Presentation to the Living to 100 SOA International Symposium
Mortality projections for Social Security Programs in Canada and its implications
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(Slide 1) Good morning, by way of introduction, I am Jean-Claude Ménard, Chief Actuary of the Canada Pension Plan, the Old Age Security Program and federal public sector pension plans in Canada.

(Slide 2) Thank you for inviting me here today to talk about the Canadian mortality trends over the past century, the Canada Pension Plan mortality experience and the mortality projections for the 25th CPP Actuarial Report. I will conclude with an international comparison of projections made by social security actuaries around the world and the use of stochastic processes to measure uncertainty of results.

(Slide 3) Over the last century, life expectancy at birth has increased by an estimated 29 years in Canada with most of the change occurring before 1950. Most experts agree that the rapid increase in life expectancy at birth that occurred during the 20th century will not continue and that future increases in life expectancy will have to take place at older ages as opposed to younger ages.

(Slide 4) A cohort life expectancy differs from the period life expectancy (presented in the previous slide) by including future mortality improvements to the calendar year mortality rates. Based on this approach, over the last century, life expectancy at birth for cohorts increases even more, averaging an estimated 33 years. This slide clearly shows that the growth in life expectancy at birth is much higher before 1950.

(Slide 5) Since the early 1970s, male and female life expectancy at age 65 has increased by about four years to 18 and 21 years for males and females, respectively. The gap between female and male life expectancies at age 65 has also narrowed but only more recently.

(Slide 6) Like many countries, the Canadian population has been aging at an increasing rate, especially since the inception of the Old Age Security (OAS) program in 1952. Since the OAS program provides a monthly retirement benefit to almost all Canadians aged 65 and over, its administrative database allows an accurate measurement of the level and trend in mortality experienced by the oldest portion of the Canadian population.

(Slide 7) When marital status, income and sex are considered together, the difference in the remaining life expectancy at age 65 could be as high as ten years. Both married males and females experience better mortality than their single counterparts. However, the marital status tends to impact men more than women; the difference is three years for men and one year for women. As people age, the marital status has a lesser impact on life expectancy.

(Slide 8) This slide expresses CPP retirement beneficiary mortality rates relative to the rates for the general population (the 2005 CHMD).

For both males and females, retirement beneficiary mortality rates at ages 60 to 64 are significantly lower than for the general population. This is because retirement beneficiaries between the ages of 60 and 64 do not include CPP disability beneficiaries and are thus somewhat healthier than the general population.

For males, mortality rates after age 65 are higher than for the general population. This is a somewhat unexpected result since CPP beneficiaries are generally thought to have a higher socio-economic status than non-CPP beneficiaries, and should therefore have lower mortality than the general male population. Part of the answer could lie in the difference between the census survey data used in constructing the CHMD Life Tables for Canada and Québec and administrative data relied upon.

For females, mortality rates are lower than for the general population from ages 66 to 72 reflecting the CPP retirement beneficiaries' higher socio-economic status.

(Slide 9) At age 60, male beneficiaries with a maximum pension live three years longer than male beneficiaries with a lower pension. The reason why individuals with high pensions have lower mortality is likely that their socio-economic background and education make them less exposed to some mortality risks. With universal access to medical care in Canada, lack of medical care can be ruled out as a significant factor.

However, in general, both genders exhibit expected patterns of convergence to the general population mortality for each level of pension as age increases.

There is a noticeable increase in the mortality ratios at age 65, particularly for the higher pension classes; this is attributable to the automatic conversion of disability beneficiaries to retirement beneficiaries at that age.

(Slide 10) Over the next few slides, I will show you how we determined our assumptions for the 25th CPP Actuarial Report based on historical data and future expectations.

(Slide 11) The increase in life expectancy at birth was quite rapid before 1965 mainly due to reduction in mortality rates under age 45. For males, 97% (10.4 years) of the total increase in life expectancy is caused by a reduction of mortality below age 45 while for females, it is 75% (11 years over 14.7 years).

Mortality improvements have slowed down since the 1970s, more so for females than for males. Thus the gap is narrowing between male and female mortality.

Over the last 20 years (1985-2005), more than half of the increase in life expectancy has been caused by the reduction in mortality rates after age 65. We expect this trend to continue in the future.

