

Overview of recent Canadian Institute of Actuaries' mortality research

Jared M. Mickall, FCIA, FSA

Presentation to the Winnipeg Actuaries'
Club on June 8, 2026



Civil Service
Superannuation
Board

Your Speaker Today

Jared Mickall, FCIA, FSA



- Director, Actuarial and Pension Services at CSSB.
- 25+ years of experience in the pension industry.
- Jared is currently Co-Vice-Chair of the Canadian Institute of Actuaries' (CIA) Actuarial Guidance Council and has served the CIA and SOA as a volunteer in various roles.
- Jared has been a presenter for the Canadian Pension & Benefits Institute on pension matters.
- Jared serves on the Board of Directors of The Osvita Foundation Inc.



Civil Service Superannuation Board

Disclaimer

- This document and session today contains views and opinions which are those of the author/presenter and do not necessarily reflect the official policy or position of any other author, agency, organization, employer or company, including the Civil Service Superannuation Board.

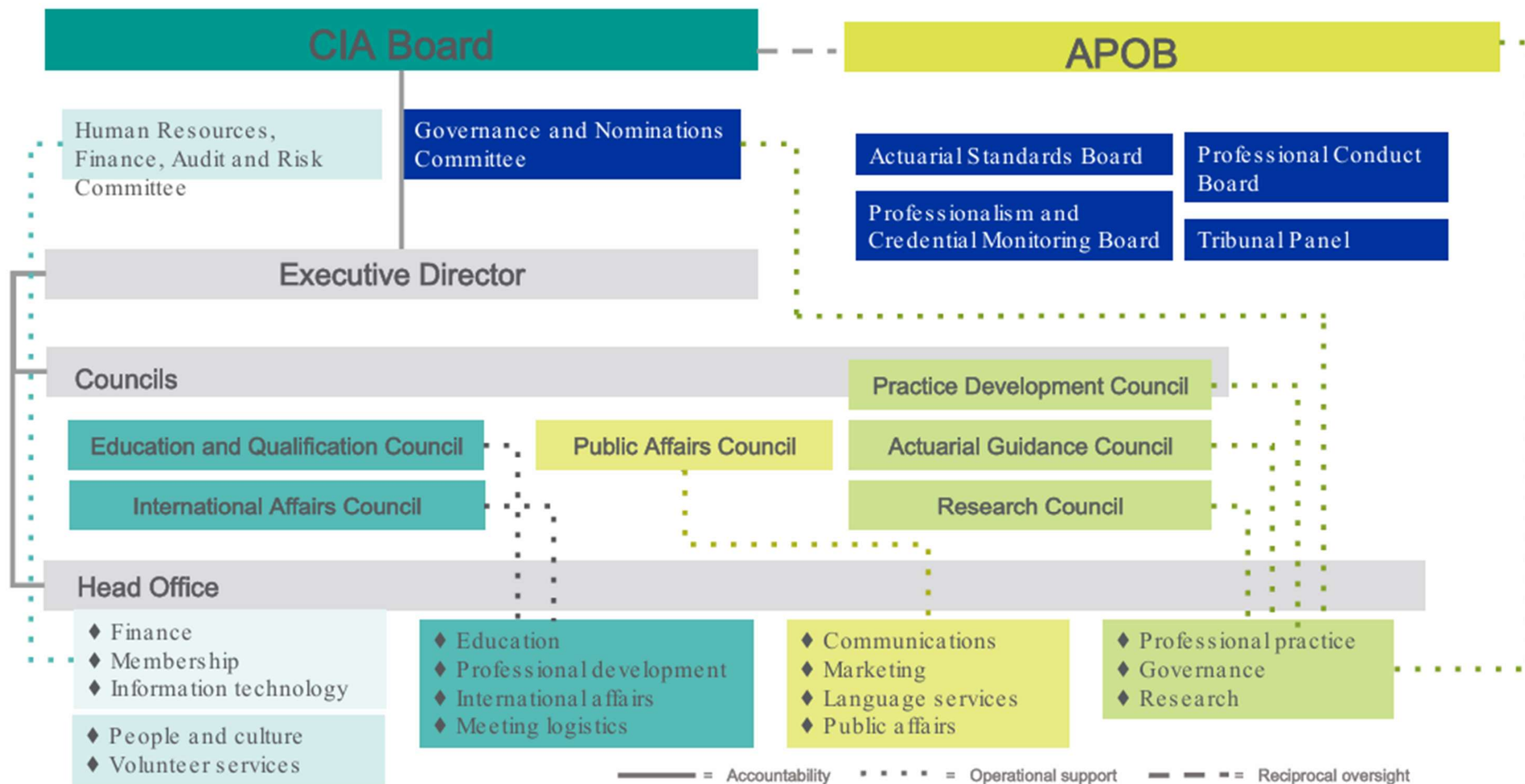


Agenda

1. Organizational Structure of Canadian Institute of Actuaries
2. Background
3. Research
 - Mortality Improvement
 - Canadian Pensioners' Mortality
4. Proposal to promulgate and relative impacts
5. Other observations
6. Close



CIA Organizational Structure



Background

Best estimate mortality assumption

The selection of an appropriate best estimate mortality assumption involves two key components:

- **Base mortality table:** the best estimate of mortality rates applicable to the plan
- **Future mortality improvement scale:** appropriate adjustments to the base mortality table to reflect expected future improvements in mortality.



