Office of the Superintendent of Financial Institutions Canada
Bureau du surintendant des institutions financières Canada

Canada Pension Plan
Retirement, Survivor and Disability Beneficiaries Mortality Study

Actuarial Study No. 16

June 2015
Office of the Chief Actuary

OSFI BSIF

Canada

Office of the Chief Actuary
Office of the Superintendent of Financial Institutions Canada
12th Floor, Kent Square Building
255 Albert Street
Ottawa, Ontario
K1A 0H2

Facsimile: (613) 990-9900
E-mail address: oca-bac@osfi-bsif.gc.ca

An electronic version of this report is available
on our Web site: www.osfi-bsif.gc.ca

TABLE OF CONTENTS

Page

LIST OF TABLES

Page

LIST OF CHARTS

Page

I. Executive Summary

A. Purpose

The Canada Pension Plan (CPP), which began in 1966, provides benefits to contributors and their families. The CPP covers employed and self-employed persons between the ages of 18 and 70 who have more than a minimum level of earnings in a calendar year. The CPP includes the majority of all members of the labour force in Canada, other than those covered by the Québec Pension Plan. In addition to providing retirement benefits, the CPP provides disability benefits to contributors and their dependents, and death and survivor benefits to contributors' surviving dependents.

This is the third CPP mortality study published by the Office of the Chief Actuary (OCA). This study provides a detailed historical analysis of the mortality of CPP retirement, survivor, and disability beneficiaries. The study is based on CPP beneficiary's data provided by Service Canada and covers the period from 1990 to 2013. At the time of this study's publication, the most current year for which data on population mortality from the Canadian Human Mortality Database[1] (CHMD) was available was 2011. For comparison purposes, a life table for Canada less Québec was derived based on the 2011 CHMD Life Tables for Canada less Québec. OCA will use the results of this study to assess the mortality levels of the Canadian population and of CPP retirement, survivor, and disability beneficiaries when producing its next triennial CPP Actuarial Report.

B. Scope

The study first describes the data and methodology used to analyze CPP beneficiaries mortality experience. The study then presents the mortality experience of CPP retirement beneficiaries, followed by the mortality experience of CPP survivor and disability beneficiaries, respectively. A conclusion of the study then follows. Detailed tables are provided in the Annex of the study, and a list of the references used and contributors to the study are provided at the end.

C. Main Findings

Retirement Beneficiaries

- Over the period 1990 to 2013, there were 2.4 million observed retirement beneficiary deaths (61% from males). Of the total deaths, about 9,000 beneficiaries were classified as centenarians (64% females). The median age at death of males increased from 76 in 1993 to 80 in 2013, while for females it increased from 77 to 83 over the same period.
- In 2013, the highest number of deaths occurred at age 83 for males and age 88 for females.
- Males experience a higher level of mortality than females at all ages. At ages between 70 and 85, females experience a level of mortality about two-thirds that of males.
- The distribution of exposures by level of pension for males who retired in years 2008 to 2013 is more heavily distributed toward higher levels of pension. Of those who started their pensions between 2008 and 2013, 16% had pensions that were less than 37.5% of the maximum benefit, 24% had pensions between 37.5% and 75% of maximum, and the remaining 60% had pensions that were equal to at least 75% of the maximum. Of the 60% of male beneficiaries receiving at least 75% of the maximum pension, about 18% had pensions at the maximum.

[1] Website address http://www.bdlc.umontreal.ca/chmd/index.htm

- The distribution of exposures by level of pension for females who retired in years 2008 to 2013 is more uniformly distributed between the levels of pension than for males. Of those who started their pensions between 2008 and 2013, 33% had pensions that were less than 37.5% of the maximum, 33% had pensions between 37.5% and 75% of maximum, and the remaining 34% had pensions of at least 75% of the maximum. Of the 34% of female beneficiaries receiving at least 75% of the maximum pension, about 4.5% had pensions at the maximum.
- A comparison of annual mortality improvement rates over the last 15 years (1998 to 2013) for retirement beneficiaries by level of pension shows that, for both males and females in the age group 65 to 94, the mortality improvement rates of those with pensions less than 37.5% of the maximum (3.0% for males, 1.7% for females) are greater than the improvement rates experienced by those at the maximum level of pension (2.5% for males, 1.4% for females).
- In 2013, males aged 65 with maximum pensions live about 2.0 years longer (20.1 vs. 18.1 years) than those with lower pensions that are less than 37.5% of the maximum. At age 85, the differential for males reduces to 0.3 years (6.3 vs. 6.0 years). For females, the differences by level of pension in period life expectancies at age 65 are more stable over time. Females aged 65 with maximum pensions live about 1.6 years longer (23.1 vs. 21.5 years) than those with pensions of less than 37.5% of the maximum, and by age 85 the differential reduces to 0.4 years (7.9 vs. 7.5 years).
- Over the past two decades, for both sexes, the differences in life expectancy at age 65 between those with maximum pensions and those with pensions less than 37.5% of the maximum have been stable.
- The analysis of the contributions from each age group to the increase in life expectancy at age 65 of retirement beneficiaries over the last 20 years (1993-2013) showed that over the first half of the period, from 1993 to 2003, about 50% of the increase in life expectancy at age 65 for males (0.75 out of 1.5 years) came from mortality improvements at ages 75 and over. For females, the corresponding proportion is 67% (0.4 out of 0.6 years) over the same period. These proportions reached 65% (1.17 out of 1.8 years) for males and 73% (1.02 out of 1.4 years) for females over the most recent 10-year period (2003-2013).
- A new CPP contributor in the mid-1970s had an average number of years of contributions of about 42 years and could be expected to receive his retirement benefits for 15 years. Since then, the age at entry in the CPP has increased, the age of benefit commencement has decreased, while life expectancy has continued to rise. As a result, a new contributor in 2013 could expect to have an average number of years of contributions of 38 years and be on benefits for 24 years.

Survivor Beneficiaries

- Of all male survivor beneficiaries, the proportion younger than age 65 decreased from 42% in 1993 to 27% in 2013. In comparison, the corresponding proportion of female survivor beneficiaries decreased from 31% to 21% over the same period.
- CPP survivor beneficiary mortality is significantly higher (by about 30% at age 65) than that of the general population. One reason might be that survivors are deeply affected by the loss of their spouse, especially at the older ages where the survivor may already be in a weakened physical and emotional condition. Also, in some cases, one could assume that losing part of the primary source of income and social support adds stress for survivors.

- A comparison of annual mortality improvement rates over the last 15 years (1998 to 2013) between survivor and retirement beneficiaries shows that, for both males and females in the age group 65 to 94, the mortality improvement rates for retirement beneficiaries (2.3% for males and 1.7% for females) are greater than the mortality improvement rates of survivor beneficiaries (2.1% for males and 1.3% for females).

Disability Beneficiaries

- Since receipt of a CPP disability benefit requires that the disability be severe, long-term and of indefinite duration or likely to result in death, mortality experienced by disability beneficiaries is much greater than that of the general population. At age 50, the mortality of a disability beneficiary is about equal to the mortality of someone aged 75 in the general population.
- Beneficiaries whose disabilities were caused by neoplasms show significant excess mortality relative to the population. In 2011, for ages 50 to 64, male disability mortality related to neoplasms stood at 230 deaths per thousand as opposed to 6 per thousand in the general population. For females in the same age group, the rates are 164 per thousand, compared to 4 per thousand in the general population.
- Annual mortality improvement rates of CPP disability beneficiaries have been lower than those experienced by the general population. Over the last fifteen years (1996 to 2011), the annual mortality improvement rate for the age group 50 to 64 was 0.8% for both sexes. In comparison, over the more recent 5 years (2006 to 2011), the annual mortality improvement rate for the same age group was 1.5%.

D. Conclusion

The aging of the Canadian population has increased substantially since the inception of the CPP in 1966. Over the last two decades, life expectancy at age 65 of CPP retirement beneficiaries increased by 2.5 years, reaching 20.5 years in 2013. More than half of this increase (1.5 years) occurred in the most recent decade. These results are directly linked to the significant reduction in mortality rates that has occurred at the older ages (75 to 89) within the past two decades. As the distribution of deaths moves towards older ages in the future, the trend of mortality improvements shifting toward the older ages is expected to continue, in turn leading to additional increases in life expectancy at age 65.

In general, for both sexes, those with higher retirement pensions experience lower mortality compared to those with lower retirement pensions. However, for both sexes, mortality differences by level of pension reduce as age increases. Over the last two decades, the difference between the life expectancies at age 65 of retirement beneficiaries receiving the maximum pension and those receiving pensions of less than 37.5% of the maximum has remained relatively stable at around 2 years for males and 1.5 years for females.

The mortality of survivor beneficiaries is significantly higher than that of the general population, possibly due to the stress resulting from losing one's spouse. In 2013, the excess survivor mortality (above that of the population) at age 65 is 31% for males and 34% for females. After age 65, mortality above that of the general population gradually reduces. Although the overall mortality of survivor beneficiaries is much higher than for retirement beneficiaries, the same trends in increased life expectancy at age 65 and mortality improvement rates can be observed for both. In 2013, a 65 year old survivor beneficiary is expected to live for another 19.5 years, or about one year less than for a retirement beneficiary of the same age.

As expected, since receipt of the CPP disability benefit requires that the disability be severe, long-term and of indefinite duration or is likely to result in death, the mortality of disability beneficiaries is significantly higher than for the general population. At 35 deaths per thousand for males and 23 deaths per thousand for females, mortality rates of disability beneficiaries aged 50 to 64 in 2011 are on average six times higher than those of the general population. For a 50 year old disability beneficiary, such level of mortality is about equal to the mortality of an individual aged 75 in the general population.

Although neoplasms represented only about 7% of all CPP disabilities in 2011, they accounted for 45% of all disability deaths that year. In 2011, for the age group 50 to 64, male mortality related to neoplasm disabilities was about 230 deaths per thousand or about 38 times greater than the mortality of the general population (6 deaths per thousand). For all other causes of disability, the male mortality rate was 23 deaths per thousand or about 4 times greater than the mortality of the general population. The same trends can be observed for female disability beneficiaries, except that the mortality rates are lower.

Notwithstanding the high level of mortality of disability beneficiaries, annual mortality improvements rates for disability beneficiaries (all causes) are lower than for the general population, but have nonetheless been observed at levels of 0.8% and 1.5% per year over the last 15 and 5 years, respectively. Specifically, disability mortality related to neoplasms has improved at levels similar to that of the general population. All these mortality improvements have in turn resulted in the probability of a 50 year old male disability beneficiary reaching age 65 (considering mortality only) increasing from 51% to 59% over the period 1990 to 2011, while for female beneficiaries, the corresponding increase was from 66% to 71%. This compares to the probability of a 50 year old reaching age 65 in the general population of over 90% in 2011.

II. Data and Methodology

A. Data Source, Validation, and Comparison

Service Canada provided the OCA with extracts as at 31 July 2014 of the CPP Master Benefit File that contain information on all CPP benefits paid since the inception of the Plan in 1966. This study covers the period from 1990 up to and including the most recent years that were considered to have complete data on new benefits emerging in a year.

For this study, the most recent years considered to have complete data are 2012 for disability benefits and 2013 for retirement and survivor benefits. The earlier year of 2012 deemed complete for disability data reflects that there are usually delays (of up to three years) in completeness of the data for a given year due to incurred but not yet reported new disability cases.

Data validation was performed on all data records. The validation showed that only a small portion of all beneficiary records (less than 0.2% of retirement records, and less than 0.1% of disability and survivor records) had incorrect or missing data, which were discarded.

This study is based on the number of deaths and life-years of exposures determined for each class of CPP beneficiaries. In this study, for any given calendar year, the term "life-years of exposures" (or simply "exposures") at age "*x*" last birthday (i.e. attained age as at the last birthday) is defined as the amount of time for which a beneficiary was exposed to the risk of death at age "*x*" during that year.

- For beneficiaries who are age "*x*" on 1 January of a calendar year, life-years of exposures at age "*x*" are measured from January 1st to the earliest of a beneficiary's time of death or time he/she reaches age "*x+1*".
- For beneficiaries who are age "*x-1*" on 1 January of a calendar year, life-years of exposures at age "*x*" are measured from the time a beneficiary reaches age "*x*" to the earlier of the beneficiary's time of death or the end of the calendar year.
- For new beneficiaries who come into pay at age "*x*" during a given calendar year, life-years of exposures at age "*x*" are measured from the time an individual becomes a beneficiary to the earlier of the beneficiary's time of death, time they reach age "*x+1*", or the end of the calendar year.
- For new beneficiaries who come into pay at age "*x-1*" during a given calendar year, life-years of exposures at age "*x*" are measured from the time the new beneficiary reaches age "*x*" to the earlier of the beneficiary's time of death or the end of the calendar year.

The following provides the number of deaths and life-years of exposures by beneficiary type, as well as a description of how the data are categorized. For all beneficiary types, the mortality experience is compared between the sexes and relative to the general Canadian population.

1. Retirement Beneficiaries

For retirement beneficiaries over the study period 1990-2013, there are 2.4 million deaths and 69.6 million life-years of exposures.

For the purpose of analysis and comparison, each CPP retirement beneficiary was classified by age, sex, and level of pension expressed as a percentage of the maximum retirement pension applicable to the age and year of commencement of the benefit.

The pension level categories were determined such that the distribution of life-years of exposures of new female retirement beneficiaries over the most recent five years would be approximately uniformly distributed across the three pension level categories of: less than 37.5%, 37.5% to less than 75%, and 75% and over. A fourth pension level of "100%" was also defined for beneficiaries with pensions greater than or equal to 99.5% of the maximum (referred to as beneficiaries receiving a maximum pension) in order to highlight the subset of beneficiaries with the highest pensions.

Given males' historically higher labour force attachment and level of earnings, their corresponding amount of exposures is generally more skewed toward the higher pension levels. As the distributions of exposures by pension level differ between males and females, achieving a uniform distribution of exposures by level of pension for both males and females would have resulted in different pension categories for males and females.

For this purpose, the following four levels of pension were established:

1) less than 37.5%,
2) 37.5% to less than 75%,
3) 75% to less than 100%[(1)], and
4) 100%[(1)]

(1) The exact ranges for the two highest categories are set as "75% to less than 99.5%" and "99.5% and above", since retirement beneficiaries with pensions very near to the maximum (at or above 99.5%) are considered to be at the maximum for this study.

2. Survivor Beneficiaries

For survivor beneficiaries over the study period 1990-2013, there are 872,000 deaths and 19.4 million life-years of exposures.

3. Disability Beneficiaries

For disability beneficiaries over the study period 1990-2012, there are 206,000 deaths and 7.0 million life-years of exposures. The mortality experience of disability beneficiaries is also analyzed by cause of disability between neoplasms and other than neoplasms.

B. Methodology used for Calculating Mortality Rates

This section provides a general overview of the methodology used in the development of the mortality rates of CPP beneficiaries over the experience periods running from 1 January 1990 to 31 December 2013 for retirement and survivor beneficiaries, and from 1 January 1990 to 31 December 2012 for disability beneficiaries.

For retirement and survivor beneficiaries, the final graduated beneficiary mortality rates represent the best estimates of the rates for years 2011 and 2013. For disability beneficiaries, the final graduated mortality rates are the best estimates for the year 2011.

To determine the beneficiary mortality rates, crude rates are first determined in the same way for all benefit types. The crude rates are then adjusted by benefit type, depending on the extent to which credibility factors were applied to compensate for low levels of exposures. These credibility-adjusted rates were then graduated across ages to obtain the final rates. The overall process is described as follows:

1. Crude Mortality Rates

For all beneficiary types, the crude mortality rate for a given calendar year, age "*x*", and sex is defined as the probability that a person of age "*x*" will die between ages "*x*" and "*x+1*" during the given year. Crude mortality rates are usually calculated by simply dividing the relevant number of deaths by the number of life-years of exposures (defined above) over the given year or period. For this study, annual crude mortality rates are determined using the Product-Limit Estimator (PLE) method, also known as the Kaplan-Meier Product-Limit Estimator method by using the survival rates (see Appendix B of Actuarial Study No.11).

2. Credibility-Based Crude Mortality Rates

The crude mortality rates for all beneficiary types as determined above were judged credible (i.e. statistically significant) if the levels of exposures were sufficiently high. The crude mortality rates for retirement beneficiaries were deemed to be credible for all ages up to age 97. In comparison, the oldest age for which survivor and disability crude mortality rates were deemed to be credible are 90 and 64 respectively. For younger survivors (below age 55) and disabled (below age 45) the crude rates were deemed to require credibility adjustments. The credibility adjustments are described as follows.

Credibility-based crude survivor and disability mortality rates are determined as a blend of observed crude and population mortality rates (CHMD) with an additional adjustment ratio applied to increase the population mortality rate component for disability mortality rates. The adjustment is applied by age group to reflect the long-term historical relationship between disability mortality experience and that of the general population. Each adjustment, for each age group, is the historical ratio of mortality experience of the disabled population relative to the mortality of the general population.

The final crude survivor mortality rates for years 2011 and 2013 were derived from the mortality experience over the period 2005 to 2013 based on regressions of the logarithms of the credibility-based mortality rates for each year over that period.

Similarly, the final crude disability mortality rates for the year 2011 were derived from the mortality experience over the period 1998 to 2012 based on regressions of the logarithms of the credibility-based mortality rates for each year over that period.

The final crude retirement rates for years 2011 and 2013 are the initial crude rates determined, as no credibility adjustment was needed.

3. Graduated Mortality Rates for Years 2011 and 2013

For years 2011 and 2013, the final crude retirement and survivor mortality rates by year, age, and sex, and all levels of pension for the retirement rates, were graduated through the age dimension to reflect a compromise between smoothness and fit. For the year 2011, the final crude disability mortality rates were similarly graduated. A graduation method was used to produce smoothed rates up to the highest advanced age where there was statistical credibility, i.e., ages 97, 90, and 64 for retirement, survivor, and disability beneficiaries, respectively. For retirement (after age 97) and survivor (after age 90) beneficiaries, mortality rates are assumed to gradually converge to the assumed ultimate mortality rates for the population of 700 per 1,000 for males and 650 per 1,000 for females at age 120. The ultimate age of 120 was determined to be realistic considering that the longest lived Canadian, Marie-Louise Meilleur, died at the age of 117 years and 230 days, and that the longest lived in the world, Jeanne Calment of France, died at the age of 122 years and 160 days (see Appendix D of Actuarial Study No.5).

III. CPP Retirement Beneficiary Mortality

A. Introduction

This section presents the methodology and results of this study regarding the mortality of CPP retirement beneficiaries by level of pension over the period 1990 to 2013. One of the objectives of this study is to develop mortality adjustment factors that reflect the differences between CPP retirement beneficiary mortality and general population mortality for the purpose of the actuarial valuations of the CPP. The term "general population" in this study is used to refer to the population of Canada less Québec, as this is the population covered by the CPP.

B. Retirement Benefit Eligibility

A person aged 60 or older with contributory earnings in at least one calendar year becomes eligible for a retirement pension upon application. Since 2012, an applicant for a retirement pension before the age of 65 does not need to have wholly or substantially ceased to be engaged in paid employment or self-employment. If a person younger than age 65 is in receipt of a CPP retirement pension and continues to work, then he/she is required to contribute (not the case prior to 2012), whereas after 65 he/she may choose to contribute. In any event, no contributions are required or permitted after attaining age 70.

C. Retirement Benefit Calculation

The initial amount of the monthly retirement pension is based on the history of pensionable earnings over the entire contributory period, which begins at age 18 and ends when the individual collects his/her retirement pension, reaches age 70, or dies. The retirement pension is equal to 25% of the average of the Year's Maximum Pensionable Earning (YMPE) for the year of retirement and the four preceding years, referred to as the Maximum Pensionable Earnings Average (MPEA), adjusted to take into account the contributor's pensionable earnings and the age of the beneficiary at pension take-up. For this purpose, the contributor's pensionable earnings for any given month are indexed by the ratio of the MPEA to the YMPE for the year to which the given month belongs. Months of low pensionable earnings may be excluded from the calculation by reason of:

- disability;
- periods of child rearing when children are less than seven years of age;
- pensions commencing after age 65; and
- the general drop-out provision (15% of lowest earnings months before 2012, 16% in 2012 and 2013 and 17% after 2013).

D. Retirement Mortality Experience for Year 2013

1. Beneficiaries

Historical data on the number of retirement beneficiaries by age and sex are presented in Table 1. As females live longer than males, female beneficiaries are on average distributed more toward the advanced ages. The number of male beneficiaries nearly doubled from 1.1 million in 1993 to 2.1 million in 2013. Over the same period, the number of female beneficiaries more than doubled from 0.9 million in 1993 to 2.2 million in 2013. The steeper increase in the number of female retirement beneficiaries can be attributed to increased labour force participation (and hence CPP eligibility) and longer lifespans. The number of beneficiaries for year 2013 by individual age and sex is presented in Table 46 of the Annex.

