



Mortality Projections for Canadian Social Security Programs

London Actuaries Club – February 25, 2021

Shayne Barrow, Senior Actuarial Officer, OCA, OSFI

Christine Dunnigan, Director, OCA, OSFI



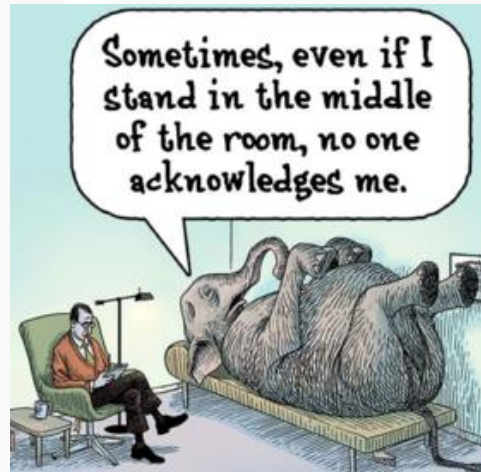
Office of the Chief Actuary

- Mandate: conduct statutory actuarial valuations on
 - Canada Pension Plan (CPP) – **20M members**
 - Old Age Security Program (OAS) - **6M beneficiaries**
 - Federal public sector pension and insurance plans – **0.8M members**
 - Canada Student Loans Program – **0.5M loans**
 - Employment Insurance Program – **19M workers**
- The Chief Actuary is solely responsible for content and actuarial opinions in reports prepared by the OCA.
- Mortality projections are developed for CPP, OAS and large federal public sector pension plans.



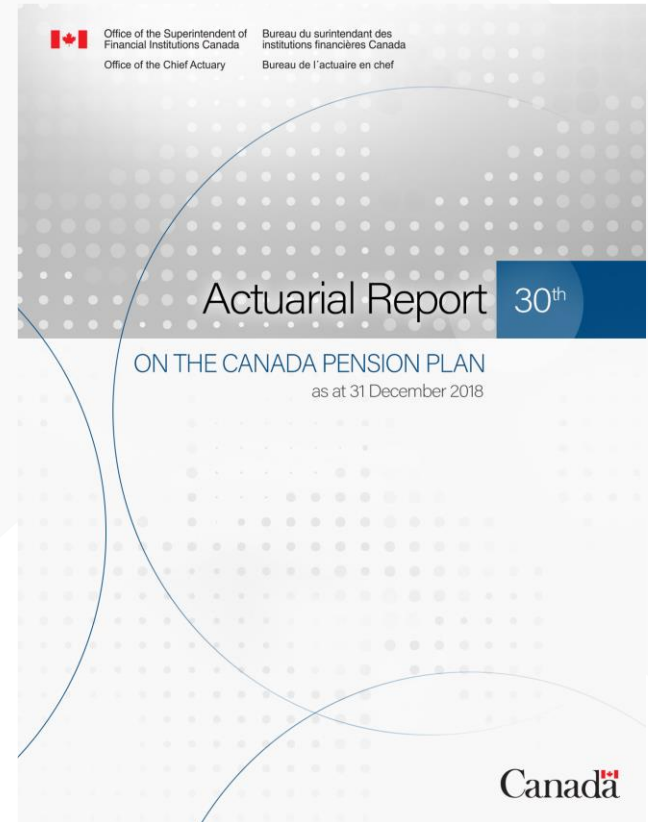
Triennial Actuarial Valuation of the CPP

- Normally, CPP mortality assumptions are the stepping stone for:
 - Population projections used in triennial valuation of the Old Age Security Program
 - Mortality improvement rates used in our statutory reports for most of the federal public sector pension plans
- CPP report was prepared and tabled before COVID-19



Triennial Actuarial Valuation of the CPP

- 30th CPP Report was Tabled by the Minister of Finance on 10 December 2019
- Separate mortality assumptions developed for:
 - General population
 - CPP Retirement Beneficiaries
 - CPP Survivor Beneficiaries
 - CPP Disability Beneficiaries
- Same mortality improvement rates are applied to all subgroups
- Starting mortality rates are different for each subgroup



Mortality Rates Projections for CPP

1. Starting point for population projections is 2015 Statistics Canada mortality rates:

- For retirees and survivors: adjustments to the population mortality
- For disabled: based on experience data

2. Assumed mortality improvement rates

- Combination of backward and forward looking approach
- Analyse historical data and understand past drivers
- Judgment-based approach to set select and ultimate improvement rates by age and sex
- Sensitivity tests to measure impact on CPP minimum contribution rates

3. Life expectancies are results of projections



Mortality Rates are Higher than Expected in CPP27

*2015 Life Expectancies without Improvements**

	MALES			FEMALES		
	Actual	CPP 27	Difference	Actual	CPP 27	Difference
at birth	79.9	80.5	-0.6	84.0	84.3	-0.3
at Age 65	19.3	19.7	-0.4	22.1	22.3	-0.2
at Age 70	15.5	15.9	-0.4	18.0	18.2	-0.2
at Age 75	12.1	12.3	-0.2	14.2	14.3	-0.1
at Age 80	9.0	9.1	-0.1	10.7	10.8	-0.1
at Age 85	6.5	6.5	0.0	7.7	7.7	0.0
at Age 90	4.4	4.4	0.0	5.3	5.3	0.0

* STATCAN 2014 – 2016 CLT (central year 2015)

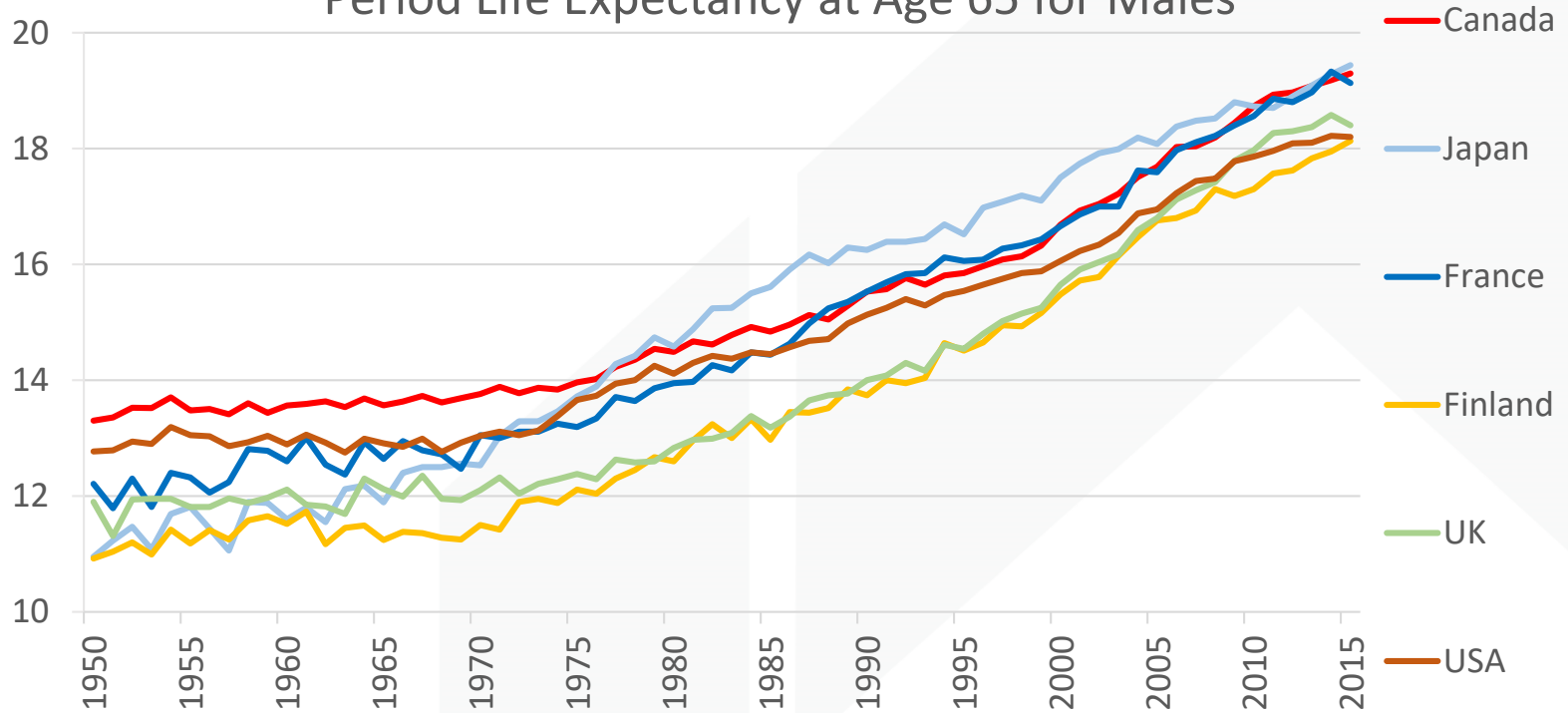


OSFI
BSIF

Office of the Chief Actuary | Bureau de l'actuaire en chef

Life Expectancy at Age 65

Period Life Expectancy at Age 65 for Males



Source: Human Mortality Database

Source for UK 2015+: Office for National Statistics, Past and projected expectations of life (ex) from the 2018-based life tables

