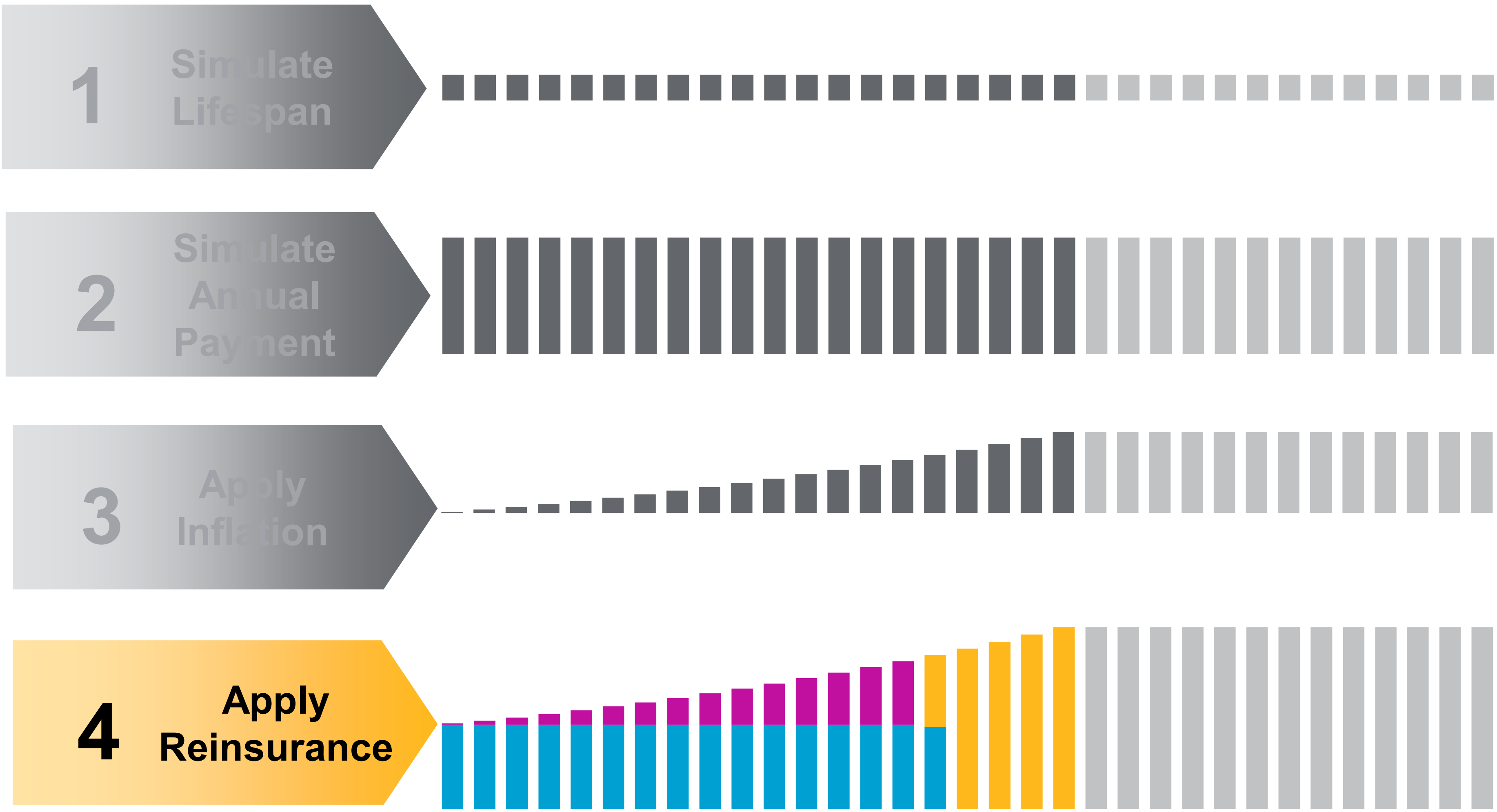
# Apply Inflation

- US Medical cost inflation has historically been higher than general price inflation
- An Economic Scenario Generator (ESG) can provide sample future inflation paths which can be applied to the simulated payments from step 2
- The US Congressional Budget Office publishes inflation forecasts that extend 10 years into the future
  - current forecasts have a CPI of 2.2% for 2023-2030; medical inflation should be one or two points higher




