



Office of the Superintendent of
Financial Institutions Canada

Bureau du surintendant des
institutions financières Canada

Office of the Chief Actuary

Bureau de l'actuaire en chef

Canadian Mortality Experience

Presentation made at the
CIA Annual Meeting Vancouver



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June 29, 2010

Canada 

Presentation

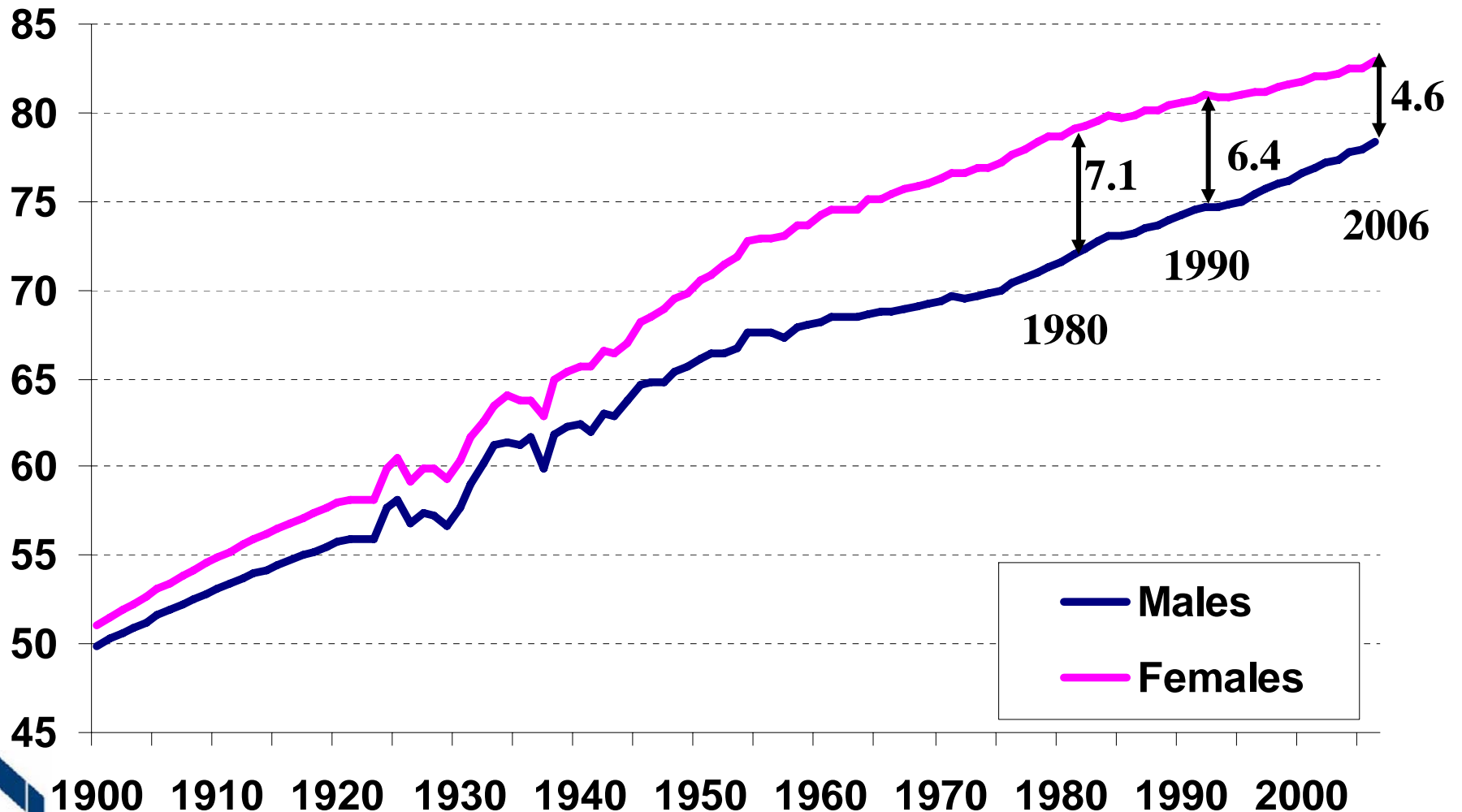
- **Life Expectancy**
- Mortality Improvements
- International Comparisons
- Other Results



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Historical Life Expectancies (At Birth)




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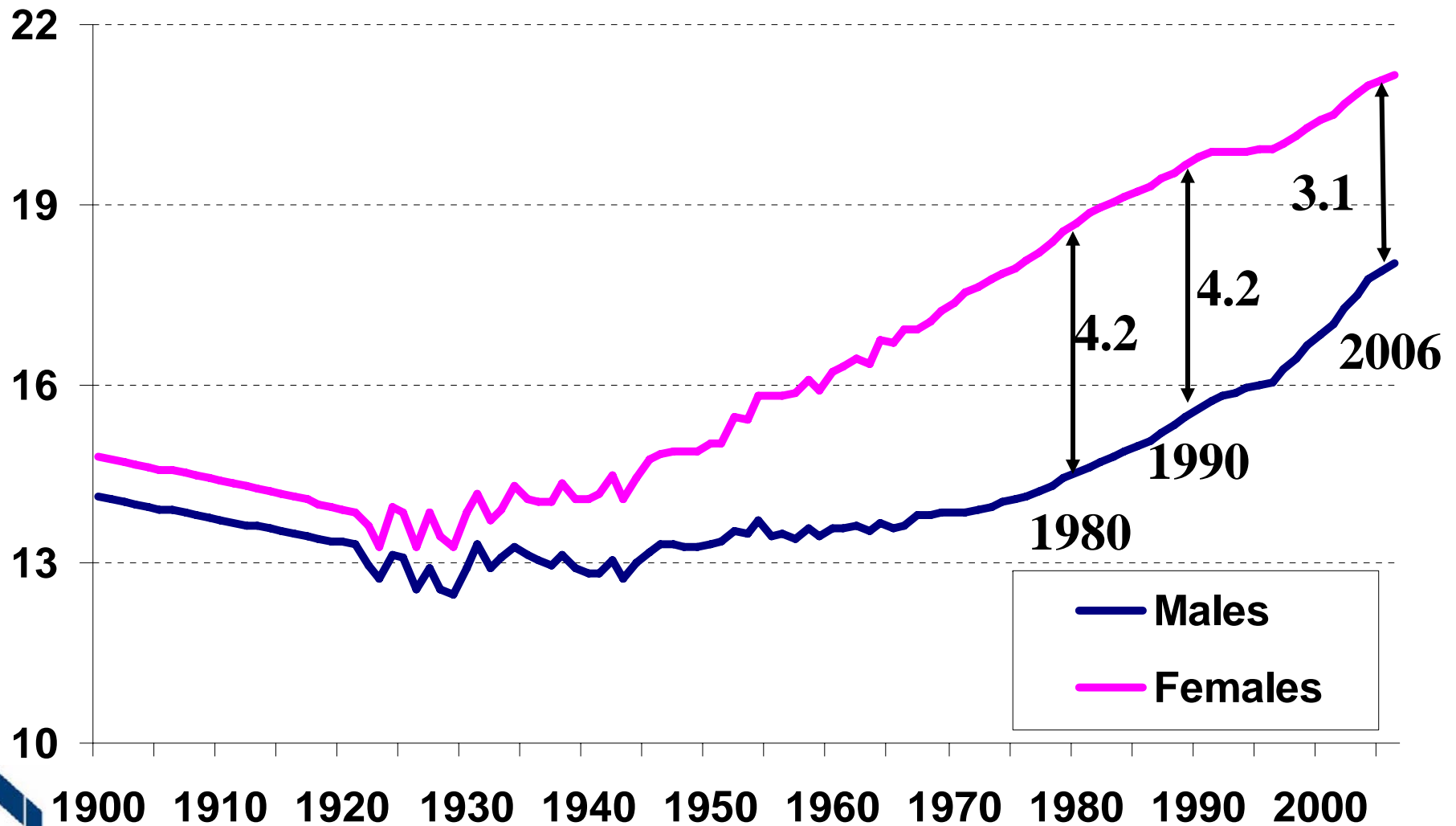
Source : Statistics Canada

Mortality

- The increase in life expectancy at birth was quite rapid before 1970s mainly due to mortality improvements under age 15.
- Mortality improvements have slowed down since the 1970s, more so for females than for males  gap narrowing between male and female mortality.
- Most of increase in life expectancy now comes from improvements at ages 65 and over.
- The maximum life span has not significantly increased over time (since most of the observed mortality improvements have occurred before age 90).