Background

CPM2014 Tables

- Canadian Pensioners' Mortality research study published in 2014
 - Examined experience from 1999 to 2008
- Three sets of base tables
 - CPM2014Priv
 - CPM2014Publ
 - CPM2014
- Statistics on general trends by amount of pension, employment type
- An improvement table: CPM-B
 - Developed based on the results of the "Canada/Quebec Pension Plan (C/QPP) Phase III Report," with refinements, using mortality data from 1967 to 2007



Background

CPM2014 Tables: Application to Canadian Pension Plans

In certain circumstances, the Standards of Practice states that mortality tables are **promulgated** by the Actuarial Standards Board. Currently, CPM2014 base tables and CPM-B improvement scales are promulgated for:

- Commuted values for non-target pension arrangement (3530 of the SOP)
 - Lump sum value a member would receive in lieu of a pension
- Actuarial evidence (4530 of the SOP)
 - Value of pension under relationship breakdown



Background

CPM2014 Tables: Application to Canadian Pension Plans

CPM2014 base tables, with or without adjustments, and CPM-B improvement scale are also widely used by pension practitioners in Canada in other work:

- Commuted values for target pension arrangement (3570 of the SOP)
 - Lump sum value a member would receive in lieu of a pension
- Funding valuations (going concern, solvency)
 - Minimum funding requirements and/or maximum permitted
- Financial reporting
 - Accrued benefit liability (asset) → balance sheet debt
 - Pension expense → DB pension cost recognized



Background

CPM2014 Tables: Other

CPM2014 base tables, with or without adjustments, and CPM-B improvement scale may have been used for other work in Canada such as:

- Valuation of post-employment non-pensions benefits
- Executive compensation disclosure
- Total compensation analysis



Research Research!

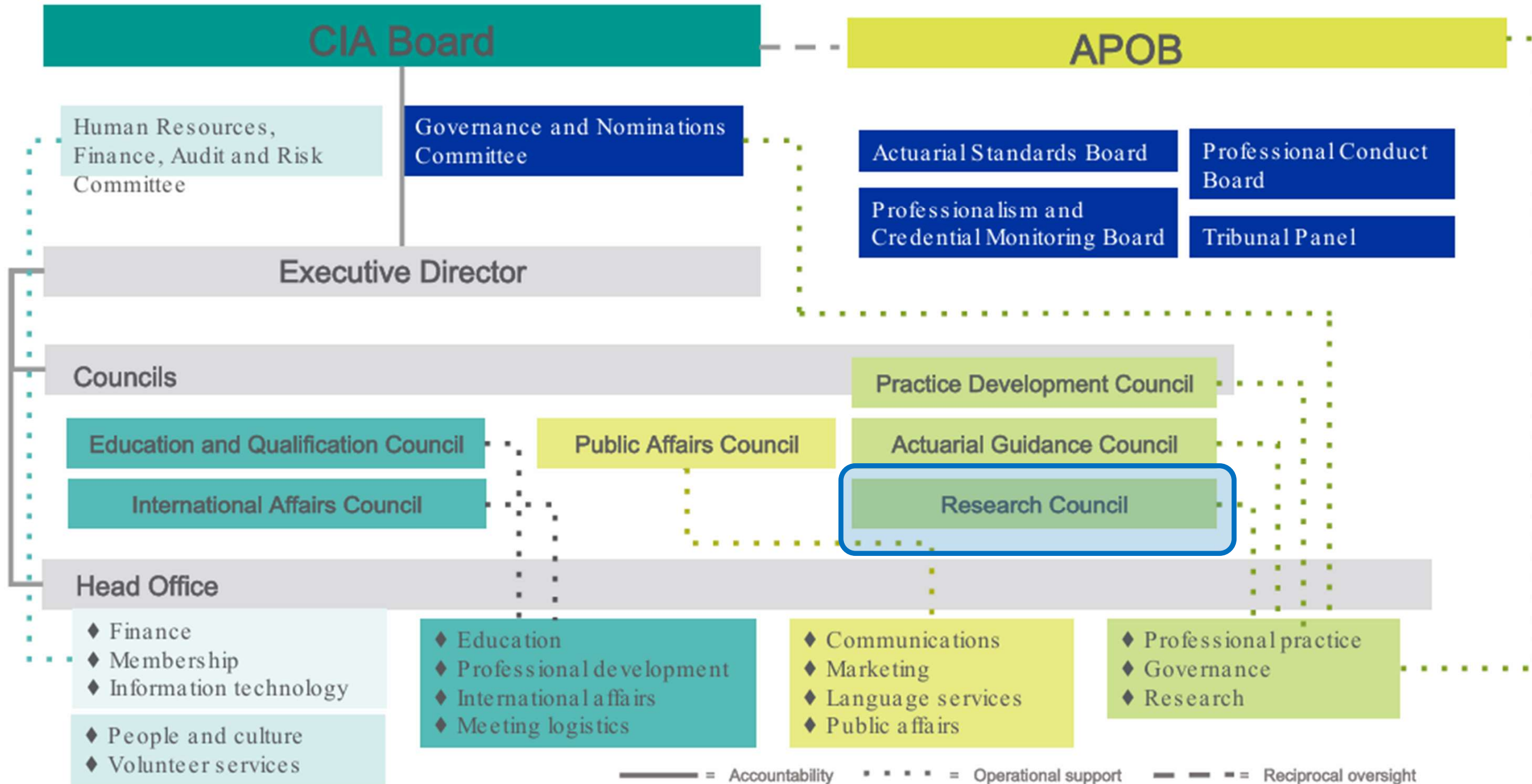
Two research projects were approved:

- Mortality Improvement in Canada
Purpose: provide a basis for the development of an updated set of assumptions for mortality improvements in Canada, which are to be used by actuaries across all practices.
- Canadian Pensioners' Mortality
Purpose: update the Canadian Pensioner Mortality (CPM) tables



