Living to 100... would Canadian pensions be sustainable?

Presentation at the Retirement Age Seminar organized by the Population Issues Working Group of IAA

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Office of the Superintendent of Financial Institutions (Canada)

Vancouver, 14 October 2015
Canadian Retirement Income System is based on a diversified approach to savings

- Canadian retirement system is a three-tiered system with mixed funding approaches
  - Old Age Security Program – a universal basic pension/supplement financed using pay-as-you-go approach
  - Canada / Québec Pension Plan – mandatory earnings-related partially funded DB plans
  - Occupational Pension Plans and tax-favoured individual savings i.e. voluntary fully funded arrangements

- Today, first two pillars replace about 40% of pre-retirement earnings for an individual with average level of earnings

Canadian retirement income system is well recognized in the world for its capacity to adapt rapidly to changing conditions.
All three pillars are important in protecting Canadian seniors from poverty

Percentage of seniors with equivalised household income before taxes below $16,900 (35% of the 2011 YMPE)

<table>
<thead>
<tr>
<th></th>
<th>Single</th>
<th>Couple</th>
<th>ALL</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>24%</td>
<td>5%</td>
<td>13%</td>
</tr>
<tr>
<td>If GIS would not be payable, the number of low-income seniors will double …</td>
<td>42%</td>
<td>13%</td>
<td>25%</td>
</tr>
<tr>
<td>If there are no employer sponsored pension plans, no retirement savings, no working income, the number of low-income seniors will double again…</td>
<td>86%</td>
<td>40%</td>
<td>60%</td>
</tr>
<tr>
<td>Finally, if we would remove the CPP (only basic OAS is left) …</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
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</table>
Aging of Canadian population: ratio of number of people aged 20-64 to 65 and over is projected to fall from 4.1 in 2013 to 2.2 in 2050.

Decrease in expenditures as % of GDP is due to the slower growth in inflation compared to growth in wages and the GDP.
The legislated contribution rate of 9.9% is sufficient to sustain the Plan over the projection period of 75 years

26th CPP Actuarial Report as at 31 December 2012:

• 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 is required to pay for benefits.

• 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?

- Best-Estimate Mortality Assumptions of the 26th CPP Report as at 31 December 2012 include future mortality improvements

<table>
<thead>
<tr>
<th>Canadian Life Expectancy</th>
<th>Males</th>
<th>Females</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cohort Born in 2013</td>
<td>86.1 years</td>
<td>89.1 years</td>
</tr>
<tr>
<td>Cohort Reaching Age 65 in 2013</td>
<td>20.9 years</td>
<td>23.3 years</td>
</tr>
</tbody>
</table>

**BUT** executive summary of the CPP26 states:

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.
**Contribution to increase in life expectancy at birth has gradually shifted to people over age 65**

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<tr>
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<tbody>
<tr>
<td>Infant mortality (&lt;1)</td>
<td>6.0</td>
<td>0.2</td>
<td>4.8</td>
<td>0.1</td>
</tr>
<tr>
<td>Mortality (1-44)</td>
<td>5.2</td>
<td>0.8</td>
<td>6.9</td>
<td>0.3</td>
</tr>
<tr>
<td>Older adult mortality (45-64)</td>
<td>0.5</td>
<td>1.4</td>
<td>2.2</td>
<td>0.6</td>
</tr>
<tr>
<td>Elderly mortality (65+)</td>
<td>0.8</td>
<td><strong>3.0</strong></td>
<td>3.2</td>
<td><strong>2.0</strong></td>
</tr>
<tr>
<td>Estimated Multivariate Effect</td>
<td>-0.2</td>
<td>-0.3</td>
<td>-0.4</td>
<td>-0.1</td>
</tr>
<tr>
<td>Total Change in Life Expectancy</td>
<td>12.4</td>
<td>5.1</td>
<td>16.7</td>
<td>3.0</td>
</tr>
</tbody>
</table>

**Over last 10 years (2003-2013) more than 70% of increases of life expectancy of CPP retirement beneficiaries aged 65+ came from ages 75 and over**

*Source: Canadian human Mortality Database, University of Montreal and Office of the Chief Actuary calculations, OCA Actuarial Study No.16*
Life Expectancy at Age 65 (Calendar)

Life Expectancy

Source: Canadian human Mortality Database, University of Montreal
Improvements in mortality related to heart diseases have been significant over the last 15 years.