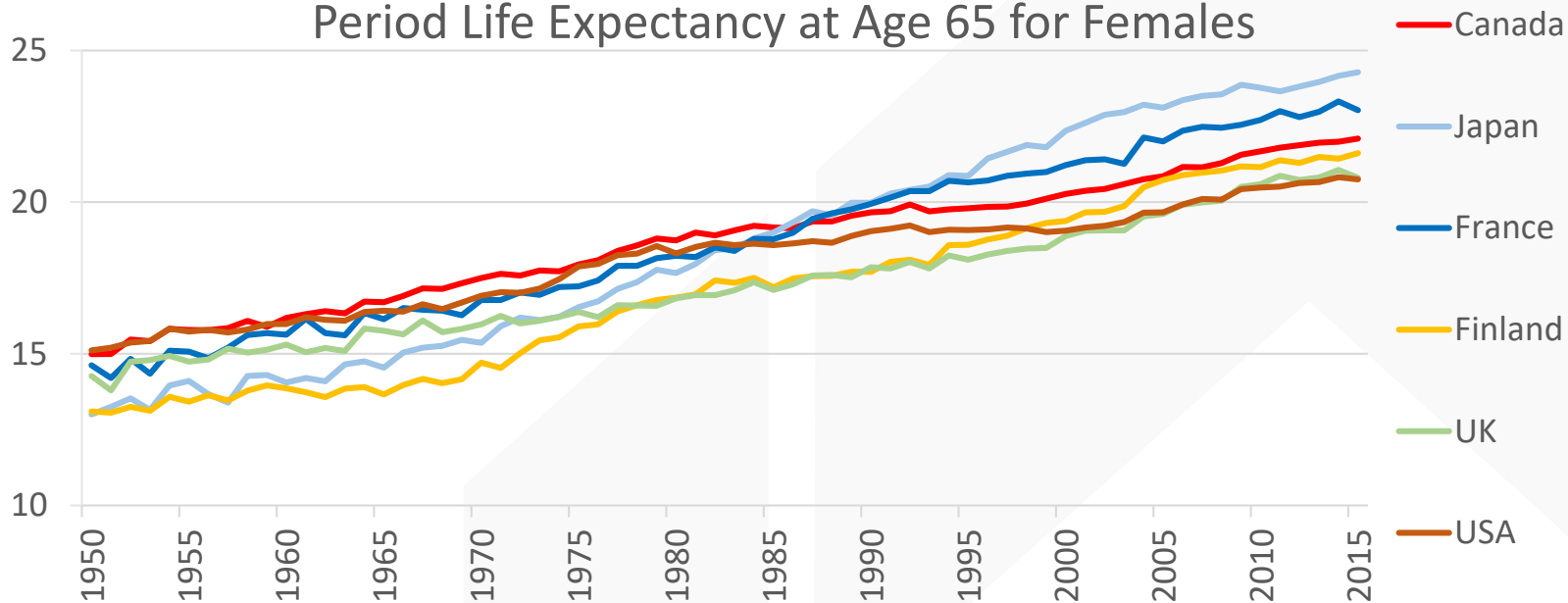


OSFI
BSIF

Office of the Chief Actuary Bureau de l'actuaire en chef

Life Expectancy at Age 65

Period Life Expectancy at Age 65 for Females



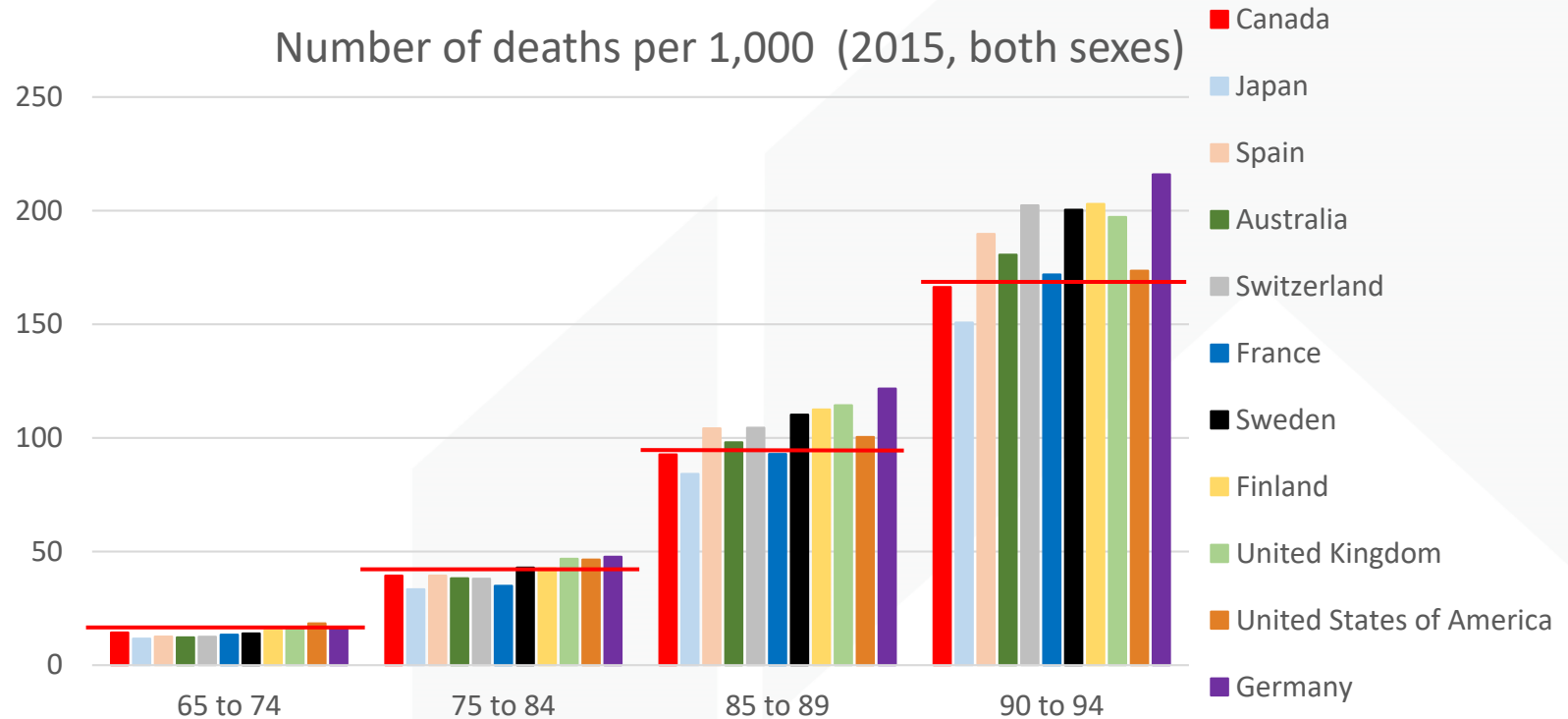
Source: Human Mortality Database

Source for UK 2015+: Office for National Statistics, Past and projected expectations of life (ex) from the 2018-based life tables