(Slide 12) This table shows the improvement rates by sex and more detailed age groups, over the last 30 years, divided into two 15-year sub-periods. For people aged 65 and over, there was an acceleration of annual improvement rates for males (from 1.0% to 2.1%) and almost no change for females (from 1.0% to 1.1%). When we expand the analysis to people aged 0 to 84, the same trends apply for both males and females.

(Slide 13) The following chart provides an overview of the average annual population-weighted mortality improvement rates in Canada for various sub-periods over the 60 year period ending in 2006.

The average annual mortality improvement rates for ages 15-64 has slowed down during the past 15 years for both males and females. At ages 65-89, the average annual mortality improvement rates are higher for females than for males except during the past 15 years. Females' mortality improvement rates were almost stable over the past 60 years, while for males, the trend is still upward. The average annual mortality improvement rates for males over the last two 15-year periods have increased from 1.1% to 2.2%.

(Slide 14) For the CPP projections, we do not make an assumption on life expectancy. Life expectancy is a result based on mortality rates. Higher mortality improvement rates will cause a higher increase in life expectancy.

The initial (2007-2011) annual mortality improvement rates are based on actual experience over the last 15 years (1991-2006), by age and sex. Mortality improvements are expected to continue in the future, but at a slower pace than most recently observed over the 15-year period ending in 2006.

The ultimate improvement rates (2031+) are set to about half of the improvements experienced by females over the last 15 years. These ultimate rates are generally higher than those used in the previous report for ages below 75. Between 2012 and 2030, it is a linear interpolation between rates for 2011 and 2031.

(Slide 15) For the age group 65 to 74, mortality rates have dropped significantly over the last 40 years for females and mostly over the last 30 years for males. However, this reduction is expected to slow down in coming years due to already low mortality rates.

(Slide 16) Since 2000, elderly mortality rates have been decreasing at a faster pace than in the previous decade.

With the same annual improvement rates (reduction rates) in mortality rates the impact would not be the same at each age.

For example, the assumed male improvement rates for the next ten years would lead to 1% more survivors from age 45 to 55 while it would lead to 16% more survivors from age 75 to 85. This is because mortality rates at older ages are higher. Therefore, the same reduction in mortality rates yield to more survivors to the following year at older ages.

(Slide 17) For the age group 75 to 84, mortality rates have continually decreased over the last 80 years. The reduction was about 45% in the last 40 years (80 deaths per 1,000 to 45 deaths per 1,000) compared to only 25% over the previous period of 40 years (107 deaths per 1,000 to 80 deaths per 1,000). A further reduction of 35% is projected (45 deaths per 1,000 to 29 deaths per 1,000).

(Slide 18) An ultimate annual reduction rate of 0.5% is assumed for the age group 85 to 89, as mentioned in slide 14. For the age group 90+, the annual reduction rate is fixed at 0.4%, which is close to the experience over the last 15 years of females in the age group 90 to 94. As a result, mortality rates are assumed to decrease from 127 to 98 deaths per 1,000 over the projection period for the age group 85 to 99.

By 2020, Canadian male mortality rates are expected to be 10% lower than US female mortality rates for the age group 85 to 99.

(Slide 19) Current mortality rates for the oldest are about at the same level as 25 years ago. For this age group, data quality is a major concern. The reduction in projected mortality rates is less than for other age groups, going from 362 to 328 deaths per 1,000 over the projection period.

(Slide 20) Life expectancy at age 65 increased by about 30% between 1966 and 2006, rising from 14 to 18 years for men and from 17 to 21 years for women. Further improvements in mortality are projected in the future, thus resulting in higher life expectancies and increased Plan costs as more contributors are expected to reach the retirement age of 65 and beneficiaries are expected to receive their benefit for a longer period.

(Slide 21) Males aged 65 in 2010 are expected to receive, on average, their retirement benefit for 20 years. Females are expected to receive their benefits for 23 years, on average. It is about 5 years more than at the inception of the Plan in 1966.

In 2050, the expected length of benefit payments will increase by almost 3 years for males at 23 years and by 2 years for females at 25 years.

At the end of the projection period, the life expectancies at age 65 are 0.7 years and 0.4 years higher than in the previous report. This follows increases of 1.4 years for males and 1 year for females from the previous report. Over two consecutive actuarial reports, the projected life expectancy at age 65 has been increased by almost two years.