Civil Service Superannuation Board

CIA Organizational Structure



Research

Mortality Improvement in Canada

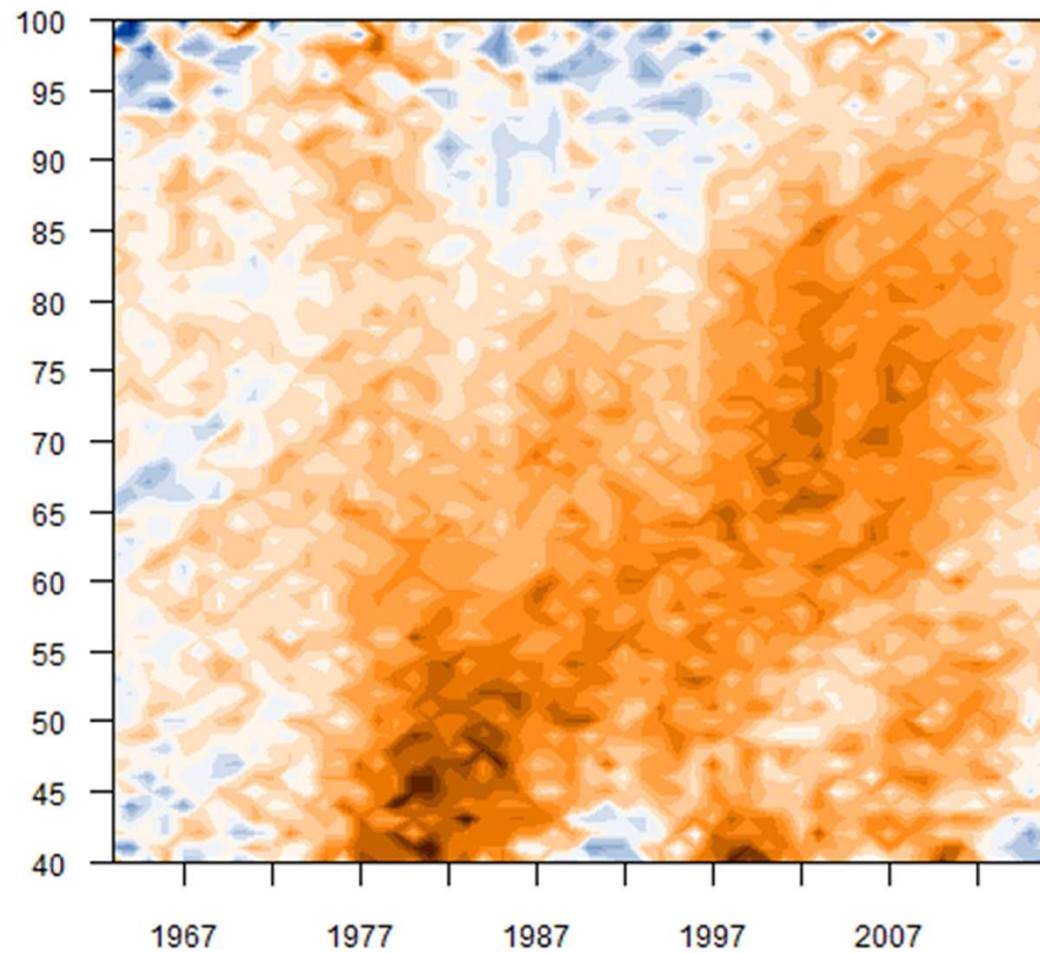
	CPM-B	MI-2017	MI-2024
Date released	February 2014	September 20, 2017	April 11, 2024
Data sources	C/QPP mortality data	Human Mortality Database(HMD), augmented by OAS	HMD, with OAS used to inform higher ages
Data period	1967-2007	1970-2013	1980-2019