OSFI
BSIF

Office of the Chief Actuary Bureau de l'actuaire en chef

After age 85, Canada along with Japan and France have the lowest mortality rates



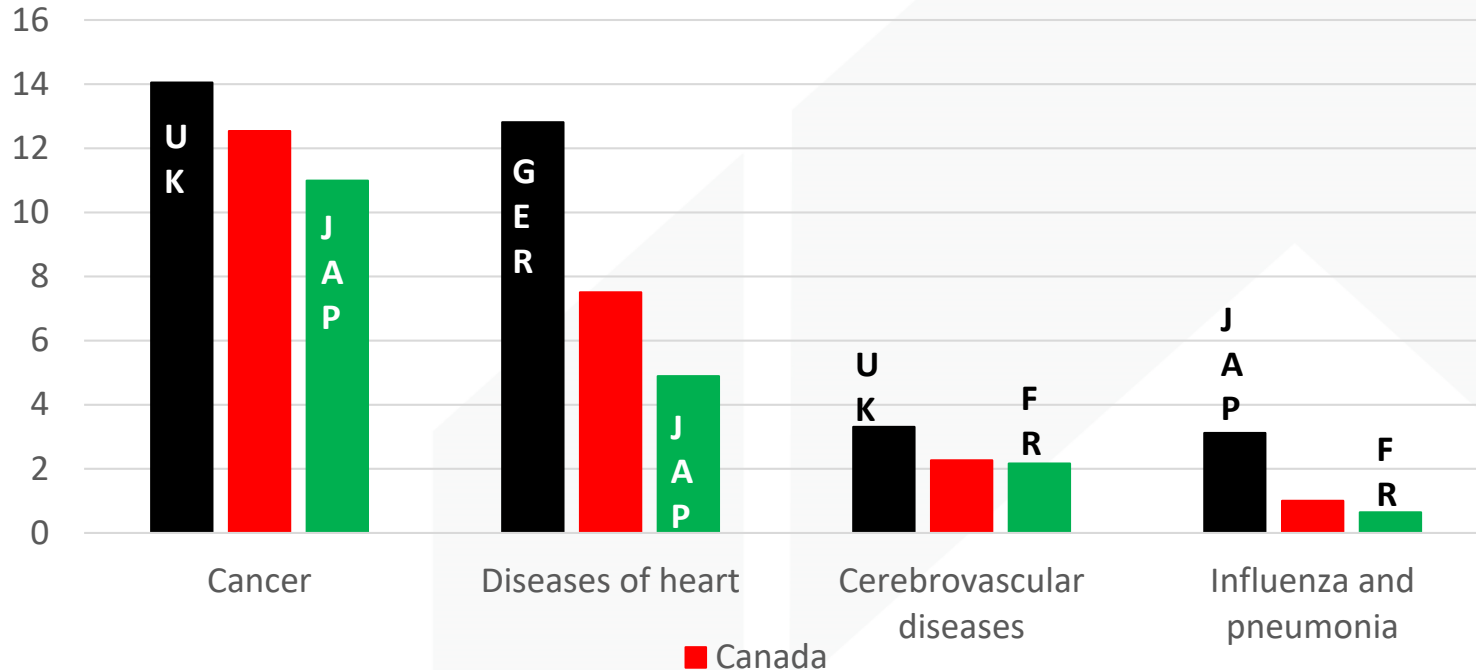
OSFI
BSIF

Source: Human Mortality Database

Office of the Chief Actuary Bureau de l'actuaire en chef

Cancer and Heart Diseases are the Leading Causes of Death in Most Countries

Mortality rates by cause (per 1,000), 75-84, both sexes, 2015

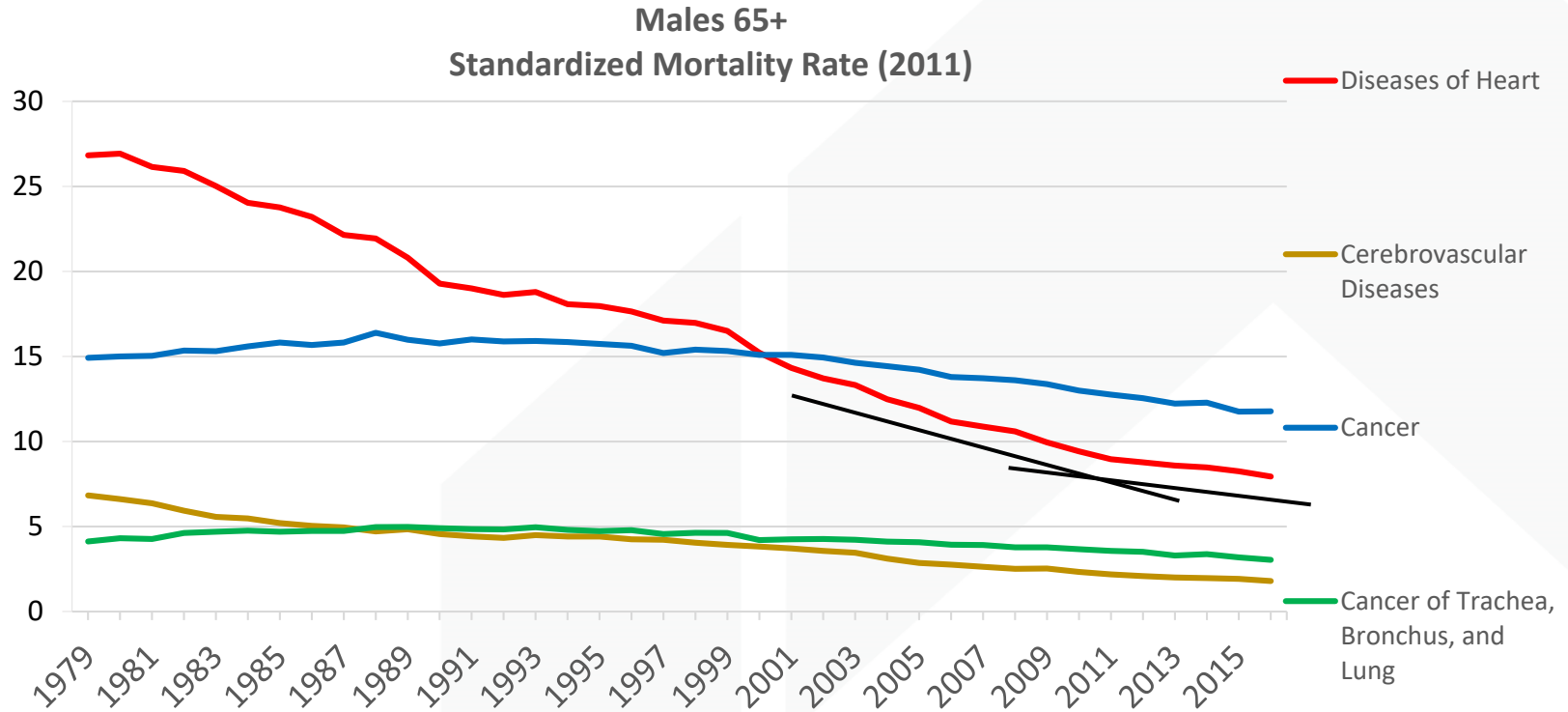


Source: World Health Organization

OSFI
BSIF

Office of the Chief Actuary Bureau de l'actuaire en chef

Improvements in mortality related to heart diseases have been significant over the last decades



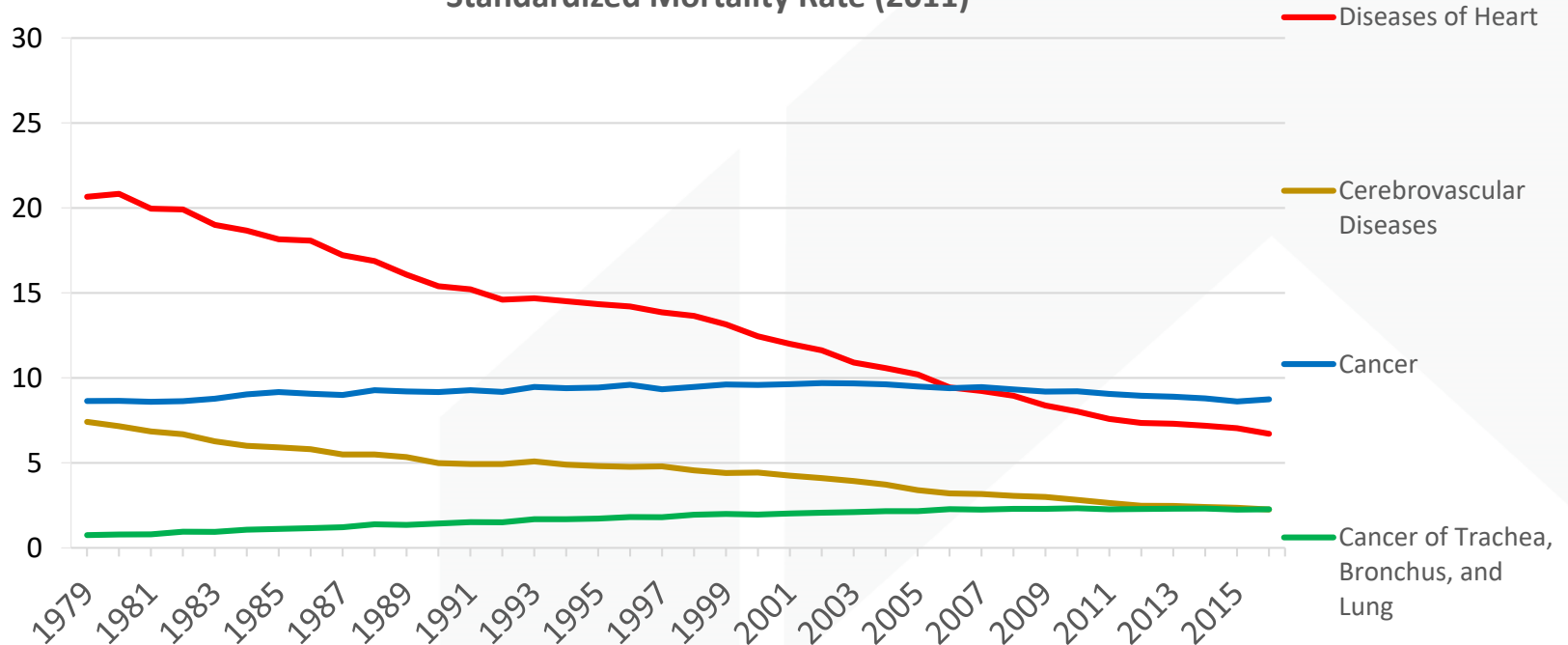
OSFI
BSIF

Source: Data from Statistics Canada, Health Division and OCA Calculations Standardized Using 2011 Canadian Population

Office of the Chief Actuary Bureau de l'actuaire en chef

For women, mortality from cancer reduces slowly

Females 65+
Standardized Mortality Rate (2011)



OSFI
BSIF

Source: Data from Statistics Canada, Health Division and OCA Calculations Standardized Using 2011 Canadian Population

Office of the Chief Actuary Bureau de l'actuaire en chef

Historical Mortality Improvement Rates

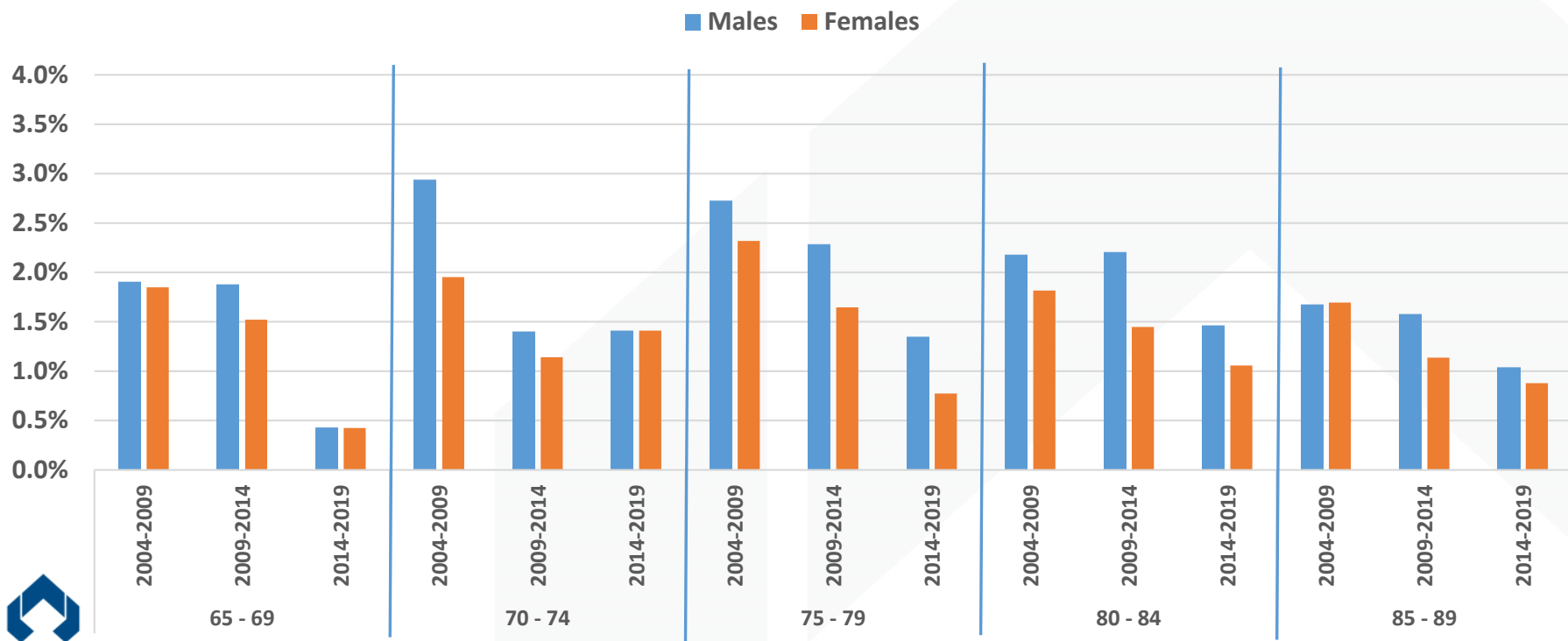
Long-Term Average

Age Group	Last 90 Years			Last 15 Years			Last 5 Years		
	Male	Female	Both	Male	Female	Both	Male	Female	Both
65-74	1.0	1.5	1.3	2.5	1.8	2.1	1.0	0.9	0.9
75-84	0.8	1.3	1.1	2.5	1.8	2.1	1.3	0.6	1.0
85-94	0.5	0.8	0.7	1.9	1.7	1.7	2.0	1.7	1.8
95-99	0.2	0.4	0.4	0.7	0.8	0.8	0.7	0.7	0.7
65+	0.8	1.1	1.0	2.2	1.6	1.9	1.4	1.1	1.3
85+	0.5	0.7	0.7	1.8	1.5	1.6	1.8	1.5	1.6

Based on CHMD until 2011 and STATCAN from 2012 to 2015 (periods ending in 2015)



Slowdown in mortality improvements in recent years: a blip or a new trend?