Table 1 Retirement Beneficiaries (1st July)

Age Group	Males					
	Number			Distribution		
	1993	2003	2013	1993	2003	2013
60-64	163,689	217,577	363,778	14%	15%	17%
65-69	360,520	407,334	615,114	31%	27%	29%
70-74	282,116	352,775	445,602	25%	24%	21%
75-79	181,860	259,159	320,106	16%	17%	15%
80-84	104,003	158,904	224,933	9%	11%	11%
85-89	42,179	69,125	118,748	4%	5%	6%
90-94	10,425	21,846	41,672	1%	1%	2%
95-99	658	3,743	7,173	0%	0%	0%
100+	0	297	682	0%	0%	0%
Total	**1,145,450**	**1,490,760**	**2,137,808**	**100%**	**100%**	**100%**

Age Group	Females					
	Number			Distribution		
	1993	2003	2013	1993	2003	2013
60-64	153,203	232,628	388,438	17%	16%	17%
65-69	285,102	369,048	613,484	31%	26%	27%
70-74	224,479	314,632	436,782	24%	22%	20%
75-79	137,424	247,975	319,133	15%	17%	14%
80-84	76,838	167,675	238,532	8%	12%	11%
85-89	31,582	79,141	150,634	3%	5%	7%
90-94	7,390	28,274	67,298	1%	2%	3%
95-99	527	5,521	15,075	0%	0%	1%
100+	0	496	2,053	0%	0%	0%
Total	**916,545**	**1,445,390**	**2,231,429**	**100%**	**100%**	**100%**

2. Deaths

The deaths are tabulated by age last birthday and sex. Table 2 presents the number of retirement beneficiary deaths by age group and sex. Over the period 1990 to 2013 there were 2.4 million observed deaths (61% from males). Of the total deaths over that period, about 9,000 beneficiaries were classified as centenarians (64% females). The percentage of female centenarians which reached 69% in 2013 is expected to grow in the future as females live longer than males and more females will have participated in the CPP. The median age at death of males increased from 76 in 1993 to 80 in 2013, while for females it increased from 77 to 83 over the same period. Female deaths are distributed more toward the older ages compared to males, as a result of females' greater longevity.

The number of male deaths increased by 41% between 1993 and 2013 (from 53,000 to 75,000) while for females the increase was 161% (from 23,000 to 60,000). The higher increase in the number of deaths for females is directly linked to their historical increase in eligibility to the CPP pension, resulting from their increased labour force participation.

Retirement beneficiary deaths by individual ages for years 1993, 2003 and 2013 are presented in Table 47 of the Annex.

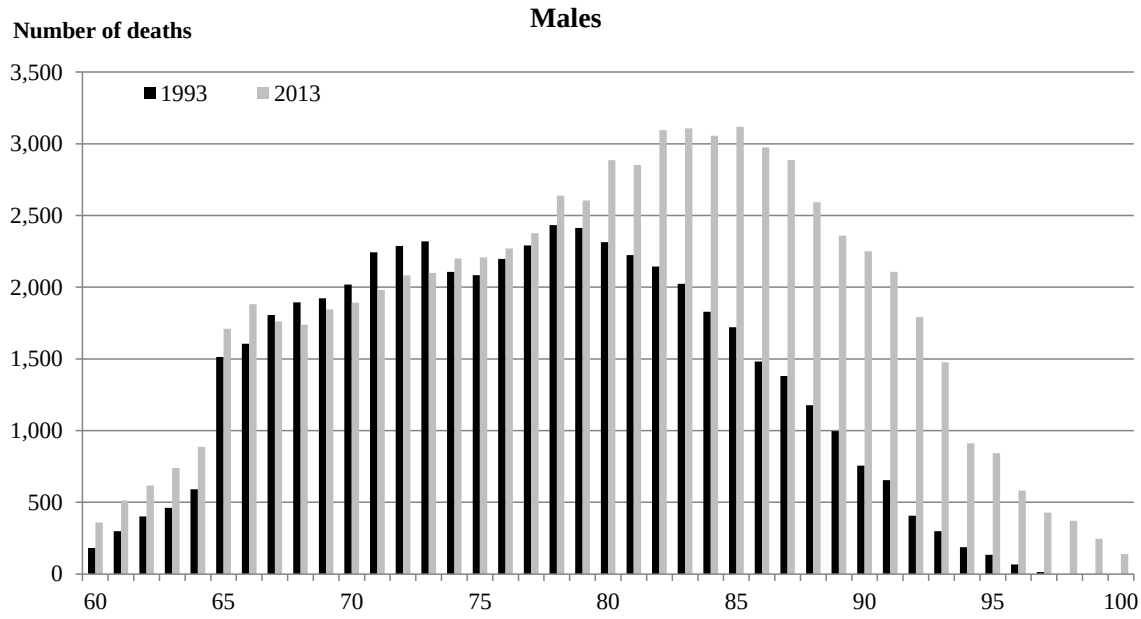
Table 2 Retirement Deaths (1990-2013)

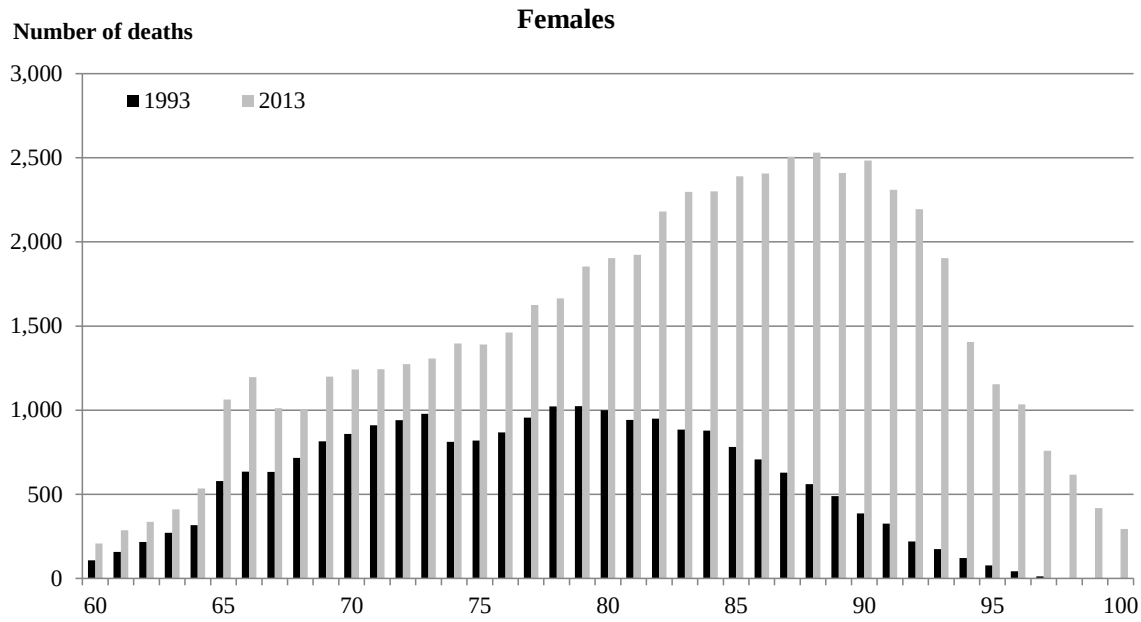
Age Group	Males						
	Number				Distribution		
	1990-2013	1993	2003	2013	1993	2003	2013
60-64	54,133	1,880	2,182	3,020	3.6%	3.4%	4.0%
65-69	193,570	8,631	7,394	8,872	16.3%	11.5%	11.9%
70-74	250,557	10,970	10,889	10,201	20.7%	17.0%	13.7%
75-79	296,918	11,399	13,143	12,068	21.6%	20.5%	16.2%
80-84	304,015	10,567	13,525	14,978	20.0%	21.1%	20.1%
85-89	234,686	6,840	10,219	14,020	12.9%	15.9%	18.8%
90-94	115,563	2,360	5,147	8,625	4.5%	8.0%	11.5%
95-99	29,035	225	1,418	2,523	0.4%	2.2%	3.4%
100+	3,274	0	158	378	0.0%	0.2%	0.5%
Total	**1,481,751**	**52,872**	**64,075**	**74,685**	**100.0%**	**100.0%**	**100.0%**
Median Age	**78.0**	**76.2**	**78.3**	**80.0**			

Age Group	Females						
	Number				Distribution		
	1990-2013	1993	2003	2013	1993	2003	2013
60-64	31,340	1,029	1,359	1,719	4.5%	3.2%	2.9%
65-69	96,109	3,364	3,973	5,433	14.7%	9.5%	9.1%
70-74	126,642	4,484	5,562	6,437	19.7%	13.2%	10.8%
75-79	158,702	4,679	7,456	7,958	20.5%	17.7%	13.3%
80-84	184,964	4,661	8,848	10,579	20.4%	21.1%	17.7%
85-89	175,332	3,192	7,969	12,197	14.0%	19.0%	20.4%
90-94	110,653	1,264	4,996	10,420	5.5%	11.9%	17.5%
95-99	37,709	142	1,638	4,062	0.6%	3.9%	6.8%
100+	5,819	0	216	844	0.0%	0.5%	1.4%
Total	**927,270**	**22,815**	**42,017**	**59,649**	**100.0%**	**100.0%**	**100.0%**
Median Age	**80.3**	**76.8**	**80.4**	**82.9**			

Chart 1 presents the evolution of the distribution of deaths by age and sex from 1993 to 2013. It clearly illustrates that the median age at death for both males and females has increased over time. In 2013, the higher number of deaths occurred at age 83 for males and age 88 for females.

Chart 1 Distribution of Retirement Deaths (1993 and 2013)





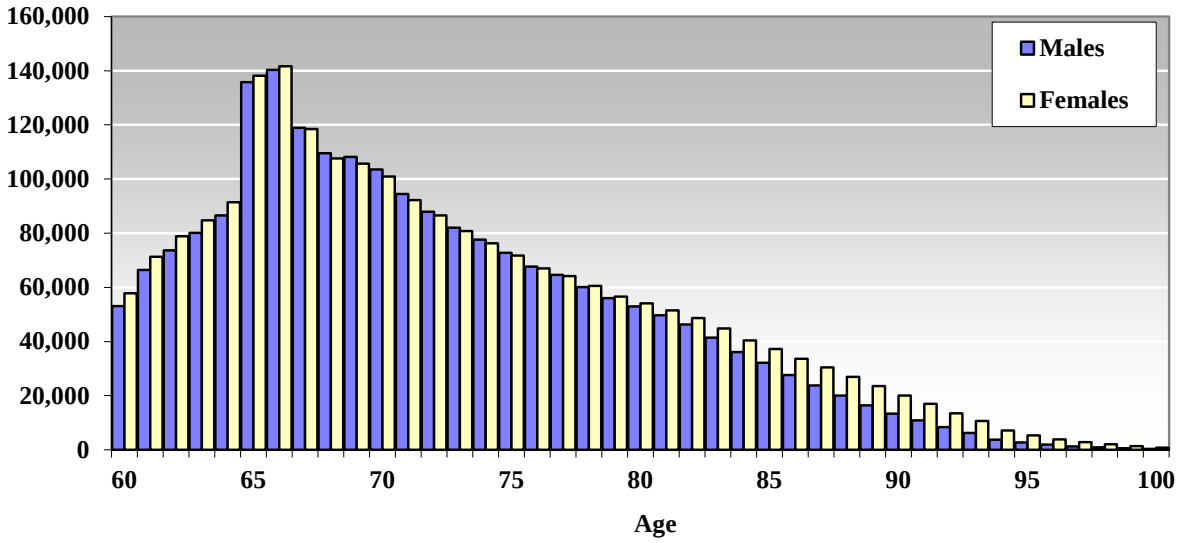
3. Exposures

Table 3 and Chart 2 highlight that the participation of females relative to males varies significantly by age group. In 2013, females had more exposures than males at ages below 67 while males had more exposures than females from age 67 to 77 mainly due to the past lower participation rate of females as contributors to the CPP. At the advanced ages of 78 and over, females have more exposures than males because of females' longer lifespans. Exposures of CPP retirement beneficiaries by individual ages for the year 2013 are presented in Table 48 of the Annex.

Table 3 Retirement Exposures (2013)

Age Group	Exposures			Distribution		
	Males	Females	Both Sexes	Males	Females	Both Sexes
60-64	359,953	384,142	744,095	16.8%	17.2%	17.0%
65-69	612,591	611,671	1,224,262	28.7%	27.4%	28.0%
70-74	445,692	436,804	882,495	20.9%	19.6%	20.2%
75-79	321,324	320,214	641,538	15.0%	14.4%	14.7%
80-84	226,398	239,558	465,955	10.6%	10.7%	10.7%
85-89	120,153	151,906	272,059	5.6%	6.8%	6.2%
90-94	42,666	68,435	111,101	2.0%	3.1%	2.5%
95-99	7,465	15,522	22,987	0.3%	0.7%	0.5%
100+	734	2,153	2,887	0.0%	0.1%	0.1%
Total	**2,136,976**	**2,230,405**	**4,367,381**	**100.0%**	**100.0%**	**100.0%**

Chart 2 Retirement Exposures by Age (2013)



4. Mortality Rates

a) Crude Retirement Mortality Rates by Age and Sex

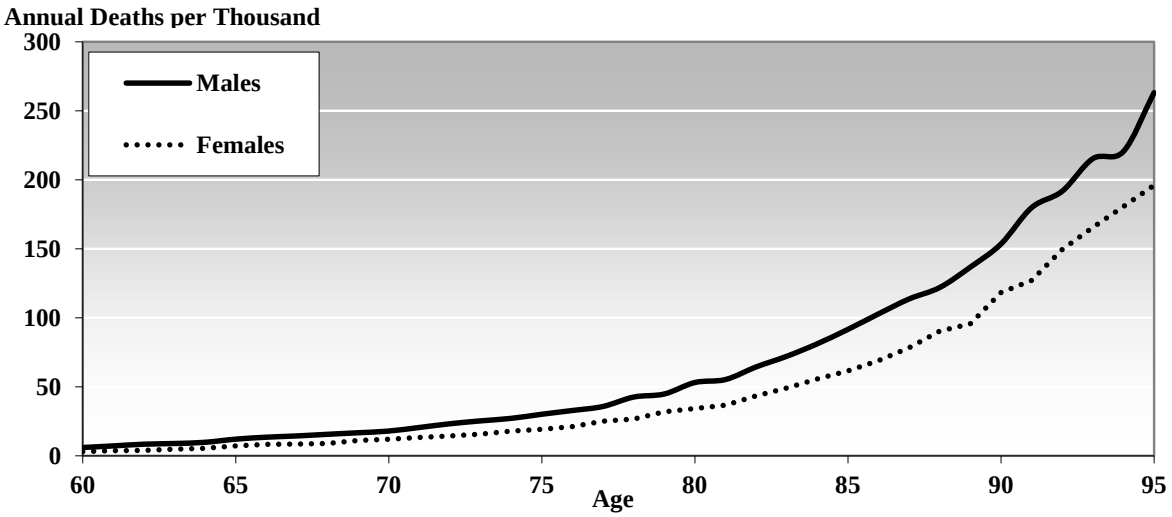
The crude retirement mortality rates for the year 2013 by age and sex are presented in Table 4. The ratio of females to males mortality rates is an indicator of the average shorter lifetime of males compared to females. However, although males experience a higher level of mortality, the relative gap between the two sexes shows variation by age. The progression of the crude mortality rates for 2013 by age and sex is displayed in Chart 3. Males experience a higher level of mortality than females at all ages. At ages between 70 and 85, females experience a level of mortality at about two-thirds of the mortality level of males.

Table 4 Crude Retirement Mortality Rates[(1)] (2013)

Age	Annual Deaths per Thousand		Ratio
	Males	Females	Females to Males
60	6.1	3.3	0.53
65	12.2	7.4	0.61
70	18.0	12.1	0.67
75	30.2	19.3	0.64
80	53.2	34.3	0.65
85	91.7	61.7	0.67
90	153.6	118.5	0.77
95	263.2	196.2	0.75

(1) Age 97 is the highest age for which credible crude mortality rates are available.

Chart 3 Crude Retirement Mortality Rates (2013)



b) Graduated Retirement Mortality Rates by Age and Sex

The graduated and extended mortality rates by age and sex and corresponding ratios of females to males mortality rates for the year 2013 are presented in Table 5.

Table 5 Graduated Retirement Mortality Rates (2013)

Age	Annual Deaths per Thousand		Ratio Females to Males
	Males	Females	
60	6.1	3.0	0.49
65	11.9	7.0	0.59
70	18.8	12.0	0.64
75	30.1	19.6	0.65
80	51.3	34.4	0.67
85	90.8	61.6	0.68
90	155.8	114.8	0.74
95	254.4	202.5	0.80
100	373.3	303.6	0.81
105	491.4	418.8	0.85
110	594.3	528.8	0.89
115	668.4	612.8	0.92
120	700.0	650.0	0.93

Although male retirement beneficiaries experience higher mortality than female beneficiaries, the gap narrows as mortality between the sexes converges at older ages. This is reflected in the rising females to males mortality ratio by age as depicted in Table 5 and Chart 4. At age 60, female mortality rates are 49% of male rates, and thereafter the ratio increases continuously to reach 93% by age 120. The crude and graduated retirement mortality rates for both sexes are shown in Chart 5.

Chart 4 Ratio of Graduated Retirement Mortality Rates (2013)

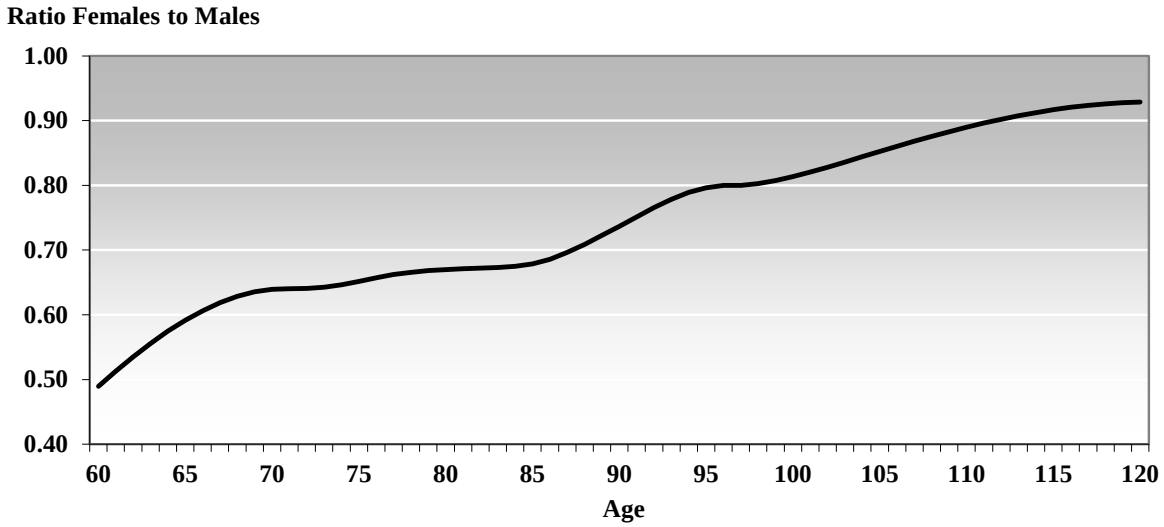
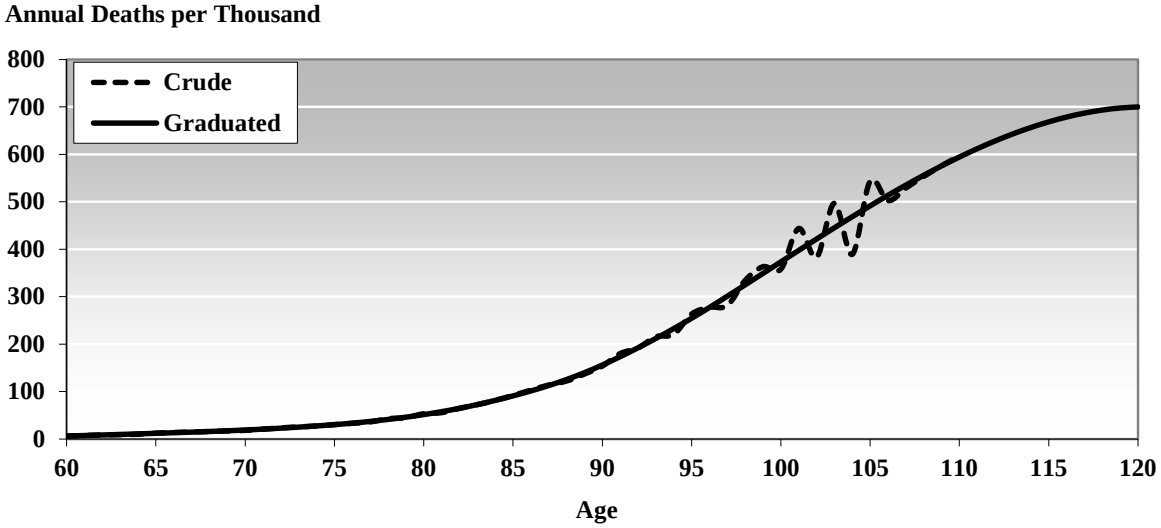
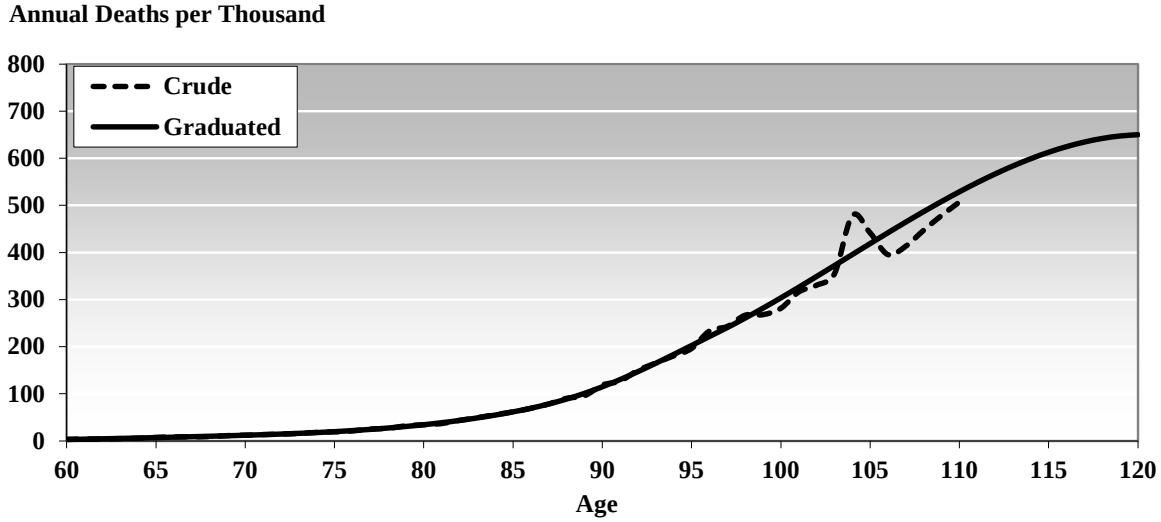


Chart 5 Crude and Graduated Retirement Mortality Rates (2013)

Males



Females



c) Graduated Retirement Mortality Rates and Ratios by Age, Sex, and Level of Pension

Deaths and exposures for males by age and level of pension for year 2013 are shown in Table 6 and Chart 6. The distribution of exposures by level of pension for males who have retired in years 2008 to 2013 is more heavily distributed toward higher levels of pension. As an example for those who have retired in years 2008 to 2013, 16% have a level of pension less than 37.5% of the maximum, 24% have a level of pension between 37.5% and less than 75% of maximum, and 60% have a level of pension of at least 75% of the maximum. Of the 60% of male beneficiaries receiving at least 75% of the maximum pension, 18.2% are classified as receiving a maximum pension (i.e., in the 100% pension level category).