Source: US Bureau of Labor Statistics

# Lifetime Medical Claims - Four Modeling Steps

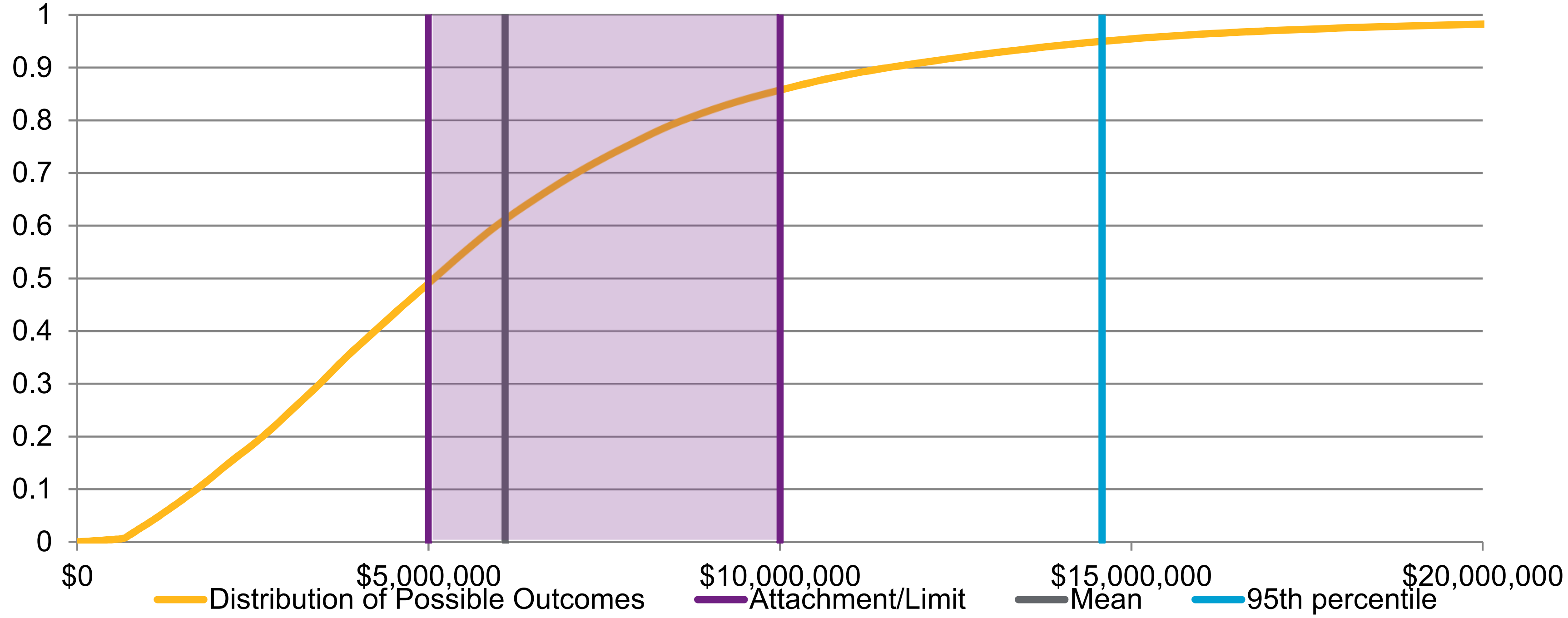


# Apply Reinsurance

## Claim 1

- Add future inflated payments and cumulative historical payments to estimate gross ultimate
- Apply reinsurance terms by layer
- Need attachment, limit, share by claim