Historical Life Expectancies (At Age 65)



Source : Statistics Canada



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Contribution to Increase In Life Expectancy

Change attributable to (in years)	Males		Females	
	1925-1965	1965-2005	1925-1965	1965-2005
Infant mortality (<1)	5.8	1.4	4.6	1.2
Child mortality (1-14)	2.5	0.5	2.5	0.4
Young adult mortality (15-44)	2.1	1.2	3.9	0.6
Older adult mortality (45-64)	0.1	2.8	1.9	1.5
Elderly mortality (65+)	0.3	<u>3.6</u>	2.2	<u>4.0</u>
Estimated Multivariate Effect	-0.1	-0.5	-0.4	-0.4
Total Change in Life Expectancy	10.7	9.1	14.7	7.4



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Mortality Improvement Rates

Average Annual Mortality Improvement Rates (%)

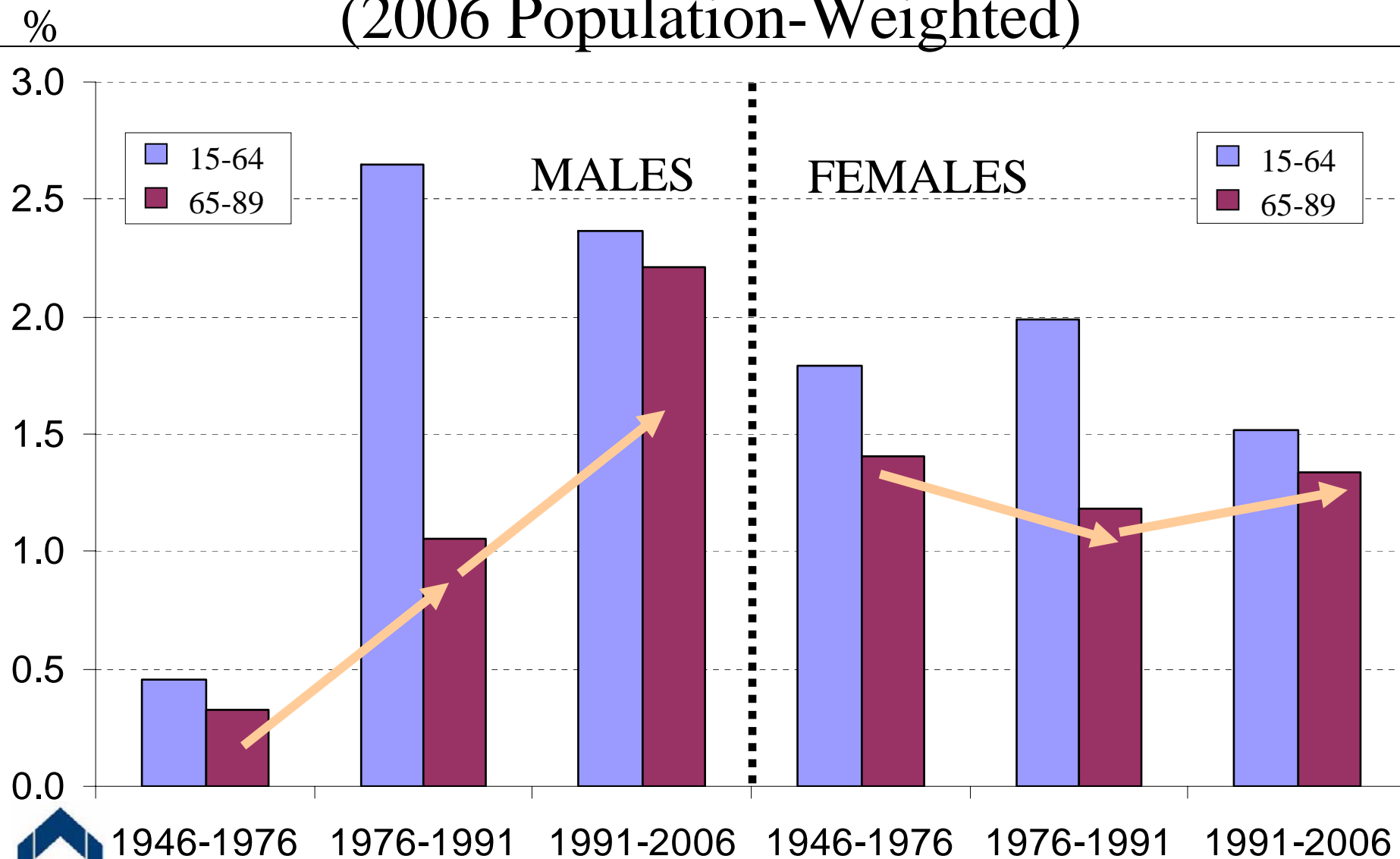
	Females		Males	
	1976-1991	1991-2006	1976-1991	1991-2006
0-44	3.0	1.6	2.8	2.6
45-64	1.9	1.5	2.7	2.3
0-64	2.2	1.5	2.7	2.4
65-74	1.5	<u>1.5</u>	1.6	<u>2.7</u>
75-84	1.2	<u>1.5</u>	0.8	<u>2.2</u>
85-89	1.0	1.0	0.4	1.5
90-94	0.6	0.5	0.0	0.8
95+	0.3	0.1	-0.1	0.4
0+	1.3	1.2	1.5	2.1
65+	1.0	1.1	1.0	2.1



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*Derived from data from the Canadian Human Mortality Database
Similar results obtained using Statistics Canada central death rates*
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Average Annual Mortality Improvement Rates (2006 Population-Weighted)



1946-1976

1976-1991

1991-2006

1946-1976

1976-1991

1991-2006

Source : Derived from data from the Canadian Human Mortality Database

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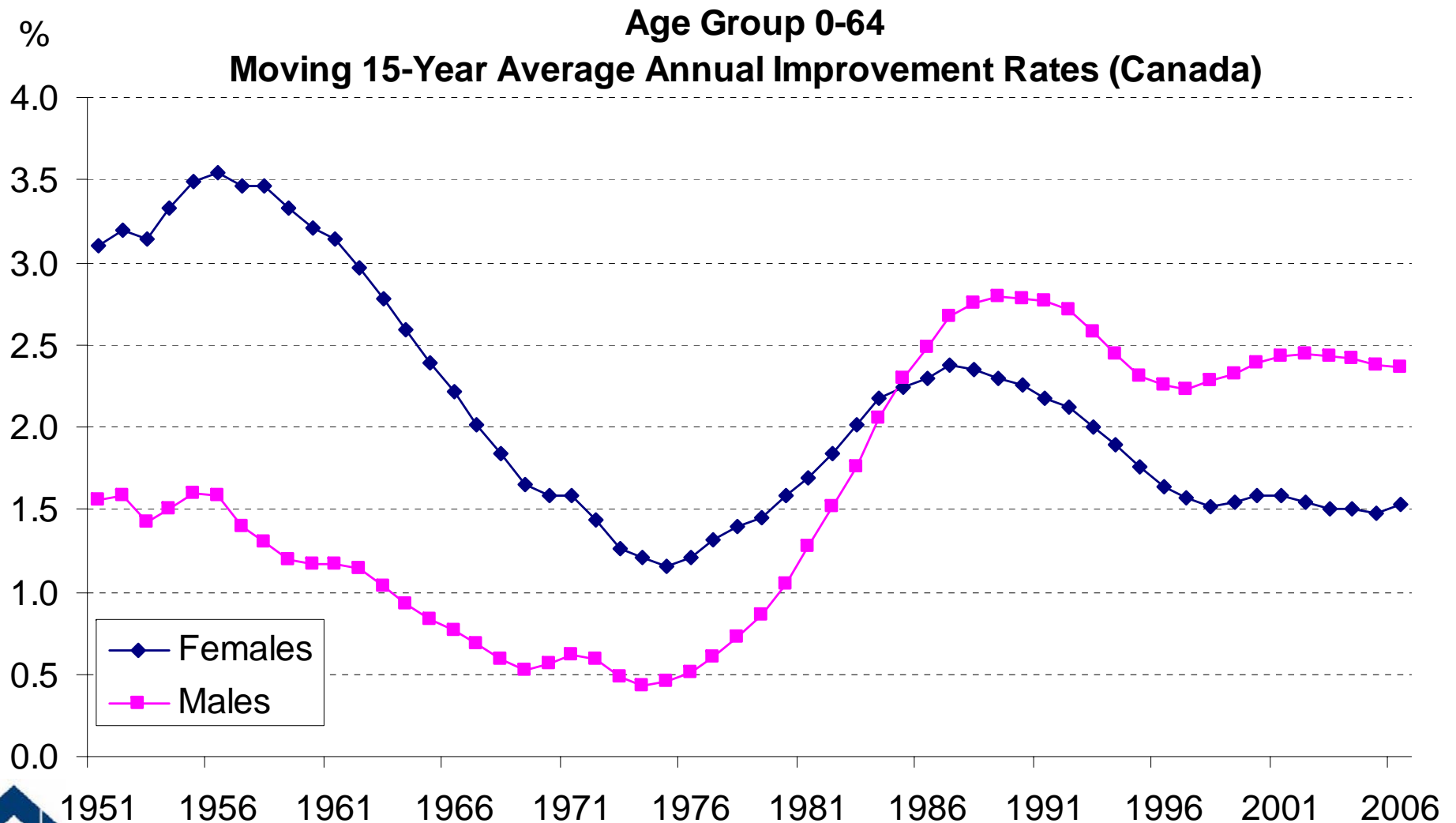
Mortality Improvements

Annual Mortality Improvement Rates

- Historical improvement rates tend to decline with age and are small or even negative for ages 90 and over.
- **Ages less than 65:** Comparing the first 15 with the last 15 years over the last 30 years, a marked slowdown is observed for both males and females, and more so for females.
- **Ages 65 and over:** Comparing the first 15 with the last 15 years over the last 30 years, slight improvements are observed for females aged less than 85 and deteriorations for ages 85+, but significant improvements for males ages 65+ are observed. Males are catching up to females.
- More recent experience (last 5, last 10) shows resurgence in improvement rates at ages 65 and over for both males and females.