Chart 7 illustrates the distribution of male exposures by age and level of pension for year 2013. Table 8 presents mortality rates for both sexes by age and level of pension for year 2013.

Table 6 Retirement Deaths and Exposures by Age and Level of Pension (Males, 2013)

	Deaths									
	< 37.5%		37.5-75%		75-100%		100%		All	
Attained Age In 2013	#	%	#	%	#	%	#	%	#	%
60-64	598	19.8%	797	26.4%	1,199	39.7%	426	14.1%	3,020	100%
65-69	1,669	18.8%	2,585	29.1%	3,460	39.0%	1,158	13.1%	8,872	100%
70-74	1,619	15.9%	2,498	24.5%	3,738	36.6%	2,346	23.0%	10,201	100%
75-79	1,596	13.2%	2,602	21.6%	4,607	38.2%	3,263	27.0%	12,068	100%
80+	3,998	9.9%	6,590	16.3%	13,725	33.9%	16,211	40.0%	40,524	100%
All Ages	**9,480**	**12.7%**	**15,072**	**20.2%**	**26,729**	**35.8%**	**23,404**	**31.3%**	**74,685**	**100%**

	Exposures									
	< 37.5%		37.5-75%		75-100%		100%		All	
Attained Age In 2013	#	%	#	%	#	%	#	%	#	%
60-64	37,176	10.3%	83,336	23.2%	168,424	46.8%	71,018	19.7%	359,953	100%
65-69	91,342	14.9%	146,130	23.9%	256,198	41.8%	118,921	19.4%	612,591	100%
70-74	60,852	13.7%	95,907	21.5%	164,288	36.9%	124,645	28.0%	445,692	100%
75-79	38,496	12.0%	62,512	19.5%	117,032	36.4%	103,285	32.1%	321,324	100%
80+	39,127	9.8%	61,936	15.6%	131,427	33.1%	164,925	41.5%	397,416	100%
All Ages	**266,993**	**12.5%**	**449,820**	**21.0%**	**837,369**	**39.2%**	**582,794**	**27.3%**	**2,136,976**	**100%**

	Exposures by Year of Emergence									
	< 37.5%		37.5-75%		75-100%		100%		All	
Year of Emergence	#	%	#	%	#	%	#	%	#	%
< 1978	41	9.5%	99	22.9%	121	27.9%	172	39.7%	432	100%
1978-1983	542	6.3%	1,311	15.2%	2,841	32.9%	3,940	45.6%	8,635	100%
1984-1989	6,250	5.9%	14,871	13.9%	36,080	33.8%	49,420	46.4%	106,620	100%
1990-1995	20,588	7.9%	41,584	16.0%	86,543	33.3%	110,987	42.7%	259,702	100%
1996-2001	40,444	10.5%	73,652	19.1%	143,475	37.2%	128,134	33.2%	385,704	100%
2002-2007	74,517	12.7%	128,641	21.9%	238,258	40.5%	147,049	25.0%	588,465	100%
2008-2013	124,610	15.8%	189,662	24.1%	330,052	41.9%	143,093	18.2%	787,418	100%
All Years	**266,993**	**12.5%**	**449,820**	**21.0%**	**837,369**	**39.2%**	**582,794**	**27.3%**	**2,136,976**	**100%**

Chart 6 Male Retirement Deaths and Exposures (by Level of Pension – 2013)

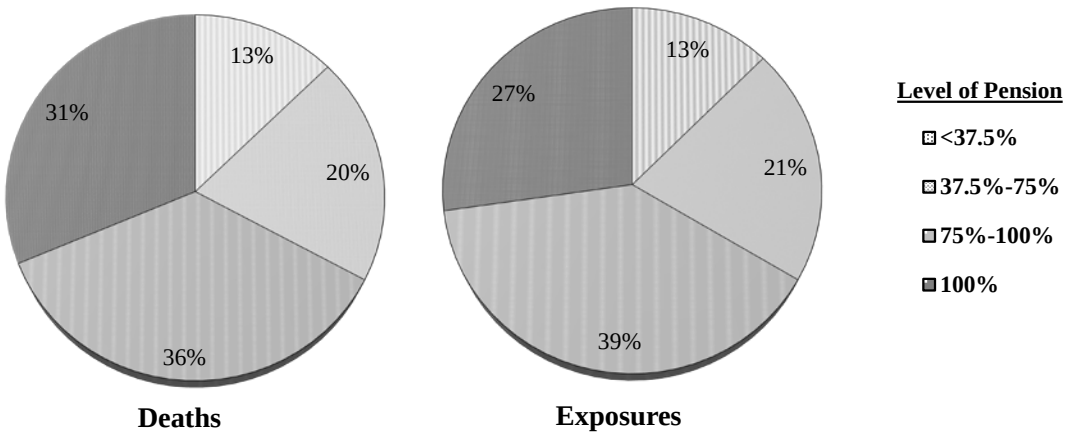
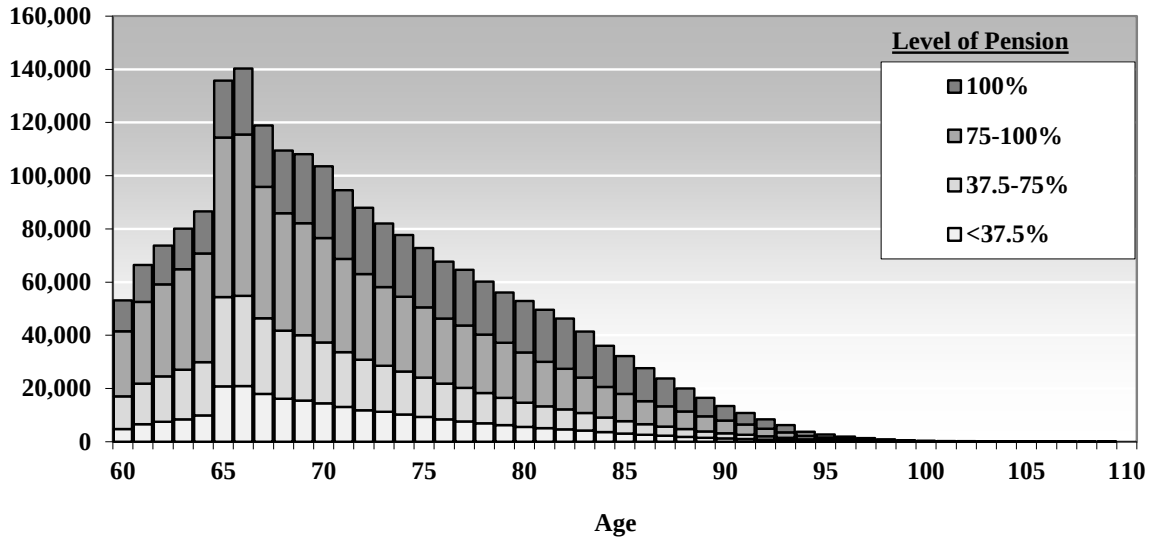


Chart 7 Male Retirement Exposures (by Age and Level of Pension – 2013)



Deaths and exposures for females by age and level of pension for year 2013 are shown in Table 7 and Chart 8. There were about 60,000 deaths and 2.2 million life-years of exposures for females in 2013. The distribution of exposures by level of pension for females who have retired in years 2008 to 2013 is more uniformly distributed between the levels of pension than males. As an example for those who have retired in years 2008 to 2013, 33% have a level of pension less than 37.5% of the maximum, 33% have a level of pension between 37.5% and less than 75% of maximum, and 34% have a level of pension of at least 75% of the maximum. Of the 34% of female beneficiaries receiving at least 75% of the maximum pension, 4.5% are classified as receiving a maximum pension (i.e., in the 100% pension level category).

Chart 9 illustrates the distribution of female exposures by age and level of pension for year 2013. Detailed mortality rates for year 2013 by individual age, sex and level of pension are presented in Tables 8 and 49 while Tables 50 through 54 of the Annex present complete life tables for each level of pension.

Table 7 Retirement Deaths and Exposures by Age and Level of Pension (Females, 2013)

	Deaths									
	< 37.5%		37.5-75%		75-100%		100%		All	
Attained Age In 2013	#	%	#	%	#	%	#	%	#	%
60-64	659	38.3%	561	32.6%	432	25.1%	67	3.9%	1,719	100%
65-69	2,336	43.0%	1,745	32.1%	1,187	21.8%	165	3.0%	5,433	100%
70-74	2,934	45.6%	1,978	30.7%	1,261	19.6%	264	4.1%	6,437	100%
75-79	3,724	46.8%	2,360	29.7%	1,568	19.7%	306	3.8%	7,958	100%
80+	18,076	47.4%	10,358	27.2%	7,527	19.8%	2,141	5.6%	38,102	100%
All Ages	**27,729**	**46.5%**	**17,002**	**28.5%**	**11,975**	**20.1%**	**2,943**	**4.9%**	**59,649**	**100%**

	Exposures									
	< 37.5%		37.5-75%		75-100%		100%		All	
Attained Age In 2013	#	%	#	%	#	%	#	%	#	%
60-64	108,006	28.1%	130,917	34.1%	126,473	32.9%	18,746	4.9%	384,142	100%
65-69	218,135	35.7%	201,742	33.0%	165,598	27.1%	26,197	4.3%	611,671	100%
70-74	175,900	40.3%	137,109	31.4%	100,660	23.0%	23,135	5.3%	436,804	100%
75-79	140,780	44.0%	96,913	30.3%	66,248	20.7%	16,273	5.1%	320,214	100%
80+	221,246	46.3%	133,579	28.0%	95,656	20.0%	27,093	5.7%	477,574	100%
All Ages	**864,067**	**38.7%**	**700,260**	**31.4%**	**554,634**	**24.9%**	**111,444**	**5.0%**	**2,230,405**	**100%**

	Exposures by Year of Emergence									
	< 37.5%		37.5-75%		75-100%		100%		All	
Year of Emergence	#	%	#	%	#	%	#	%	#	%
<1978	411	32.1%	447	34.9%	305	23.8%	118	9.2%	1,281	100%
1978-1983	6,102	37.2%	4,994	30.4%	3,928	23.9%	1,397	8.5%	16,421	100%
1984-1989	69,048	43.8%	46,052	29.2%	32,962	20.9%	9,578	6.1%	157,641	100%
1990-1995	125,230	44.3%	81,711	28.9%	58,838	20.8%	16,818	6.0%	282,597	100%
1996-2001	177,413	43.8%	121,423	29.9%	85,600	21.1%	21,000	5.2%	405,437	100%
2002-2007	228,535	38.8%	187,364	31.8%	145,473	24.7%	27,775	4.7%	589,147	100%
2008-2013	257,327	33.1%	258,268	33.2%	227,528	29.2%	34,758	4.5%	777,882	100%
All Years	**864,067**	**38.7%**	**700,260**	**31.4%**	**554,634**	**24.9%**	**111,444**	**5.0%**	**2,230,405**	**100%**

Chart 8 Female Retirement Deaths and Exposures (by Level of Pension – 2013)

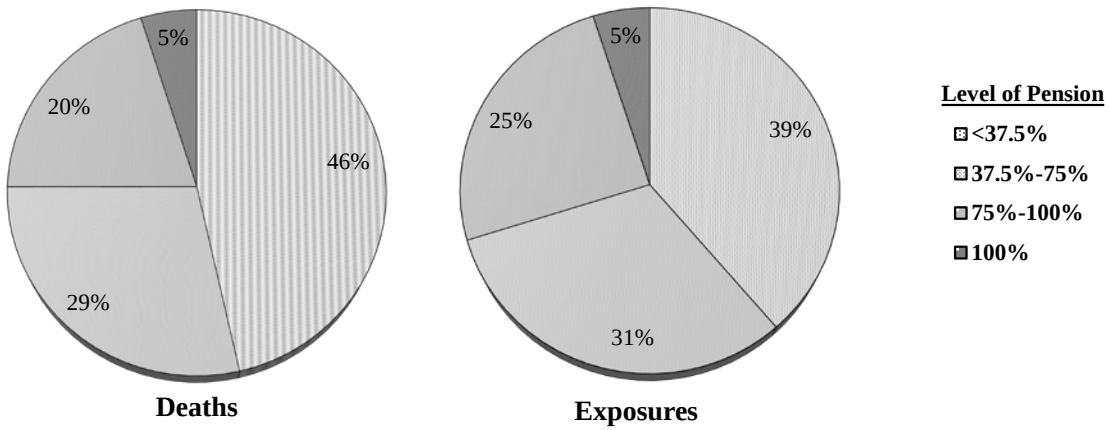
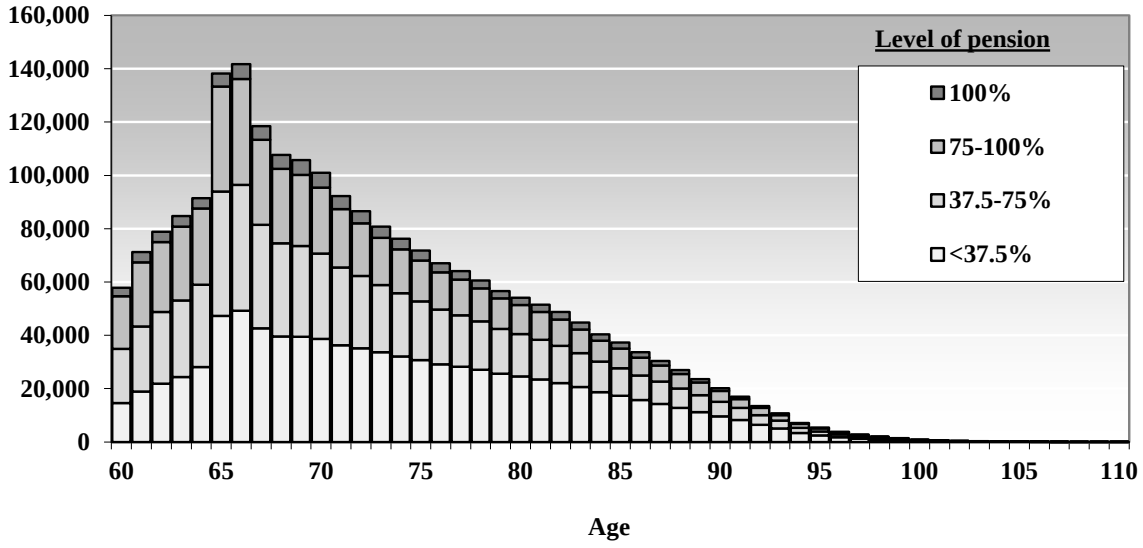


Chart 9 Female Retirement Exposures (by Age and Level of Pension – 2013)



Charts 10, 11 and Table 9 show the ratios of each level of pension mortality to the all levels of pension mortality. In general, for both sexes, those with higher pensions experience lower mortality, while those with lower pensions experience higher mortality. In addition, for both sexes, each level of pension mortality exhibits convergence to the all levels of pension mortality as age increases. Male retirement beneficiaries at 100% of the maximum retirement pension have the lowest male mortality ratios of 0.68 at age 60, 0.76 at age 70, and 0.89 at age 80. In comparison, male retirement beneficiaries with the lowest level of pension (i.e., less than 37.5% of the maximum retirement pension) have the highest mortality ratios of 2.2 at age 60, 1.2 at age 70, and 1.09 at age 80. Female retirement beneficiaries at 100% of the maximum retirement pension have the lowest female mortality ratios of 0.77 at age 60, 0.75 at age 70, and 0.87 at age 80. In comparison, female retirement beneficiaries with the lowest level of pension have the highest mortality ratios of 1.47 at age 60, 1.14 at age 70, and 1.05 at age 80. The level of pension has relatively more of an impact on male than female mortality rates.