OSFI
BSIF

Source: OAS Mortality Fact Sheet – November 2020

Office of the Chief Actuary Bureau de l'actuaire en chef

Future drivers of mortality are not easy to quantify

- “Easy” gains have been somewhat achieved:
 - Previous improvement in heart disease mortality will be tough to duplicate
 - Favorable effects of decreasing smoking prevalence should continue for awhile but will diminish in 20-30 years.
- Future drivers of mortality could be:

FAVORABLE

- ✓ Enhanced medical treatment
- ✓ Pharmaceuticals
- ✓ Technology Breakthroughs

UNFAVORABLE

- ✓ Pandemics
- ✓ Increasing drug resistance
- ✓ Natural and man-made disasters

Source: Longevity, The dark side, Sam Gutterman, Longevity 12, Chicago, Sept. 2016



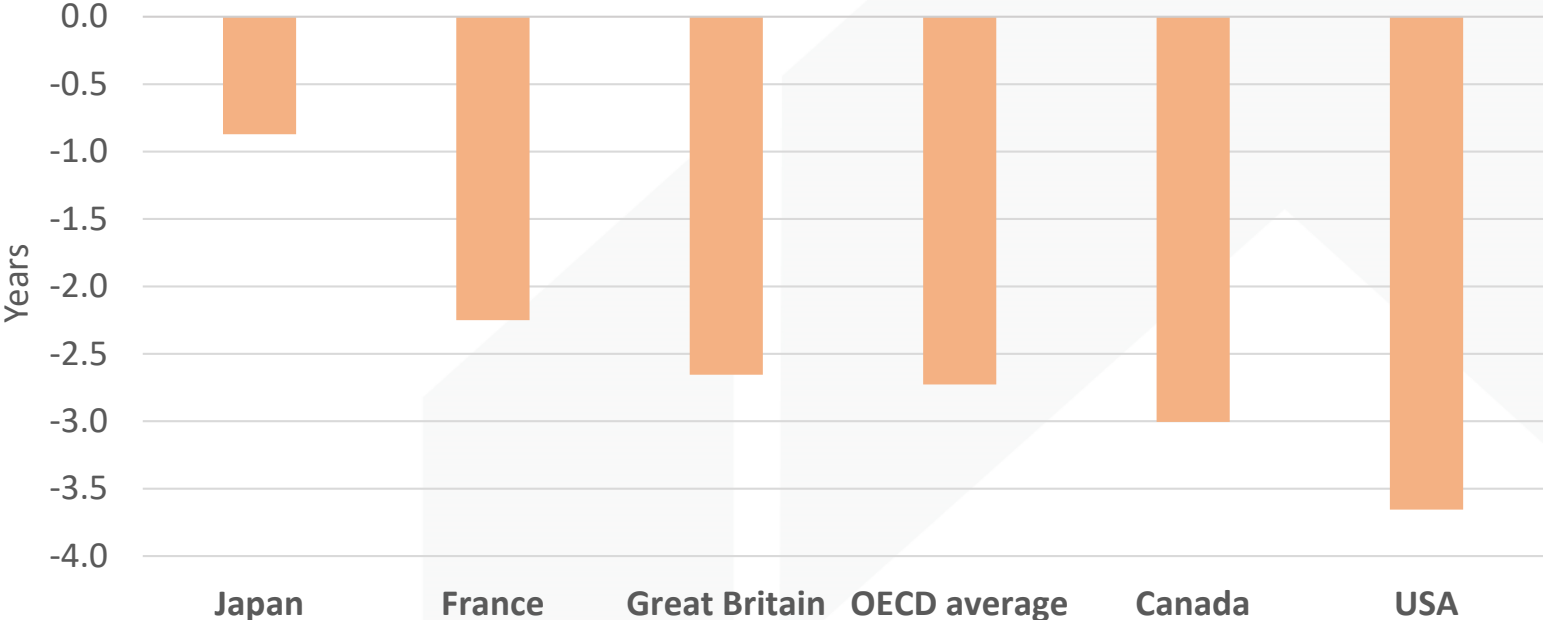
OSFI
BSIF

Office of the Chief Actuary Bureau de l'actuaire en chef

- Other factors: obesity, opioids, income inequality, aging

By 2050, cost of obesity in Canada is projected to be 3 years of unrealized gains in life expectancy

The impact on life expectancy in years, average 2020-2050

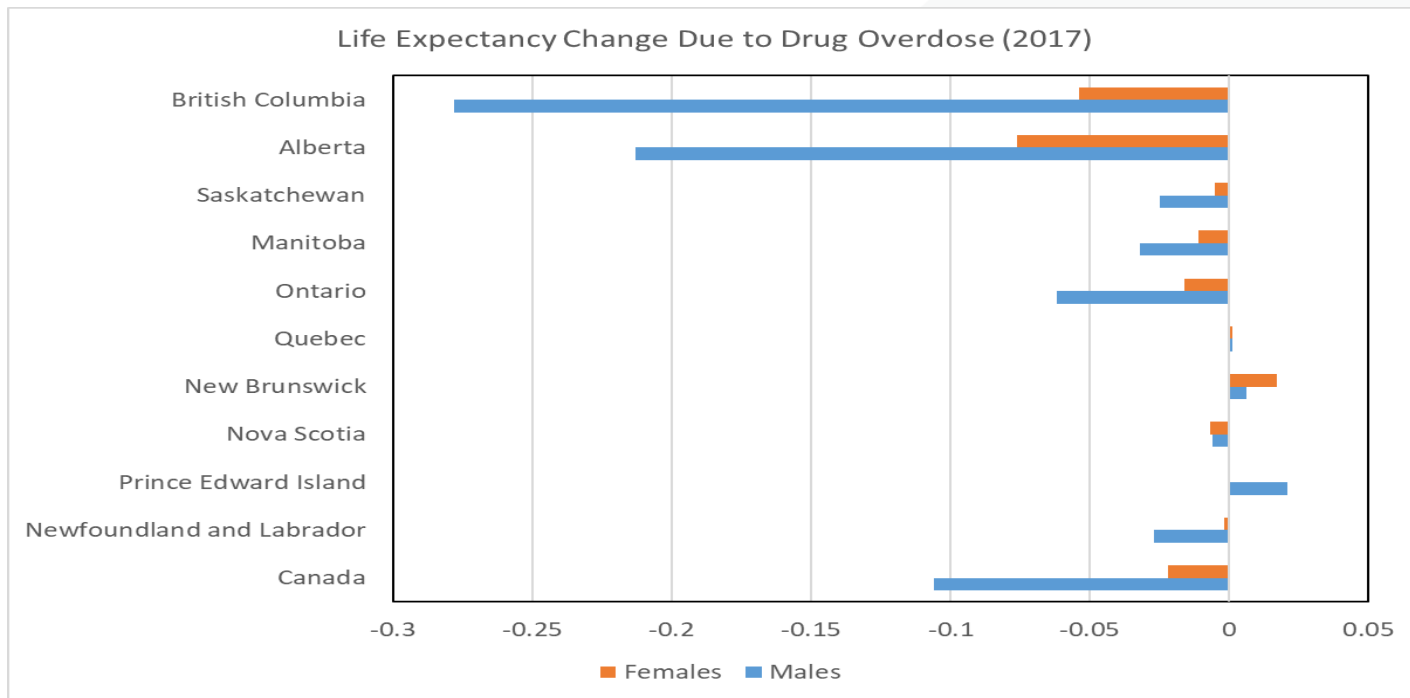


OSFI
BSIF

Source: OECD (2019), *The Heavy Burden of Obesity: The Economics of Prevention*, OECD Health Policy Studies, OECD Publishing, Paris, <https://doi.org/10.1787/67450d67-en>.

Office of the Chief Actuary | Bureau de l'actuaire en chef

In 2017, in Canada, death rates due to opioid overdose were 1.6 – 2.1 times higher than in 2015



Source: Statistics Canada Vital Statistics: Death Database (3233) and population estimates (3604).
National Report: Apparently Opioid-related Deaths in Canada (June 2019)

