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# CANADIAN PENSIONERS' MORTALITY: A REVIEW OF THE FINAL REPORT

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**T**his article provides an overview of the Final Report on Canadian Pensioners' Mortality (Report) of the Pension Experience Subcommittee (subcommittee) of the Canadian Institute of Actuaries' (CIA) Research Committee following its landmark study of mortality patterns in Canada. For the full Report, please visit the CIA website and search for [Document 214013](#).

## INTRODUCTION

In 2008, the research committee formed the subcommittee to review mortality experience of Canadian pensioners and to develop and maintain Canadian pension mortality tables and improvement scales.

To achieve those two goals, the CIA commissioned two experience studies:

- The first study ("C/QPP Study") reviewed mortality experience of all persons receiving a retirement pension from the Canada Pension Plan and the Quebec Pension Plan, individually and in both plans together using data from 2005 through 2007. The results are contained in a report prepared by Louis Adam of Université Laval, available at this link: [Phase 2 C/QPP Study](#). The C/QPP Study also reviewed the trends in mortality experience since 1967, the first year that C/QPP pensions became payable, which helped develop the mortality improvement scales in the Report. The results of this part of the C/QPP Study can be found here: [Phase 3 C/QPP Study](#).
- The second study (the Registered Pension Plan Study [RPP Study]), reviewed the experience of a number of Canadian registered pension plans in the public and private sectors. The results of the RPP Study are summarized in the Report.

The primary goals of the two C/QPP studies and the RPP Study were to build base mortality tables and mortality improvement

scales that may be used for actuarial valuations for funding and/or financial reporting purposes. In addition, the Report notes that these same tables may be considered for use to determine lump sum pension commuted values or division of pension benefits on marriage breakdown.

The Report presents a set of mortality rates based on the RPP Study and mortality improvement scales, the latter based on the C/QPP Study and assumptions used in the [26<sup>th</sup> CPP Actuarial Report](#). As stated in the Report, the subcommittee notes that adjustments to the published tables may be appropriate in many circumstances.

## CONSTRUCTION OF THE MORTALITY TABLES

The RPP Study used mortality experience from calendar years 1999 to 2008 from a subset of Canadian public-sector and private-sector registered pension plans. From this data, the following mortality tables for 2014 were developed:

1. 2014 Mortality Table (CPM 2014) – developed from the combined mortality experience of private-sector and public-sector plans.
2. 2014 Public Sector Mortality Table (CPM 2014 Publ).
3. 2014 Private Sector Mortality Table (CPM 2014 Priv).

The final mortality tables can be found via a [link in the report](#) in Section 1.1.1 along with [separate tables](#) produced for the years 1999 to 2013.

The Report makes the following notes and comments regarding the use of these tables:

- **Industry Experience:** The subcommittee was not able to develop mortality tables by industry due to lack of data. However, the subcommittee did make observations on actual to expect-

ed (A/E) ratios relative to the CPM tables by industry and prepared an Excel workbook to assist actuaries in this area.

- **Blue, White, and Mixed Collar:** The subcommittee received very little data by collar type, so no such breakdown was provided.
- **Size Adjustment Factors:** The subcommittee found that in both the RPP Study and C/QPP Study there was significant experience variation by size of pension. As a result, the subcommittee developed size adjustment factors that can be used with the base mortality tables, available via a [link](#) in Section 1.1.4.
- **Application:** The Report expresses the expectation that actuaries working on Canadian pension plans will adopt the table that is most reasonable and appropriate for the plan in question. The subcommittee has the view that actuaries should consider whether modifications to the base tables are warranted to reflect actual and credible experience in plans with sufficient scale and/or experience in similar plans within the same industry.

### CONSTRUCTION OF MORTALITY IMPROVEMENT SCALES

Based on the C/QPP Study’s review of trends in mortality experience since 1967, the following male and female improvement scales were developed.

- CPM Improvement Scale B (CPM-B) – improvements by age that decrease in a linear fashion for years 2012 to 2030, and ultimate rates applicable for years after 2030.
- CPM Improvement scale B1-2014 (CPM-B1D2014) – improvement rates by age only, designed to approximate

## THE USE OF SIZE ADJUSTMENTS FACTORS IS WARRANTED DUE TO THE OVERWHELMING EVIDENCE THAT ALL ELSE BEING EQUAL, MORTALITY RATES VARY SIGNIFICANTLY WITH THE SIZE OF A PENSION.