Chart 10 Male Retirement Mortality Ratios (by level of pension, 2013)

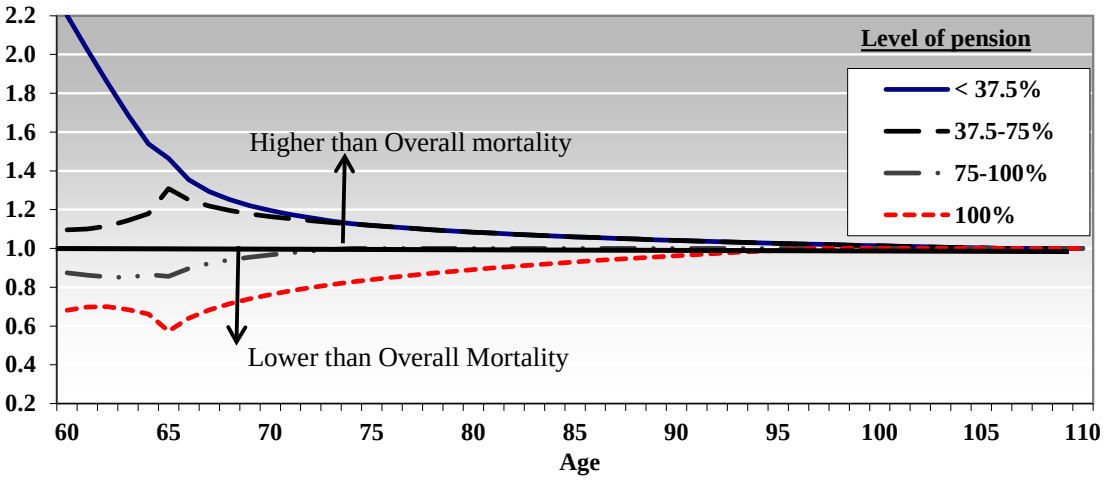


Chart 11 Female Retirement Mortality Ratios (by level of pension, 2013)

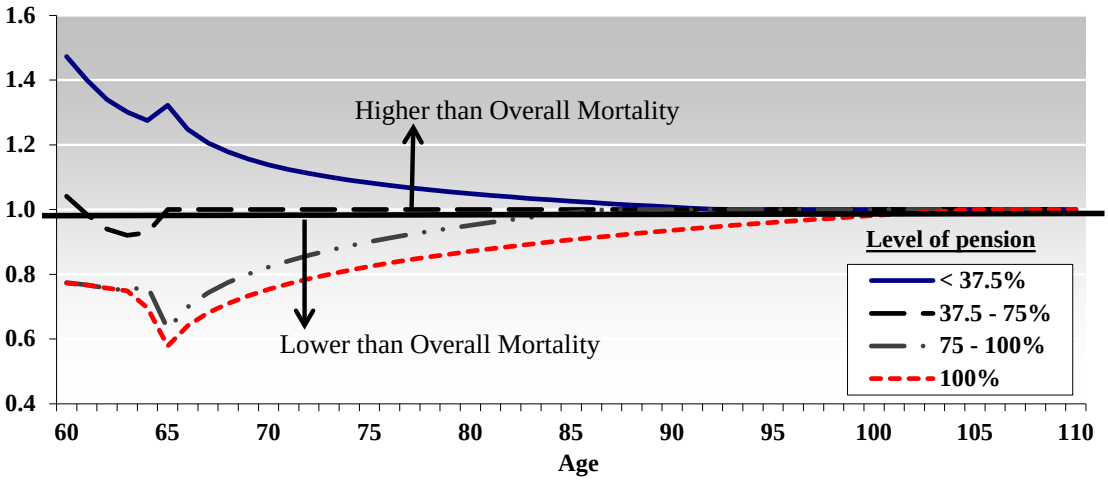


Table 8 Retirement Mortality Rates by Level of Pension (2013)

	Annual Deaths per Thousand									
	Males					Female				
	Level of Pension as % of Maximum					Level of Pension as % of Maximum				
Age	All	< 37.5%	37.5-75%	75-100%	100%	All	< 37.5%	37.5-75%	75-100%	100%
60	6.1	13.4	6.7	5.3	4.2	3.0	4.4	3.1	2.3	2.3
61	7.2	14.6	7.9	6.2	5.0	3.7	5.2	3.6	2.8	2.9
62	8.3	15.4	9.3	7.1	5.8	4.4	6.0	4.2	3.4	3.5
63	9.5	16.0	10.8	8.0	6.5	5.3	6.9	4.8	4.0	3.9
64	10.7	16.4	12.6	9.2	7.1	6.1	7.8	5.7	4.7	4.3
65	11.9	17.4	15.5	10.2	6.8	7.0	9.3	7.0	4.4	4.1
66	13.1	17.8	16.4	11.8	8.4	8.0	9.9	8.0	5.6	5.1
67	14.4	18.6	17.5	13.3	9.8	8.9	10.7	8.9	6.6	6.1
68	15.7	19.7	18.8	14.8	11.2	9.9	11.6	9.9	7.7	7.0
69	17.2	21.0	20.2	16.4	12.7	10.9	12.6	10.9	8.7	8.0
70	18.8	22.5	21.9	18.2	14.3	12.0	13.7	12.0	9.9	9.1
71	20.7	24.3	23.8	20.2	16.1	13.2	14.9	13.2	11.1	10.2
72	22.7	26.3	26.0	22.4	18.1	14.5	16.2	14.5	12.5	11.4
73	24.9	28.5	28.3	24.8	20.3	16.0	17.6	16.0	14.0	12.8
74	27.4	30.9	30.9	27.4	22.6	17.7	19.3	17.7	15.7	14.4
75	30.1	33.7	33.7	30.1	25.3	19.6	21.3	19.6	17.7	16.2
76	33.3	37.0	37.0	33.3	28.3	21.9	23.5	21.9	20.0	18.3
77	36.9	40.7	40.7	36.9	31.8	24.5	26.1	24.5	22.6	20.7
78	41.1	45.1	45.1	41.1	35.9	27.4	29.0	27.4	25.5	23.4
79	45.9	50.0	50.0	45.9	40.5	30.7	32.3	30.7	28.9	26.5
80	51.3	55.6	55.6	51.3	45.7	34.4	36.1	34.4	32.7	29.9
81	57.5	62.0	62.0	57.5	51.8	38.6	40.3	38.6	37.1	33.9
82	64.6	69.3	69.3	64.6	58.6	43.4	45.1	43.4	42.0	38.5
83	72.5	77.5	77.5	72.5	66.4	48.8	50.5	48.8	47.6	43.6
84	81.2	86.4	86.4	81.2	75.0	54.8	56.5	54.8	53.9	49.4
85	90.8	96.2	96.2	90.8	84.5	61.6	63.2	61.6	61.0	55.9
86	101.2	106.8	106.8	101.2	94.8	69.4	70.9	69.4	69.2	63.3
87	112.6	118.4	118.4	112.6	106.3	78.4	79.8	78.4	78.4	72.0
88	125.3	131.4	131.4	125.3	119.1	88.8	90.1	88.8	88.8	82.1
89	139.7	146.0	146.0	139.7	133.7	101.0	102.0	101.0	101.0	93.9
90	155.8	162.3	162.3	155.8	150.0	114.8	115.7	114.8	114.8	107.5
91	173.4	180.0	180.0	173.4	168.0	130.3	130.9	130.3	130.3	122.6
92	192.2	198.9	198.9	192.2	187.2	147.1	147.3	147.1	147.1	139.2
93	211.9	218.7	218.7	211.9	207.6	165.0	165.0	165.0	165.0	156.9
94	232.6	239.3	239.3	232.6	229.1	183.5	183.5	183.5	183.5	175.4
95	254.4	261.0	261.0	254.4	251.8	202.5	202.5	202.5	202.5	194.5
96	277.1	283.6	283.6	277.1	275.8	221.7	221.7	221.7	221.7	213.9
97	300.9	307.1	307.1	300.9	300.9	240.6	240.6	240.6	240.6	233.2
98	324.9	330.8	330.8	324.9	324.9	260.7	260.7	260.7	260.7	253.8
99	349.1	354.6	354.6	349.1	349.1	281.8	281.8	281.8	281.8	275.5
100	373.3	378.3	378.3	373.3	373.3	303.6	303.6	303.6	303.6	298.1
101	397.5	401.9	401.9	397.5	397.5	326.1	326.1	326.1	326.1	321.4
102	421.5	425.3	425.3	421.5	421.5	349.0	349.0	349.0	349.0	345.4
103	445.2	448.2	448.2	445.2	445.2	372.2	372.2	372.2	372.2	369.7
104	468.6	470.7	470.7	468.6	468.6	395.5	395.5	395.5	395.5	394.4
105	491.4	492.7	492.7	491.4	491.4	418.8	418.8	418.8	418.8	418.8
110	594.3	594.3	594.3	594.3	594.3	528.8	528.8	528.8	528.8	528.8
115	668.4	668.4	668.4	668.4	668.4	612.8	612.8	612.8	612.8	612.8
120	700.0	700.0	700.0	700.0	700.0	650.0	650.0	650.0	650.0	650.0

Table 9 Retirement Mortality Ratios by Level of Pension (2013)

	Males					Females				
	Level of Pension as % of Maximum					Level of Pension as % of Maximum				
Age	**All**	**< 37.5%**	**37.5-75%**	**75-100%**	**100%**	**All**	**< 37.5%**	**37.5-75%**	**75-100%**	**100%**
60	1.000	2.201	1.096	0.874	0.682	1.000	1.473	1.041	0.775	0.772
61	1.000	2.023	1.101	0.862	0.697	1.000	1.400	0.985	0.763	0.794
62	1.000	1.852	1.116	0.853	0.700	1.000	1.340	0.940	0.753	0.786
63	1.000	1.688	1.144	0.849	0.685	1.000	1.301	0.920	0.750	0.749
64	1.000	1.539	1.180	0.864	0.662	1.000	1.275	0.929	0.764	0.696
65	1.000	1.465	1.308	0.856	0.573	1.000	1.322	1.000	0.631	0.579
66	1.000	1.354	1.251	0.897	0.640	1.000	1.248	1.000	0.699	0.641
67	1.000	1.293	1.218	0.922	0.682	1.000	1.206	1.000	0.743	0.681
68	1.000	1.252	1.196	0.941	0.714	1.000	1.178	1.000	0.775	0.710
69	1.000	1.221	1.178	0.955	0.740	1.000	1.156	1.000	0.801	0.734
70	1.000	1.196	1.165	0.967	0.762	1.000	1.139	1.000	0.823	0.754
71	1.000	1.175	1.153	0.977	0.781	1.000	1.124	1.000	0.842	0.771
72	1.000	1.157	1.143	0.986	0.798	1.000	1.112	1.000	0.859	0.786
73	1.000	1.142	1.134	0.994	0.813	1.000	1.101	1.000	0.874	0.800
74	1.000	1.128	1.127	1.000	0.827	1.000	1.091	1.000	0.888	0.813
75	1.000	1.118	1.118	1.000	0.839	1.000	1.082	1.000	0.900	0.824
76	1.000	1.110	1.110	1.000	0.851	1.000	1.075	1.000	0.912	0.835
77	1.000	1.103	1.103	1.000	0.862	1.000	1.067	1.000	0.923	0.845
78	1.000	1.096	1.096	1.000	0.872	1.000	1.061	1.000	0.933	0.854
79	1.000	1.090	1.090	1.000	0.882	1.000	1.055	1.000	0.943	0.863
80	1.000	1.084	1.084	1.000	0.891	1.000	1.049	1.000	0.952	0.871
81	1.000	1.079	1.079	1.000	0.900	1.000	1.044	1.000	0.960	0.879
82	1.000	1.074	1.074	1.000	0.908	1.000	1.039	1.000	0.968	0.886
83	1.000	1.069	1.069	1.000	0.916	1.000	1.034	1.000	0.976	0.893
84	1.000	1.064	1.064	1.000	0.923	1.000	1.030	1.000	0.984	0.900
85	1.000	1.060	1.060	1.000	0.931	1.000	1.026	1.000	0.991	0.907
86	1.000	1.056	1.056	1.000	0.937	1.000	1.022	1.000	0.998	0.913
87	1.000	1.052	1.052	1.000	0.944	1.000	1.018	1.000	1.000	0.919
88	1.000	1.048	1.048	1.000	0.951	1.000	1.014	1.000	1.000	0.925
89	1.000	1.045	1.045	1.000	0.957	1.000	1.011	1.000	1.000	0.930
90	1.000	1.041	1.041	1.000	0.963	1.000	1.008	1.000	1.000	0.936
91	1.000	1.038	1.038	1.000	0.969	1.000	1.004	1.000	1.000	0.941
92	1.000	1.035	1.035	1.000	0.974	1.000	1.001	1.000	1.000	0.946
93	1.000	1.032	1.032	1.000	0.980	1.000	1.000	1.000	1.000	0.951
94	1.000	1.029	1.029	1.000	0.985	1.000	1.000	1.000	1.000	0.956
95	1.000	1.026	1.026	1.000	0.990	1.000	1.000	1.000	1.000	0.960
96	1.000	1.023	1.023	1.000	0.995	1.000	1.000	1.000	1.000	0.965
97	1.000	1.021	1.021	1.000	1.000	1.000	1.000	1.000	1.000	0.969
98	1.000	1.018	1.018	1.000	1.000	1.000	1.000	1.000	1.000	0.973
99	1.000	1.016	1.016	1.000	1.000	1.000	1.000	1.000	1.000	0.978
100	1.000	1.014	1.014	1.000	1.000	1.000	1.000	1.000	1.000	0.982
101	1.000	1.011	1.011	1.000	1.000	1.000	1.000	1.000	1.000	0.986
102	1.000	1.009	1.009	1.000	1.000	1.000	1.000	1.000	1.000	0.990
103	1.000	1.007	1.007	1.000	1.000	1.000	1.000	1.000	1.000	0.993
104	1.000	1.005	1.005	1.000	1.000	1.000	1.000	1.000	1.000	0.997
105	1.000	1.003	1.003	1.000	1.000	1.000	1.000	1.000	1.000	1.000
110	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
115	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
120	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000

E. Comparison of Retirement and Population Mortality (2011)

Since CPP retirement beneficiaries represent a substantial portion of the older Canadian population, the retirement beneficiary mortality rates are compared to the mortality of the population of Canada less Québec for the year 2011, which was the most current year for which data on population mortality from the Canadian Human Mortality Database (CHMD) was available.

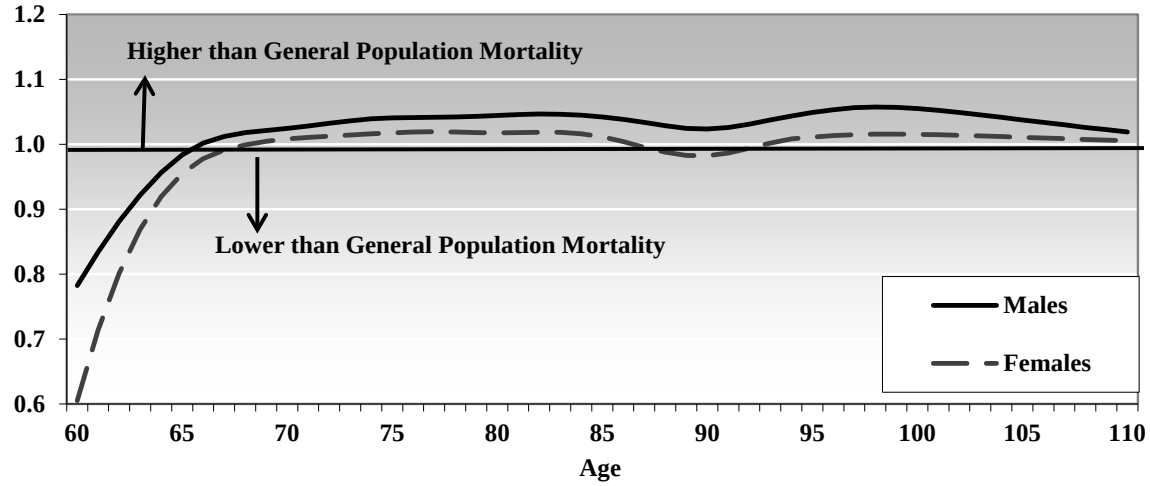
For this purpose of comparison, a life table for Canada less Québec was derived based on the 2011 CHMD Life Tables for Canada and Québec. The resulting Canada less Québec table was then graduated by age and sex and extended to age 120. Tables 10, 11 and Chart 12 show the ratios of CPP retirement beneficiary mortality rates to the population mortality rates by age and sex for year 2011.

Table 10 Retirement and Population Mortality (2011)

	Males			Females		
	Annual Deaths Per Thousand		Ratio Retirement to Population	Annual Deaths Per Thousand		Ratio Retirement to Population
Age	Retirement	Population[(1)]		Retirement	Population[(1)]	
60	6.1	7.7	0.78	2.9	4.7	0.61
65	11.7	11.9	0.98	7.3	7.6	0.96
70	19.4	18.9	1.02	12.2	12.1	1.01
75	31.6	30.4	1.04	20.4	20.0	1.02
80	53.4	51.2	1.04	35.9	35.3	1.02
85	94.3	90.5	1.04	63.5	62.7	1.01
90	159.5	155.9	1.02	118.7	120.8	0.98
95	255.6	243.6	1.05	205.9	203.6	1.01
100	369.1	349.8	1.06	314.1	309.2	1.02

(1) Canada less Québec based on CHMD 2011 Life Tables for Canada and Québec. OCA calculations.

Chart 12 Ratios of Retirement to Population Mortality[(1)] (2011)



(1) Canada less Quebec based on CHMD 2011 Life Tables for Canada and Québec. OCA calculations.

Table 11 Retirement to Population Mortality Ratios by Level of Pension (2011)

	Males					Females				
		Level of Pension as % of Maximum					Level of Pension as % of Maximum			
Age	**All**	**< 37.5%**	**37.5- 75%**	**75-100%**	**100%**	**All**	**< 37.5%**	**37.5-75%**	**75-100%**	**100%**
60	0.783	1.702	1.068	0.578	0.544	0.605	0.947	0.547	0.499	0.334
61	0.834	1.682	1.070	0.649	0.573	0.713	1.045	0.649	0.554	0.329
62	0.881	1.627	1.073	0.720	0.595	0.801	1.102	0.731	0.591	0.329
63	0.922	1.546	1.094	0.792	0.618	0.869	1.131	0.808	0.636	0.390
64	0.957	1.469	1.134	0.856	0.640	0.920	1.146	0.877	0.692	0.489
65	0.984	1.401	1.239	0.917	0.597	0.955	1.163	0.893	0.667	0.538
66	1.002	1.341	1.219	0.959	0.667	0.978	1.148	0.926	0.734	0.620
67	1.012	1.308	1.207	0.984	0.712	0.991	1.140	0.945	0.776	0.673
68	1.018	1.282	1.196	1.000	0.745	0.999	1.132	0.958	0.806	0.712
69	1.022	1.261	1.187	1.012	0.770	1.005	1.125	0.967	0.829	0.743
70	1.025	1.245	1.180	1.022	0.792	1.008	1.118	0.973	0.848	0.770
71	1.028	1.232	1.175	1.028	0.811	1.011	1.112	0.979	0.864	0.792
72	1.033	1.222	1.172	1.033	0.829	1.013	1.106	0.983	0.877	0.812
73	1.037	1.214	1.170	1.037	0.846	1.014	1.101	0.987	0.889	0.829
74	1.040	1.207	1.167	1.040	0.860	1.016	1.097	0.990	0.901	0.846
75	1.041	1.198	1.163	1.041	0.873	1.018	1.093	0.993	0.911	0.861
76	1.042	1.189	1.158	1.042	0.884	1.019	1.090	0.996	0.920	0.875
77	1.042	1.181	1.154	1.042	0.893	1.020	1.085	0.998	0.928	0.887
78	1.042	1.174	1.150	1.042	0.903	1.019	1.081	0.999	0.935	0.897
79	1.043	1.168	1.147	1.043	0.912	1.018	1.076	0.999	0.941	0.907
80	1.045	1.163	1.145	1.045	0.921	1.018	1.072	1.000	0.947	0.917
81	1.046	1.158	1.143	1.046	0.930	1.018	1.069	1.001	0.953	0.927
82	1.047	1.153	1.141	1.047	0.938	1.019	1.066	1.003	0.959	0.936
83	1.047	1.147	1.137	1.047	0.944	1.019	1.063	1.004	0.965	0.945
84	1.045	1.141	1.133	1.045	0.950	1.017	1.058	1.003	0.968	0.951
85	1.042	1.133	1.127	1.042	0.953	1.012	1.050	0.999	0.968	0.954
86	1.039	1.124	1.120	1.039	0.956	1.004	1.040	0.992	0.965	0.955
87	1.034	1.114	1.113	1.034	0.957	0.996	1.029	0.985	0.962	0.954
88	1.029	1.105	1.105	1.029	0.958	0.988	1.019	0.978	0.959	0.953
89	1.025	1.098	1.098	1.025	0.960	0.983	1.012	0.974	0.958	0.955
90	1.024	1.094	1.094	1.024	0.964	0.983	1.009	0.974	0.961	0.961
91	1.026	1.094	1.094	1.026	0.971	0.987	1.011	0.978	0.969	0.969
92	1.031	1.097	1.097	1.031	0.981	0.994	1.017	0.987	0.981	0.981
93	1.038	1.101	1.101	1.038	0.991	1.002	1.023	0.995	0.993	0.993
94	1.044	1.105	1.105	1.044	1.002	1.009	1.028	1.002	1.003	1.003
95	1.049	1.108	1.108	1.049	1.011	1.011	1.029	1.005	1.009	1.009
96	1.054	1.111	1.111	1.054	1.020	1.014	1.029	1.008	1.014	1.014
97	1.057	1.112	1.112	1.057	1.027	1.015	1.029	1.010	1.015	1.015
98	1.058	1.111	1.111	1.058	1.032	1.016	1.028	1.012	1.016	1.016
99	1.057	1.108	1.108	1.057	1.036	1.016	1.027	1.012	1.016	1.016
100	1.055	1.104	1.104	1.055	1.038	1.016	1.025	1.012	1.016	1.016
101	1.052	1.099	1.099	1.052	1.039	1.015	1.023	1.012	1.015	1.015
102	1.049	1.094	1.094	1.049	1.040	1.014	1.021	1.012	1.014	1.014
103	1.046	1.088	1.088	1.046	1.040	1.013	1.018	1.011	1.013	1.013
104	1.042	1.083	1.083	1.042	1.039	1.012	1.016	1.011	1.012	1.012
105	1.038	1.077	1.077	1.038	1.038	1.011	1.014	1.010	1.011	1.011
110	1.019	1.050	1.019	1.019	1.019	1.006	1.006	1.006	1.006	1.006
115	1.006	1.021	1.006	1.006	1.006	1.002	1.002	1.002	1.002	1.002
120	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000

At age 60, the mortality ratio of CPP retirement mortality (all levels combined) to population mortality is 0.78 for males and 0.61 for females. At age 65, the ratios are 0.98 for males and 0.96 for females. After age 65, the mortality ratios for both sexes increase up until age 75. After age 75, the ratios remain greater than 1.00 but show more variability for females. In general, at ages 65 and above, the ratios of retirement beneficiary to population mortality rates are lower for females than for males.

For both sexes, retirement beneficiary mortality rates at ages 60 to 64 are significantly lower than for the population. The reason for 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 population. At age 65, disability beneficiaries automatically become retirement beneficiaries and the mortality ratios rise accordingly.

For male CPP retirement beneficiaries, mortality rates after age 65 are higher than for the population. This could be viewed as somewhat unexpected since male retirement beneficiaries, who constitute a large portion of the male population aged 65 and over (89% in 1991 and 97% in 2011, see Table 12), should exhibit similar mortality to that of the population. However, Table 12 shows that this has not been the case since 1991. Life expectancy at age 65 (which represents a summary measure of mortality over age 65) has been lower for male CPP retirement beneficiaries than the population throughout the period 1991 to 2011. The difference could be attributed to the difference between the population census survey data used by the CHMD in constructing its Life Tables for Canada and Québec and the administrative data relied upon for this study.