Probability of Losses Exceeding:
Attachment: 51%
Attachment + Limit : 14%

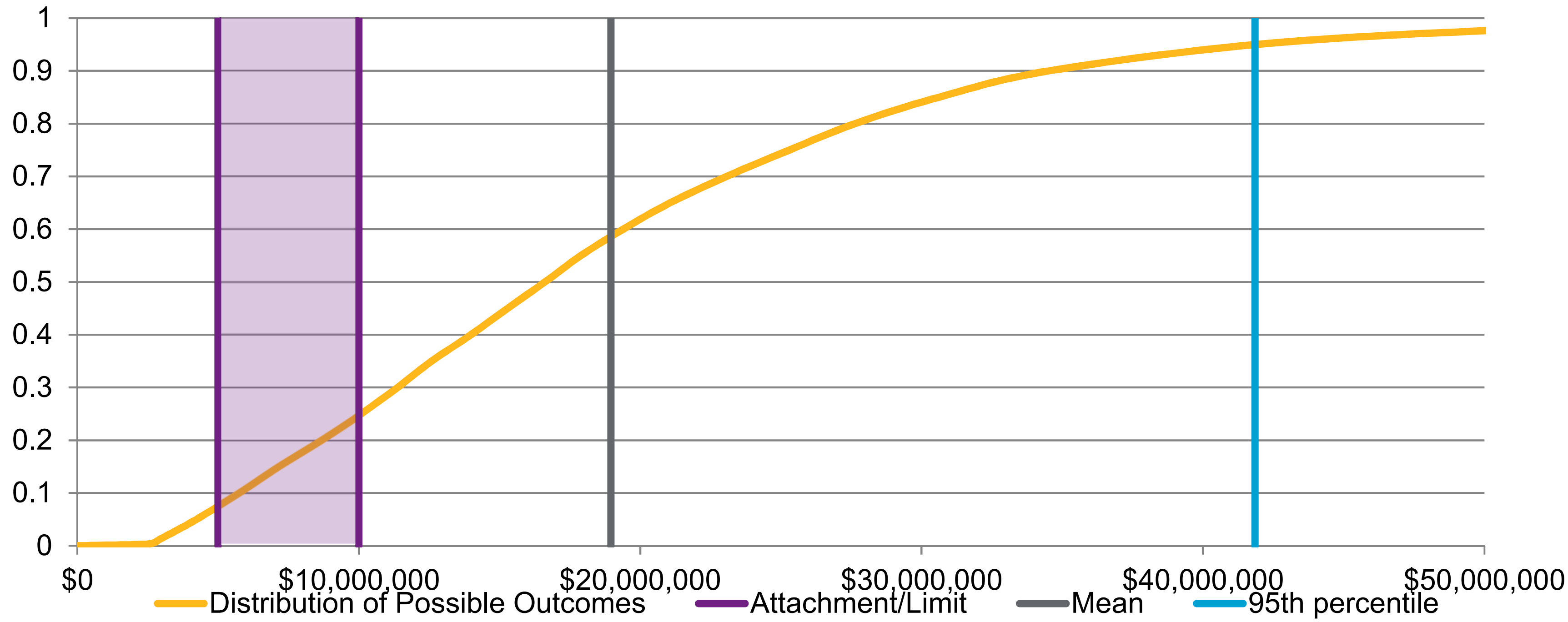


# Apply Reinsurance

## Claim 2

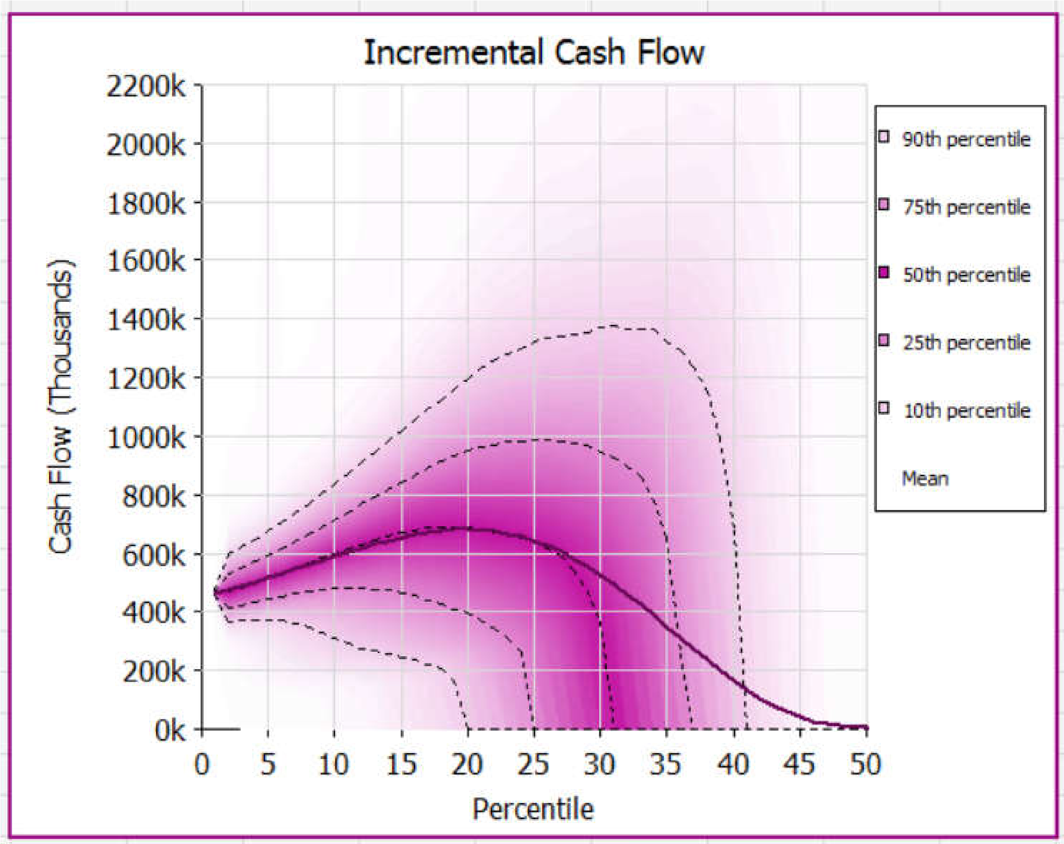
- Add future inflated payments and cumulative historical payments to estimate gross ultimate
- Apply reinsurance terms by layer
- Need attachment, limit, share by claim

