Presentation by Chief Actuary, Jean-Claude Ménard
Office of the Chief Actuary (OCA)
Office of the Superintendent of Financial Institutions Canada (OSFI)
at the
Society of Actuaries (SOA) 2014 Annual Meeting
on the topic of: Living to 100…will the Canada Pension Plan be
sustainable?

Orlando, FL, U.S.A.
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Good morning. Thank you for inviting me to talk to you today. 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.

Presentation Outline *(Slide 2)*
Today I will briefly talk about the financial status of the CPP, and then discuss the Canadian mortality trends over the past century, and to which degree these trends are projected to impact future mortality rates of the Canadian population.

I will then compare Canadian projections with those of other countries and present different scenarios that illustrate the impact of the uncertainty of mortality projections. Next, I will try to answer the question: "Can we live beyond 100 years?" Finally, I will discuss how the mortality of beneficiaries of Canadian employer-sponsored pension plans compares with that of general population.

Purpose of the Actuarial Report on the Canada Pension Plan as at 31 December 2012 *(Slide 3)*
The Office of the Chief Actuary is required by law to produce an actuarial report on the CPP every three years. The 26th CPP Actuarial Report was tabled before Parliament by the Minister of Finance in December 2013.

The purpose of the Report is to inform stakeholders about the current and projected financial status of the Plan and to calculate the minimum contribution rate that stabilizes asset/expenditures ratio of the Plan over the long-term. For this actuarial report, the minimum contribution rate is determined to be 9.84% for years 2016 and thereafter. It is lower than the legislated contribution rate of 9.9%.

The legislated contribution rate of 9.9% is sufficient to sustain the Plan over the projection period of 75 years *(Slide 4)*
The report states that with the legislated contribution rate of 9.9%, contributions are more than sufficient to cover expenditures until 2023. Starting from 2023, a proportion of investment income is required to pay the expenditures. In 2030, 22% of investment earnings will be required to pay for benefits.

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[1] Remarks to be accompanied by slide presentation, which can be found at the following link: http://www.osfi-bsif.gc.ca/Eng/oca-bac/sp-ds/Pages/jcm20141027_slides.aspx

Results contained in this report confirm that the 9.9% contribution rate is sufficient to financially sustain the Plan and to accumulate assets of $300 billion in 2020.

So, what is about living to 100 and CPP? *(Slide 5)*
Life expectancies at birth in 2013 projected under the best-estimate assumptions for the CPP are 86 years for males and 89 for females. At the same time, the report identifies high uncertainty related to future mortality improvements. In particular, if life expectancies continue to increase at the current rate, especially for ages 75 to 89, the long-term mortality assumptions will need to be adjusted.

Life Expectancy at Birth (Calendar) *(Slide 6)*
This slide presents the calendar life expectancy at birth. Calendar year life expectancy is calculated using the mortality rates of a given year, and it is usually the number reported by statistical agencies around the world.

Since 1901, life expectancy at birth in Canada has increased by an estimated 33 years with most of the change occurring before 1950. Future increases in life expectancy are expected to take place at older ages as opposed to younger ages, which means that the impact on life expectancy at birth will be limited.

Contribution to increase in life expectancy at birth has gradually shifted to people over age 65 *(Slide 7)*
This table shows a slowdown in the rate of increase in life expectancy at birth between the first and later parts of the 20th century. Over the 20 years from 1989 to 2009, 59% of the increase in life expectancy for males has come from mortality improvements at ages 65 and over. For females, the proportion is 67% over the same period. This trend is expected to continue in the future.

Improvements in mortality related to heart diseases have been significant over the last 15 years *(Slide 8)*
The significant increases in Canadian life expectancies at age 65 that have been observed over the last few decades can be explained in great part by the improvements in mortality related to heart diseases. These rates were improving at around 5% per year at ages 65 and over for males and 4% per year for females. In the future, we could expect that reductions in mortality from malignant neoplasm may hopefully become an important factor.