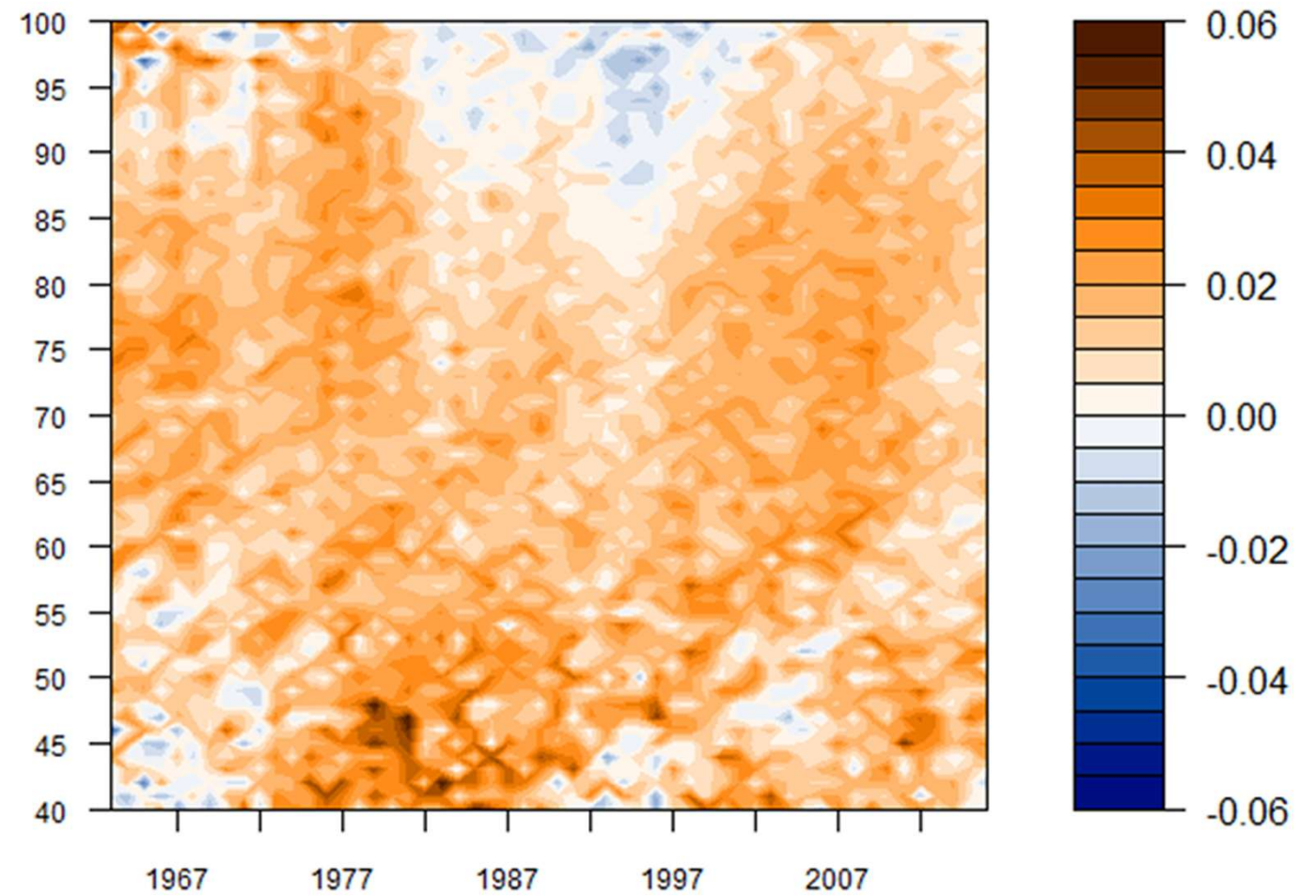
Research

Mortality Improvement in Canada

Canadian Males



Canadian Females



Source: HMD data for Canada, males, 1959-2019, ages 40-100, seven-year moving average MI rates

Research

Mortality Improvement in Canada

	CPM-B	MI-2017	MI-2024
Initial rates	Improvement rates by age decreasing linearly for 2012-30; short-term rates blended to long-term rates	2013 improvement rates smoothed using standard actuarial graduation techniques	Model-fitted rates based on 2019 improvement rates decomposed into age, period and cohort comps.
First year of projection	2012	2014	2020
Long-term mortality improvement rate	0.8% up to age 82; decreasing to 0.3% by ages 97-107 (expert judgment)	1.0% for ages 0-90 (expert judgment)	1.3% for ages 40-90 (data-driven stochastic modelling)
Ages with no improvement assumed	Above attained age 115	Above attained age 103	Below attained age 20 and above attained age 110
Convergence period	20 years (attained in 2031)	20 years (attained in 2033)	30 years (attained in 2049)



Research

Mortality Improvement in Canada

Observations on differences in MI tables

- **Historical data** used to establish initial mortality improvement rates
- Differing rates also due to **smoothing and modelling approaches**, and selection of **explanatory variables**.



Research

Mortality Improvement in Canada

Observations on differences in MI tables

- **LTMI** for core ages is higher under the MI-2024 scale (1.3%) than under the MI-2017 (1.0%) and CPM-B (0.8%) scales.
 - Does not necessarily indicate a recent shift in Canadian MI trends, but rather method difference.
 - LTMI under the MI-2017 and CPM-B scales were derived primarily through expert judgment.
 - LTMI under MI-2024 is derived from stochastic mortality models fitted to historical data.



Research

Mortality Improvement in Canada

Observations on differences in MI tables

- **LTMI** for core ages is higher under the MI-2024 scale (1.3%) than under the MI-2017 (1.0%) and CPM-B (0.8%) scales.
 - MI-2024 report includes a **reasonable range** for the LTMI 30 years after the jump-off year 2019 is between 1.0% and 1.9%.
 - MI-2024 report notes that the lowest best estimate among three modelled approaches was selected (1.3%), placing relatively greater weight on recent experience.



Research

Mortality Improvement in Canada

Observations on differences in MI tables

- **Convergence period** represents a judgment choice in the development of each scale. For core ages, CPM-B converges in 2031, MI-2017 in 2033 and MI-2024 in 2049.
- The longer convergence period under MI-2024 results in the long-term improvement assumption having a relatively smaller impact on life expectancy than under MI-2017.



Research

2024 Canadian Pensioner Mortality Research Project

- Sept. 2021, the CIA retained Ad Res to carry out the research project
- Apr. 2023, request to Canadian pension plans for experience data
 - Experience data from as early as 2010 to as late as 2023
 - 33 plans included (48 plans provided, 15 removed for data quality)
 - Covering nearly 1.6 million individual records & 330,000+ deaths

**More than three times the volume
of experience data compared to 2014 study**

- 2014 study of Canadian Pensioner Mortality (CPM) tables examined experience from 1999 to 2008



Research

2024 Canadian Pensioner Mortality Research Project

- The research team evaluated several modelling and mortality table construction approaches and ultimately selected a fully parametric model that captured:
 - age and cohort effects,
 - mortality improvement during the observation period,
 - seasonal (intra-year) fluctuations, and
 - temporary mortality spikes (e.g., during the COVID-19 pandemic).



Research

2024 Canadian Pensioner Mortality Research Project

- Calibration of CPM2024 explicitly accounts for mortality associated with COVID-19
- Two periods of excess mortality associated with COVID-19.
 - April/May 2020 period was a clear outlier. Treated as a one-time event to be excluded in determining the base mortality rates.
 - December 2020/January 2021 period was comparable in magnitude to the excess mortality experienced during heavy influenza seasons. Included in determining the base mortality rates.



Research

2024 Canadian Pensioner Mortality Research Project

- The study produced a series of 10 tables for both amounts-weighted and lives-weighted (for a total of 20 tables)

	Male retiree	Male surviving spouse	Female retiree	Female surviving spouse
Combined	✓	✓	✓	✓
Light	✓	x	✓	✓
Heavy	✓	x	✓	✓

- “Light” variants which result in longer life expectancies
- “Heavy” variants which result in shorter life expectancies.