Mortality Improvement Rates

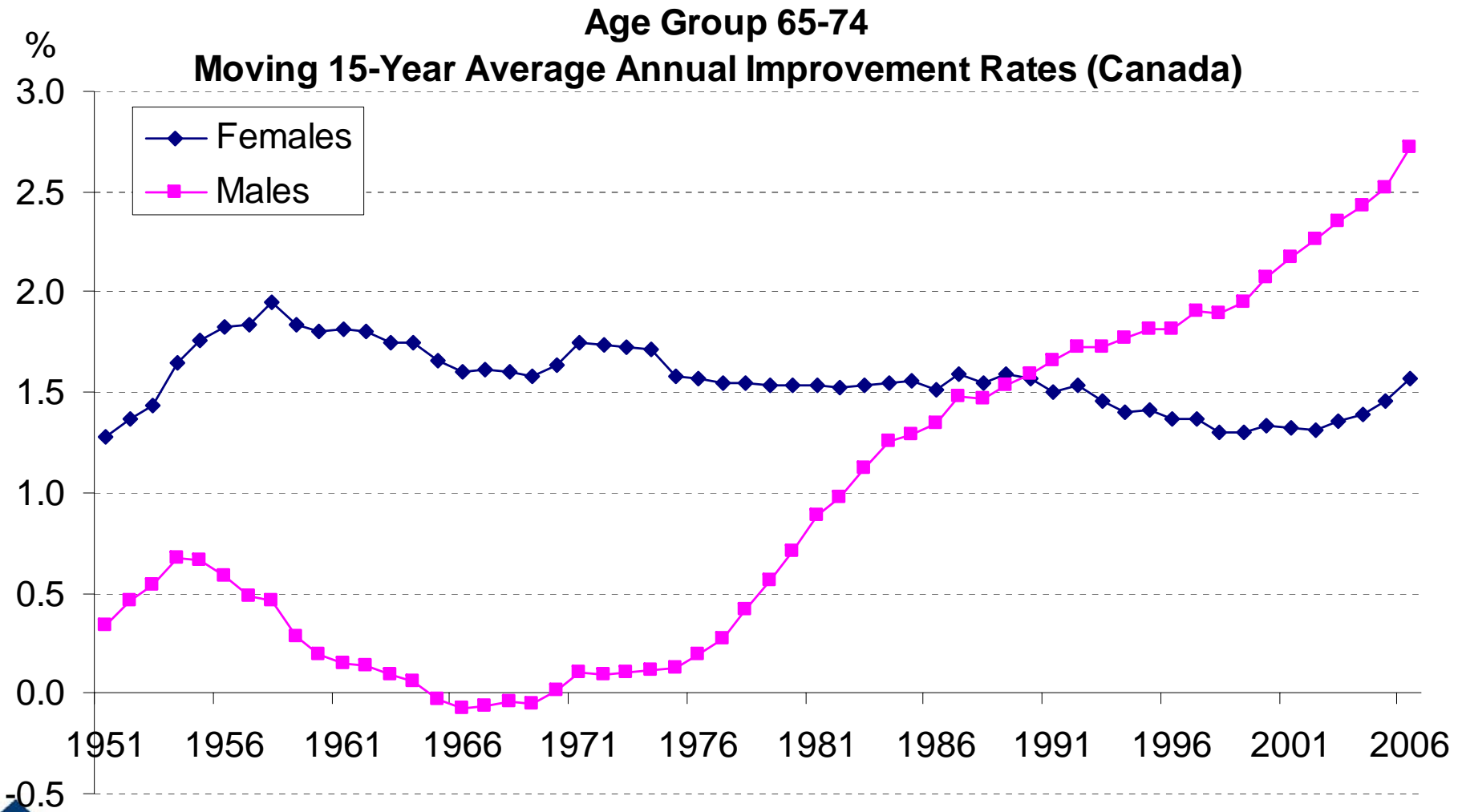


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Source : Derived from data from the Canadian Human Mortality Database

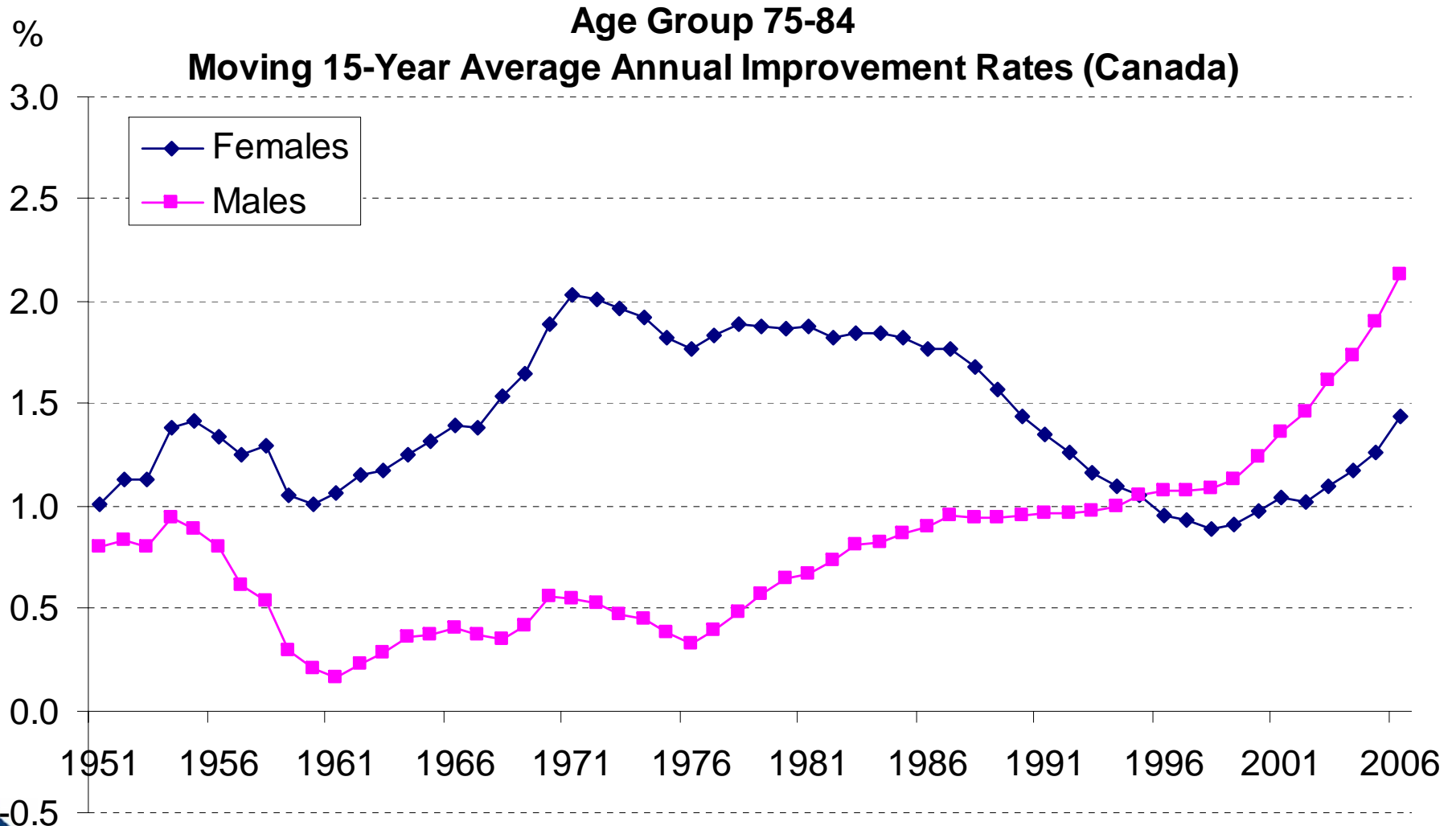
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Mortality Improvement Rates



Source : Derived from data from the Canadian Human Mortality Database
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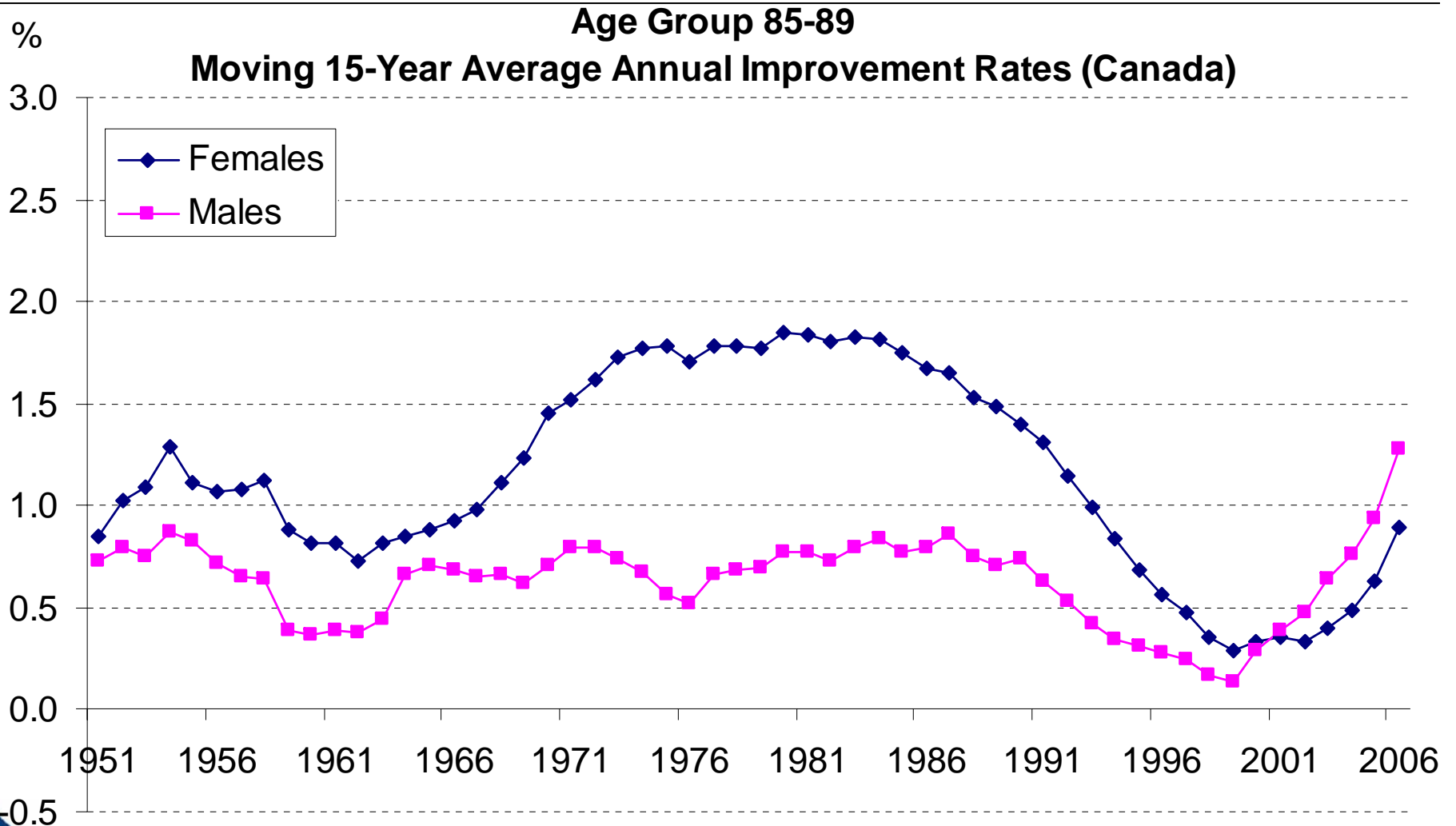
Mortality Improvement Rates