Life expectancy at Age 65 (Calendar) *(Slide 9)*
Since the early 1970s, male and female life expectancy at age 65 has increased by about five years to 19 and 22 years, respectively. It represents a pace of increase of more than a year per decade. The gap between female and male life expectancies at age 65 has also narrowed but only more recently.

Heat map of historical and projected mortality improvement rates for males
(Slide 10)

We do not make an assumption about future life expectancy; rather, we make assumptions on the future trends of mortality rates by age and sex. A heat map is a useful tool to analyse the trends in mortality improvement rates.

This slide presents the historical heat map for Canadian males, as well as our projections. As it could be seen, in late the 60s – early 70s, the mortality rates among young males increased significantly (purple spot). We believe that this phenomenon was caused by an increase in accidental deaths caused in particular by unsafe driving. Deterioration in male mortality could be observed in mid-90s for males aged between late 20s and early 40s and is related to AIDS.

The positive cohort effect for males born approximately in the 1930s and 1940s is also well seen. In our projections we assume that this cohort effect will continue for some time and then gradually disappear. In general, mortality is assumed to continue to improve, but at a slower pace than it was seen over the recent decades.

Heat map of historical and projected mortality improvement rates for females
(Slide 11)

For Canadian females there is no discernible historical cohort effect. A significant calendar year effect is seen for females aged less than 45 in the 1950s and early 1960s with mortality improvement rates close to 5% per year. It is believed to be related to reduction of mortality as a result of giving birth.

The recent historical as well as projected improvement rates are more moderate. It is assumed that the gap between male and female mortality rates will continue to shrink. At the same time, we believe, that male mortality rates will continue to be higher than those of females, that is women will still live longer than men.

Canadian mortality rates at ages 15 to 54 are significantly lower than U.S.A. rates *(Slide 12)*

The next several slides compare evolution of mortality rates by age groups for Canadians and Americans with more focus on Canada. United States numbers are based on the 2012 Old Age, Survivors And Disability Insurance Program (OASDI) Trustees Report.

For the age group 15 to 54, over the last 40 years, the reduction in Canadian mortality rates was about 57%. This is a little higher than the 50% reduction over the previous 40-year period. However, it is worth noting that mortality rates are now decreasing at a slower pace: decrease of 28% in the last 20 years as opposed to 40% in the previous 20 years. We project a further reduction of 38% over the next 40 years.

Current mortality for this age group is 40% lower than for the U.S.A. mainly due to much lower mortality from accidents, heart diseases and homicides.

Mortality Rates for older age groups have decreased over the last 80 years, more so over the last 40 years for males *(Slide 13)*
For age group 55 to 64, the recent reduction of 57% in mortality rates over the last 40 years was much more dramatic compared to 26% reduction over the previous 40-year period. In addition, male mortality rates for this age group have been decreasing at a much faster pace in the last two decades than in previous decades. A further reduction of 33% is projected. Current mortality for this age group is 27% lower than for the U.S.A. mainly due to lower mortality caused by diseases of the heart, accidents and diabetes.

For ages 65 to 74, 7 deaths per 1,000 are from cancer, while only 3 deaths per 1,000 are from heart diseases *(Slide 14)*
Age group 65 to 74 has experienced similar pattern and magnitude of reduction in mortality as age group 55 to 64. A further reduction of 40% is projected. Once again, male mortality rates in this age group have been decreasing at a faster pace in the last two decades than in previous decades.

For this age group, cancer is responsible for the vast majority of deaths. Current mortality is 21% lower than for the U.S.A. mainly due to lower mortality caused by diseases of the heart, lower respiratory diseases and diabetes.

Male mortality rates for ages 75 to 84 for Canada are projected to become lower than US female mortality rates *(Slide 15)*
For the age group 75 to 84, the reduction in mortality rates was about 43% over the last 40 years compared to only 31% over the previous 40-year period. A further reduction of 37% is projected. Current mortality is 17% lower than for the U.S.A. mainly due to lower mortality caused by diseases of the heart and lower respiratory diseases.