For females, the historical pattern of difference in mortality between CPP retirement beneficiaries and the population is somewhat different compared to males over the period 1991 through 2011. Although in 2011 female retirement mortality rates are higher than for the population, in 1991 they were lower. This may be related to the fact that the ratio of female retirement beneficiaries to the population was much lower (48%) than for males (89%) in 1991. As such, in contrast to males, female retirement beneficiaries in 1991 could be viewed as representing a sub-group of the population with different characteristics than the overall population. In particular, this sub-group of the female population would have had some work history. This specific characteristic may explain the lower mortality of female beneficiaries compared to the population in 1991, because as shown previously, higher earnings histories are associated with lower mortality.

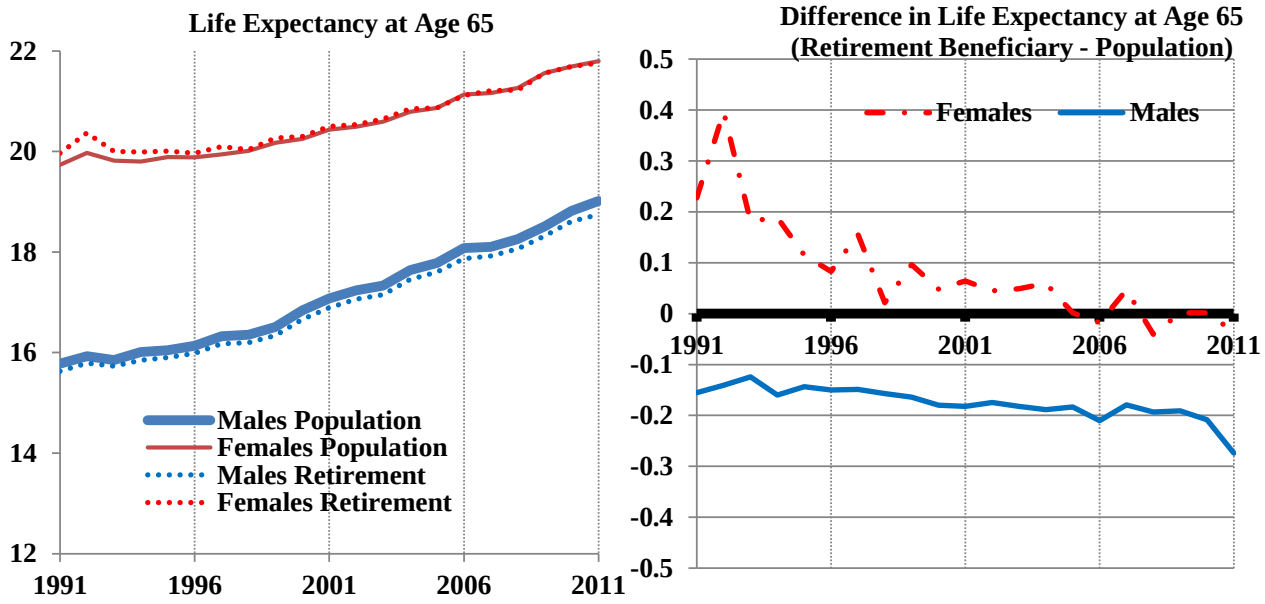
Table 12 and Chart 13 reveal that as the proportion of female beneficiaries in the population gradually increased from 1991 to 2011, female retirement mortality converged toward that of the population, as reflected by the differences in life expectancies. Note however, that even in 2011, the proportion of female beneficiaries in the population (82%) is still much lower than for males (97%). It remains to be seen whether the difference between female beneficiary and population mortality will eventually be similar to the corresponding difference for males as the proportion of female beneficiaries in the population approaches that of males in the future.

Table 12 Comparison of Retirement Period Life Expectancies at Age 65 (1991-2011)

	Period Life Expectancy at Age 65							
	Males				Females			
Year	Retirement	Population	Difference	Ratio Beneficiaries to Population (Age 65+)[1]	Retirement	Population	Difference	Ratio Beneficiaries to Population (Age 65+)[1]
1991	15.63	15.78	-0.15	89%	19.96	19.74	0.22	48%
1996	15.98	16.13	-0.15	93%	19.97	19.88	0.09	58%
2001	16.89	17.08	-0.19	95%	20.50	20.43	0.07	67%
2006	17.87	18.08	-0.21	96%	21.12	21.14	-0.02	74%
2011	18.74	19.02	-0.28	97%	21.76	21.80	-0.04	82%

(1) Derived from the ratio of the number of beneficiaries to the population as at1st July of each year.

Chart 13 Retirement and Population Life Expectancies at 65 (1991-2011)



F. Retirement Mortality Improvement Rates

1. Comparison with 26th CPP Actuarial Report

Historical average annual mortality improvement rates measure the pace of change in mortality over time. The "improvement" indicates that mortality rates have decreased over time, which in turn has led to increased longevity. Mortality improvement rates may be used to formulate assumptions about how mortality may evolve in the future. Table 13 and Charts 14 and 15 show annual mortality improvement rates for retirement beneficiaries over the last 15 years (1998 to 2013) and last 5 years (2008 to 2013). The table and charts also shows the improvement rates that were assumed for the 26th CPP Actuarial Report for the first five years (2009-2014) of the mortality projection in the report. Improvement rates at very advanced ages (95 and over) should be interpreted with caution due to low exposures, greater variation of results, and the effects of the smoothing (graduation) of the mortality rates at advanced ages.

As shown in Table 13, over the last 15 years, male retirement beneficiary mortality improvement rates for age groups 65 to 84 are between 0.5 and 1.2 percentage points higher than female rates, while they are relatively the same for ages 85 and over. Over the most recent 5 years, male retirement beneficiary mortality improvement rates are lower or similar to those observed over the last 15 years for ages below 75 while they are higher for ages over 75. For females, improvement rates over the last 5 years are relatively the same as observed over the last 15 years for ages below 85 and somewhat higher for ages 85 and over.

For males aged 65 to 74, mortality improvements observed over the last 5 years are less than those assumed under the 26th CPP Actuarial Report for the first five years of the projections (2009-2014). For ages 75 and over, the experience over the last 5 years is higher than assumed under the 26th CPP Actuarial Report except at the very advanced ages. For females, improvement rates over the last 5 years are equal to or somewhat higher than assumed for the first 5years of projections under the 26th CPP Actuarial Report for all ages 65 and above.

Table 13 Average Annual Retirement Mortality Improvement Rates

Age Group	1998-2013(1)		2008-2013(1)		26th CPP AR (2009-2014)(2)	
	Males	Females	Males	Females	Males	Females
65-69	2.7%	1.7%	2.1%	1.6%	2.6%	1.6%
70-74	3.0%	1.8%	2.6%	2.0%	2.9%	1.7%
75-79	2.8%	1.9%	2.9%	1.9%	2.6%	1.7%
80-84	2.4%	1.9%	2.7%	2.1%	2.3%	1.6%
85-89	1.9%	1.8%	2.1%	2.3%	1.9%	1.4%
90-94	1.1%	1.2%	1.7%	1.2%	1.3%	1.2%
95-99	0.7%	0.7%	0.2%	1.4%	0.8%	0.8%
65-94	2.3%	1.7%	2.4%	1.9%	2.3%	1.5%
65-74	2.8%	1.8%	2.4%	1.8%	2.7%	1.7%
75-89	2.3%	1.8%	2.6%	2.1%	2.2%	1.5%

(1) Improvement rates obtained using the corresponding 2013 exposures and populations as weights.
(2) 26th CPP Actuarial Report improvement rates for 2009-2014 are for Canada less Québec.

Chart 14 Average Annual Retirement Mortality Improvement Rates (Males)

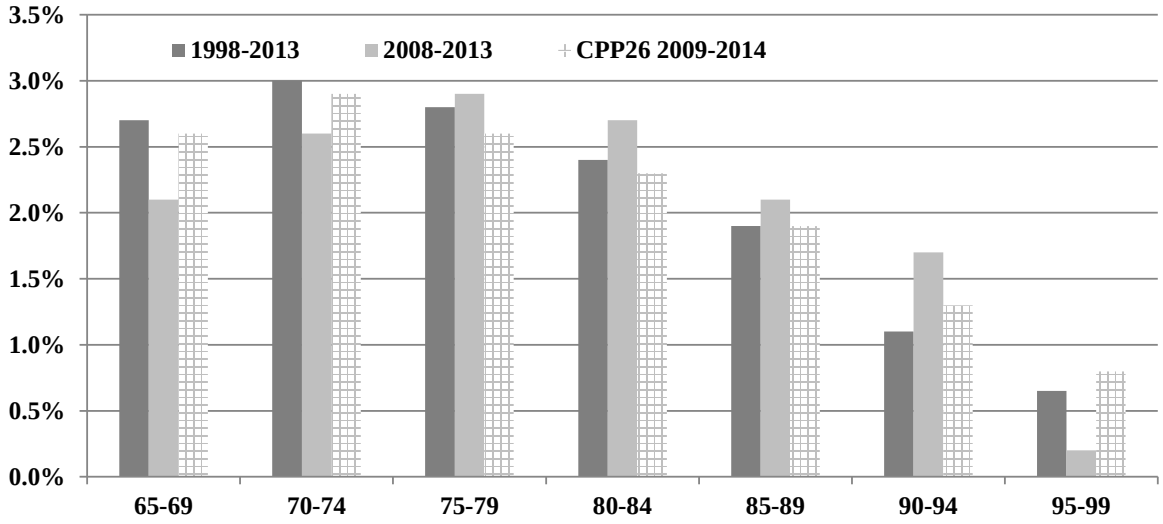
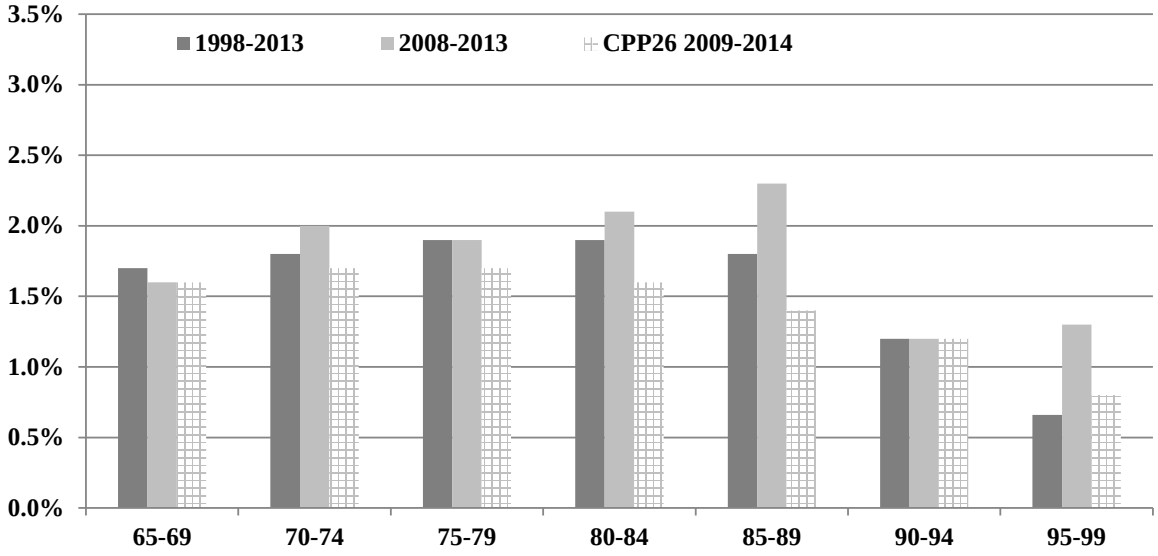


Chart 15 Average Annual Retirement Mortality Improvement Rates (Females)



2. Comparison by Level of Pension

Table 14 shows a comparison of annual mortality improvement rates for retirement beneficiaries by level of pension. A comparison of annual mortality improvement rates over the last 15 years for retirement beneficiaries by level of pension shows that for both males and females in age group 65 to 94, the mortality improvement rates for retirement beneficiaries with a level of pension of less than 37.5% of the maximum (3% for males, 1.7% for females) are greater than the mortality improvement rates experienced by those at the maximum level of pension (2.5% for males, 1.4% for females).

Table 15 shows cumulative mortality improvement rates from 1998 to 2013 by level of pension.

Table 14 Average Annual Retirement Improvement Rates (by Level of Pension, 1998-2013)

Age	Males					Females				
Group	< 37.5%	37.5-75%	75-100%	100%	All	< 37.5%	37.5-75%	75-100%	100%	All
65-69	3.3%	2.2%	3.4%	3.3%	2.7%	1.2%	1.3%	2.7%	1.3%	1.7%
70-74	3.4%	2.9%	3.0%	3.7%	3.0%	1.6%	1.7%	2.3%	2.2%	1.8%
75-79	3.4%	2.7%	2.4%	3.4%	2.8%	1.7%	1.9%	2.3%	2.0%	1.9%
80-84	2.8%	2.0%	2.2%	2.5%	2.4%	2.0%	1.7%	2.1%	1.6%	1.9%
85-89	2.2%	1.7%	1.7%	1.9%	1.9%	1.9%	1.7%	1.9%	1.1%	1.8%
90-94	1.6%	0.9%	1.0%	0.9%	1.1%	1.4%	1.1%	1.3%	0.9%	1.2%
95-99	1.4%	0.5%	0.5%	0.3%	0.6%	0.7%	0.7%	0.1%	1.4%	0.7%
65-94	3.0%	2.2%	2.4%	2.5%	2.3%	1.7%	1.6%	2.0%	1.4%	1.7%
65-74	3.4%	2.6%	3.2%	3.5%	2.8%	1.4%	1.5%	2.5%	1.8%	1.8%
75-89	2.7%	2.0%	2.0%	2.2%	2.3%	1.8%	1.6%	1.9%	1.3%	1.8%

Table 15 Cumulative Retirement Improvement Rates by Age (Level of Pension, 1998-2013)

Age Group	Males					Females				
	< 37.5%	37.5-75%	75-100%	100%	All	< 37.5%	37.5-75%	75-100%	100%	All
65-69	39.8%	28.9%	40.9%	39.1%	33.2%	16.9%	18.4%	33.4%	18.3%	22.8%
70-74	40.9%	35.8%	36.6%	42.9%	36.2%	21.3%	22.2%	29.5%	28.3%	24.2%
75-79	40.8%	33.8%	30.9%	40.7%	34.9%	22.2%	24.8%	29.5%	26.1%	24.6%
80-84	35.0%	26.5%	28.4%	31.7%	30.1%	26.0%	22.7%	27.5%	21.2%	25.0%
85-89	28.3%	22.4%	23.0%	24.6%	24.6%	25.3%	23.3%	24.8%	15.6%	23.8%
90-94	21.4%	12.8%	13.8%	12.3%	15.0%	18.6%	15.2%	17.4%	12.1%	17.0%
95-99	18.8%	7.2%	7.2%	4.0%	9.3%	9.9%	10.0%	1.8%	18.8%	9.5%
65-94	36.5%	28.7%	30.1%	31.1%	30.0%	22.6%	21.4%	26.6%	19.5%	22.9%
65-74	40.4%	32.5%	38.8%	41.6%	34.9%	19.4%	20.4%	31.5%	24.4%	23.5%
75-89	33.9%	26.3%	25.7%	28.6%	29.9%	23.4%	21.7%	24.8%	18.3%	24.4%

3. Comparison with Population

Table 16 presents a comparison of retirement beneficiary mortality improvement rates with those of the population of Canada less Québec. Since population mortality statistics are only available through to year 2011, the last 15 and 5 years have been set to 1996 to 2011 and 2006 to 2011. Under both periods examined, the population mortality improvement rates are very similar to those observed for CPP retirement beneficiaries, with some exceptions at the older ages.

Table 16 Population and Retirement Average Annual Mortality Improvement Rates[(1)]

Age Group	Males				Females			
	1996-2011		2006-2011		1996-2011		2006-2011	
	Retirement	Population[(1)]	Retirement	Population[(1)]	Retirement	Population[(1)]	Retirement	Population[(1)]
65-69	2.8%	2.8%	2.6%	2.7%	1.6%	1.9%	2.2%	2.2%
70-74	3.0%	2.9%	2.9%	3.0%	1.7%	1.8%	2.2%	2.2%
75-79	2.7%	2.7%	3.0%	3.0%	1.8%	2.0%	1.7%	2.0%
80-84	2.3%	2.6%	2.4%	2.3%	1.9%	2.0%	1.6%	1.7%
85-89	1.7%	1.8%	1.7%	2.4%	1.5%	1.5%	2.2%	2.5%
90-94	1.0%	1.1%	1.9%	1.9%	1.1%	1.0%	1.5%	1.2%
95-99	0.6%	0.6%	0.7%	1.6%	0.7%	0.6%	0.5%	1.2%
65-94	2.3%	2.4%	2.4%	2.6%	1.6%	1.7%	1.9%	1.9%
65-74	2.9%	2.9%	2.8%	2.9%	1.6%	1.9%	2.2%	2.2%
75-89	2.2%	2.4%	2.4%	2.6%	1.7%	1.8%	1.9%	2.1%

(1) Population mortality improvement rates are based on CHMD data for the period 1996 to 2011, using 2011 population as weights. Population mortality improvement rates are for Canada less Québec based on CHMD data for Canada and Québec. OCA calculations.

G. Retirement Period Life Expectancies

1. By Age, Sex, and Level of Pension

Tables 17 and 18 show period life expectancies (i.e., without future mortality improvements) for male and female retirement beneficiaries for year 2013, respectively. Life expectancies for the population as projected under the 26th CPP Actuarial report are also shown for comparison purposes.

For each level of pension except the maximum level, male retirement beneficiary period life expectancies are generally equal to or lower than those for the all levels of pension. The all levels of pension life expectancies are lower than for the population at all ages.

From Table 17 it can also be observed that in 2013, the period life expectancies for males at age 65 with maximum pensions live about 2.0 years longer than those with pensions less than 37.5% of the maximum. At age 85, the differential for males is of 0.3 years. For females, in comparison, the

differences in the period life expectancies for females are more stable over time since at age 65 those with maximum pensions live about 1.6 years longer than those with pensions less than 37.5% of the maximum and at age 85, the differential is of 0.4 years.

Table 17 Retirement Period Life Expectancies (Males, 2013)

	Level of Pension as % of Maximum					
Age	**< 37.5%**	**37.5-75%**	**75-100%**	**100%**	**ALL**	**Population[(1)]**
65	18.1	18.2	19.1	20.1	19.0	19.4
70	14.6	14.6	15.2	16.0	15.2	15.6
75	11.3	11.3	11.8	12.3	11.8	12.1
80	8.4	8.4	8.7	9.0	8.7	9.1
85	6.0	6.0	6.1	6.3	6.1	6.6
90	4.1	4.1	4.2	4.3	4.2	4.6

(1) As projected in 2013 in the 26th CPP Actuarial Report (Canada less Quebec).

Table 18 shows that for pensions at or below 75% of the maximum, period life expectancies for females are lower than those for the all levels of pension. The all levels of pension life expectancies are slightly lower than for the population at all ages. For females, the difference in life expectancies between the highest and lowest level of pension at age 65 is 1.6 years and reduces to 0.4 year by age 85.

Table 18 Retirement Period Life Expectancies (Females, 2013)

	Level of Pension as % of Maximum					
Age	**< 37.5%**	**37.5-75%**	**75-100%**	**100%**	**ALL**	**Population[(1)]**
65	21.5	22.0	22.5	23.1	22.0	22.2
70	17.6	17.9	18.2	18.7	17.9	18.1
75	13.9	14.0	14.2	14.7	14.0	14.2
80	10.5	10.6	10.6	11.0	10.6	10.8
85	7.5	7.6	7.6	7.9	7.6	7.8
90	5.1	5.1	5.1	5.3	5.1	5.4

(1) As projected in 2013 in the 26th CPP Actuarial Report (Canada less Quebec).

The evolution of period life expectancies at age 65 by level of pension is presented in Table 19 and Charts 16 and 17. Over the past two decades, for both sexes, the difference in life expectancy at age 65 between those with maximum pensions and those with pensions less than 37.5% of the maximum has been stable.