Civil Service Superannuation Board

Research

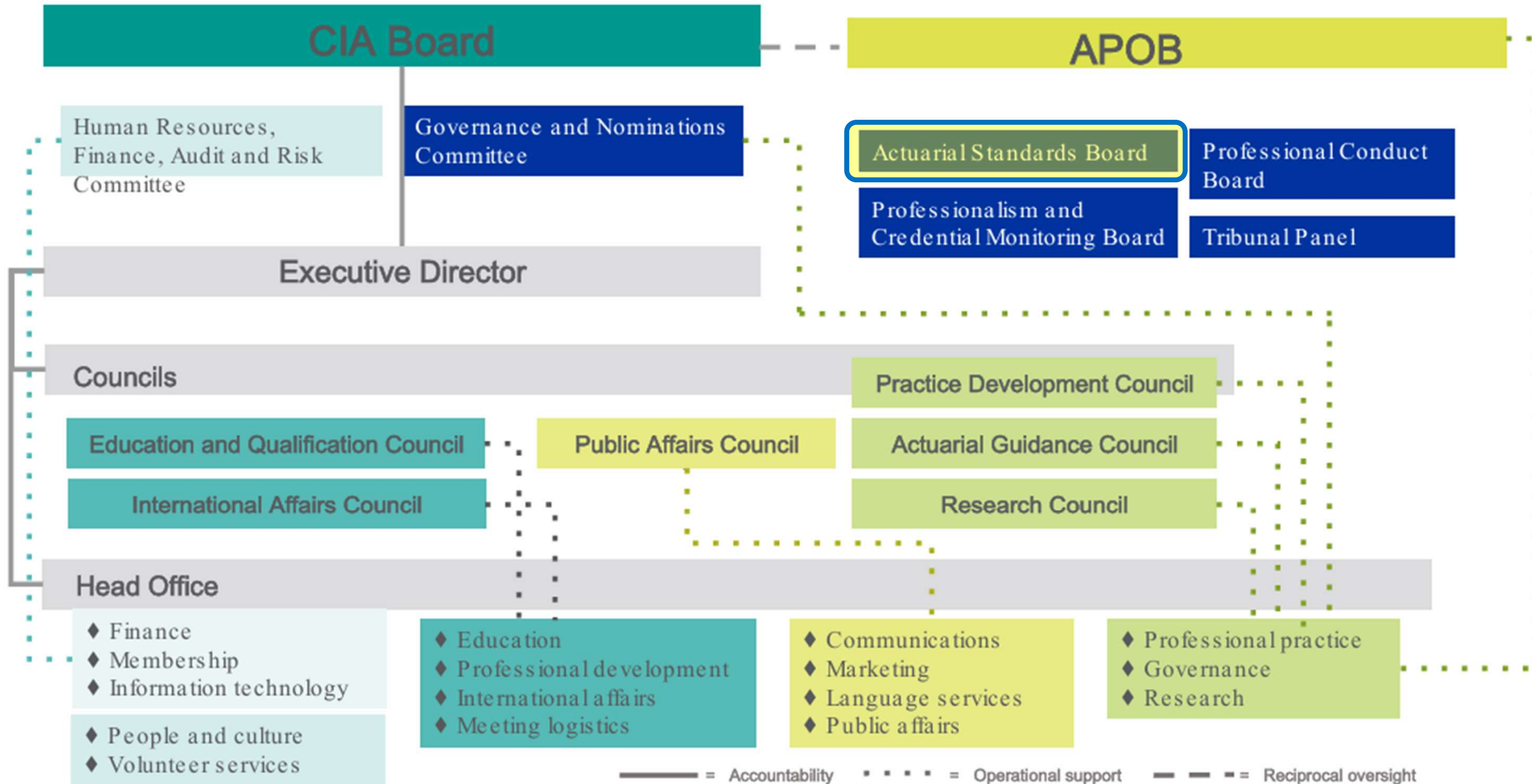
2024 Canadian Pensioner Mortality Research Project

- The tables below illustrate the impact on lifetime annuity factors by moving from the combined CPM2014 tables to the combined CPM2024 tables

Males				Females			
Age	CPM2014	CPM2024	Impact	Age	CPM2014	CPM2024	Impact
35	21.66	21.79	+0.6%	35	22.21	22.24	+0.1%
45	19.94	20.05	+0.6%	45	20.63	20.68	+0.2%
55	17.58	17.62	+0.2%	55	18.39	18.46	+0.4%
65	14.47	14.32	-1.0%	65	15.35	15.38	+0.2%
75	10.40	10.18	-2.1%	75	11.42	11.36	-0.5%
85	5.94	5.89	-0.8%	85	6.92	6.87	-0.7%
95	2.70	2.83	+4.8%	95	3.25	3.33	+2.5%

The annuities are paid at the beginning of the month, calculated in 2024 and based on a 4% interest rate. The factors reflect generational projection with scale CPM-B, applied from 2014 for CPM2014 and from 2024 for CPM2024

CIA Organizational Structure



Initial Communication

Proposal to promulgate

- Oct. 16, 2025, designated group established by Actuarial Standards Board
 - Review the mortality basis promulgated for 3530 and 4530 of the SOP.
 - Current basis: CPM2014 with CPM-B was effective **Oct. 1, 2015**
- May 6, 2026, ASB proposes to promulgate the use of the mortality rates for 3530 and 4530 of the SOP as follows:
 - Proposed basis: CPM2024, amount weighted with MI-2024, to be effective Feb. 1, 2027
 - Comment deadline: July 15, 2026



Initial Communication

Proposal to promulgate

Effect of changing **base** mortality table from CPM2014 to CPM2024

Table A_N: Effect on non-indexed commuted value factors				
Age	Male, single	Female, single	Male, J&S60%	Female, J&S60%
25	-0.2%	0.3%	-0.1%	0.1%
35	-0.2%	0.3%	-0.1%	0.1%
45	-0.2%	0.3%	-0.1%	0.1%
55	-0.2%	0.4%	-0.1%	0.1%
65	-1.0%	0.2%	-0.5%	-0.1%

Commuted value factors of annuity deferred to age 60 (or immediate if older than 60) were calculated based on March 2026 interest rates (3.4% for 10 years, 5.1% thereafter for non-indexed pensions, and 1.4% for 10 years, 3.0% thereafter for fully indexed (both prior to and after retirement) pensions)

Initial Communication

Proposal to promulgate

Effect of changing **base** mortality table from CPM2014 to CPM2024

Table A_l: Effect on fully indexed commuted value factors				
Age	Male, single	Female, single	Male, J&S60%	Female, J&S60%
25	-0.3%	0.3%	-0.2%	0.1%
35	-0.4%	0.3%	-0.2%	0.1%
45	-0.4%	0.3%	-0.2%	0.1%
55	-0.4%	0.4%	-0.2%	0.1%
65	-1.2%	0.2%	-0.6%	-0.1%