CPM improvement Scale B for pension valuations in 2014 and 2015.

The subcommittee recommends that practitioners use the two-dimensional mortality improvement scale CPM-B. CPM-B1D2014 is applicable for 2014 and 2015 valuations only and should not be used thereafter as it would result in an overstatement of actuarial liabilities.

The Report observes that notation for mortality rates and improvement rates is not standardized within the profession. The subcommittee used the following definitions, which were also used by the Society of Actuaries in connection with the two-dimensional Scale BB:

$q_x^y$	means the probability that a person, age $x$ nearest birthday at the beginning of calendar year $y$ , will die before reaching the end of the calendar year. Both $x$ and $y$ are defined at the beginning of the one-year period.
$I_x^y$	means the improvement rate in mortality for persons aged $x$ nearest birthday at the start of calendar year $y-1$ to those aged $x$ at the start of calendar year $y$ . In this case, $x$ is constant throughout the one year period, and $y$ is defined at the end of the period.

$$q_x^y = q_x^y (1 - I_x^y)$$

### DEVELOPMENT OF MORTALITY TABLES AND SIZE ADJUSTMENT FACTORS

The Report describes data gathering and analysis in some detail and states that

thirteen contributors were ultimately used in the RPP Study. Some points to note regarding the data used are as follows:

- no salary information was used for active lives;
- no beneficiary data was used;
- pensioners with monthly incomes of \$10 or less were excluded and incomes were capped at \$10,000;
- the form of pension was not considered because insufficient information was available;
- IBNR factors were based on the CIA's Individual Annuitant Mortality Study.

Comparing the data with A/E ratios using UP94@2004 Scale AA, the subcommittee found that the UP94@2004 mortality and improvement scale both had much higher mortality rates and that the slope of the curve was quite different from the CPM tables.

### INDUSTRY WEIGHTINGS

Each study noted that mortality does vary by industry. However, the data received by the CIA for the RPP Study was not distributed by industry in the same proportions as found in the Canadian population; i.e., education was over-represented in the data while construction and finance were under-represented. However, the subcommittee did adjust the data by industry using Statistics Canada CANSIM Series 280-011 for a count of Canadian DB plans by industry and using information for industry groups under the North American Industry Classification

System and Standard Industrial Classification System (refer to Table 6 in the Report). Records were split into private sector or public sector according to the data. Separate public sector and private sector tables were prepared with the industry-weighted data.

### CONSTRUCTION OF THE ACTUAL MORTALITY TABLES

The mortality tables were calculated by Bob Howard using a method approved by the subcommittee, as described in section 2.2.

The Report explains that the use of size adjustments factors is warranted due to the overwhelming evidence that all else being equal, mortality rates vary significantly with the size of a pension. Different size adjustments factors are provided for male and female pensioner groups.

Charts 1 and 2 of the Report illustrate how much lower mortality rates are under the CPM tables as compared to the UP94@2014 rates. The rates coalesce only at ages above 95. Table 10 shows how annuity factors increase in step with monthly pension amounts, reflecting that pension amounts are a key factor in determining mortality rates.

### DEVELOPMENT OF THE ACTUAL MORTALITY IMPROVEMENT SCALES

As in previous studies, a new mortality improvement scale was developed in this study. These rates are subjective as they vary by income, level of education and place of residence. The RPP Study did not have enough data to produce a mortality improvement scale but the C/QPP Study did in its Phase III report. Please refer to CAN - 4 - M, F Mortality Improvement Rate Charts, which illustrate that the Scale AA Improvement Scale is too low and that actual mortality improvement has been much higher in Canada since 1967.

The subcommittee then checked the mortality improvement scales against the rates used

**THE REPORT SHOWS LIABILITY INCREASES FROM 4.1 PERCENT TO 10.3 PERCENT WHEN COMPARING CPM2014 WITH SCALE CPM-B TO UP94 WITH SCALE AA.**

by various social security actuaries. The rates in the future years are lower than the improvement rates currently experienced in the C/QPP Study; however, they provide a level of both conservatism and realism in the mortality improvement scales. For purposes of the Report, the ultimate mortality improvement rates are taken from the 26<sup>th</sup> CPP Actuarial Report.