Table 19 Retirement Period Life Expectancies at Age 65 (1990-2013)

	Males						Females					
	Level of Pension as a % of Maximum						Level of Pension as a % of Maximum					
Year	<37.5%	37.5% to 75%	75% to 100%	100%	All	Difference 100% with <37.5%	<37.5%	37.5% to 75%	75% to 100%	100%	All	Difference 100% with <37.5%
1990	14.2	15.4	15.6	16.3	15.7	2.1	19.5	20.0	20.2	19.6	19.7	0.2
1991	14.3	15.1	15.7	16.4	15.6	2.1	19.5	20.3	20.2	20.5	20.0	1.0
1992	14.0	15.5	15.8	16.5	15.8	2.5	19.9	20.4	20.5	20.9	20.4	1.0
1993	14.1	15.2	15.8	16.4	15.7	2.3	19.5	20.2	20.3	21.0	20.0	1.4
1994	14.1	15.4	15.9	16.6	15.8	2.5	19.5	20.2	20.3	20.4	20.0	0.9
1995	14.5	15.4	15.9	16.6	15.9	2.1	19.5	20.3	20.6	21.2	20.0	1.7
1996	14.4	15.3	16.0	16.8	16.0	2.4	19.5	20.2	20.4	21.1	20.0	1.5
1997	14.6	15.5	16.2	16.9	16.2	2.3	19.7	20.3	20.4	20.7	20.1	1.0
1998	14.8	15.5	16.1	17.0	16.2	2.3	19.7	20.2	20.3	21.1	20.0	1.4
1999	14.8	15.7	16.3	17.2	16.3	2.4	19.9	20.5	20.4	21.3	20.3	1.4
2000	15.3	16.0	16.5	17.5	16.7	2.3	19.9	20.6	20.6	21.2	20.3	1.4
2001	15.4	16.4	16.8	17.7	16.9	2.3	20.1	20.8	20.8	21.4	20.5	1.4
2002	15.5	16.3	16.9	18.0	17.1	2.5	20.1	20.8	20.9	21.7	20.5	1.6
2003	15.7	16.4	17.0	18.2	17.2	2.4	20.2	20.8	21.1	21.7	20.6	1.5
2004	16.0	16.7	17.3	18.5	17.5	2.6	20.5	21.1	21.1	21.6	20.9	1.2
2005	16.4	16.9	17.4	18.6	17.6	2.2	20.4	21.1	21.4	22.0	20.9	1.6
2006	16.6	17.1	17.7	18.9	17.9	2.3	20.7	21.3	21.5	21.8	21.1	1.1
2007	16.7	17.1	17.8	19.0	17.9	2.3	20.8	21.4	21.6	22.4	21.2	1.7
2008	17.0	17.2	18.0	19.1	18.1	2.1	20.8	21.4	21.6	22.2	21.2	1.4
2009	17.3	17.6	18.2	19.3	18.3	2.0	21.1	21.6	22.1	22.5	21.6	1.4
2010	17.7	17.9	18.5	19.6	18.6	1.8	21.3	21.8	22.2	22.5	21.7	1.2
2011	17.8	17.9	18.6	19.9	18.7	2.1	21.3	21.9	22.3	22.4	21.8	1.1
2012	18.1	18.1	18.8	20.0	18.9	1.9	21.5	22.1	22.5	22.7	22.0	1.1
2013	18.1	18.2	19.1	20.1	19.0	2.0	21.5	22.0	22.5	23.1	22.0	1.6

Chart 16 Males Retirement Life Expectancy at Age 65 (High and Low Pension, 1990-2013)

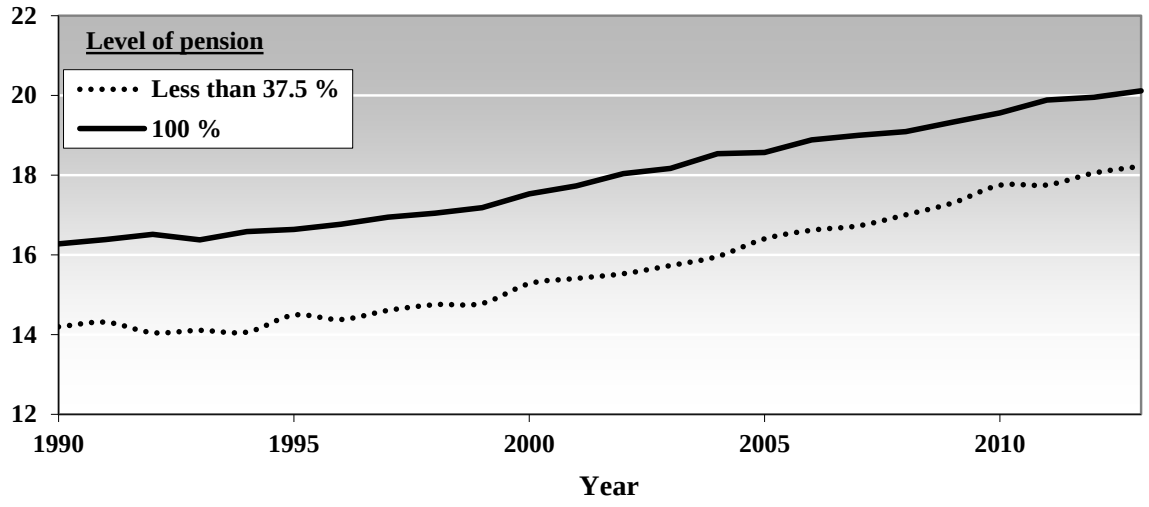
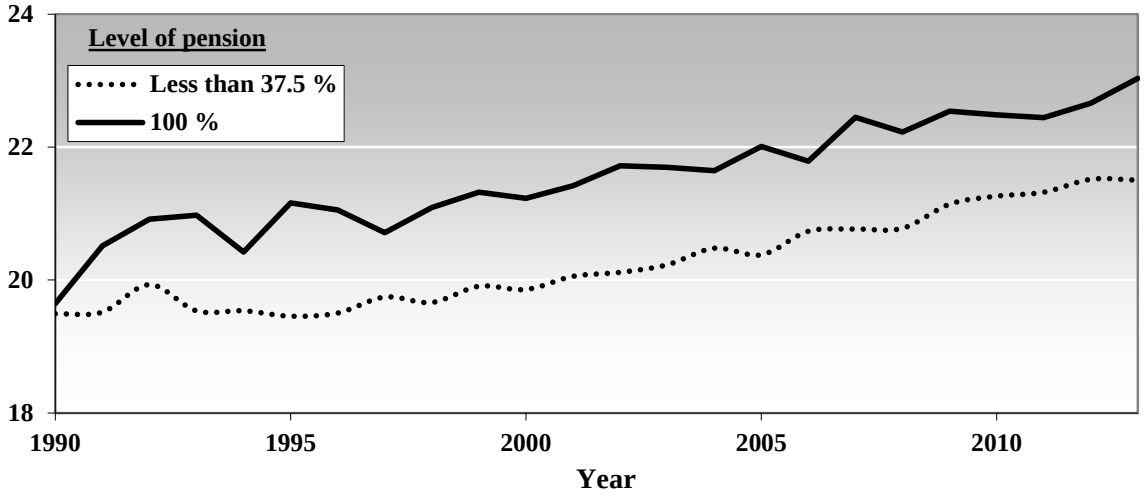


Chart 17 Females Retirement Life Expectancy at Age 65 (High and Low Pension, 1990-2013)



2. Contributions to Increase in Life Expectancy at Age 65 (1993 to 2013).

Empirical evidence in Table 20 shows the contributions to the increase in life expectancy at age 65 of retirement beneficiaries by age-group over the last 20 years (1993-2013). Over the first half of the period, from 1993 to 2003, about 50% of the increase in life expectancy at age 65 for males (0.75 out of 1.5 years) came from mortality improvements (i.e., reductions in mortality rates) at ages 75 and over. For females, the corresponding proportion is 67% (0.4 out of 0.6 years) over the same period. These proportions reached 65% (1.17 out of 1.8 years) for males and 73% (1.02 out of 1.4 years) for females over the most recent 10-year period (2003-2013).

As the distribution of deaths moves towards older ages in the future, the trend of mortality improvements shifting toward the older ages is expected to continue, in turn leading to additional increases in life expectancy at age 65. Over the last 10 years (2003-2013), life expectancy at age 65 of male beneficiaries grew by about 1.8 years or 0.3 of a year more than the previous 10-year period 1993-2003, while life expectancy at age 65 of female beneficiaries grew by 1.4 years or 0.8 of year more than over 1993-2003.

Table 20 Contribution to Increase in Life Expectancy at Age 65

	1993-2003				2003-2013			
Change Attributable to Age Group	**Males**		**Females**		**Males**		**Females**	
65-74	0.75	50%	0.20	33%	0.63	35%	0.38	27%
75-79	0.29	19%	0.13	22%	0.45	25%	0.28	20%
80-84	0.29	19%	0.13	22%	0.36	20%	0.28	20%
85-89	0.09	6%	0.07	12%	0.27	15%	0.28	20%
90+	0.09	6%	0.07	11%	0.09	5%	0.18	13%
Total Change in Life Expectancy at Age 65	1.5	100%	0.6	100%	1.8	100%	1.4	100%

H. Work and Retirement Periods of CPP Beneficiaries

This section presents an historical overview of the length of work and retirement periods of contributors and beneficiaries of the Canada Pension Plan.

Table 21 shows the average age of first time CPP contributors, the average age of new CPP retirement beneficiaries, as well as information regarding the actual and expected ages at death for the given cohort of CPP retirement beneficiaries.

It should be noted, that for any given year the first time CPP contributors and new CPP retirement beneficiaries are analyzed on the calendar year basis, i.e., they are not the same group of CPP participants. On the contrary, the analyses of the actual and expected ages at death are done on the cohort basis, i.e., new CPP retirement beneficiaries of a given year are followed through years to the date of their death. The following definitions provide a more detailed explanation of the information included in Table 21 and Chart 18.

Definitions

Average Age of First Time CPP Contributors

A first time CPP contributor is an individual who makes a valid CPP contribution for the first time after reaching age 18. A valid contribution is one that is made on annual earnings that are greater than the Year's Basic Exemption ($3,500) and where the contribution is not fully refunded.

As the Plan has slowly matured since its inception, the average age of first time CPP contributors decreased from about 25 years in the early 1970s to 22 years by the mid-1980s. The longer period of formal post-secondary education as well as changes in immigration policies may have resulted in the reversal of this trend over the 1990s and 2000s. Over the last decade, the age of first time contributors has varied between 24.0 and 24.7[1].

Average Age of New CPP Retirement Beneficiaries

The average age of new CPP retirement beneficiaries represents the average age at their benefit take-up date. At the outset of the Plan, there was an initial 10-year transition period before one could receive a full retirement pension in 1976. During the transition period, there was a prorating factor that applied to the pension that grew from 10% in 1967 to 100% for 1976 and thereafter. This transition provision created an incentive to delay retirement, and the average age of new CPP retirement beneficiaries was over age 66 until 1976. The introduction in 1987 of the flexible retirement take-up age provision drove the average age of new retirement beneficiaries below 65. Over the last decade, the average age at pension take-up has stabilized at around 62.5 years.

Death Ratio

For the purpose of this study, the death ratio for any given year is equal to the ratio of the number of new CPP retirement beneficiaries for that year who died prior to July 2014 to the total number of new CPP retirement beneficiaries for that year. For example, almost all CPP retirement beneficiaries who took their benefits in 1970 died by July 2014. On the other side of the spectrum, only 1% of 2013 new CPP retirement beneficiaries died by July 2014.

[1] Currently, 20% of all first-time CPP contributors are over age 30.

Actual Average Age at Death for Retirees' Cohort

The actual average age at death for a given retirees' cohort represents the actual average age at death for those members of a CPP retirement beneficiaries' cohort who took their CPP retirement benefit in a given year and who died prior to July 2014. For example, the cohort of new CPP retirement beneficiaries in 1970 who died prior to July 2014 has an average age at death of 80.8. In comparison, the cohort of new CPP retirement beneficiaries in 2013 who died prior to July 2014 have an average age at death of 64.

Expected Average Age at Death for Retirees' Cohort (26th CPP Actuarial Report)

The expected average age at death for a given retirees' cohort is the weighted average of the actual average age at death for deceased members of this cohort and the expected average age at death for the remaining members of this cohort as at July 2014. The expected average age at death for the remaining members as at July 2014 is determined using the assumptions of the 26th CPP Actuarial Report as at 31 December 2012 including the assumed future mortality improvements.

The Evolution of the Length of Work and Retirement Periods

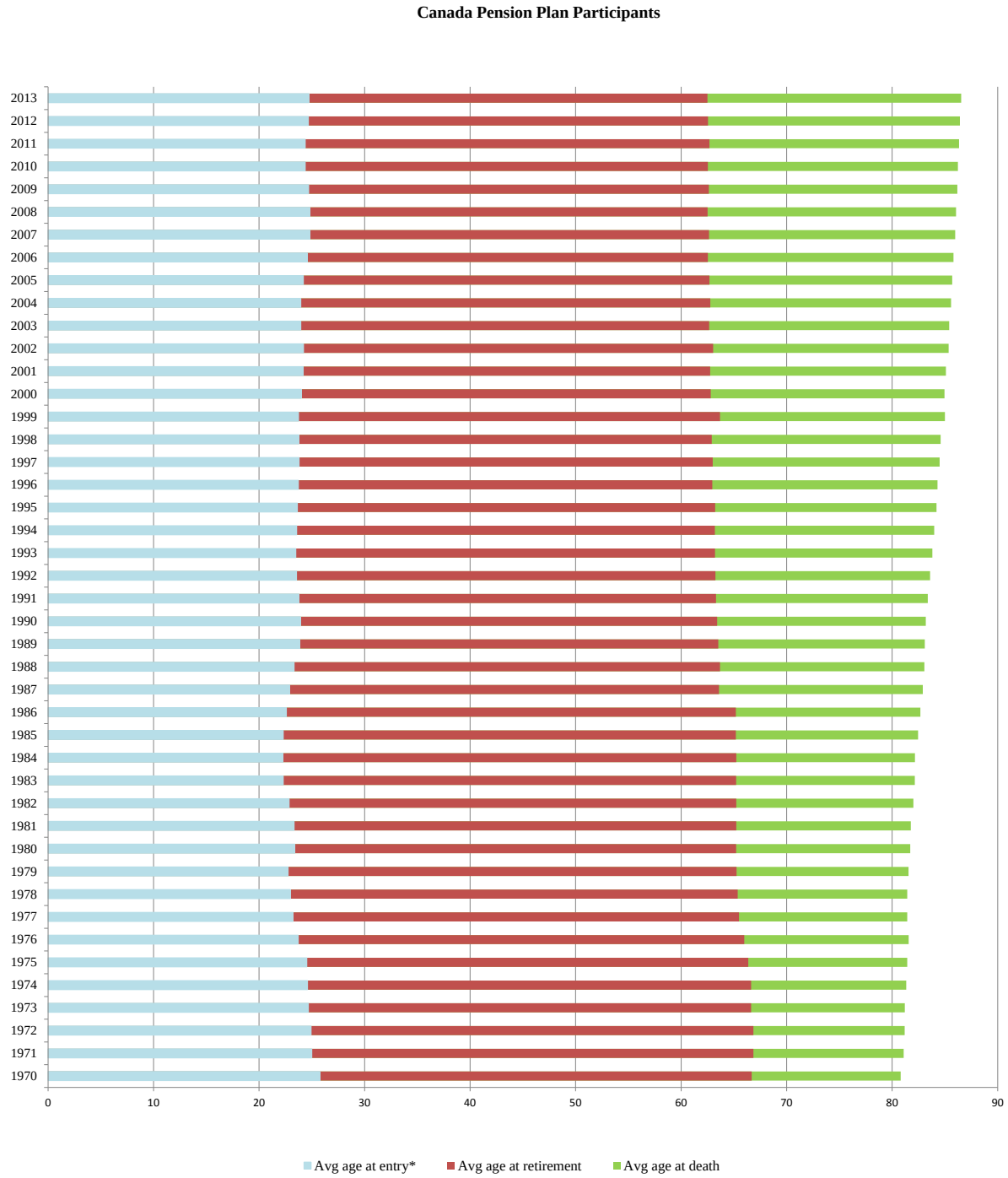
As it can be seen from Table 21, the actual and expected average ages at death for a retirees' cohort are very close for earlier cohorts of CPP retirement beneficiaries, since the majority of the retirees of these cohorts died prior to July 2014 (death ratios are close to one). As time progresses, cohorts of retirees become younger, and the difference between the actual and expected average ages of death becomes larger.

Table 21 Evolution of Various Average Ages of CPP Contributors and Retirees (1970-2013)

Year (retirement benefit take-up)	Average Age of First Time CPP Contributors[1]	Average Age of New CPP Retirement Beneficiaries	Death Ratio (from year to July 2014)	Actual Average Age at Death for Retirees' Cohort	Expected Average Age at Death for Retirees' Cohort (CPP26)
1970	25.8	66.7	0.9997	80.8	80.8
1971	25.0	66.9	0.9995	81.1	81.1
1972	24.9	66.9	0.9994	81.2	81.2
1973	24.7	66.6	0.9993	81.2	81.2
1974	24.6	66.6	0.9990	81.3	81.3
1975	24.5	66.4	0.9982	81.4	81.4
1976	23.7	66.0	0.9970	81.5	81.6
1977	23.2	65.5	0.9941	81.3	81.4
1978	23.0	65.4	0.9907	81.2	81.4
1979	22.8	65.3	0.9848	81.2	81.5
1980	23.4	65.2	0.9772	81.3	81.7
1981	23.3	65.2	0.9675	81.1	81.8
1982	22.9	65.2	0.9530	81.1	82.0
1983	22.3	65.2	0.9336	81.0	82.1
1984	22.3	65.2	0.9133	80.7	82.2
1985	22.3	65.2	0.8859	80.5	82.5
1986	22.6	65.2	0.8528	80.3	82.7
1987	22.9	63.6	0.7528	79.0	82.9
1988	23.3	63.7	0.7060	78.5	83.1
1989	23.9	63.5	0.6610	77.8	83.1
1990	23.9	63.4	0.6175	77.2	83.2
1991	23.8	63.3	0.5699	76.7	83.4
1992	23.6	63.3	0.5232	76.1	83.6
1993	23.5	63.2	0.4775	75.6	83.8
1994	23.6	63.2	0.4387	75.1	84.0
1995	23.6	63.2	0.3984	74.6	84.2
1996	23.7	63.0	0.3566	73.7	84.3
1997	23.8	63.0	0.3235	73.4	84.5
1998	23.8	62.9	0.2912	72.7	84.6
1999	23.7	63.7	0.2814	74.0	85.0
2000	24.0	62.8	0.2276	71.4	85.0
2001	24.2	62.8	0.2006	70.8	85.1
2002	24.2	63.0	0.1812	71.2	85.4
2003	24.0	62.7	0.1516	69.7	85.4
2004	24.0	62.8	0.1319	69.4	85.6
2005	24.2	62.7	0.1120	68.6	85.7
2006	24.6	62.5	0.0934	68.0	85.8
2007	24.8	62.6	0.0803	68.4	86.0
2008	24.8	62.5	0.0616	66.7	86.1
2009	24.7	62.6	0.0493	66.9	86.2
2010	24.4	62.5	0.0377	65.6	86.2
2011	24.4	62.7	0.0280	65.3	86.3
2012	24.7	62.6	0.0178	64.6	86.4
2013	24.7	62.5	0.0089	63.9	86.5

(1) Currently, 20% of all first-time CPP contributors are over age 30.

Chart 18 Work and Retirement Periods for CPP Beneficiaries (1970-2013)



* Currently, 20% of all first-time CPP contributors are over age 30.

IV. CPP Survivor Beneficiary Mortality

A. Introduction

This section presents the methodology and results of the study on the mortality of CPP survivor beneficiaries. One of the goals of this study is to develop mortality ratios for CPP survivor beneficiaries relative to the general population. Again, the term "general population" is used to refer to the population of Canada less Québec, as this is the population covered by the CPP.

B. Survivor Benefit Eligibility

A legal spouse, a separated legal spouse not cohabiting with a common-law partner, or a common-law partner, surviving a deceased contributor, is eligible for a survivor benefit if the following conditions are met as at the date of the contributor's death.

The deceased contributor must have made contributions during the lesser of ten calendar years, or one-third of the number of years included wholly or partly in his or her contributory period, but not for less than three years.

If the surviving spouse is the separated legal spouse of the deceased contributor, there must be no cohabiting common-law partner at the time of death. If the survivor is the common-law partner of the deceased contributor, they must have cohabited for not less than one year immediately before the death of the contributor. If the common-law partner is of the same-sex as the deceased contributor, the death must have occurred on or after 17 April 1985.

If under the age of 35, the surviving spouse or common-law partner must have dependent children or be disabled. If the survivor is between ages 35 and 45 and is not disabled and does not have children, then the benefit is reduced. A surviving spouse or common-law partner with dependent children means a survivor who wholly or substantially supports a child of the deceased contributor where the child is under age 18, aged 18 or over but under age 25 and attending school full-time, or aged 18 or over and disabled, having been disabled without interruption since attaining age 18 or the time of the contributor's death, whichever occurred later. Survivors who are not (due to their age or absence of children) eligible for an immediate benefit do become eligible at age 65.

C. Survivor Benefit Calculation

The initial amount of the monthly survivor benefit depends on the age of the survivor, the survivor's disability status, and the presence of dependent children. In the case that both a survivor and retirement benefit are payable, the survivor's benefit is reduced. If both a survivor and disability benefit are payable, then the disability benefit is reduced. The following five cases describe how the survivor benefit is calculated.