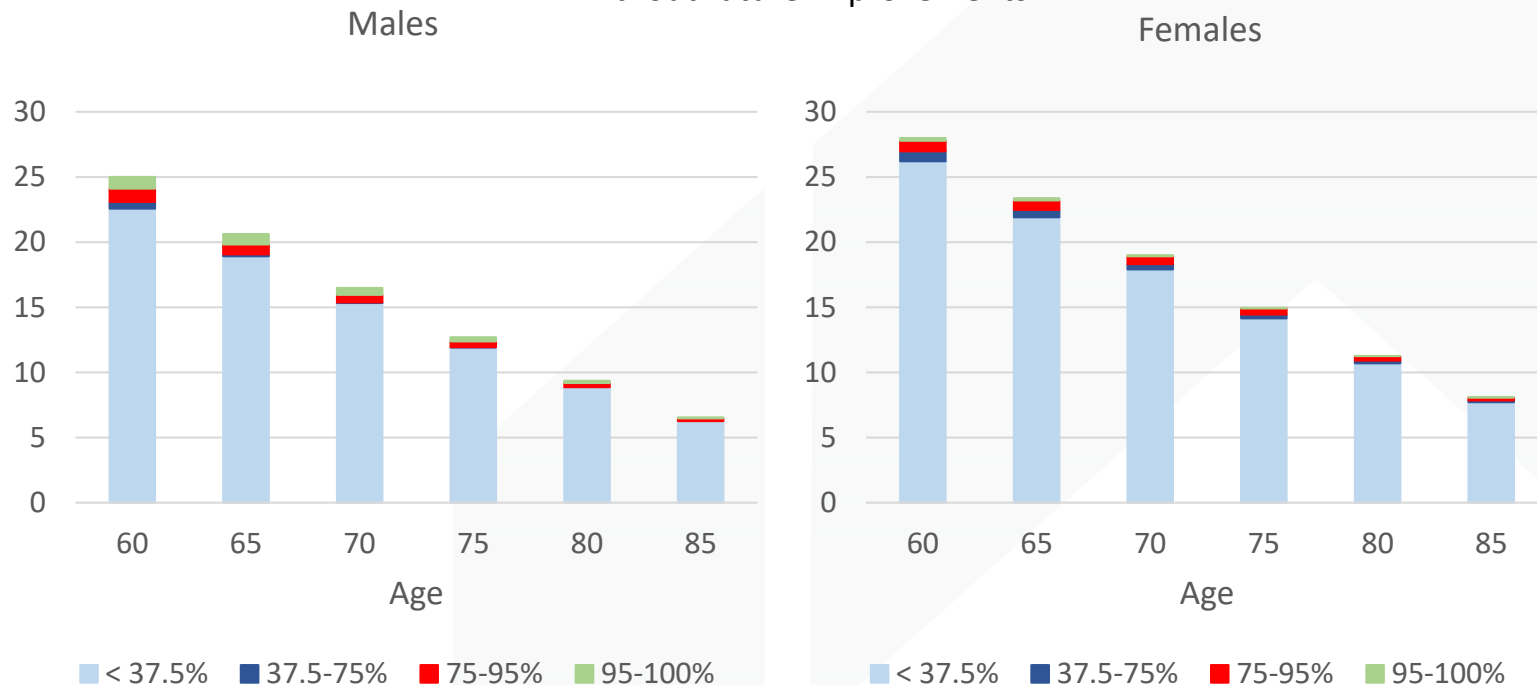


OSFI
BSIF

Office of the Chief Actuary Bureau de l'actuaire en chef

Mortality differences by socio-economic level diminish with age

Life Expectancies of CPP Retirement Beneficiaries by Level of Base CPP Pension (2019),
without future improvements



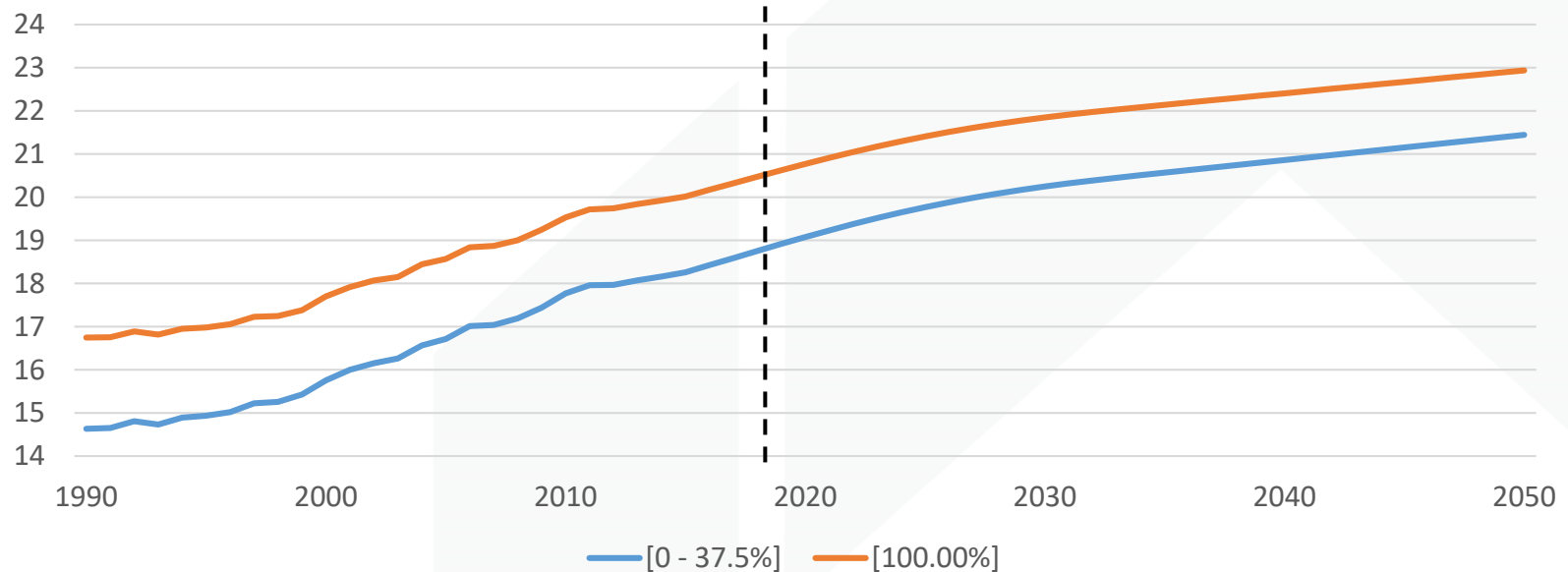
OSFI
BSIF

Office of the Chief Actuary Bureau de l'actuaire en chef

Source: OCA, 30th Actuarial Report on the Canada Pension Plan as at 31 December 2018

The gap in life expectancy by benefit level is stable over time

Males Retirement Life Expectancy at Age 65 (High and Low Pension)

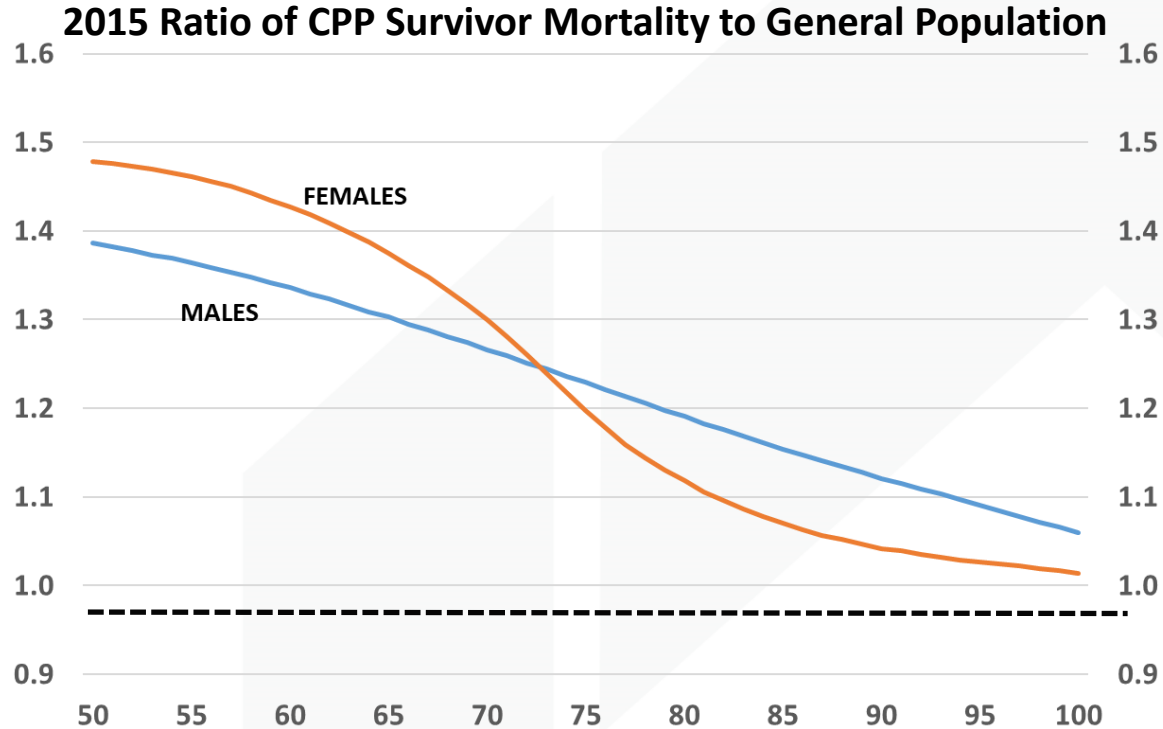


OSFI
BSIF

Source: OCA, 30th Actuarial Report on the Canada Pension Plan as at 31 December 2018