Source : Derived from data from the Canadian Human Mortality Database

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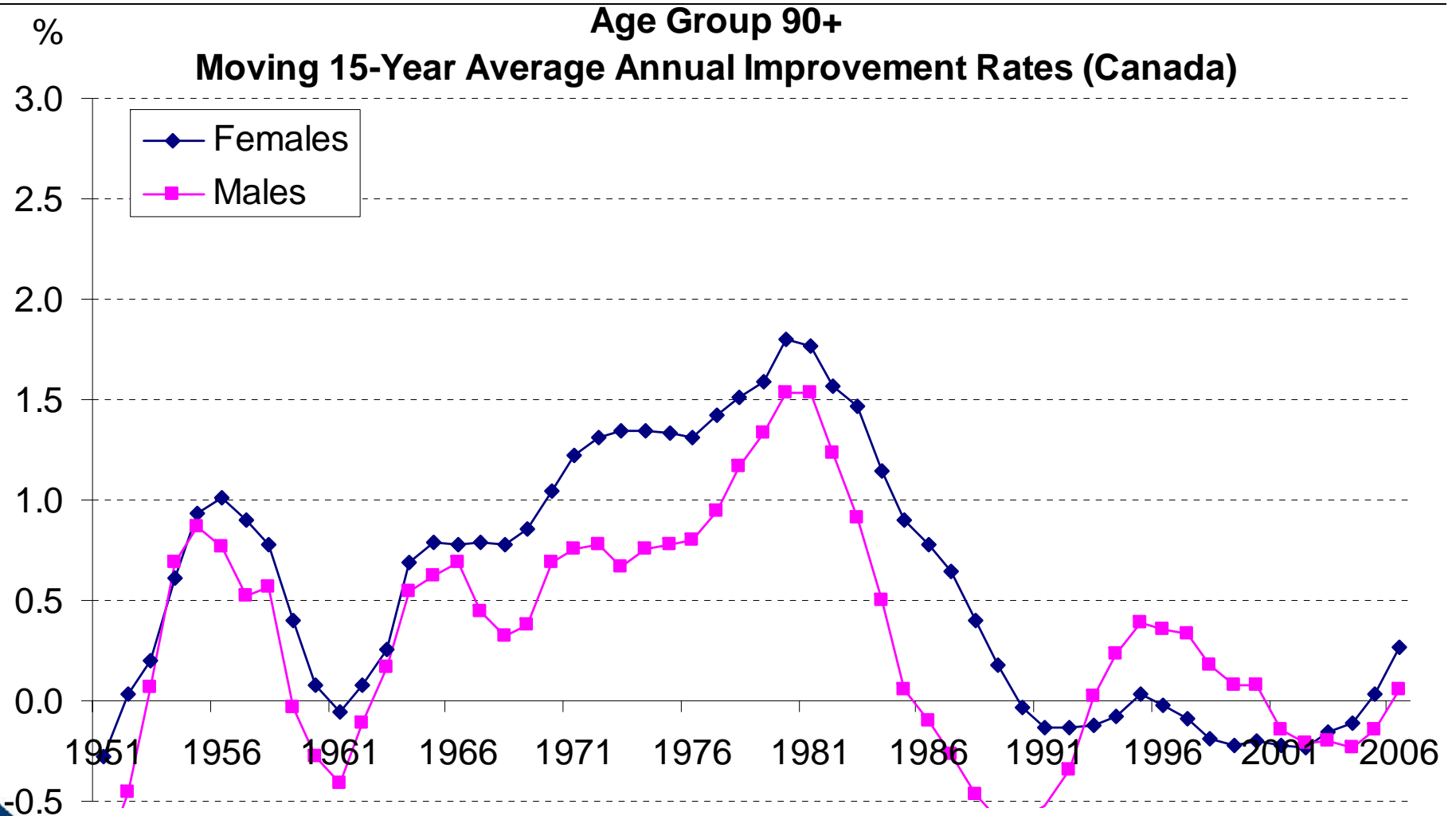
Mortality Improvement Rates



Source : Derived from data from the Canadian Human Mortality Database

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Mortality Improvement Rates



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Presentation

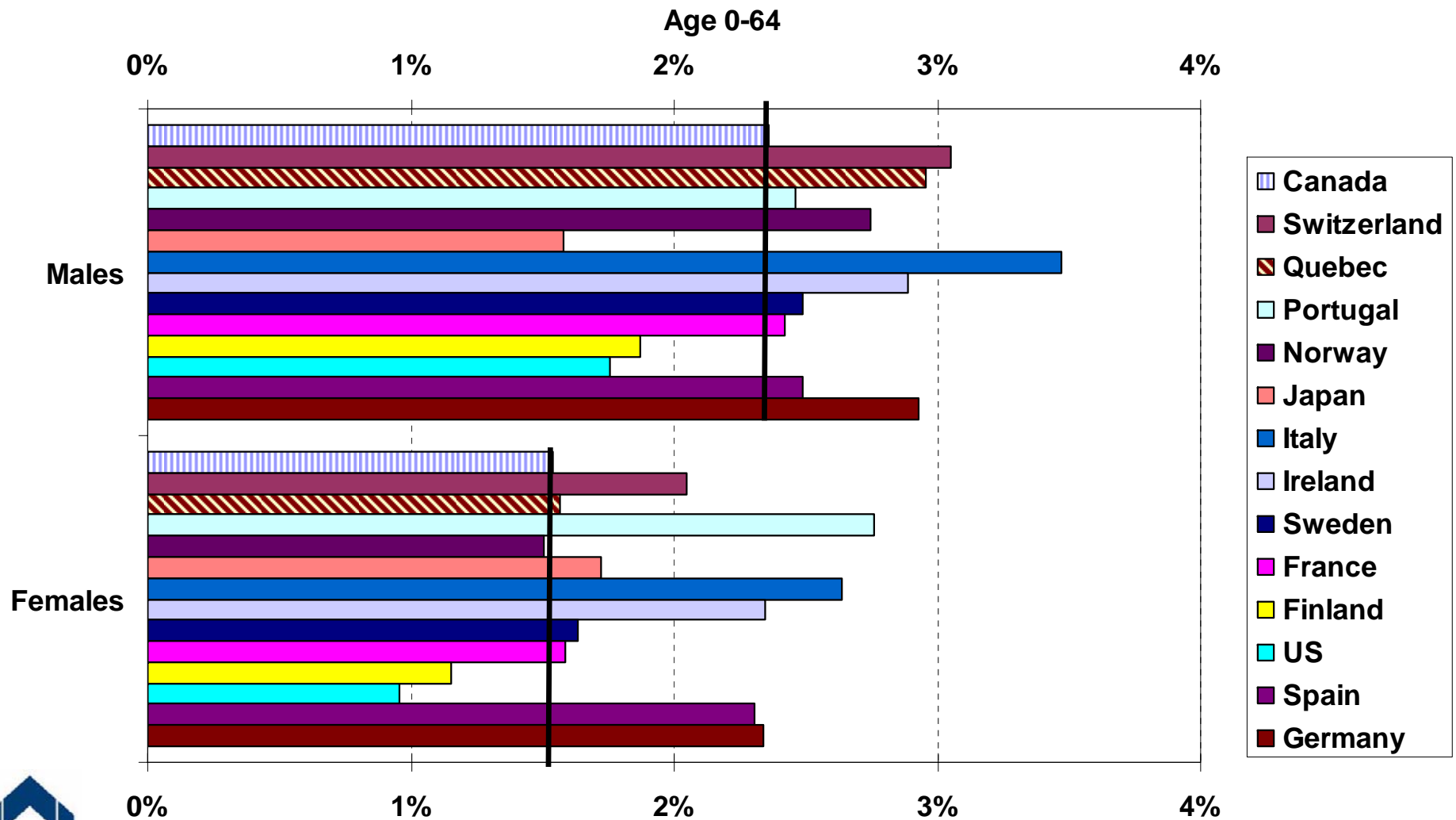
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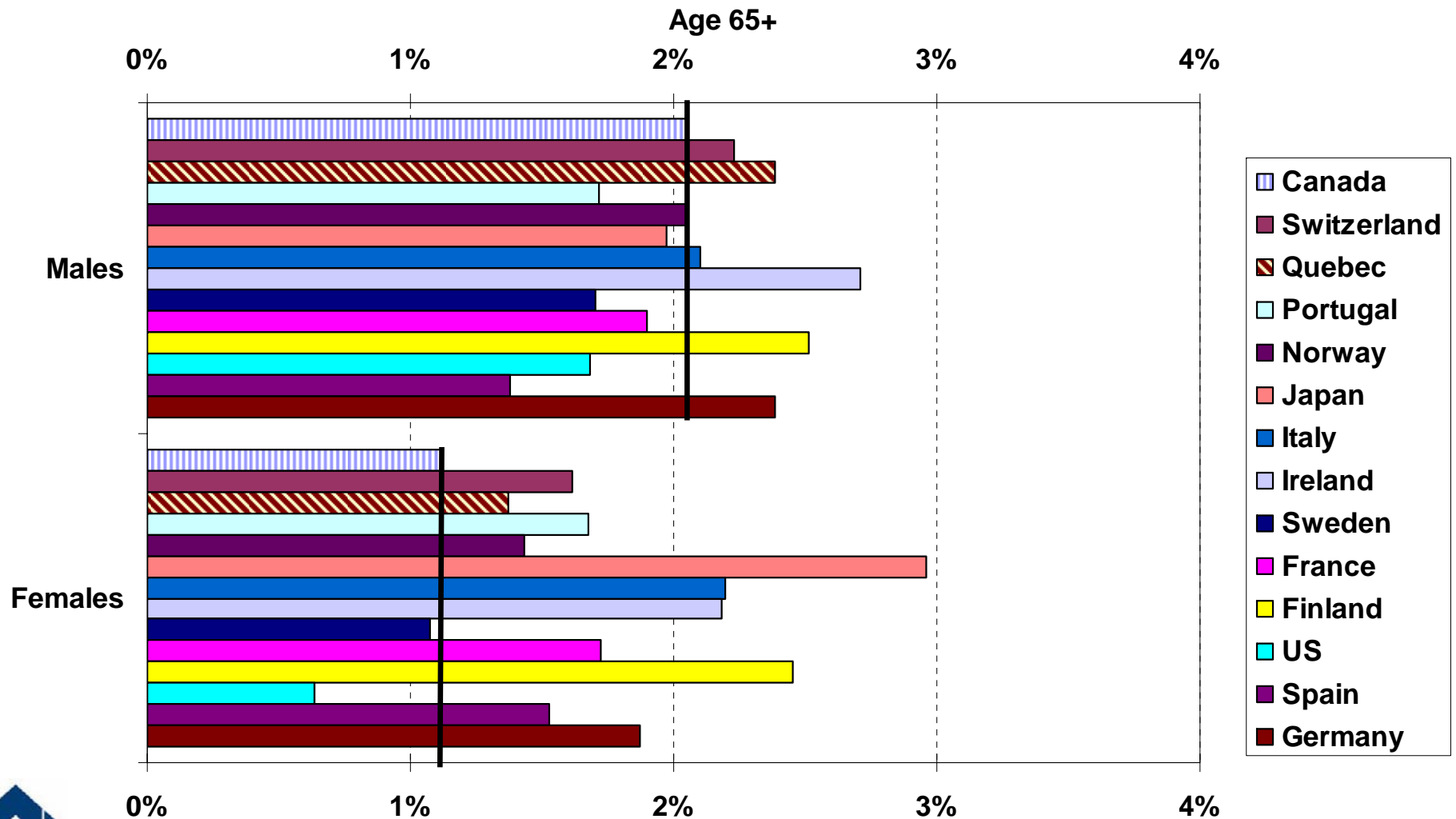
Mortality Improvements – International Comparison (1991-2006)