Commuted value factors of annuity deferred to age 60 (or immediate if older than 60) were calculated based on March 2026 interest rates (3.4% for 10 years, 5.1% thereafter for non-indexed pensions, and 1.4% for 10 years, 3.0% thereafter for fully indexed (both prior to and after retirement) pensions)

Initial Communication

Proposal to promulgate

Effect of changing base mortality table from CPM2014 to CPM2024 and improvement scale from CPM-B to MI-2024

Table B_N: Effect on non-indexed commuted value factors				
Age	Male, single	Female, single	Male, J&S60%	Female, J&S60%
25	4.2%	4.0%	3.6%	3.5%
35	3.6%	3.5%	3.1%	3.1%
45	3.0%	3.0%	2.7%	2.7%
55	2.3%	2.5%	2.1%	2.2%
65	1.5%	2.3%	1.8%	2.1%

Commuted value factors of annuity deferred to age 60 (or immediate if older than 60) were calculated based on March 2026 interest rates (3.4% for 10 years, 5.1% thereafter for non-indexed pensions, and 1.4% for 10 years, 3.0% thereafter for fully indexed (both prior to and after retirement) pensions)

Initial Communication

Proposal to promulgate

Effect of changing base mortality table from CPM2014 to CPM2024 and improvement scale from CPM-B to MI-2024

Table B_I: Effect on fully indexed commuted factors				
Age	Male, single	Female, single	Male, J&S60%	Female, J&S60%
25	6.0%	5.6%	5.4%	5.2%
35	5.1%	5.0%	4.7%	4.7%
45	4.2%	4.3%	4.0%	4.0%
55	3.2%	3.5%	3.2%	3.3%
65	2.2%	3.1%	2.7%	3.0%

Commuted value factors of annuity deferred to age 60 (or immediate if older than 60) were calculated based on March 2026 interest rates (3.4% for 10 years, 5.1% thereafter for non-indexed pensions, and 1.4% for 10 years, 3.0% thereafter for fully indexed (both prior to and after retirement) pensions)

Initial Communication

Proposal to promulgate

Sensitivity of factors to alternative LTMLs ranging from 1.0% to 1.9%

Table C_N: Effect on non indexed commuted value factors				
Age	Male, single	Female, single	Male, J&S60%	Female, J&S60%
25	2.6% - 7.2%	2.6% - 6.4%	2.3% - 5.8%	2.3%- 5.5%
35	2.3% - 6.2%	2.4% - 5.6%	2.1% - 5.1%	2.1%- 4.9%
45	2.0% - 4.9%	2.2% - 4.7%	1.8% - 4.2%	1.9%- 4.2%
55	1.7% - 3.6%	2.0% - 3.7%	1.6% - 3.3%	1.7%- 3.3%
65	1.0% - 2.5%	1.9% - 3.2%	1.4% - 2.8%	1.7%- 3.0%

Commuted value factors of annuity deferred to age 60 (or immediate if older than 60) were calculated based on March 2026 interest rates (3.4% for 10 years, 5.1% thereafter for non-indexed pensions, and 1.4% for 10 years, 3.0% thereafter for fully indexed (both prior to and after retirement) pensions)

Initial Communication

Proposal to promulgate

Sensitivity of factors to alternative LTMLs ranging from 1.0% to 1.9%

Table C_l: Effect on fully indexed commuted value factors				
Age	Male, single	Female, single	Male, J&S60%	Female, J&S60%
25	3.7%- 10.3%	3.7%- 9.2%	3.5%- 8.8%	3.5%- 8.4%
35	3.3%- 8.8%	3.4%- 8.0%	3.1%- 7.7%	3.2%- 7.4%
45	2.8%- 7.0%	3.1%- 6.7%	2.7%- 6.4%	2.8%- 6.3%
55	2.3%- 5.1%	2.7%- 5.2%	2.3%- 4.9%	2.4%- 4.9%
65	1.5%- 3.5%	2.5%- 4.4%	2.0%- 4.0%	2.3%- 4.3%

Commuted value factors of annuity deferred to age 60 (or immediate if older than 60) were calculated based on March 2026 interest rates (3.4% for 10 years, 5.1% thereafter for non-indexed pensions, and 1.4% for 10 years, 3.0% thereafter for fully indexed (both prior to and after retirement) pensions)

Other Observations Planning

Consider a female age 65 in 2024



Probability of Survival

CPM2024 (Retirees, Combined) with MI-2024

Survival probability

65 67 69 71 73 75 77 79 81 83 85 87 89 91 93 95 97 99 101 103 105 107 109 111 113 115 117 119