Office of the Chief Actuary Bureau de l'actuaire en chef

Survivor Beneficiaries have a Much Higher Mortality than the Population



Source: OCA, *Survivor Mortality Study 2018*



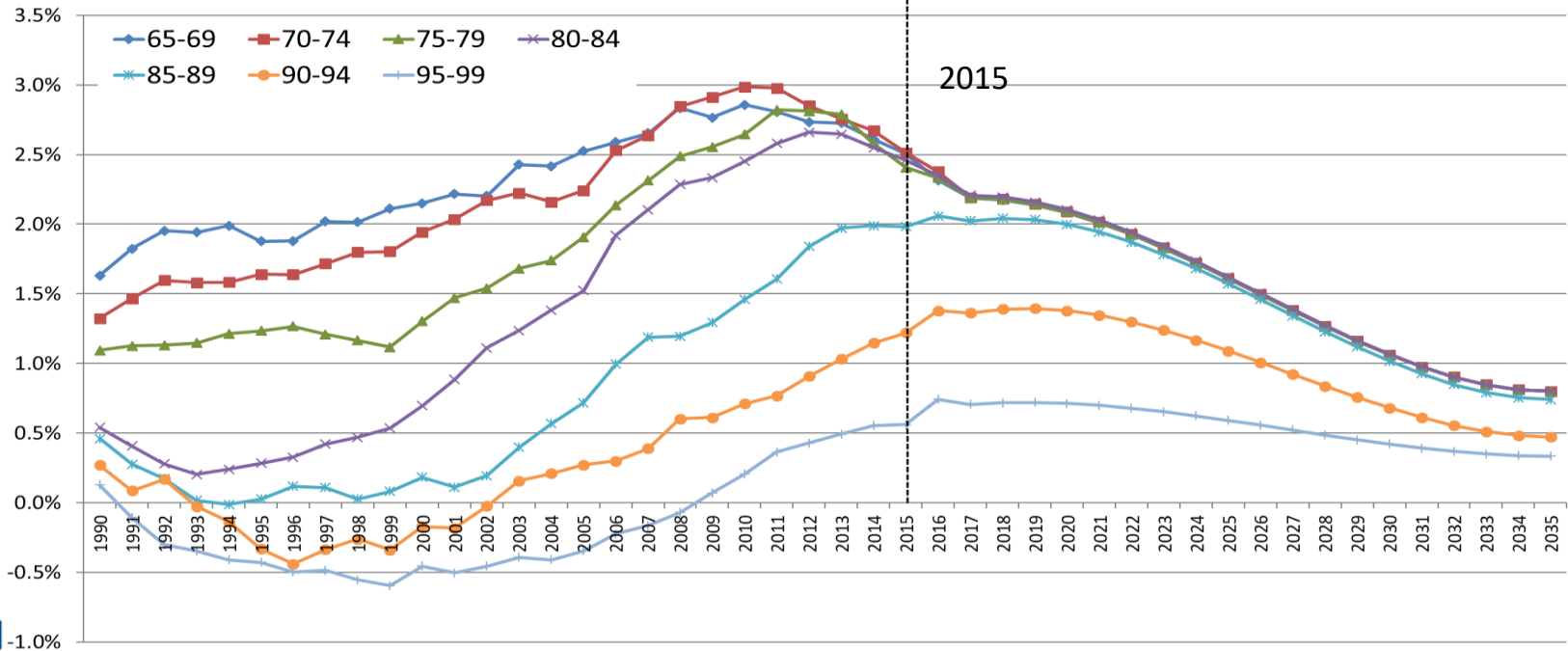
OSFI
BSIF

Office of the Chief Actuary Bureau de l'actuaire en chef

CPP30 Assumes that Mortality will Continue to Improve but at a Slower Pace

Historical and Projected Mortality Improvement Rates – Males

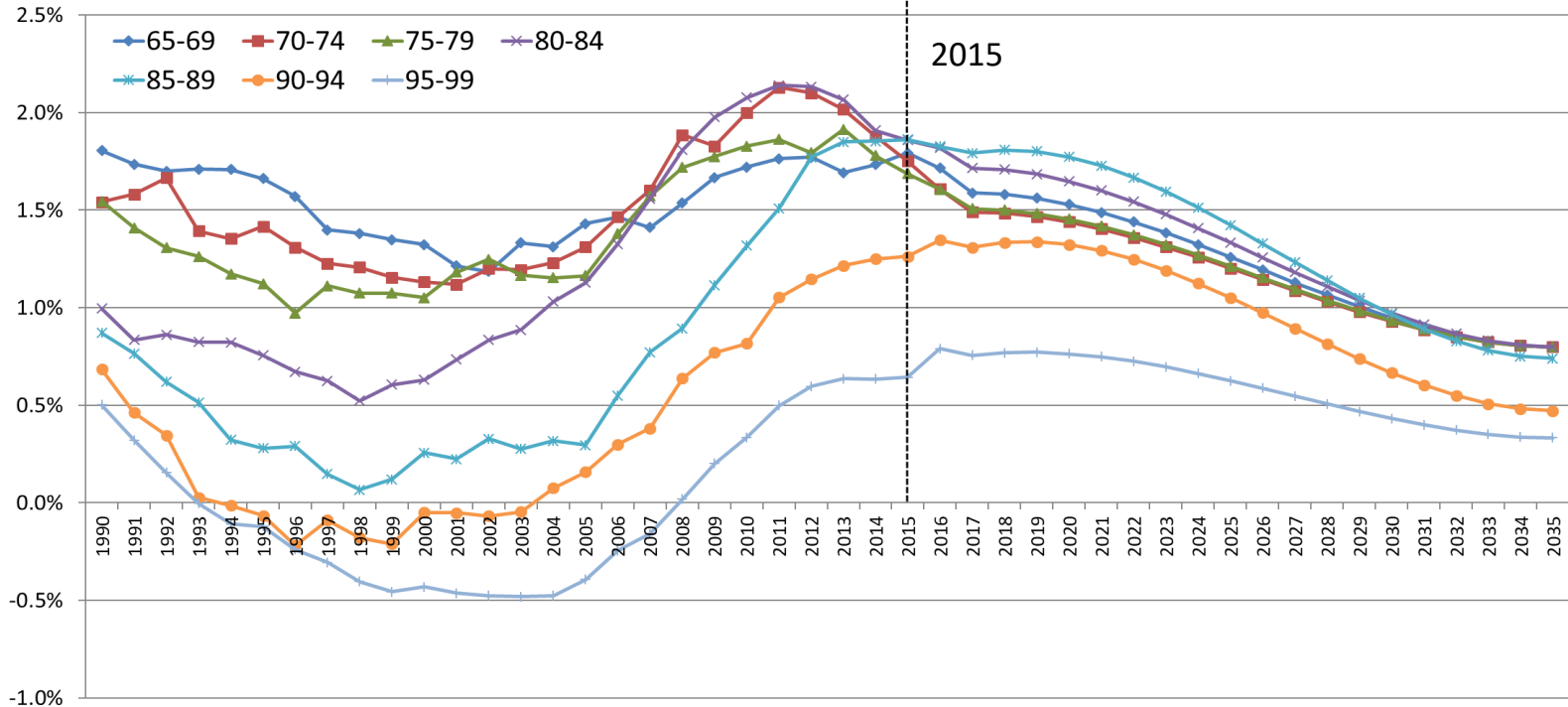
(Historical is based on CHMD and STATCAN, 15-year Average)



CPP30 Assumes that Mortality will Continue to Improve but at a Slower Pace

Historical and Projected Mortality Improvement Rates – Females

(Historical is based on CHMD and STATCAN, 15-year Average)



OSFI
BSIF

Office of the Chief Actuary | Bureau de l'actuaire en chef

CPP30 Annual Mortality Improvement Rates

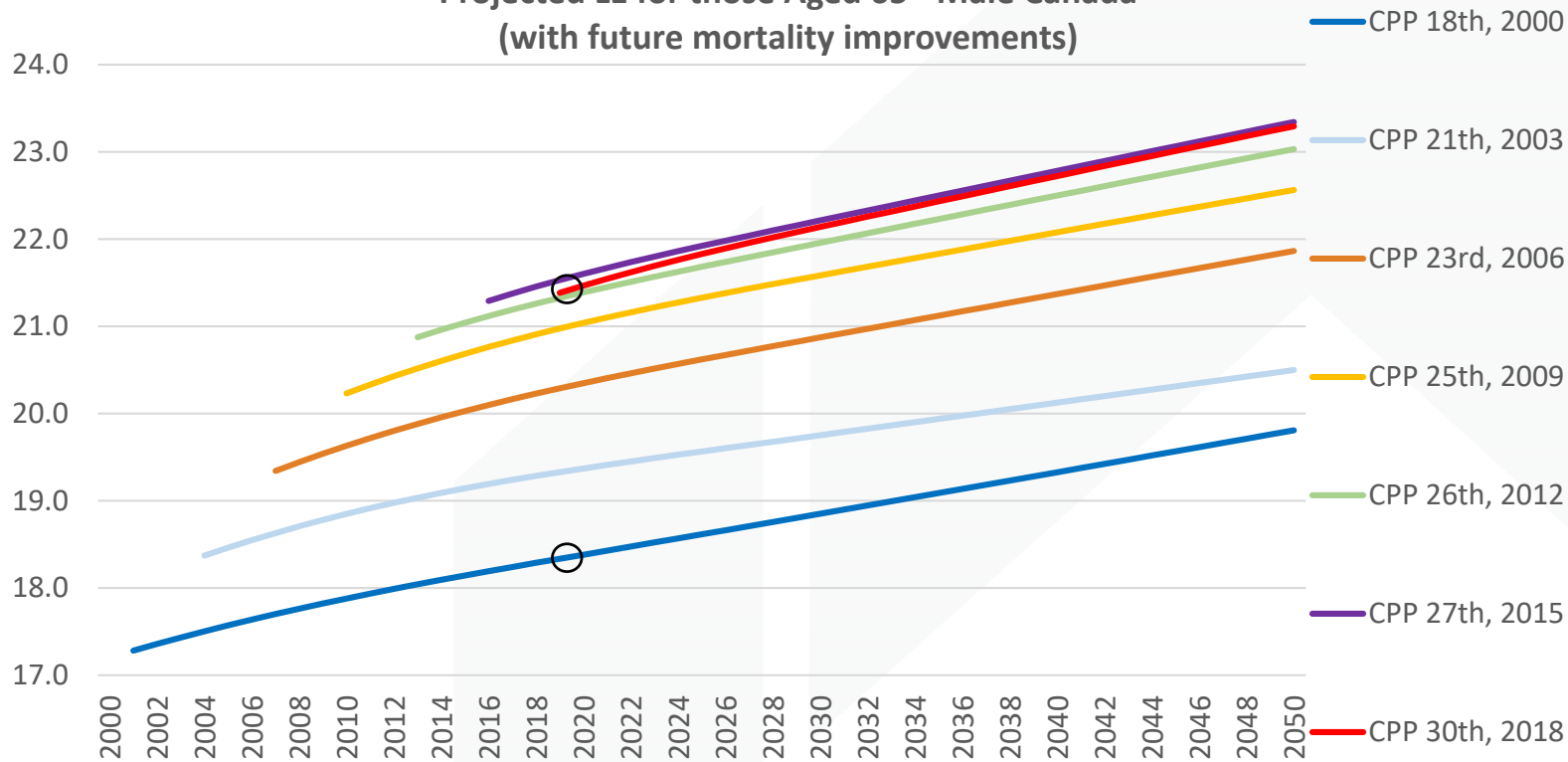
	Males			Females		
	2016-2017 ⁽¹⁾	2018-2034 ⁽¹⁾	2035+	2016-2017 ⁽¹⁾	2018-2034 ⁽¹⁾	2035+
0	1.1	1.0	0.8	0.7	0.8	0.8
1-14	3.3	2.0	0.8	1.6	1.2	0.8
15-44	1.9	1.3	0.8	1.0	0.9	0.8
45-64	1.9	1.4	0.8	1.4	1.1	0.8
65-74	2.3	1.5	0.8	1.6	1.2	0.8
75-84	2.3	1.5	0.8	1.6	1.2	0.8
85-89	2.1	1.5	0.8	1.8	1.3	0.8
90-94	1.5	1.1	0.5	1.4	1.0	0.5
95+	0.5	0.4	0.2	0.5	0.4	0.2

⁽¹⁾ The mortality improvement rates shown for 2016-2017 and 2018-2034 represent average rates over these periods.