Source: Data from Statistics Canada, Health Division and OCA Calculations
Standardized Using 2001 Canadian Population
After age 85, Canada along with Japan and France has the lowest mortality rates

Number of deaths per 1,000 (2011, both sexes)

Source: International Human Mortality Database
Heat map of historical and projected mortality improvement rates for males

Male MIR based on HMD, 15 years moving average with projection

- Deterioration due to Accidents
- Deterioration due to AIDS
- Cohort Effect

Key:
- 4.75%-5.00%
- 4.25%-4.75%
- 3.75%-4.25%
- 3.25%-3.75%
- 2.75%-3.25%
- 2.25%-2.75%
- 1.75%-2.25%
- 1.25%-1.75%
- 0.75%-1.25%
- 0.25%-0.75%
- -0.25%-0.25%
- -0.75%--0.25%
- -1.25%--0.75%
- -1.75%--1.25%

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Male mortality rates for ages 75 to 84 for Canada are projected to become lower than US female mortality rates.

Ages 75-84

Death Rate per 1,000 Top 5 Causes

<table>
<thead>
<tr>
<th>Cause</th>
<th>Canada</th>
<th>U.S.</th>
<th>Ratio Can/US</th>
</tr>
</thead>
<tbody>
<tr>
<td>Malignant Neoplasms</td>
<td>13.7</td>
<td>12.0</td>
<td>1.14</td>
</tr>
<tr>
<td>Diseases of the Heart</td>
<td>9.0</td>
<td>12.0</td>
<td>0.75</td>
</tr>
<tr>
<td>Cerebrovascular</td>
<td>2.9</td>
<td>2.9</td>
<td>0.99</td>
</tr>
<tr>
<td>Lower Respiratory</td>
<td>2.6</td>
<td>3.7</td>
<td>0.69</td>
</tr>
<tr>
<td>Diabetes</td>
<td>1.5</td>
<td>1.4</td>
<td>1.02</td>
</tr>
</tbody>
</table>

Source: Canada: Office of the Chief Actuary, 26th CPP Actuarial Report and Statistics Canada catalogue 84-215-x

All rates are standardized using the 2012 Canadian population
Uncertainty of Results

Life Expectancies at age 65 if MIRs by cause are sustained

<table>
<thead>
<tr>
<th></th>
<th>Males</th>
<th>Females</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diseases of the heart</td>
<td>4.6%</td>
<td>4.1%</td>
</tr>
<tr>
<td>Malignant Neoplasms</td>
<td>1.3%</td>
<td>0.2%</td>
</tr>
<tr>
<td>Other Causes</td>
<td>1.7%</td>
<td>0.7%</td>
</tr>
</tbody>
</table>

CPP26 Projections

Office of the Chief Actuary

Bureau de l’actuaire en chef
The likelihood of premature mortality decreased dramatically

Evolution of Distribution of Age at Death (15th to 85th Percentile)

Probabilities are based on the mortality rates of the calendar year of birth.

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The number of people aged 90 and over increases dramatically (in thousands) % of Population

Increase from 2010 to 2050
90-99: 450%
100+: 900%

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Half of Canadians aged 20 today are expected to live to age 90

Probability of living to 90 for Canada, the U.S. and the U.K.

Source: 2012 OASDI Trustees Report, UK Office for National Statistics, 26th CPP Actuarial Report

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Conclusion

• Retirement is expensive and will become even more expensive in the future with improved longevity

• Projected mortality rates after 2030 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.
Living to 100... would Canadian pensions be sustainable?

Appendix

14 October 2015
Canadian mortality rates at ages 15 to 54 are significantly lower than US rates

Ages 15-54

Death Rate per 1,000
Top 5 Causes         Canada  U.S.  Ratio Can/US
Malignant Neoplasms  0.342  0.401  0.85
Accidents            0.192  0.361  0.53
Diseases of the Heart 0.157  0.306  0.51
Suicides            0.143  0.146  0.98
Homicides          0.020  0.082  0.24

Source: Canada: Office of the Chief Actuary, 26th CPP Actuarial Report and Statistics Canada catalogue 84-215
All rates are standardized using the 2012 Canadian population

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Mortality Rates for older age groups have decreased over the last 80 years, more so over the last 40 years for males.