1. New Survivor Age 45 to 65

The amount of monthly benefit payable until the surviving spouse or common-law partner attains age 65 is composed of two portions: a flat-rate benefit depending only on the year in which the survivor benefit is payable ($181.75 in 2015) and an earnings-related benefit depending initially only on the contributor's record of pensionable earnings under the Plan as at the date of death. The initial earnings-related portion (maximum of $399.38 in 2015) is equal to 37.5% of either the retirement pension of the deceased contributor the retirement pension if he or she had been receiving a pension, or the retirement pension that would have been payable to the deceased contributor if the contributory period had ended at the time of death, with no actuarial adjustment in either case.

2. New Survivor under Age 45 without Dependent Children and not Disabled

An eligible spouse or common-law partner, without dependent children and not disabled, who becomes widowed before age 35 is not entitled to a survivor's benefit but may be entitled at a later date if she or he becomes disabled (see 4) or attains age 65 (see 5). If such a survivor is between 35 and 45 years of age, she or he is entitled to a benefit amount calculated as described in 1 above but reduced (until the earlier of disablement or attainment of age 65) by 1/120 of such an amount for each month that the new survivor's age is less than 45.

3. New Survivor under Age 45 with Dependent Children

An eligible spouse or common-law partner who becomes widowed prior to age 45 and with dependent children is entitled to a survivor benefit calculated as in 1 above. Under certain circumstances, the survivor benefit is reduced or even discontinued when the survivor no longer has any dependent children. If the survivor is then under age 45 and not disabled, she or he is considered to be a new survivor entitled only to the benefit in accordance with 2 above.

4. Disabled Survivor under Age 65

An eligible surviving spouse or common-law partner under age 65 is entitled to a survivor benefit calculated as in 1 above whenever she or he is disabled. If the disabled surviving spouse or common-law partner recovers from disability before age 45, the survivor benefit is discontinued or reduced to what it would be for a new survivor in accordance with 2 above.

5. Survivor Age 65 or Older

At age 65 or upon becoming widowed at a later age, an eligible surviving spouse or common-law partner is entitled to a monthly benefit equal to 60% of the retirement pension (maximum of $639 in 2015) of the deceased contributor if he or she had been receiving a pension, or the retirement pension that would have been payable to the deceased contributor if the contributory period had ended at the time of death, with no actuarial adjustment in either case.

D. Survivor Mortality Experience for Year 2013

1. Beneficiaries

Historical data on the number of survivor beneficiaries by age group and sex are presented in Table 22. As females live longer than males, female beneficiaries are on average distributed more toward the advanced ages. The number of male beneficiaries has increased by over 2.5 times or 156% from about 76,000 in 1993 to 193,000 in 2013. Over the same period, the number of female beneficiaries increased by 45% from about 604,000 in 1993 to 875,000 in 2013. The steeper increase in the number of male survivor beneficiaries can be attributed to the increased labour force participation of females (and hence CPP eligibility) as well as the increase in male life expectancies. In 2013, there were 1.1 million survivor beneficiaries (82% female).

Of all male survivor beneficiaries, the proportion of male survivor beneficiaries younger than age 65 decreased from 42% in 1993 to 27% in 2013. In comparison, for females, this proportion has decreased from 31% in 1993 to 21% in 2013. The number of beneficiaries for the years 1993, 2003 and 2013 by individual age and sex is presented in Table 55 of the Annex.

Table 22 Survivor Beneficiaries (1st July)

Age Group	Males					
	Number			Distribution		
	1993	2003	2013	1993	2003	2013
< 35	565	263	204	1%	0%	0%
35-39	1,412	1,084	671	2%	1%	0%
40-44	2,926	3,141	1,981	4%	2%	1%
45-49	4,489	5,842	4,690	6%	4%	2%
50-54	5,556	8,989	9,534	7%	7%	5%
55-59	7,149	12,581	15,233	9%	10%	8%
60-64	10,133	14,379	20,734	13%	11%	11%
65-69	11,997	16,947	26,678	16%	13%	14%
70-74	11,777	20,348	27,674	16%	16%	14%
75-79	9,524	19,982	28,346	13%	15%	15%
80-84	6,483	15,492	27,789	9%	12%	14%
85-89	2,794	8,222	19,497	4%	6%	10%
90-94	657	2,988	8,408	1%	2%	4%
95-99	69	512	1,607	0%	0%	1%
100+	9	42	153	0%	0%	0%
Total	**75,540**	**130,812**	**193,199**	100%	100%	100%

Age Group	Females					
	Number			Distribution		
	1993	2003	2013	1993	2003	2013
< 35	5,261	2,680	1,741	1%	0%	0%
35-39	8,236	5,428	3,428	1%	1%	0%
40-44	13,880	12,546	7,486	2%	2%	1%
45-49	21,472	21,802	15,889	4%	3%	2%
50-54	29,356	33,318	31,508	5%	4%	4%
55-59	41,460	48,878	50,180	7%	6%	6%
60-64	64,354	63,377	70,886	11%	8%	8%
65-69	92,878	82,940	95,405	15%	10%	11%
70-74	113,551	114,140	110,009	19%	14%	13%
75-79	103,036	140,654	127,825	17%	18%	15%
80-84	72,862	137,353	142,951	12%	17%	16%
85-89	30,979	85,567	126,106	5%	11%	14%
90-94	5,830	34,565	71,087	1%	4%	8%
95-99	390	6,416	18,412	0%	1%	2%
100+	10	416	2,485	0%	0%	0%
Total	**603,555**	**790,080**	**875,398**	100%	100%	100%

2. Deaths

Table 23 presents the number of survivor beneficiary deaths by age group and sex. Over the period 1990 to 2013 there were 872,000 observed deaths (83% from females). Of the total deaths, about 7,000 were classified as centenarians (92% females). The median age at death of males increased from 77 in 1993 to 84 in 2013, while for females it increased from 79 to 87 over the same period. Female deaths are distributed more toward the older ages compared to males, as a result of females' greater longevity.

The number of male deaths almost tripled between 1993 and 2013 (from 3,400 to 10,000) while for females the increase was 140% (from 18,000 to 43,000). The higher increase in the number of deaths for males is directly linked to the historical increase in eligibility of females to the CPP pension, resulting from their increased labour force participation.

Survivor beneficiary deaths by individual ages for years 1993, 2003 and 2013 are presented in Table 56 of the Annex.

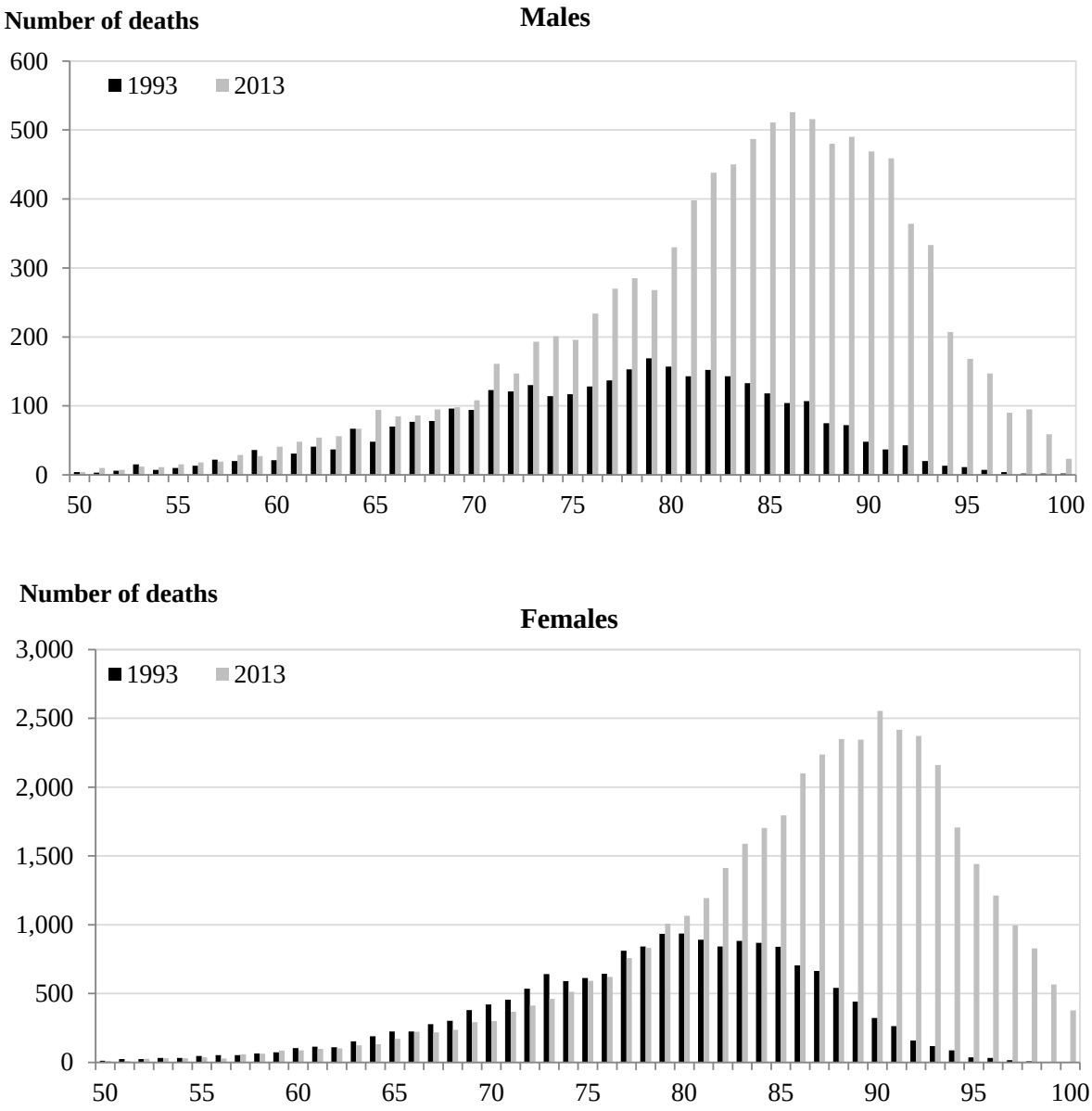
Table 23 Survivor Deaths (1990-2013)

	Males						
	Number				Distribution		
Age Group	1990-2013	1993	2003	2013	1993	2003	2013
<50	642	26	28	24	1%	0%	0%
50-54	1,126	35	52	44	1%	1%	0%
55-59	2,448	101	87	108	3%	1%	1%
60-64	5,194	197	217	266	6%	3%	3%
65-69	9,736	369	371	458	11%	6%	5%
70-74	16,820	582	816	810	17%	12%	8%
75-79	25,434	704	1,273	1,253	21%	19%	13%
80-84	32,043	728	1,501	2,103	21%	23%	21%
85-89	29,944	476	1,303	2,523	14%	20%	25%
90-94	17,212	161	732	1,832	5%	11%	18%
95-99	4,815	26	205	559	1%	3%	6%
100+	592	4	25	81	0%	0%	1%
Total	**146,006**	**3,409**	**6,610**	**10,061**	**100%**	**100%**	**100%**
Median Age	**80.9**	**77.1**	**80.5**	**83.9**			

	Females						
	Number				Distribution		
Age Group	1990-2013	1993	2003	2013	1993	2003	2013
<50	1,996	107	88	52	1%	0%	0%
50-54	3,112	127	135	109	1%	0%	0%
55-59	6,666	290	275	274	2%	1%	1%
60-64	14,614	672	608	543	4%	2%	1%
65-69	30,446	1,410	1,221	1,143	8%	4%	3%
70-74	58,546	2,645	2,445	2,056	15%	7%	5%
75-79	102,673	3,846	4,901	3,812	22%	15%	9%
80-84	153,983	4,424	7,563	6,964	25%	22%	16%
85-89	177,343	3,194	8,588	10,826	18%	25%	25%
90-94	124,873	954	5,945	11,212	5%	18%	26%
95-99	44,955	95	1,857	5,041	1%	6%	12%
100+	6,453	7	183	1,022	0%	1%	2%
Total	**725,660**	**17,771**	**33,809**	**43,054**	**100%**	**100%**	**100%**
Median Age	**83.7**	**78.8**	**83.8**	**87.2**			

Chart 19 presents the evolution of the distribution of deaths by age and sex from 1993 to 2013. It clearly illustrates that the median age at death for both males and females has increased over time. In 2013, the number of deaths peaks at age 86 for males and age 90 for females.

Chart 19 Distribution of Survivor Deaths (Ages 50 and over, 1993 and 2013)



3. Exposures

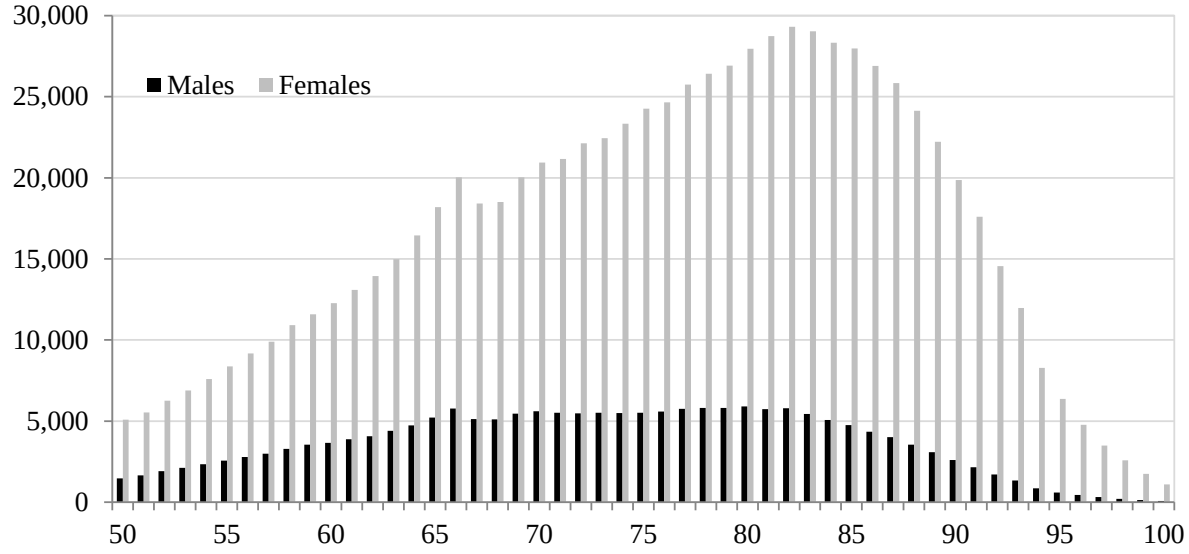
Table 24 and Chart 20 highlight that the participation of females relative to males varies significantly by age group. Male survivor exposures are considerably lower than female exposures at all ages as it accounted for 11% of the total exposure in 1993 and 18% of the total exposure in 2013. One reason is that CPP participation rates for females have historically been lower than males, which has resulted in fewer potential male survivors. A second reason is that male mortality is materially higher than female mortality and thus males are less likely to survive to older ages. This second effect from higher male mortality is augmented by the fact that males are on average several years older than their female spouses. Exposures of CPP survivor beneficiaries by individual ages for the years 1993, 2003 and 2013 as presented in Table 57 of the Annex.

Table 24 Survivor Exposures (1990-2013)

	Males						
	Number				Distribution		
Age Group	1990-2013	1993	2003	2013	1993	2003	2013
<50	223,449	9,187	10,165	7,469	12%	8%	4%
50-54	192,077	5,443	8,901	9,474	7%	7%	5%
55-59	265,187	7,029	12,489	15,177	9%	10%	8%
60-64	342,213	9,882	14,225	20,722	13%	11%	11%
65-69	406,015	11,676	16,922	26,661	16%	13%	14%
70-74	441,496	11,594	20,221	27,604	16%	16%	14%
75-79	435,455	9,427	19,927	28,467	13%	15%	15%
80-84	353,521	6,475	15,561	27,938	9%	12%	14%
85-89	208,121	2,811	8,320	19,745	4%	6%	10%
90-94	75,521	685	3,061	8,649	1%	2%	4%
95-99	13,905	68	531	1,681	0%	0%	1%
100+	1,229	9	44	161	0%	0%	0%
Total	**2,958,190**	**74,288**	**130,368**	**193,748**	**100%**	**100%**	**100%**

	Females						
	Number				Distribution		
Age Group	1990-2013	1993	2003	2013	1993	2003	2013
<50	988,685	46,895	41,856	28,403	8%	5%	3%
50-54	752,807	27,913	32,853	31,355	5%	4%	4%
55-59	1,091,738	39,771	48,135	49,944	7%	6%	6%
60-64	1,540,386	61,550	62,439	70,727	10%	8%	8%
65-69	2,085,239	89,567	82,133	95,184	15%	10%	11%
70-74	2,649,290	110,462	112,906	110,009	19%	14%	13%
75-79	2,997,698	101,729	139,426	128,018	17%	18%	15%
80-84	2,774,649	72,784	136,908	143,378	12%	17%	16%
85-89	1,858,199	31,226	86,131	127,087	5%	11%	14%
90-94	762,331	5,951	35,176	72,265	1%	4%	8%
95-99	164,796	411	6,606	18,972	0%	1%	2%
100+	15,964	11	436	2,620	0%	0%	0%
Total	**17,681,783**	**588,273**	**785,006**	**877,963**	**100%**	**100%**	**100%**

Chart 20 Survivor Exposures (Ages 50 and over, 2013)



4. Mortality Rates

a) Crude Survivor Mortality Rates by Age and Sex

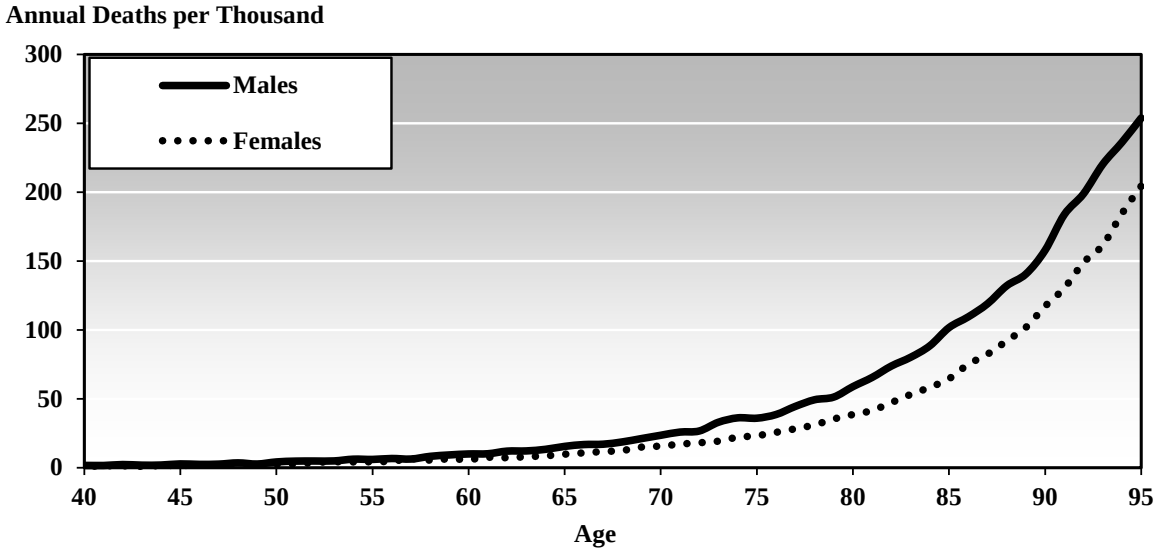
The crude survivor mortality rates for the year 2013 by age and sex are presented in Table 25. The ratio of females to males mortality is an indicator of the average shorter lifetime of males compared to females. However, although males experience a higher level of mortality, the relative gap between the two sexes shows variation by age. The progression of the crude mortality rates for 2013 by age and sex is displayed in Chart 21. Males experience a higher level of mortality than females at all ages. Males show more fluctuations in their crude mortality rates than females due to males' lower exposures.

Table 25 Crude Survivor Mortality Rates(1) (2013)

Age	Annual Deaths per Thousand		Ratio
	Males	Females	Females to Males
50	4.15	2.56	0.62
55	5.98	4.27	0.71
60	9.95	5.94	0.60
65	15.44	9.77	0.63
70	23.52	15.68	0.67
75	35.91	23.18	0.65
80	58.84	38.59	0.66
85	101.67	64.56	0.64
90	157.84	117.24	0.74
95	253.83	204.42	0.81

(1) Age 97 is the highest age for which credible crude mortality rates are available.

Chart 21 Crude Survivor Mortality Rates (2013)



b) Graduated Survivor Mortality Rates by Age and Sex

The graduated survivor mortality rates by age and sex and corresponding ratios of females to males mortality for the year 2013 are presented in Table 26. Detailed graduated mortality rates for year 2013 by individual age and sex are presented in Table 27 and a complete life table for survivors aged 50 and over is presented in Table 58 of the Annex.