Source : Derived from data from the Canadian Human Mortality Database

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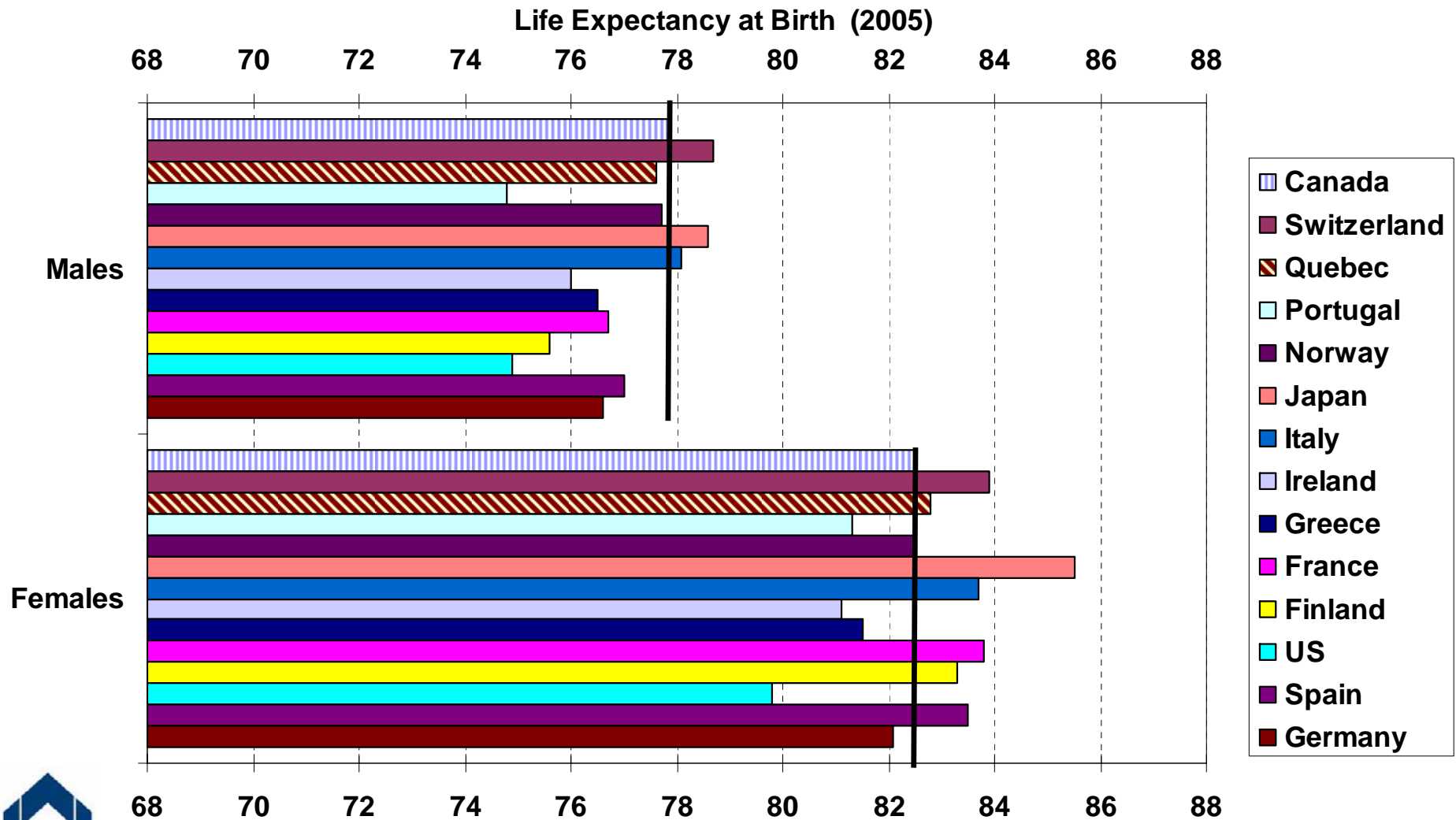
Mortality Improvements – International Comparison (1991-2006)



Source : Derived from data from the Canadian Human Mortality Database

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Life Expectancy – International Comparison