1

1

0.75

0.75

0.5

0.5

0.25

0.25

0

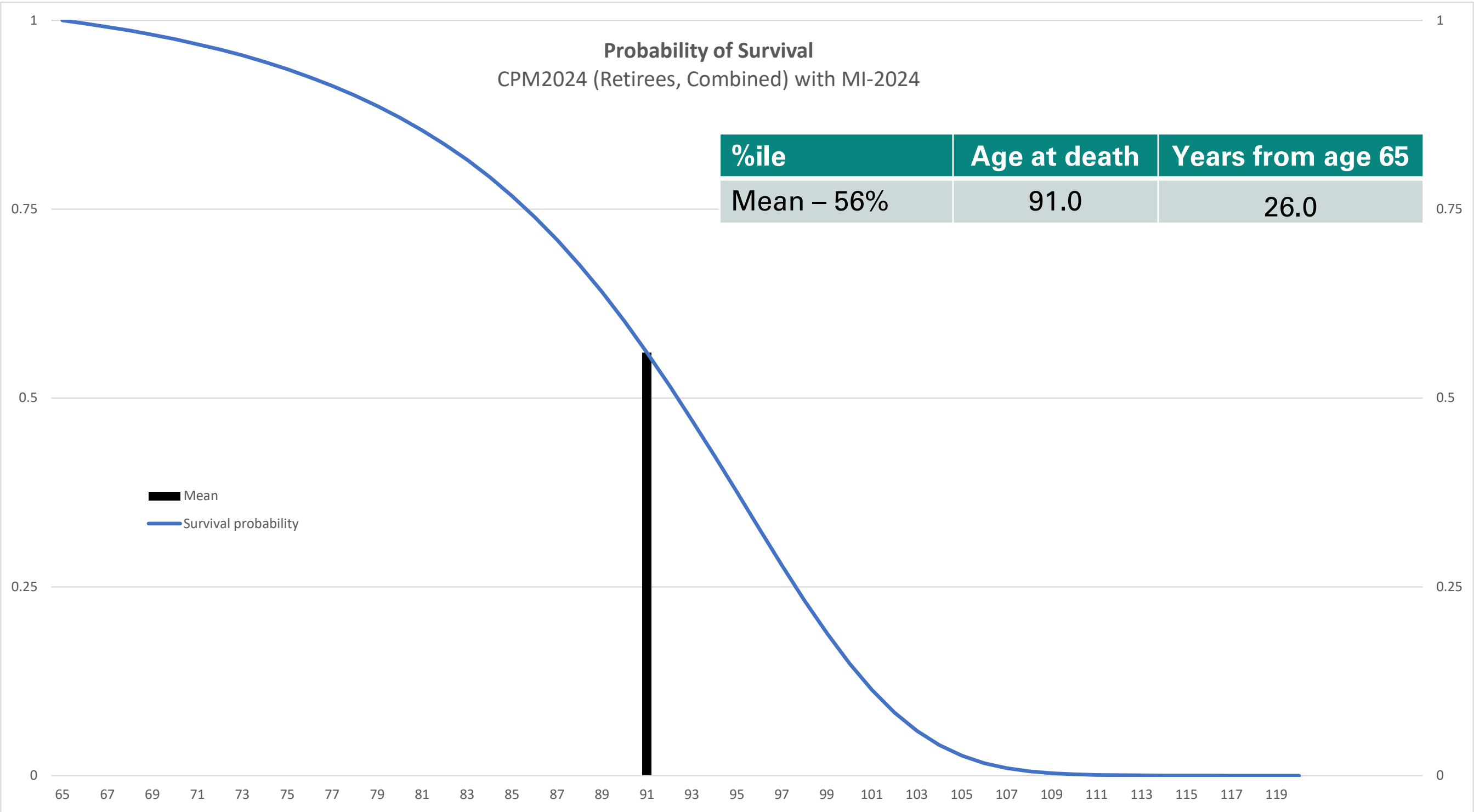
0

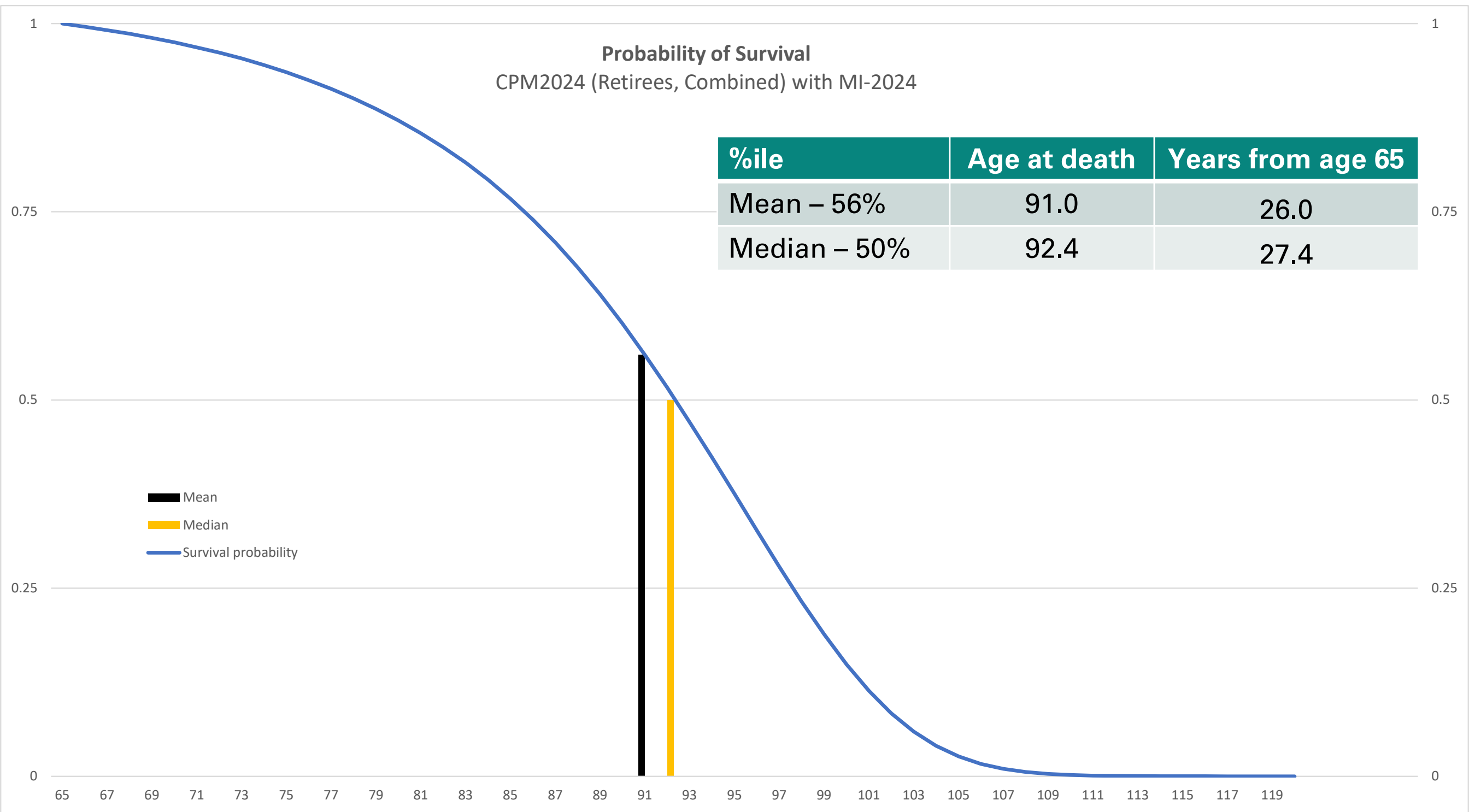
Probability of Survival
CPM2024 (Retirees, Combined) with MI-2024