Probability of Losses Exceeding:
Attachment: 93%
Attachment + Limit: 75%



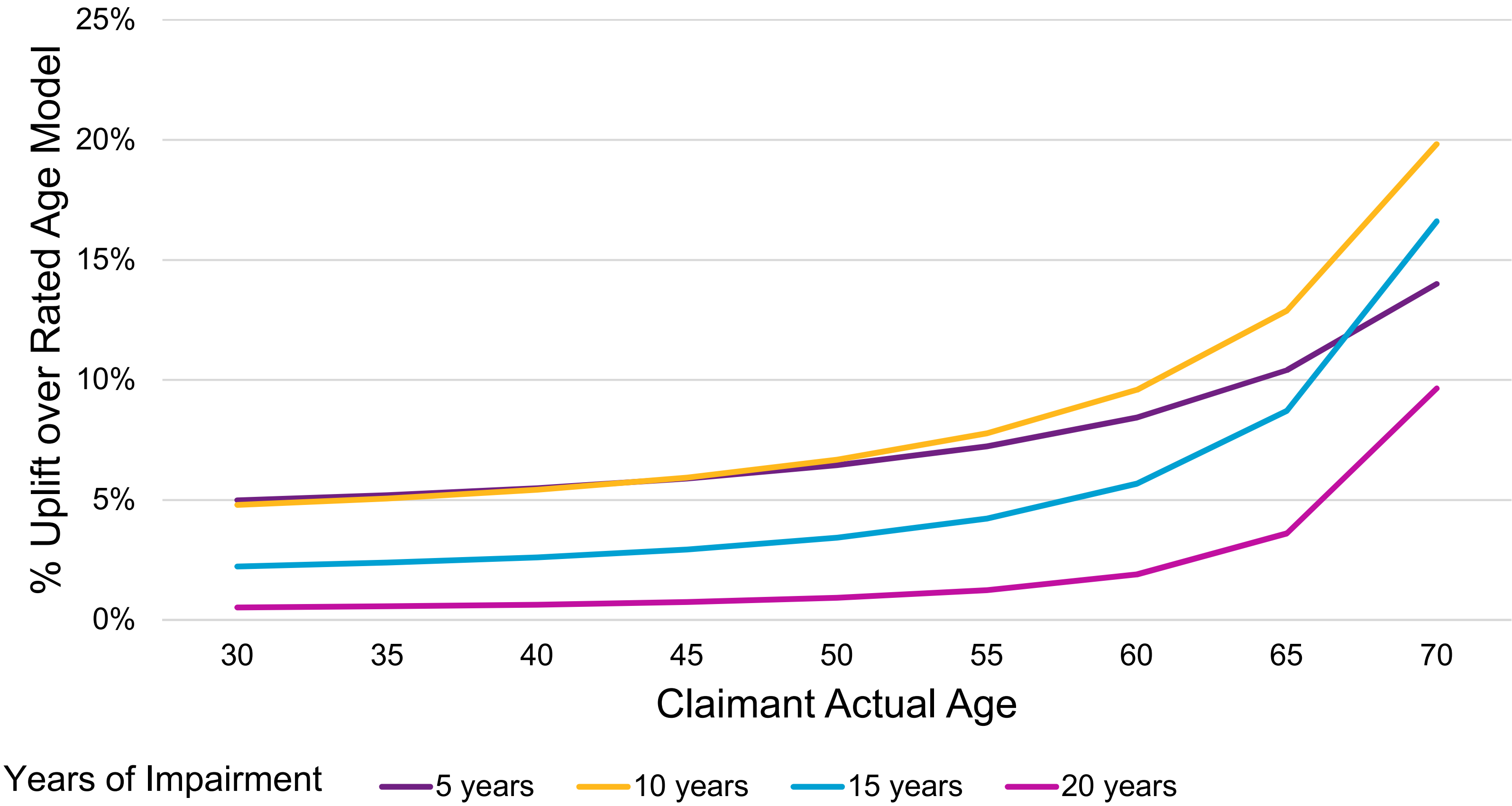
# Results: Model Outputs

- The model produces a full set of future cash flows on both a gross and net basis
  - Results can also be discounted using yield curves that correspond with the economic scenarios driving inflation
- Number of simulations can be increased if needed for greater precision at the 95th and higher percentiles



# Results: Impact of Blended Mortality

- The blended model will produce a higher liability estimate than the rated age model, and the impact will vary depending on claimant age and years of impairment
  - Older claimants generally have a higher uplift than younger claimants



# Recap

- Lifetime medical claims can be modeled using mortality assumptions
  - It is important to consider the risk that the impairment is overestimated (and therefore that the liability is underestimated)
  - Blending rated with population mortality can help mitigate this risk
- Modeling lifetime claims requires four steps
  - Simulating life span
  - Simulating Annual Payment
  - Apply Inflation
  - Apply Reinsurance
- The impact of blending rated and actual mortality depends on two main factors
  - Actual age of the claimant
  - Amount of impairment

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# Thank You