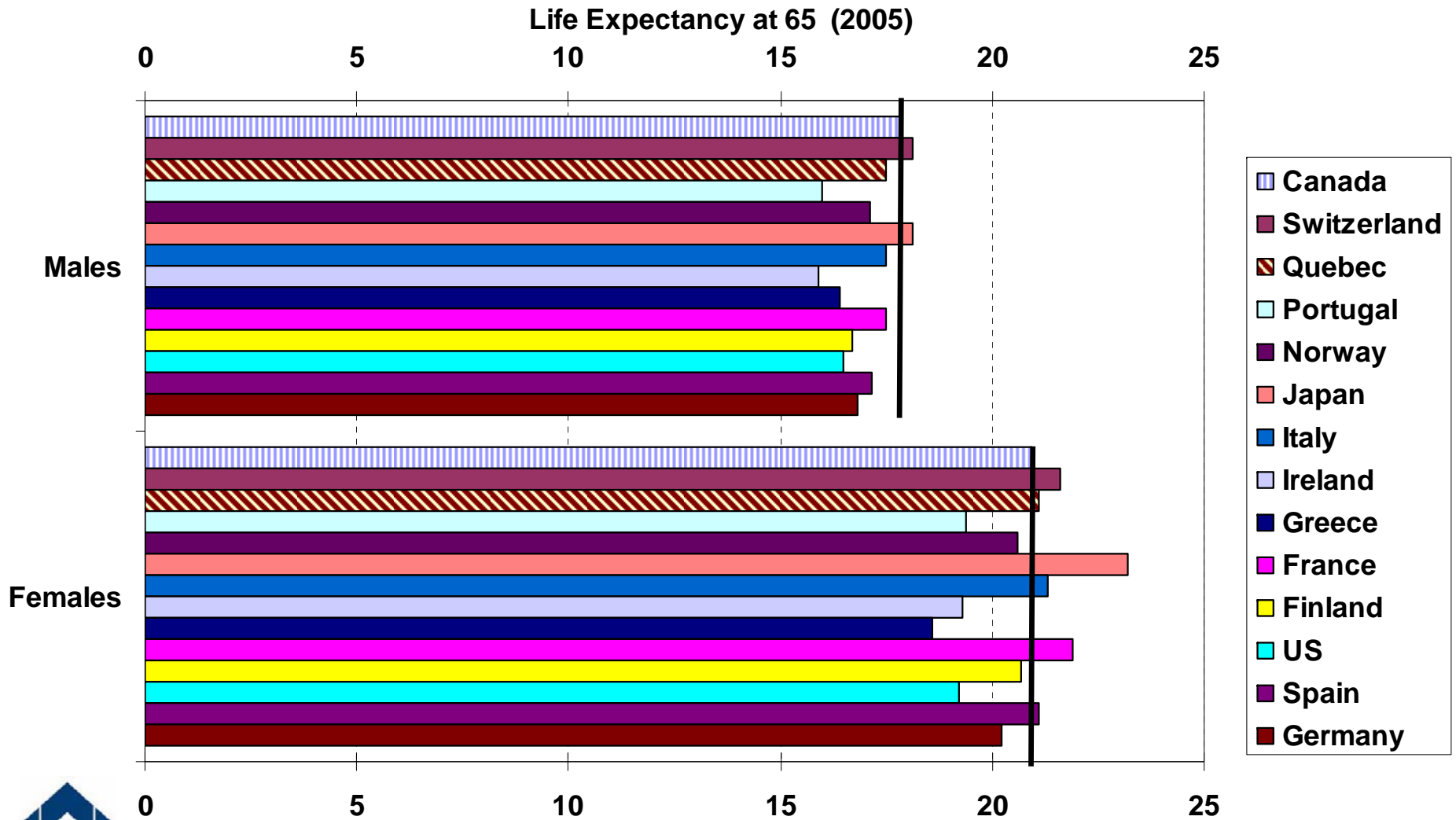


Source : Derived from data from the Canadian Human Mortality Database

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Life Expectancy – International Comparison



Source : Derived from data from the Canadian Human Mortality Database

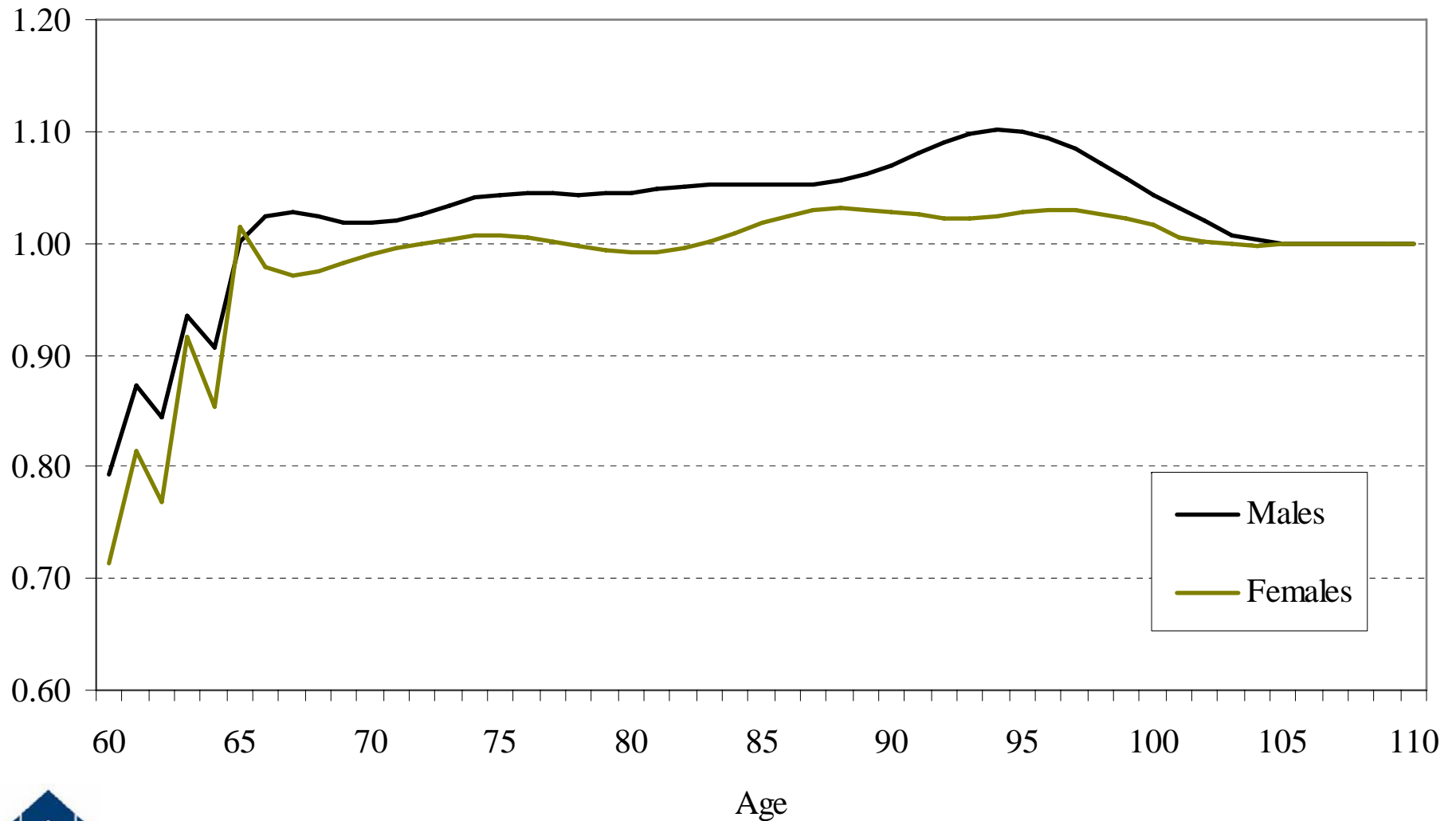
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CPP Mortality vs. General Population

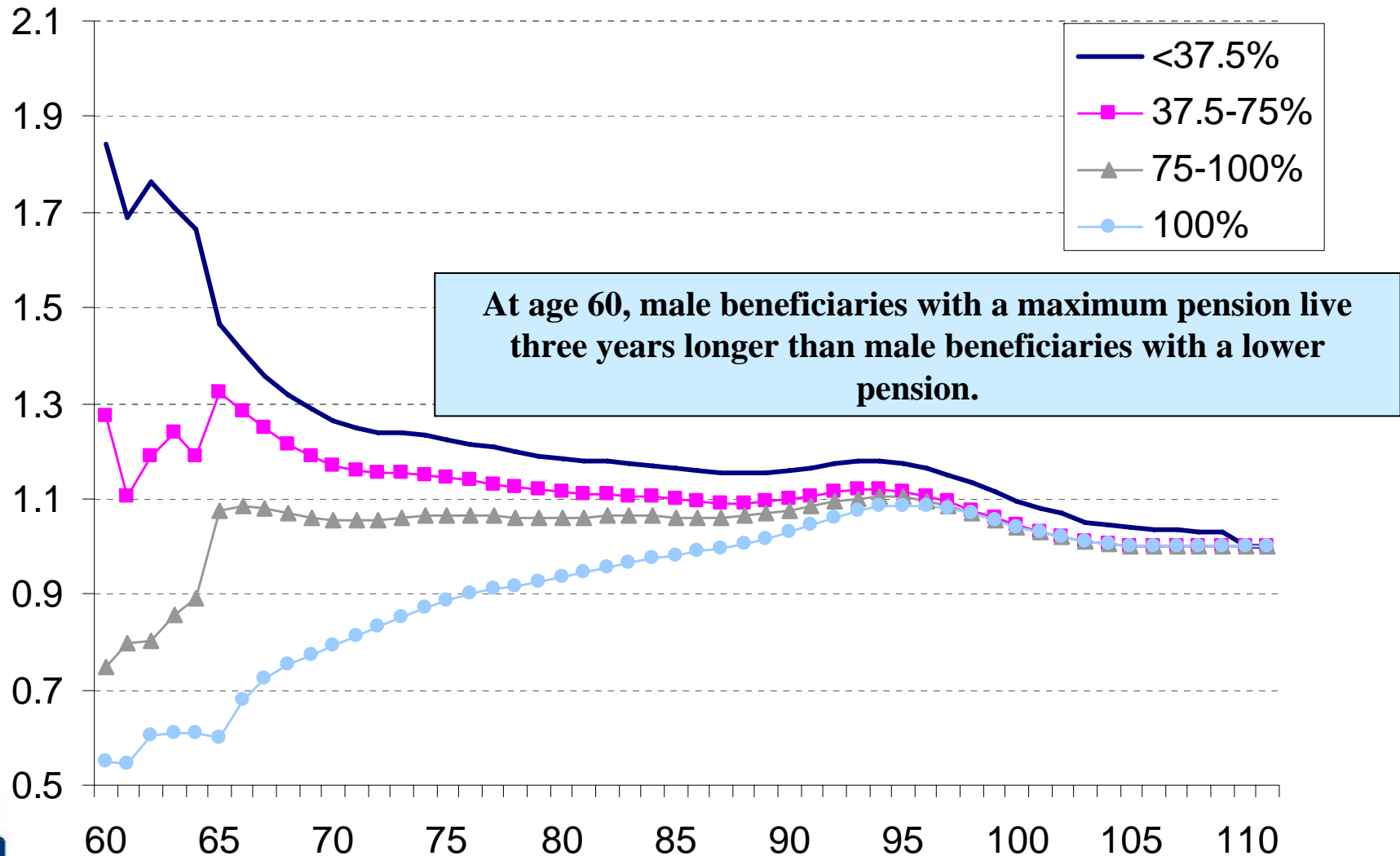


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Source : Office of the Chief Actuary, Actuarial Study # 7, July 2009