(Slide 22) Despite a major increase in life expectancy at birth, the maximum lifespan did not increase significantly in the last century. Few people live beyond 110 years. The following graph shows the probability of survival for a male newborn from 1925 to 2075 based on period life tables. The “squaring” of the survival curve is the result of expected lifetimes increasing and the maximum age that can be attained being about 120 years. As indicated on the graph by the intersection of the vertical line at age 65 with the survival curves, the probability of reaching age 65 increased substantially in the past. Based on period life tables of 1925, males had a 57% probability of reaching age 65. This figure increased to 87% by 2010 and is projected to reach 93% by 2075.

(Slide 23) Based on period life tables of 1925, about 70% of females could expect to die between the ages of 24 and 84; that is 15% of females died prematurely before age 24 while 15% died after age 84.

Removing the 15% of the people in a cohort at the two extremities allows a better assessment of the costs associated with financing retirement. By 2010, this range had moved forward and narrowed to an age range of 72 to 95 years. This trend is expected to continue in the future but at a much slower pace compared to the past. In 2075, it is expected that 70% of females will die between the ages of 79 and 98.

While the probability of reaching age 65 has significantly increased in the past (from 60% to 91%), it is expected to only increase marginally in the future, reaching 95% by 2075. In my view, it is much more important to look at the probability of reaching age 85 in the future to properly assess the costs of pension plans. For females, the probability is expected to increase from 56% to 72% in 2075.

(Slide 24)

(Slide 25) Actuaries from various social security organizations are projecting life expectancies far into the future. This graph shows the projection of life expectancy at age 65 until 2040.

The purple bar (first portion) shows the life expectancy in 2005, the burgundy bar (second portion) shows the additional life expectancy in 2020 and the third yellow bar shows the additional life expectancy in 2040.

The three vertical dotted lines show the position of Canada in 2005, 2020 and 2040.
In 2005, both Swiss and Japanese men enjoyed the highest life expectancy at age 65 for males at 18 years. Canadian men were not far behind.

Our assumption is reasonable when compared with assumptions used by other countries. Indeed if the trends over the past 15 years continue, we might become the country with the highest life expectancy at 65 in 2020.

(Slide 26) This graph shows the same information for females.

In 2005, with a life expectancy at age 65 of 23.2 years, Japanese women have more than one year over the following top ranked countries in this category: French (21.9 years), Swiss (21.5 years). Italy, Canada, and Spain follow. Canadian women had a life expectancy at age 65 of 21 years.

Our assumption seems also reasonable when compared with other countries.

(Slide 27) For 2010 to 2050, Canadian life expectancy at birth (with assumed future mortality improvements) is projected to grow from 85.4 to 88.1 years for males and from 88.3 to 90.5 years for females. A narrowing of the gap between male and female life expectancies has been observed over the last 30 years in Canada.

Based on the mortality experience by age and sex of the last 81 known years (1926 to 2006), a stochastic approach was used to generate low- and high-cost scenarios over the 75 year projection period. It was projected that, on average, the life expectancy of a male aged 65 in 2050 will be in the range 19 years to 25 years with 80% probability. For a female aged 65 in 2050, life expectancy is projected to be in the range 20 years to 28 years.

(Slide 28) The actuarial report on the Canada Pension Plan is based on the projection of its revenues and expenditures over a long period of time. Under a set of best-estimate assumptions, the most recent actuarial report confirms that the legislated contribution rate of 9.9% is sufficient to pay future expenditures and accumulate assets of $275 billion in 2020, or 4.7 times the expenditures. Having said that, both the length of the projection period and the number of assumptions required ensure that actual future experience will not develop precisely in accordance with the best-estimate assumptions. For the second time, in the most recent actuarial reports, many of the sensitivity tests are determined based on stochastic modeling techniques that estimate the probability distribution of the outcome for each of the main assumptions.

This chart shows the evolution of the asset to expenditure ratio under three scenarios: the best-estimate assumption and the two stochastically determined scenarios based on a 80% confidence interval. The result is that the minimum contribution rate required to finance the plan over a 75-year period could fall between 9.3% and 10.3%.

(Slide 29) For a pension plan actuary, the future challenge is not so much to project how many people will still be alive at 100, but more so at age 85 as it was shown in previous slides.

Thank you. I will be pleased to answer any questions you might have.