Elderly Mortality Rates have decreased over the last 80 years, more so over the last 10 years *(Slide 16)*
U.S.A. and Canadian mortality rates of the 85 to 89 age group were quite similar prior to 1999. However, since 1999, Canadian rates have been reducing faster than American ones. The reduction over that decade was 21%. Canadian rates are currently 15% lower than for the U.S.A. mainly due to much lower mortality caused by diseases of the heart and Alzheimer's. A further reduction of 30% is projected by 2049.

For ages over 90, heart diseases remains the main cause of death *(Slide 17)*
The 90 and over age group mortality rates have been decreasing but at a slower pace than for other age groups. A reduction of 26% was experienced over the last 40 years, compared to a reduction of 14% over the previous 40-year period.

For this age group, projections become very uncertain, even for the short and medium terms. As of 2009, Canadian mortality for 90 and over age group is 15% lower than the U.S.A. mortality, due to lower mortality caused by diseases of the heart and Alzheimer's.

Currently, Canadian seniors are living longer than those in the U.K. and the U.S.A. *(Slide 18)*
As was seen from the previous slides, current Canadian mortality rates are lower than those in the U.S.A. For older ages, this difference is projected to widen. In comparison, while current mortality rates in Canada for ages 65 and over are lower than those in the U.K., by 2049 the situation is projected to reverse. This is a result of higher ultimate mortality rates used in U.K. projections.

The likelihood of premature mortality decreased dramatically *(Slide 19)*
It is also interesting to consider the evolution over time of the range of ages in which a given percentage of deaths are expected to occur. This slide shows the progression of the age range over time in which 70% of deaths are expected to occur, where both 15% of the oldest deaths and 15% of the youngest deaths are excluded.

The historical large gains in life expectancy can be seen from this table. Based on period life tables of 1925, about 70% of males could expect to die between the ages of 12 and 83; that is, 15% of males died prematurely before age 12, while 15% who were the strongest died after age 83. By 2013, the age range in which 70% of deaths occur had both moved forward and narrowed to an age range of 68 to 92. A similar shift and narrowing in range can be seen for females. Again, this trend is expected to continue in the future, but at a slower pace compared to the past.

Cohort life expectancy at age 65 *(Slide 20)*
A cohort life expectancy differs from the period or calendar life expectancy shown in the beginning of this presentation. It includes future mortality improvements to the calendar year of mortality rates. Canadian life expectancy at age 65 is projected to increase by three years to reach 25 years within the next 50 years. It means that half of Canadian retirees are expected to live past age 90.

This will result in increased costs for pension plans as beneficiaries are expected to receive their benefit for a longer period.

Uncertainty of Results: Life Expectancies at age 65 if MIRs by cause are sustained *(Slide 21)*
Future mortality projections are very uncertain. As such, it is useful to consider alternative projection scenarios. This chart presents the life expectancies at age 65 under a scenario where the annual MIRs of the last 15 years (1994-2009) by cause are assumed to remain constant over the entire projection period.

Due to the higher recent mortality improvement rates for males, this scenario leads to a narrowing of the gap between male and female life expectancies at age 65 and, eventually, higher life expectancy for males than for females by 2026 and thereafter. In 2075, male life expectancy would surpass that of females by over 5 years. This scenario serves as a reminder that setting future assumptions only on recent experience may lead to unintended results.

Uncertainty of Results: Life Expectancies at age 65 if heart diseases and cancer gradually removed over 75 years *(Slide 22)*
Next, let us consider a scenario where mortality related to heart diseases and malignant neoplasms is gradually eliminated over the next 75 years. This scenario results in cohort life expectancies at age 65 that will surpass those projected under the latest Canada Pension Plan actuarial report by 2017 for female and by 2024 for males. By 2075, cohort life expectancies will be about 3 years higher for females and about 4 years higher for males than under CPP26.

Canadians of all ages are projected to live to age 90 with probability of more than 40% *(Slide 23)*
This slide presents the probability of surviving to age 90 from a given age in 2012 for Canada, the U.K. and the U.S.A. It is interesting to look at the shape of the curves. The probability is higher for younger ages due to the projected decreases in mortality rates. On the other hand, for older age groups, the probabilities of living to 90 increases since only individuals who have already reached older ages are considered.