Male RTR Mortality Ratio (vs. CHMD2005) by Level of Pension

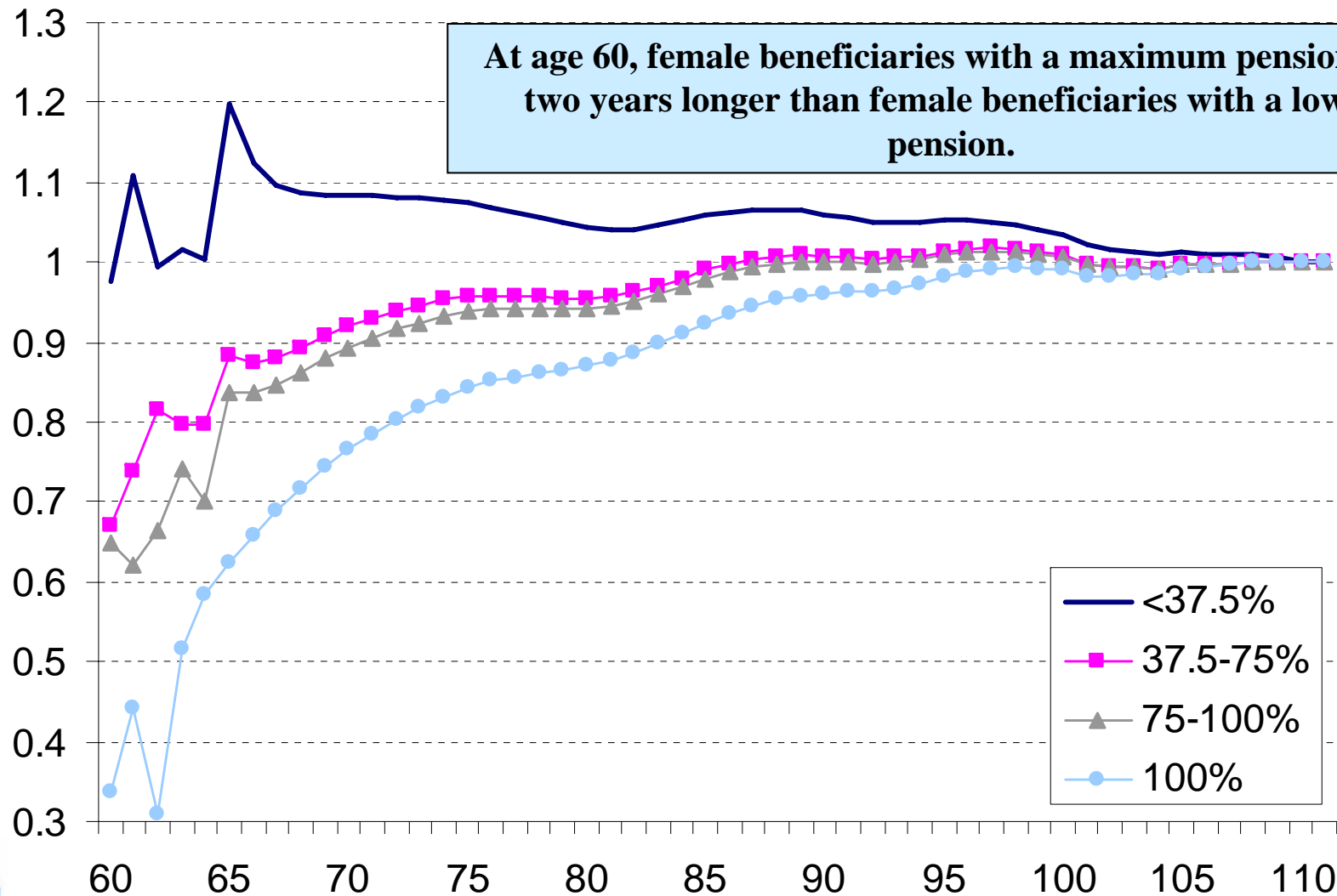


Source : Office of the Chief Actuary, Actuarial Study # 7, July 2009

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Female RTR Mortality Ratio (vs. CHMD2005) by Level of Pension



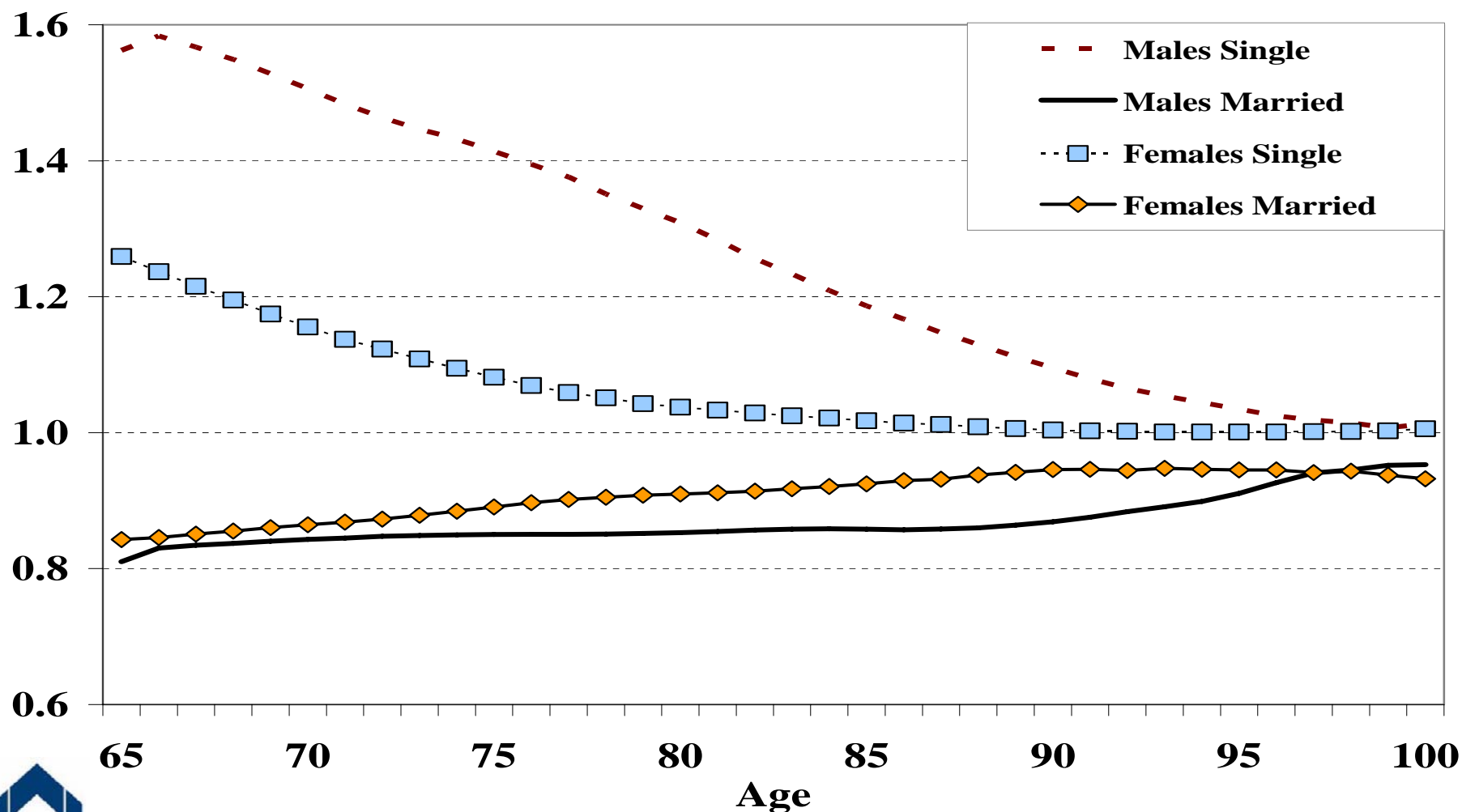
Source : Office of the Chief Actuary, Actuarial Study # 7, July 2009



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Mortality Ratios by Marital Status



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Source : Old Age Security Administrative Database, Actuarial Study no 5, February 2006

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Life Expectancies at 65 by Status

Status	Males				Females			
	Total	Single	Married	Difference	Total	Single	Married	Difference
OAS	16.6	14.2	17.9	+3.7	20.2	19.7	21.0	+1.3
Low Income Seniors	15.0	13.0	16.3	+3.3	19.0	18.6	19.8	+1.2
High-Income Seniors	19.5	17.6	20.6	+3.0	22.4	22.1	23.3	+1.2
Differential Between High and Low Income Seniors	+4.5	+4.6	+4.3	-	+3.4	+3.5	+3.5	-
Born in Canada	16.2	-	-	-	19.9	-	-	-
Born Outside Canada	17.8	-	-	-	21.1	-	-	-



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Source : Old Age Security Administrative Database, Actuarial Study no 5, February 2006

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Evolution of Age Range in Which Given Percentage of Deaths are Expected to Occur*