Ages 55-64

Death Rate per 1,000
Top 5 Causes   Canada   U.S.   Ratio Can/US
Malignant Neoplasms   2.95   3.07   0.96
Diseases of the Heart   1.11   1.93   0.57
Accidents   0.24   0.37   0.65
Diabetes   0.19   0.33   0.57
Cerebrovascular   0.19   0.30   0.62

Source: Canada: Office of the Chief Actuary, 26th CPP Actuarial Report and Statistics Canada catalogue 84-215-x
All rates are standardized using the 2012 Canadian population.
For ages 65 to 74, 7 deaths per 1,000 are from cancer, while only 3 deaths per 1,000 are from heart diseases.

### Ages 65-74

- **Malignant Neoplasms**: 7.1 (Canada), 6.8 (U.S.), Ratio: 1.04
- **Diseases of the Heart**: 2.9 (Canada), 4.3 (U.S.), Ratio: 0.67
- **Lower Respiratory**: 0.8 (Canada), 1.5 (U.S.), Ratio: 0.53
- **Cerebrovascular**: 0.7 (Canada), 0.8 (U.S.), Ratio: 0.79
- **Diabetes**: 0.5 (Canada), 0.7 (U.S.), Ratio: 0.75

**Source:**
- Canada: Office of the Chief Actuary, 26th CPP Actuarial Report and Statistics Canada catalogue 84-215-x

*All rates are standardized using the 2012 Canadian population*
Elderly Mortality Rates have decreased over the last 80 years, more so over the last 10 years.

Ages 85-89

Source: Canada: Office of the Chief Actuary, 26th CPP Actuarial Report and Statistics Canada catalogue 84-215-x
All rates are standardized using the 2012 Canadian population.
For ages over 90, heart diseases remain the main cause of deaths

Ages 90+

Death Rate per 1,000

<table>
<thead>
<tr>
<th>Top 5 Causes</th>
<th>Canada</th>
<th>U.S.</th>
<th>Ratio Can/US</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diseases of the Heart</td>
<td>51.1</td>
<td>62.5</td>
<td>0.82</td>
</tr>
<tr>
<td>Malignant Neoplasms</td>
<td>21.4</td>
<td>16.7</td>
<td>1.28</td>
</tr>
<tr>
<td>Cerebrovascular</td>
<td>16.3</td>
<td>13.5</td>
<td>1.21</td>
</tr>
<tr>
<td>Alzheimer’s</td>
<td>10.2</td>
<td>14.1</td>
<td>0.72</td>
</tr>
<tr>
<td>Lower Respiratory Diseases</td>
<td>8.5</td>
<td>7.6</td>
<td>1.2</td>
</tr>
</tbody>
</table>

Source: Canada: Office of the Chief Actuary, 26th CPP Actuarial Report and Statistics Canada catalogue 84-215-x

All rates are standardized using the 2012 Canadian population.
Heat map of historical and projected mortality improvement rates for females

Significant Improvements in mothers’ health
Uncertainty of Results: Life Expectancies at 65 if heart diseases and cancer gradually removed over 75 years

### Annual Improvement Rates for other causes

<table>
<thead>
<tr>
<th></th>
<th>Males</th>
<th>Females</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>1.7%</td>
<td>0.7%</td>
</tr>
<tr>
<td>2030+</td>
<td>0.35%</td>
<td>0.35%</td>
</tr>
</tbody>
</table>

CPP26 Projections
Probability of living to 80 for Canada, the U.S. and the U.K.

Source: 2012 OASDI Trustees Report, UK Office for National Statistics, 26th CPP Actuarial Report

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Can We Live Beyond 100 Years?
Probability of living to 100 for Canada, the U.S. and the U.K.

Source: 2012 OASDI Trustees Report, UK Office for National Statistics, 26th CPP Actuarial Report

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Survival Curves for a Life Expectancy of 100 (Males)

\[ e_0 = 80 \quad e_0 = 100 \]

Probability of Survival from Age 0 to Attained Age

- CHMD 2009
- Reduction of mortality rates at each age by 87%
- Increased Life Span to 140
To live beyond 100…

• If mortality rates decrease at the same pace as observed over the past 15 years (2.5%/year males, 1.5%/year females), a life expectancy of 100 could be attained in 85 years (2094) for males and in 112 years (2121) for females.

• A reduction of mortality rates at each age by 87% for males and 82% for females results in a life expectancy of 100.

• Life expectancy of 100 is also achievable if the maximum life span increases to 140 years for males and 132 years for females.

• Life expectancy of 100 is also achievable if mortality rates below age 96 are zero followed by current mortality rates from ages 97 to 115.