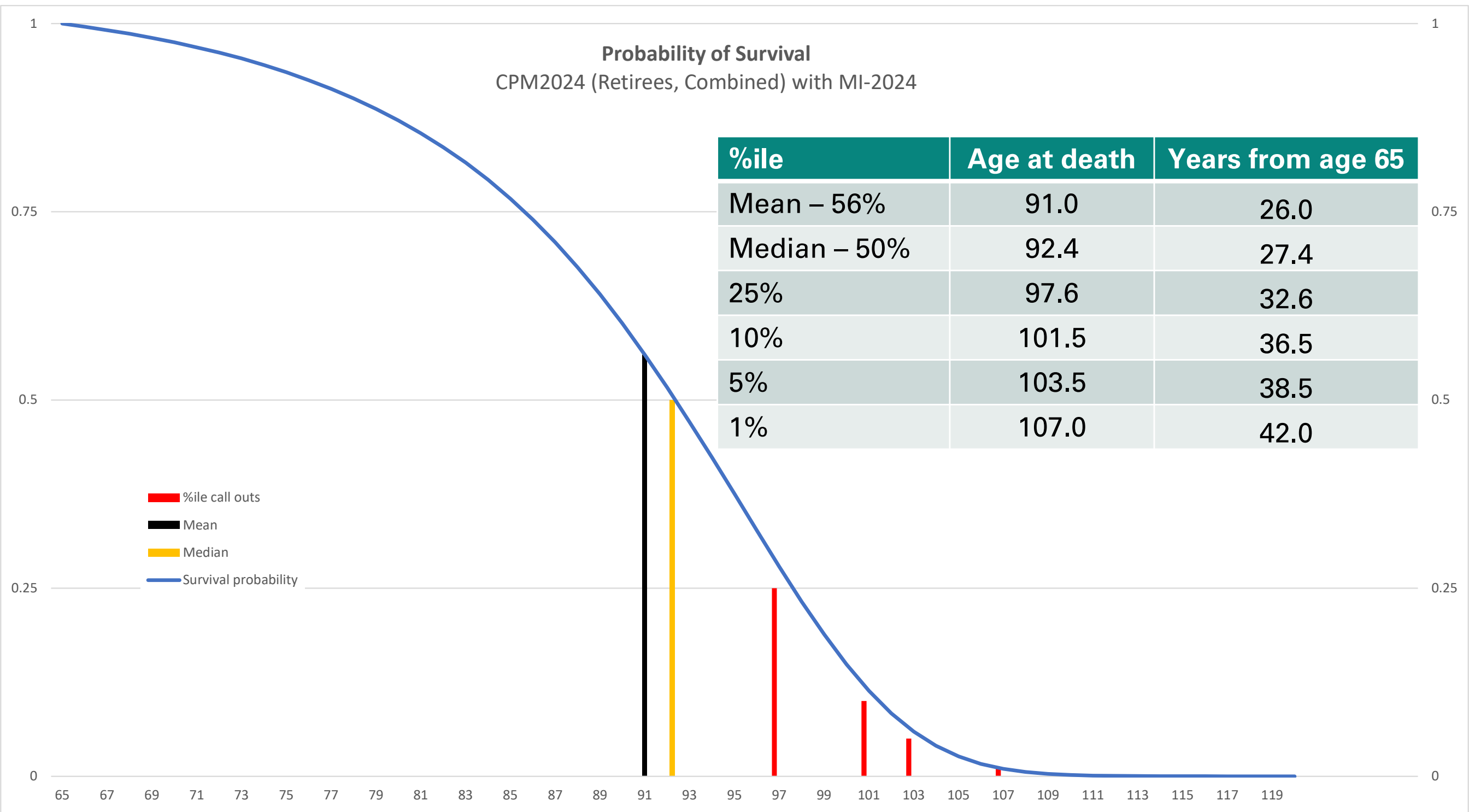
%ile	Age at death	Years from age 65
Mean – 56%	91.0	26.0

Mean

Survival probability







%ile	Age at death	Years from age 65
Mean – 56%	91.0	26.0
Median – 50%	92.4	27.4
25%	97.6	32.6
10%	101.5	36.5
5%	103.5	38.5
1%	107.0	42.0

Other observations

Planning - a female age 65 in 2024

%ile	Age at death	Years from age 65	Present value factor*	% save more relative to CV	% spend less relative to CV
Commuted value			16.17		
Mean – 56%	91.0	26.0	16.62	+2.8%	-2.7%
Median – 50%	92.4	27.4	17.11	+5.8%	-5.5%
25%	97.6	32.6	18.77	+16.0%	-13.8%
10%	101.5	36.5	19.78	+22.3%	-18.2%
5%	103.5	38.5	20.26	+25.2%	-20.1%
1%	107.0	42.0	21.00	+29.8%	-23.0%

* Interest rate of 4% per year. Single life payable annually at beginning of year. For CV factor, mortality rates are female CPM2024 with MI-2024. For non-CVs, factors are term certain.



Civil Service Superannuation Board

Other Observations

General

- Commuted values for target pension arrangement (3570 of the SOP)
 - Lump sum value a member would receive in lieu of a pension
- Funding valuations (going concern, solvency)
 - Minimum funding requirements and/or maximum permitted
- Financial reporting
 - Accrued benefit liability (asset) → balance sheet debt
 - Pension expense → DB pension cost recognized
- Social security