Evolution of CPP Mortality Projections over 7 Actuarial Reports

Projected LE for those Aged 65 - Male Canada
(with future mortality improvements)

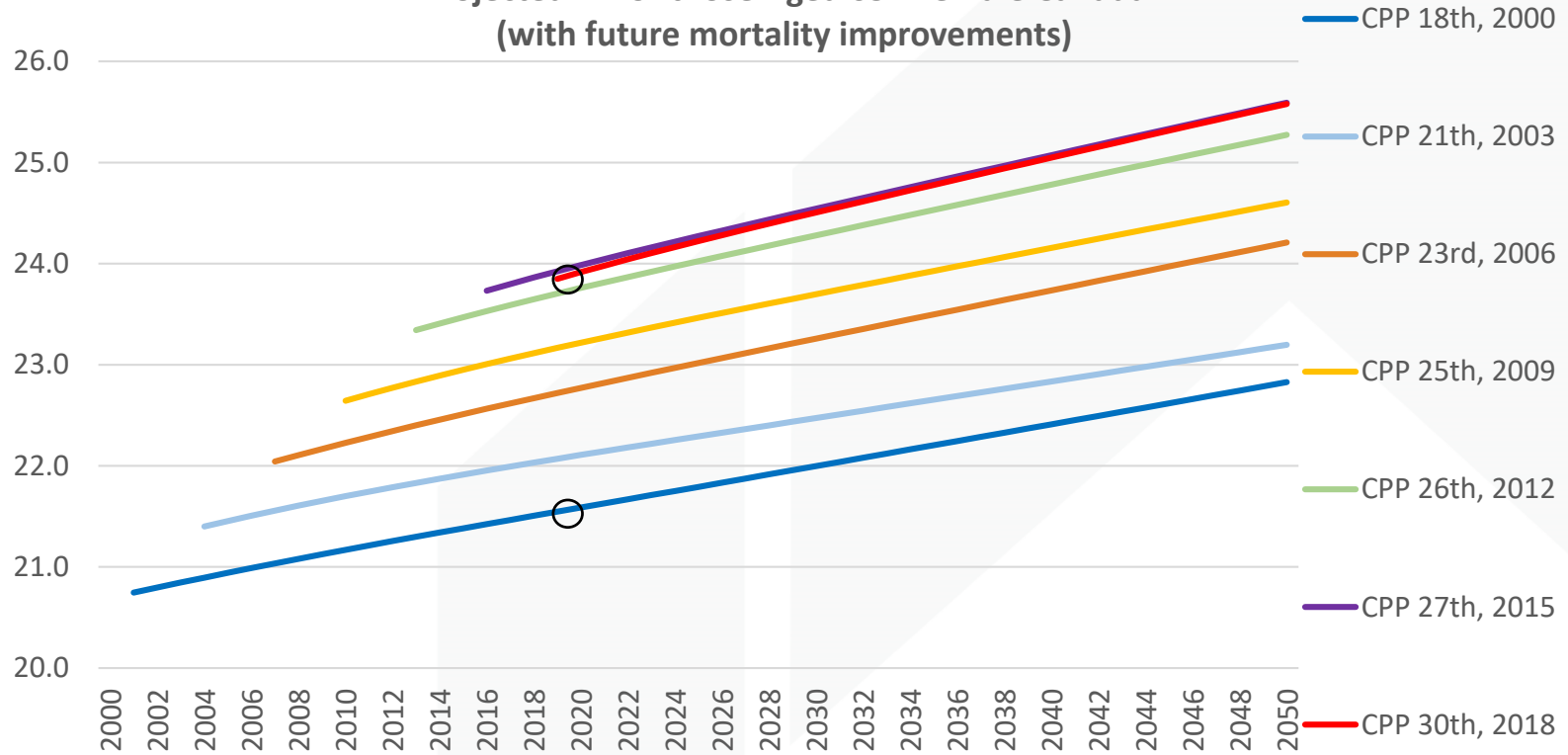


OSFI
BSIF

Office of the Chief Actuary Bureau de l'actuaire en chef

Evolution of CPP Mortality Projections over 7 Actuarial Reports

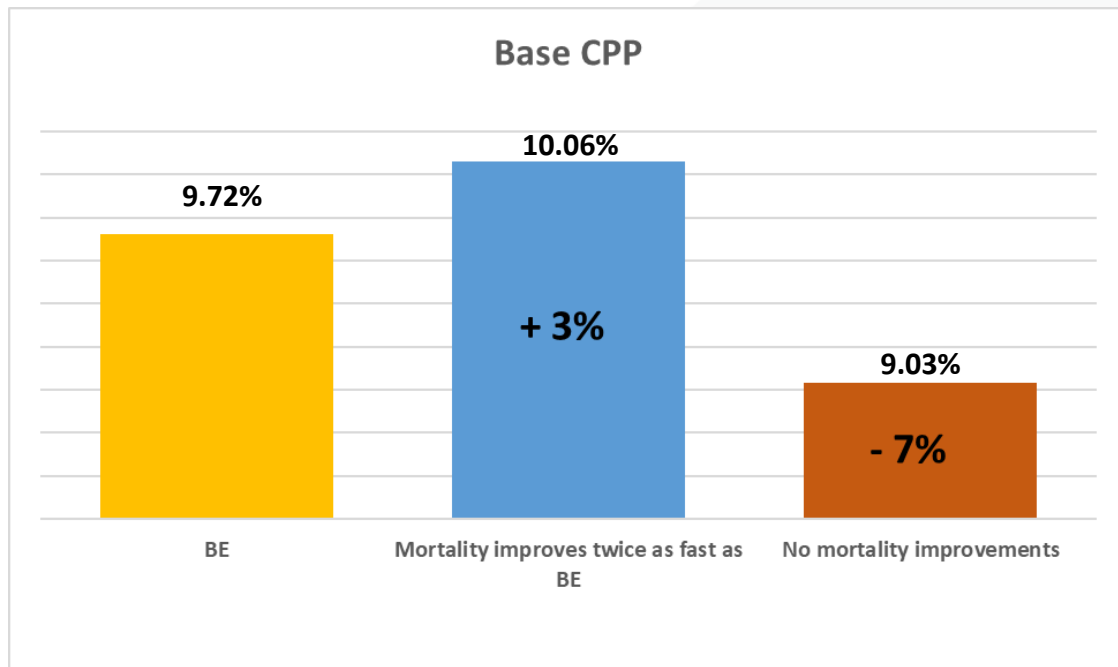
Projected LE for those Aged 65 - Female Canada
(with future mortality improvements)



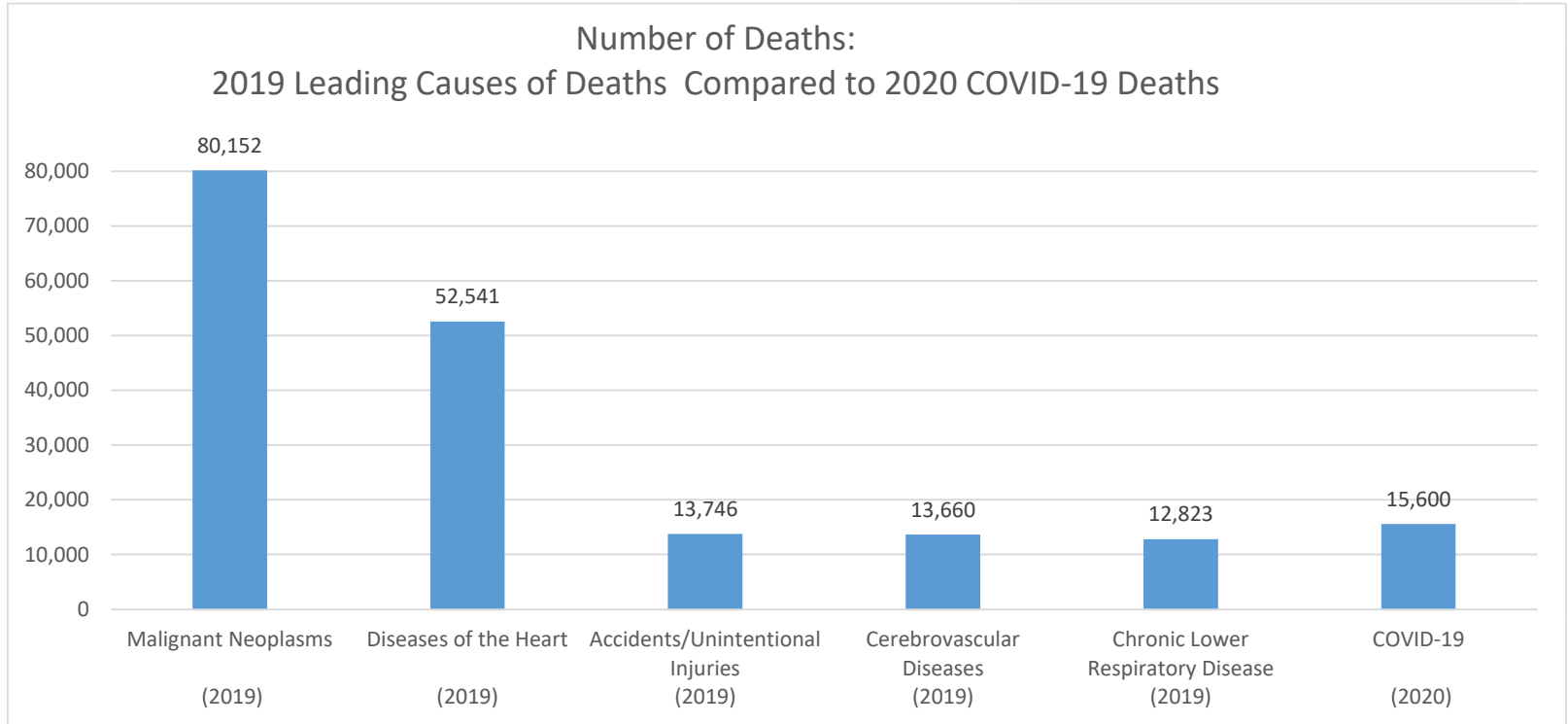
OSFI
BSIF

Office of the Chief Actuary | Bureau de l'actuaire en chef

Relative impact of different mortality assumptions on the base CPP minimum contribution rate