For all three countries and for all ages, chances to survive to age 90 are quite high. Due to higher assumed mortality improvements, these probabilities are higher in the U.K. for ages lower than 70. However, Canadians fare better for older ages, due to the lower current mortality rates.

Can We Live Beyond 100 Years? Probability of living to 100 for Canada, the U.S.A. and the U.K. *(Slide 24)*
As we saw, it is quite likely that we can live to age 90. But, can we live beyond age 100? This slide is similar to the previous one, except it looks at the surviving to age 100.

For Canada and the U.S.A. these probabilities are under 10% for most of the ages. The U.K. has the highest probabilities of living to 100 of the three countries at all ages between 0 and 85 due to higher assumed future mortality improvement rates.

Survival Curves for a Life Expectancy of 100 (Males) *(Slide 25)*
What could happen to mortality rates in order for Canadians to have a life expectancy at birth of 100?

We came up with several alternatives. This chart presents a comparison of the current survival curve and two alternatives. Under the first scenario, current mortality rates at each age are reduced by 87% (dotted blue survival curve). Under the second

alternative, the life-span is increased to 140 (red survival curve), and the current mortality rates are redistributed across ages 0 to 140.

Another possibility is to assume that nobody dies before age 97 and then current mortality rates will be in place for ages 97 and over.

If mortality rates decrease at the same pace as observed over the past 15 years, a life expectancy of 100 could be attained by 2094 for males and by 2121 for females. If we wish to live to 100 today, we need either to reduce current mortality rates dramatically or increase our life span. In our view, both routes are not very likely.

Mortality rates of pension plans vary from those of the general population (Slide 26)

Mortality rates of a population subgroup, for example participants of a pension plan, are affected by shared characteristics of its members: type of employment, level of income, education, etc.

Large plans in Canada that have sufficient membership to perform mortality studies use its own mortality tables for funding valuations. At the same time, small and medium size plans generally rely on tables recommended by the Canadian Institute of Actuaries.

In February 2014, the Canadian Institute of Actuaries has published the mortality table together with a projection scale. This table is based on the Canadian experience and is for the use by Canadian registered pension plans. The analysis was done separately for public and private sectors pension plans. Prior to that, the commonly used table was the Uninsured Pensioner Mortality table 1994 (UP94) with the projection scale AA that is based on American experience.

Federal public sector pension plans have large membership. As such, in developing the starting point of mortality projections for federal public sector pension plans, we analyse mortality rates of each plan. On another hand, we believe that the mortality rates of the federal public sector pension plan members will improve at the same pace as those of the general Canadian population.

Life expectancy under Canadian Pensioners' Mortality 2014 table (CPM2014) is significantly higher than under the Uninsured Pensioner Mortality table 1994 (UP94) *(Slide 27)*

The next two slides show the projected life expectancies at age 65 for Canada Pension Plan, federal public sector pension plans, UP94 and CPM2014. The solid bars correspond to calendar life expectancies (i.e. based on the mortality rates of 2014), and the shaded parts show the increase caused by future mortality improvements.

If we compare CPP and federal public sector pension plans, 2014 mortality rates are lower for pension plans than for CPP. The exception is Canadian Forces non-officers. The difference in future assumed mortality improvements is due to the fact that figures shown for federal public sector pension plans are based on their most recent statutory

actuarial reports and use mortality improvements assumption of the 25th CPP Actuarial Report.

If CPP is compared to CPM2014, not surprisingly, mortality rates of general Canadian population are higher than those of members of registered pension plans. However, future pace of mortality improvements is similar.

Life expectancy under CPM2014 is significantly higher than under UP94 *(Slide 28)*
The picture for females is close to that of males, except that females are expected to experience lower future improvements in mortality**.**

Conclusions *(Slide 29)*
To conclude, retirement is expensive and will become even more expensive in the future with improved longevity. Projection of mortality rates is a difficult exercise, since future mortality rates are highly uncertain, especially for people older than age 90.

It is a professional duty of the actuary to examine all available information in order to develop best-estimate mortality assumptions.

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