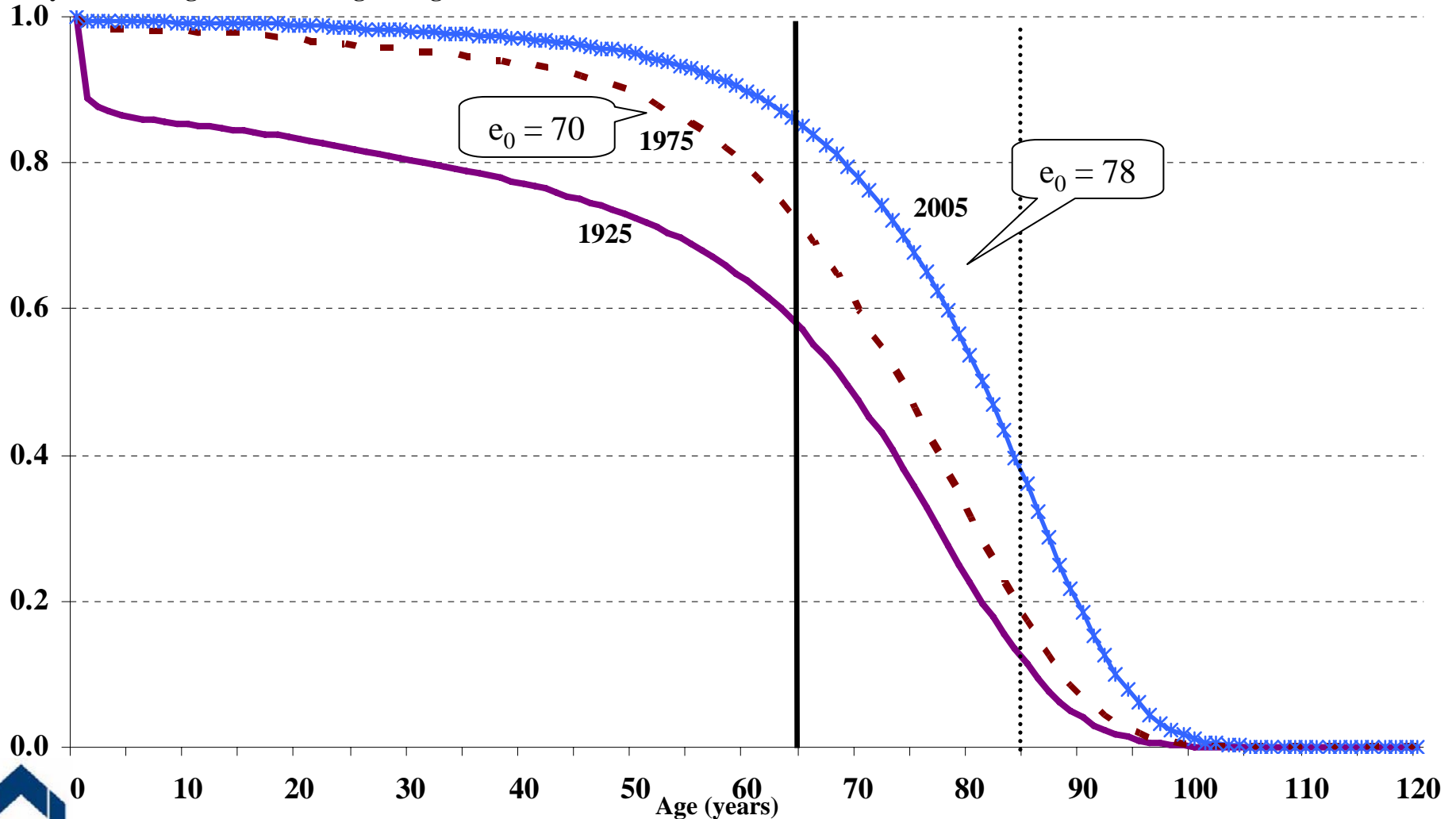
Year	Male Range			Female Range		
	15%	70%	15%	15%	70%	15%
1925	(0-16)	(17-83)	(84+)	(0-23)	(24-84)	(85+)
1950	(0-49)	(50-85)	(86+)	(0-55)	(56-87)	(88+)
1975	(0-55)	(56-86)	(87+)	(0-63)	(64-91)	(92+)
2000	(0-64)	(65-89)	(90+)	(0-69)	(70-94)	(95+)
2005	(0-65)	(66-91)	(92+)	(0-70)	(71-94)	(95+)

* Based on mortality rates of a given year



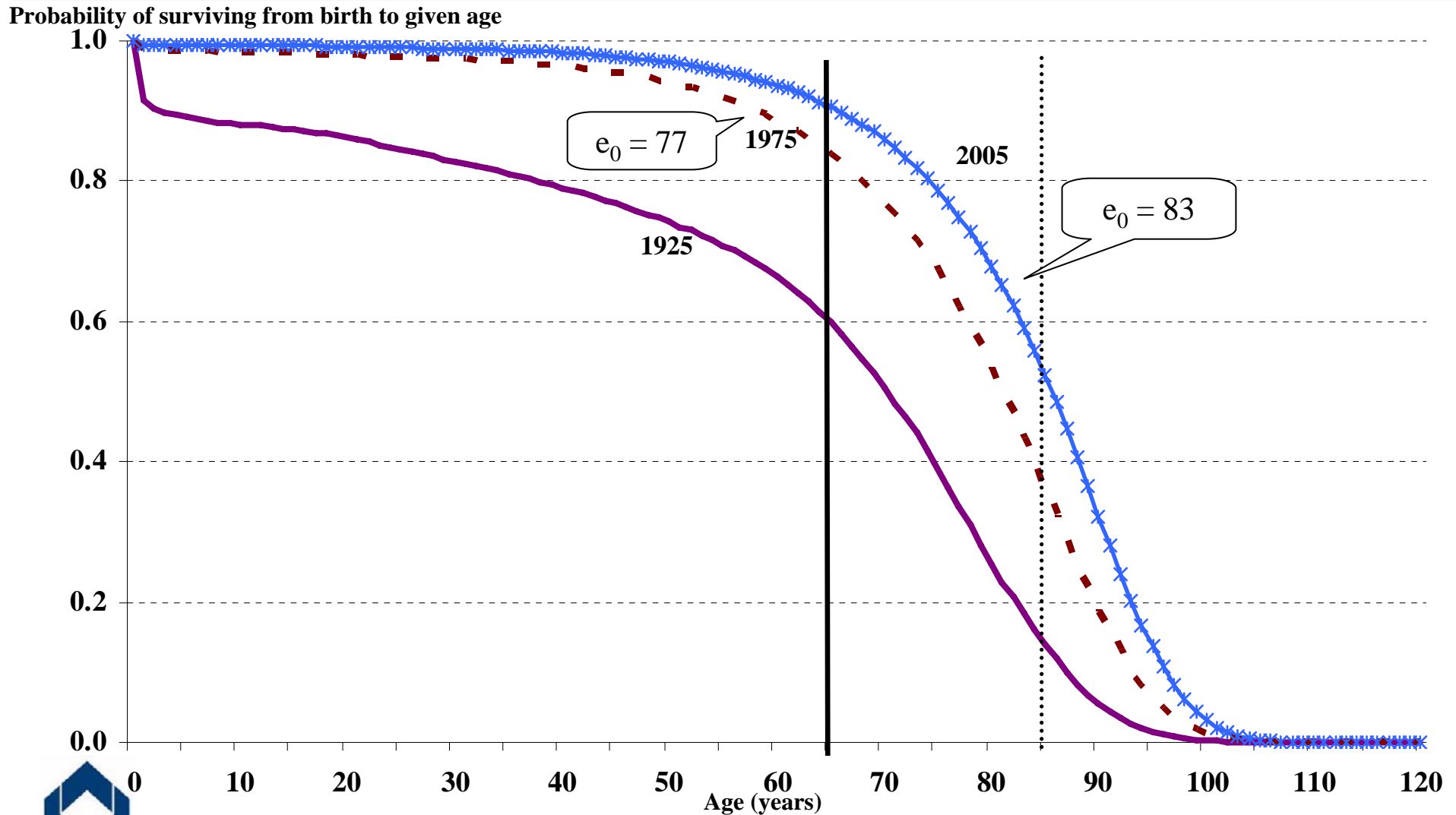
Survival Curves at Birth for Canadian Males

Probability of surviving from birth to given age



70% of males could expect to die between ages 17 and 83 (1925), between 66 to 91 (2005).

Survival Curves at Birth for Canadian Females



70% of females could expect to die between ages 24 and 84 (1925),
between 71 and 94 (2005).

Survival Probabilities*

Canada

Males

Year	${}_{20}P_0$	${}_{45}P_{20}$	${}_{65}P_0$	${}_{20}P_{65}$	${}_{35}P_{65}$
1925	83.2%	68.6%	57.1%	19.9%	0.2%
1950	93.0%	70.7%	65.7%	20.9%	0.2%
1970	96.3%	72.7%	70.0%	23.7%	0.4%
2000	98.9%	84.8%	83.8%	37.1%	0.8%
2005	98.9%	86.0%	85.0%	42.4%	1.3%

Females

1925	86.2%	69.5%	59.9%	23.4%	0.4%
1950	94.7%	79.3%	75.1%	28.3%	0.3%
1970	97.5%	85.1%	82.9%	40.5%	1.1%
2000	99.2%	90.7%	90.0%	55.1%	2.0%
2005	99.2%	91.3%	90.5%	57.7%	2.7%



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* Based on mortality rates of a given year

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Thank You

Michel Montambeault, Senior actuary
Office of the Superintendent of Financial Institutions
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