COVID-19 Leading Cause of Death in 2020

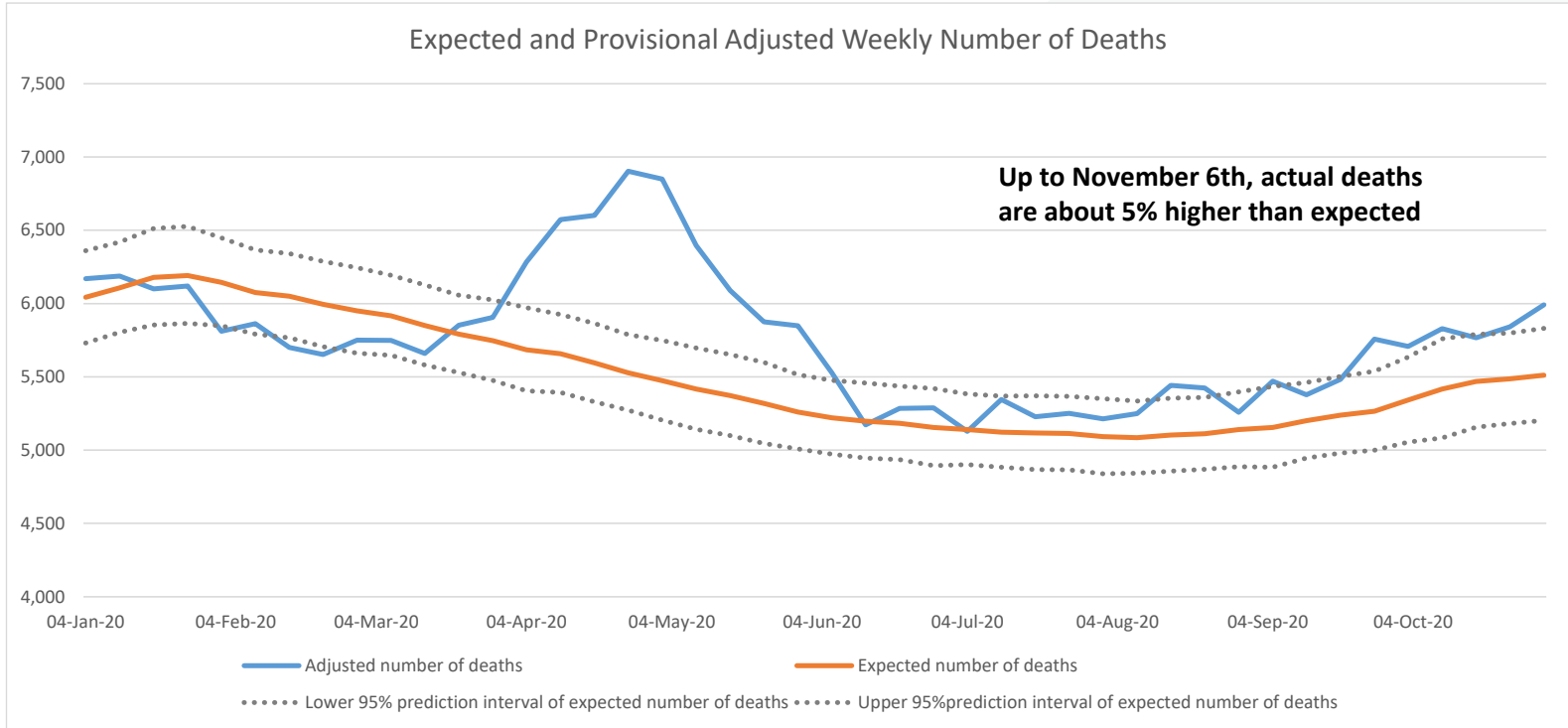


Sources: Statistics Canada. Statistics Canada. Table 13-10-0394-01 Leading causes of death, total population, by age group

OSFI
BSIF

Office of the Chief Actuary Bureau de l'actuaire en chef

COVID-19 Impact – Excess Deaths in Canada



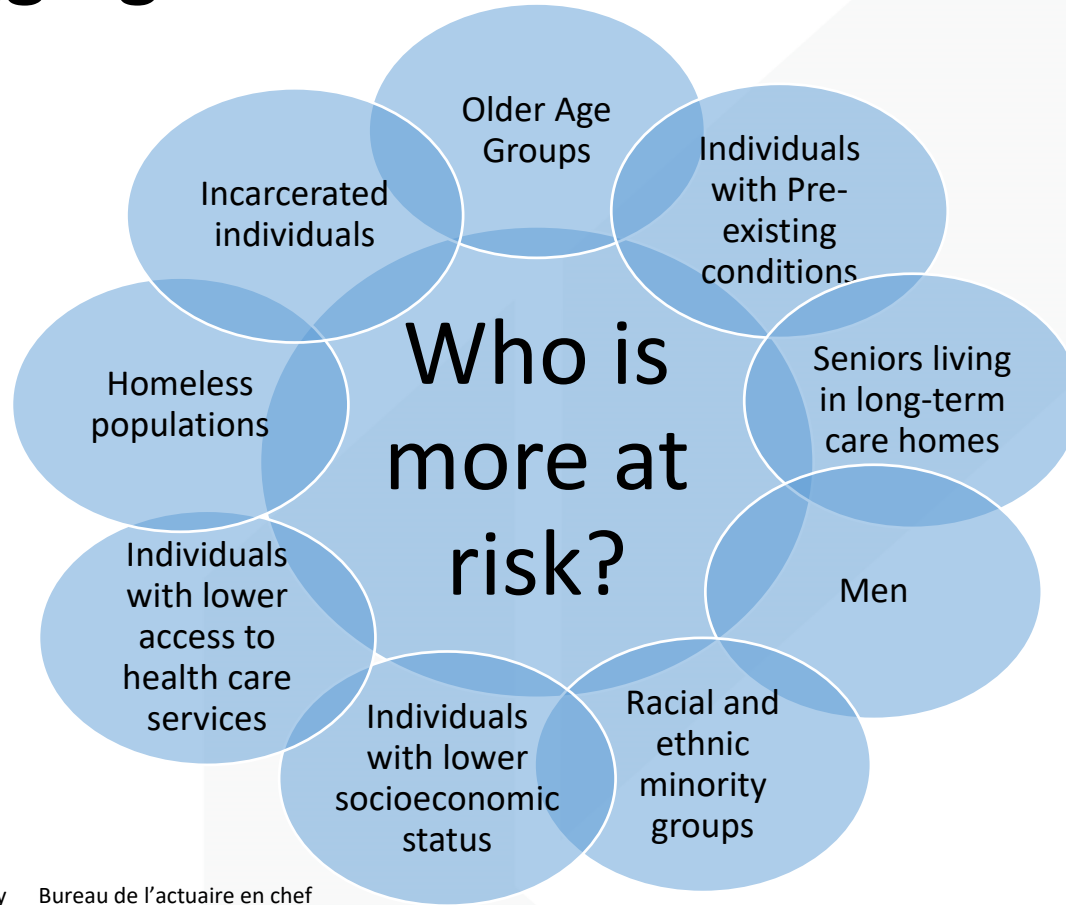
Source: Statistics Canada. Table 13-10-0784-01 Adjusted number of deaths, expected number of deaths and estimates of excess mortality, by week



OSFI
BSIF

Office of the Chief Actuary Bureau de l'actuaire en chef

Aggregate Numbers are Not Enough



Higher Short-Term Mortality Rates

Extent will depend on many factors:

- Roll out of vaccination in Canada
- Government measures and willingness of population to follow health directives until vaccination of more at risk populations is completed
- New variants of the virus and effectiveness of vaccine to these new variants

Still early to measure effect on short-term period life expectancy:

- Recent research in the US points to a potential reduction in life expectancy at birth of 1.1 years in 2020 with estimated reductions for the Black and Latino populations that are 3 to 4 times that for Whites.
- Recent research in the UK points to potential reductions in life expectancy at birth of 0.9 years for women and 1.2 years for men.



Uncertainty in the Longer Term is even Higher



What was the life expectancy of those who died from COVID-19 compared to the general population? Will there be a 'harvesting effect'?



Indirect consequences of the pandemic difficult to measure at this point:

- Impact of delayed surgeries/treatment
- Long-term health effects of COVID-19 survivors
- Impact of social isolation and job losses on mental health (e.g. increased drug and alcohol use)
- Impact of behavioural changes (social distancing, hand washing, face masks)
- Impact on medical research advancements



It will take years until the effect of the pandemic on mortality is known, and data could be an issue in getting the full picture.



Conclusion

- Increasing longevity at older ages is expected to continue to put financial pressure on programs targeted to older population.
- Even without the pandemic, there is a lot of uncertainty related to future mortality.
- Understanding the past is important but we need to look into future.
- Extra care and analysis will be needed to reflect the pandemic in future mortality assumptions, especially if starting point for mortality rates is 2020 or 2021.



Useful OCA Links

Actuarial Reports:

<https://www.osfi-bsif.gc.ca/Eng/oaca-bac/ar-ra/Pages/default.aspx>

Actuarial Studies:

<https://www.osfi-bsif.gc.ca/Eng/oaca-bac/as-ea/Pages/default.aspx>

Fact Sheets and Other Reports:

<https://www.osfi-bsif.gc.ca/Eng/oaca-bac/fs-fr/Pages/default.aspx>



OSFI
BSIF

Office of the Chief Actuary Bureau de l'actuaire en chef



Office of the Superintendent of
Financial Institutions Canada

Bureau du surintendant des
institutions financières Canada

Thank You!



OSFI
BSIF

Canada