The gender-specific improvement scales were developed as follows:

- short-term rates applicable to years 2000–2011 are set equal to the smoothed 10-year experience based on the C/QPP income class 4 (35 percent of maximum pension and above) from the C/QPP Study for ages 65 and higher;
- short-term rates for years 2000–2011 for ages up to age 50 are set equal to the CPP assumption for 2010 as reported in 26<sup>th</sup> CPP Actuarial Report. Note there are no mortality rates available at these younger ages;
- short-term rates for years 2000–2011 for ages 51–64 are linear interpolations between the above rates for ages 50 and 65;
- ultimate rates (applicable for years 2030 and beyond) for ages 0–114 are set equal to the CPP year 2030 actuarial assumptions for those ages, as disclosed in the 26<sup>th</sup> CPP Actuarial Report,
- rates for ages 115 and higher are zero;
- rates for years 2012–2019 are derived by linear interpolation between the short-term rates and the ultimate rates.

The subcommittee also encourages the use of the two-dimensional improvement scale versus the one-dimensional table provided for use for the years 2014 and 2015.

## FINANCIAL IMPLICATIONS

Based on the results of both the C/QPP Study and the RPP Study, it is clear that the overall level of recent mortality experience is significantly lower than anticipated by UP94 table with Scale AA and exhibits a different shape by age as well. The C/QPP Study also shows that mortality improvement rates experienced in recent years have been substantially higher than indicated by Scale AA. Therefore, the adoption of the CPM tables and scales reflecting Canadian mortality experience is warranted.

Adoption of the tables presented in the Report will likely result in an increase in recognized costs for Canadian pension plans. The Report has attempted to show the impact of adopting the new tables using immediate-annuity and deferred-annuity calculations at an interest rate of 4 percent per annum based on a Jan. 1, 2014 calculation date. Table 11 of the Report (reproduced below) shows increases from 4.1 percent to 10.3 percent when comparing CPM2014 with Scale CPM-B to UP94 with Scale AA. Table 12 also illustrates that size adjustments are material, especially for males, and can result in higher annuity factors.

Table 11.  
Monthly life annuities at 4% in 2014 without size adjustment

Table Scale	UP-94 AA	CPM2014 AA		CPM2014 CPM-B	
	Annuity	Annuity	Incr	Annuity	Incr
M55	16.68	17.23	3.3%	17.36	4.1%
M65	13.06	13.98	7.0%	14.17	8.5%
M75	9.09	9.87	8.5%	10.03	10.3%
M85	5.38	5.65	5.0%	5.69	5.7%
F55	17.41	18.04	3.6%	18.23	4.7%
F65	14.10	14.94	6.0%	15.13	7.3%
F75	10.28	11.01	7.1%	11.16	8.6%
F85	6.25	6.63	6.2%	6.68	6.9%

**Table 12.**  
**Monthly life annuities on CPM2014 with CPM-B at 4% in 2014 with size adjustment for the indicated monthly pension**

Pension	Not adjusted	\$1,200		\$2,400		\$3,600	
	Annuity	Annuity	Incr	Annuity	Incr	Annuity	Incr
M55	17.36	16.89	-2.7%	17.14	-1.2%	17.54	1.0%
M65	14.17	13.62	-3.9%	13.91	-1.8%	14.39	1.5%
M75	10.03	9.43	-6.0%	9.75	-2.8%	10.28	2.4%
M85	5.69	5.14	-9.5%	5.43	-4.5%	5.91	3.9%
F55	18.23	18.11	-0.7%	18.28	0.3%	18.40	1.0%
F65	15.13	14.98	-1.0%	15.20	0.4%	15.35	1.5%
F75	11.16	10.98	-1.6%	11.24	0.7%	11.42	2.3%
F85	6.68	6.51	-2.6%	6.76	1.1%	6.94	3.8%

## CONCLUSIONS

Key conclusions and findings presented in the Report are as follows:

- Canadian mortality experience and improvement rates are better and increase pension costs relative to the United States.
- Pension size is strongly correlated to improved mortality experience.
- Mortality experience differs significantly as between public and private sector pension plan members.

The Report presents the results of a landmark study for Canada for which extensive data analysis was undertaken. Because the Report has significant implications for pension funding and financial reporting, I would recommend that all Canadian actuaries review the Report carefully and that the CIA hold educational sessions at future meetings to explain the Report's methodology, findings and implications. ■