Table 26 Graduated Survivor Mortality Rates (2013)

	Annual Deaths per Thousand		Ratio
Age	Males	Females	Females to Males
50	3.93	2.79	0.71
55	6.06	4.68	0.77
60	9.69	6.48	0.67
65	14.79	9.66	0.65
70	23.40	15.56	0.66
75	36.94	23.46	0.64
80	58.91	38.29	0.65
85	98.63	65.50	0.66
90	161.74	121.15	0.75
95	251.20	204.06	0.81
100	357.02	309.94	0.87
105	472.94	425.96	0.90
110	579.33	533.51	0.92
115	663.13	614.51	0.93
120	700.00	650.00	0.93

Although male survivors experience higher mortality than females, the gap narrows as mortality between the sexes converges at older ages. This is reflected in the rising females to males mortality ratio at the older ages as shown in Table 26 and Chart 22. At age 50, female mortality is 71% of male mortality. The females to males mortality ratio shows some variation and reaches a low of 63% at age 73. After age 73, the ratio generally increases, reaching a level of 93% by age 120. Chart 23 presents a comparison of crude and graduated mortality rates.

Chart 22 Ratio of Graduated Survivor Mortality Rates (2013)

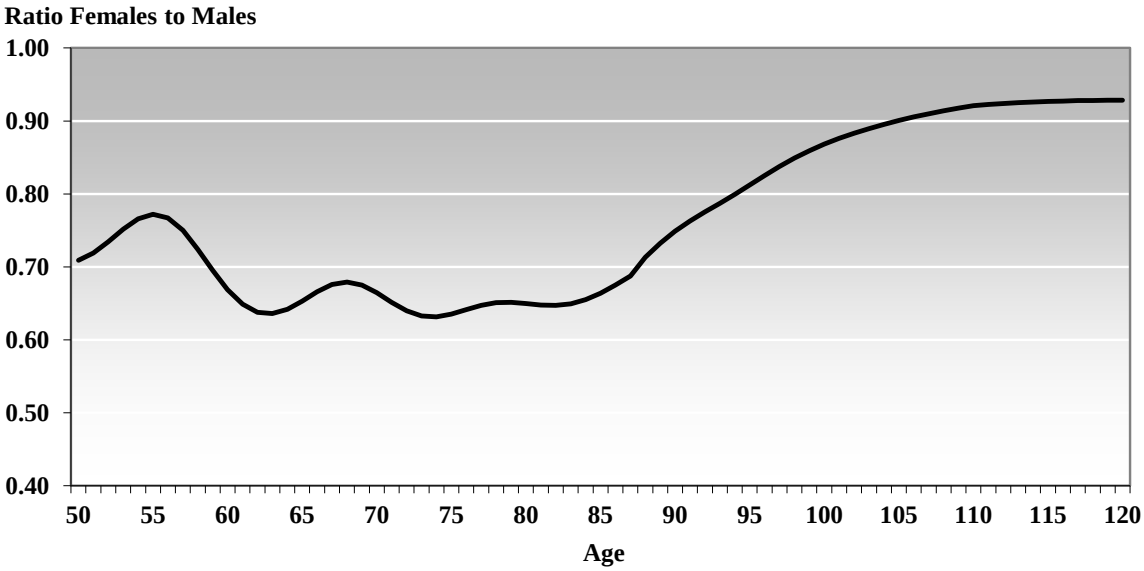
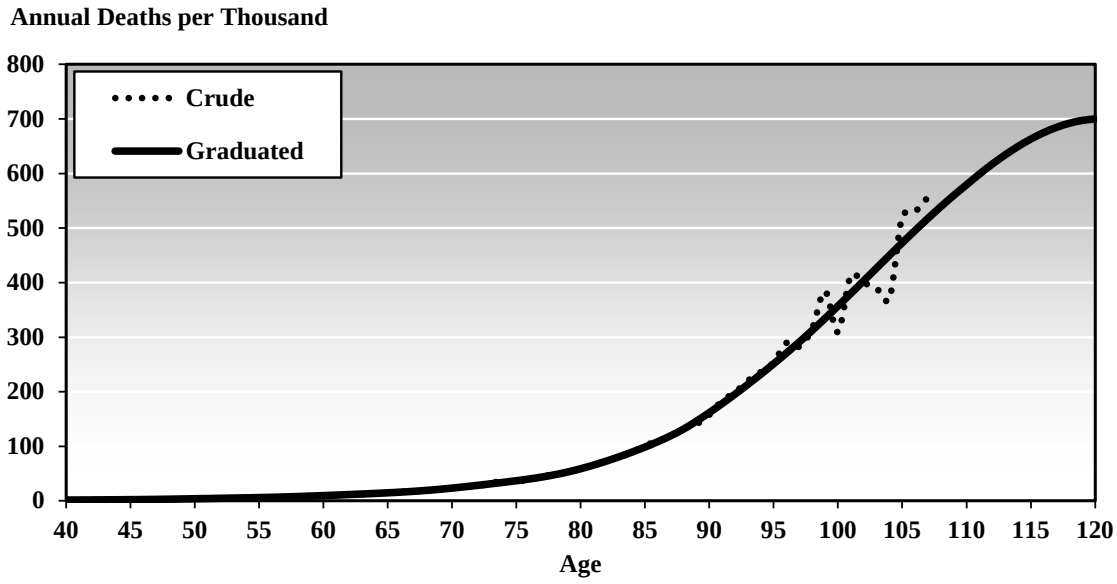


Chart 23 Crude and Graduated Survivor Mortality Rates (2013)

Males



Females

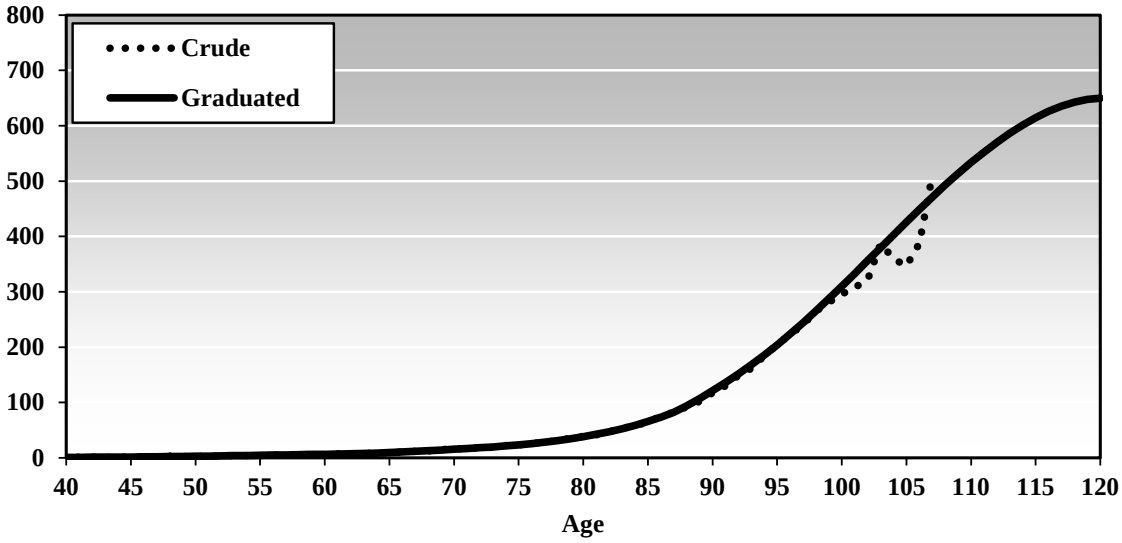


Table 27 Survivor Mortality Rates by Age and Sex (2013)

	Annual Deaths per Thousand		Ratio Females		Annual Deaths per Thousand		Ratio Females		Annual Deaths per Thousand		Ratio Females
Age	Males	Females	to Males	Age	Males	Females	to Males	Age	Males	Females	to Males
35	1.1	0.7	0.60	**66**	16.0	10.7	0.67	**97**	291.3	244.0	0.84
36	1.2	0.7	0.61	**67**	17.5	11.8	0.68	**98**	312.5	265.3	0.85
37	1.2	0.8	0.61	**68**	19.2	13.0	0.68	**99**	334.5	287.4	0.86
38	1.3	0.8	0.61	**69**	21.2	14.3	0.68	**100**	357.0	309.9	0.87
39	1.4	0.9	0.62	**70**	23.4	15.6	0.66	**101**	380.0	332.9	0.88
40	1.5	1.0	0.63	**71**	25.9	16.9	0.65	**102**	403.3	356.2	0.88
41	1.6	1.1	0.65	**72**	28.5	18.3	0.64	**103**	426.6	379.5	0.89
42	1.8	1.2	0.67	**73**	31.3	19.8	0.63	**104**	449.9	402.8	0.90
43	1.9	1.3	0.69	**74**	34.0	21.5	0.63	**105**	472.9	426.0	0.90
44	2.1	1.5	0.71	**75**	36.9	23.5	0.64	**106**	495.6	448.7	0.91
45	2.3	1.6	0.72	**76**	40.1	25.7	0.64	**107**	517.8	471.0	0.91
46	2.5	1.8	0.72	**77**	43.8	28.3	0.65	**108**	539.2	492.7	0.91
47	2.8	2.0	0.71	**78**	48.0	31.3	0.65	**109**	559.8	513.6	0.92
48	3.2	2.2	0.71	**79**	53.1	34.6	0.65	**110**	579.3	533.5	0.92
48	3.5	2.5	0.71	**80**	58.9	38.3	0.65	**115**	663.1	614.5	0.93
50	3.9	2.8	0.71	**81**	65.6	42.5	0.65	**120**	700.0	650.0	0.93
51	4.3	3.1	0.72	**82**	73.0	47.2	0.65				
52	4.8	3.5	0.73	**83**	81.0	52.6	0.65				
53	5.2	3.9	0.75	**84**	89.5	58.6	0.66				
54	5.6	4.3	0.77	**85**	98.6	65.5	0.66				
55	6.1	4.7	0.77	**86**	108.5	73.3	0.68				
56	6.6	5.1	0.77	**87**	119.4	82.1	0.69				
57	7.3	5.4	0.75	**88**	131.6	93.9	0.71				
58	8.0	5.8	0.72	**89**	146.1	107.0	0.73				
59	8.8	6.1	0.70	**90**	161.7	121.2	0.75				
60	9.7	6.5	0.67	**91**	178.3	136.1	0.76				
61	10.6	6.9	0.65	**92**	195.6	151.6	0.78				
62	11.6	7.4	0.64	**93**	213.5	168.1	0.79				
63	12.6	8.0	0.64	**94**	232.0	185.6	0.80				
64	13.7	8.8	0.64	**95**	251.2	204.1	0.81				
65	14.8	9.7	0.65	**96**	271.0	223.6	0.82				

E. Comparison of Survivor Beneficiary and Population Mortality (2011)

In this section, the mortality of the CPP survivor beneficiaries is compared to the mortality of the population of Canada less Québec for the year 2011. The earlier section which compared the mortality of the retirement beneficiary to the population mortality includes a description of how the derivation of the mortality of the population for year 2011 was done.

Tables 28 and Chart 24 show the ratios of CPP survivor beneficiary mortality rates to the population mortality rates by age and sex for year 2011.

CPP survivor beneficiary mortality is seen to be significantly higher than that of the general population. One reason might be that survivors are deeply affected by the loss of their spouse, especially at the older ages where the survivor may already be in a weakened physical and emotional condition. Also, in some cases, one could assume that losing part of the primary source of income and social support adds stress to the survivors. At age 50, the male survivor mortality rate is 33% higher than the mortality rate of the male population, while the female survivor mortality rate is 40% higher than the female population. At age 65, the excess mortality is 31% for males and 34% for females. After age 65, the mortality levels between survivors and the general population gradually converge, with the rate of convergence faster for females.

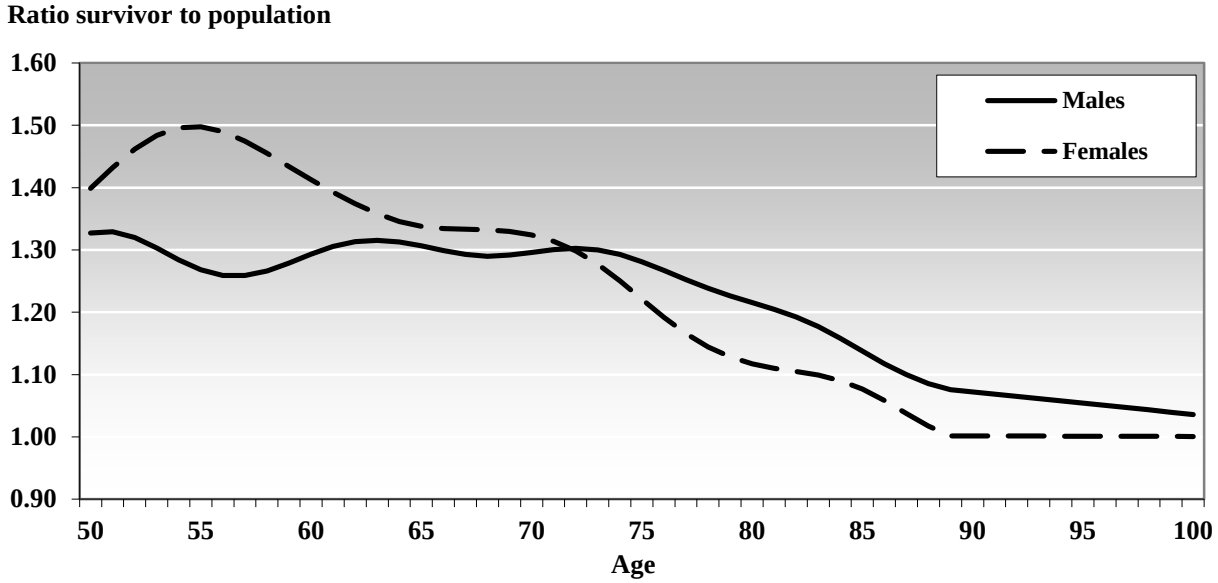
Table 28 Survivor and Population Mortality (2011)

	Males			Females		
	Annual Deaths per Thousand			Annual Deaths per Thousand		
Age	Survivor	Population[(1)]	Ratio Survivor to Population	Survivor	Population[(1)]	Ratio Survivor to Population
50	4.03	3.04	1.33	2.93	2.09	1.40
55	6.32	4.99	1.27	4.75	3.17	1.50
60	10.00	7.73	1.29	6.65	4.71	1.41
65	15.60	11.94	1.31	10.17	7.61	1.34
70	24.54	18.93	1.30	16.06	12.13	1.32
75	38.88	30.35	1.28	24.43	20.00	1.22
80	62.18	51.15	1.22	39.45	35.30	1.12
85	102.95	90.50	1.14	67.55	62.74	1.08
90	167.01	155.77	1.07	120.94	120.75	1.00
95	257.39	244.18	1.05	203.79	203.55	1.00
100	362.95	350.31	1.04	309.67	309.43	1.00

(1) Canada less Québec based on CHMD 2011 Life Tables for Canada and Québec. OCA calculations.

Chart 24 clearly shows that the male and female survivor to population mortality ratio curves have different shapes. Male mortality ratios are generally stable between ages 50 and 75, and thereafter decrease monotonically. Female mortality ratios generally decrease with age, but are higher than for males from age 50 to 70. From age 70 onward, female mortality ratios are lower than for males and continuously decrease until age 90, where it is assumed that female survivor mortality reaches the mortality level of the general population. Table 29 presents the survivor beneficiary mortality rates by individual age and sex for the year 2011and the corresponding survivor to population mortality ratios.

Chart 24 Ratios of Survivor to Population Mortality[(1)] (2011)



(1) Canada less Québec based on CHMD 2011 Life Tables for Canada and Québec. OCA calculations.

Table 29 Ratio of Survivor to Population Mortality (2011)

	Annual Deaths Per Thousand				Mortality Ratios		
	Survivors		General Population[(1)]		Survivors/ Population		Survivors Females /
Age	Male	Female	Male	Female	Male	Female	Males
50	4.0	2.9	3.0	2.1	1.33	1.40	0.73
51	4.5	3.3	3.4	2.3	1.33	1.43	0.73
52	4.9	3.6	3.7	2.5	1.32	1.46	0.74
53	5.4	4.0	4.1	2.7	1.30	1.48	0.75
54	5.8	4.4	4.5	2.9	1.28	1.50	0.75
55	6.3	4.8	5.0	3.2	1.27	1.50	0.75
56	6.9	5.1	5.5	3.4	1.26	1.49	0.74
57	7.5	5.5	6.0	3.7	1.26	1.47	0.73
58	8.3	5.8	6.5	4.0	1.27	1.45	0.71
59	9.1	6.2	7.1	4.3	1.28	1.43	0.68
60	10.0	6.7	7.7	4.7	1.29	1.41	0.67
61	11.0	7.2	8.4	5.1	1.31	1.39	0.65
62	12.0	7.8	9.2	5.7	1.31	1.37	0.64
63	13.2	8.5	10.0	6.2	1.32	1.36	0.64
64	14.3	9.3	10.9	6.9	1.31	1.35	0.65
65	15.6	10.2	11.9	7.6	1.31	1.34	0.65
66	17.0	11.2	13.1	8.4	1.30	1.33	0.66
67	18.5	12.3	14.3	9.2	1.29	1.33	0.66
68	20.3	13.5	15.7	10.1	1.29	1.33	0.67
69	22.3	14.7	17.3	11.1	1.29	1.33	0.66
70	24.5	16.1	18.9	12.1	1.30	1.32	0.65
71	27.0	17.5	20.8	13.3	1.30	1.31	0.65
72	29.7	18.9	22.8	14.6	1.30	1.30	0.64
73	32.6	20.6	25.1	16.1	1.30	1.28	0.63
74	35.6	22.4	27.6	17.9	1.29	1.25	0.63
75	38.9	24.4	30.4	20.0	1.28	1.22	0.63
76	42.4	26.8	33.5	22.4	1.27	1.19	0.63
77	46.4	29.4	37.1	25.2	1.25	1.17	0.63
78	51.0	32.4	41.2	28.3	1.24	1.14	0.63
79	56.2	35.7	45.8	31.6	1.23	1.13	0.63
80	62.2	39.4	51.2	35.3	1.22	1.12	0.63
81	68.9	43.7	57.2	39.4	1.20	1.11	0.63
82	76.4	48.5	64.0	43.9	1.19	1.11	0.64
83	84.6	54.1	71.8	49.2	1.18	1.10	0.64
84	93.4	60.4	80.7	55.4	1.16	1.09	0.65
85	103.0	67.5	90.5	62.7	1.14	1.08	0.66
86	113.3	75.7	101.4	71.5	1.12	1.06	0.67
87	124.6	84.8	113.3	81.8	1.10	1.04	0.68
88	137.1	95.2	126.3	93.6	1.09	1.02	0.69
89	151.1	106.8	140.5	106.6	1.08	1.00	0.71
90	167.0	120.9	155.8	120.7	1.07	1.00	0.72
95	257.4	203.8	244.2	203.6	1.05	1.00	0.79
100	362.9	309.7	350.3	309.4	1.04	1.00	0.85
105	476.9	425.8	468.5	425.6	1.02	1.00	0.89
110	579.3	533.5	579.3	533.5	1.00	1.00	0.92
115	663.1	614.5	663.1	614.5	1.00	1.00	0.93
120	700.0	650.0	700.0	650.0	1.00	1.00	0.93

(1) Derived from CHMD Canada and Québec Tables using the 2011 population as weights.

F. Survivor Mortality Improvement Rates

1. Comparison by Age and Sex

Table 30 and Charts 25 and 26 show the annual mortality improvement rates for survivor beneficiaries over the last 15 years (1998 to 2013) and last 5 years (2008 to 2013). The table and charts also show the improvement rates that were assumed for the 26th CPP Actuarial Report for the first five years (2009-2014) of the mortality projection in the report. Improvement rates at very advanced ages (95 and over) should be interpreted with caution due to low exposures, greater variation of results, and the effects of the graduation at the advanced ages.

As shown in Table 30, over the last 15 years, male survivor beneficiary mortality improvement rates for ages 65 to 79 are between 1.1 and 1.4 percentage points higher than female rates, while the differential is smaller for ages 50 to 64 and ages 80 and over. For the most recent 5 years, survivor beneficiary mortality improvement rates are generally higher than those observed over the last 15 years.

For those aged 65 to 74, male mortality improvements observed over the last 5 years are lower than those assumed for the first 5 years of projection under the 26th CPP Actuarial Report, while females mortality improvements observed over the same period are slightly higher. For ages 75 and over, mortality improvements observed over the last 5 years are higher than assumed under the first five years of the 26th CPP Actuarial Report for both sexes.

A comparison of annual mortality improvement rates over the last 15 years between survivor beneficiaries and retirement beneficiaries (Table 13) shows that for both males and females in age group 65 to 94, the mortality improvement rates for retirement beneficiaries (2.3% for males and 1.7% for females) are greater than the mortality improvement rates experienced by survivor beneficiaries (2.1% for males and 1.3% for females).

Table 30 Average Annual Survivors Mortality Improvement Rates

Age Group	1998-2013(1)		2008-2013(1)		26th CPP AR (2009-2014)(2)	
	Males	Females	Males	Females	Males	Females
50-64	2.0%	1.7%	2.5%	2.7%	1.9%	1.6%
65-69	2.7%	1.6%	2.5%	2.0%	2.6%	1.6%
70-74	2.9%	1.5%	1.8%	1.9%	2.9%	1.7%
75-79	2.9%	1.5%	4.3%	1.5%	2.6%	1.7%
80-84	2.2%	1.4%	2.3%	1.5%	2.3%	1.6%
85-89	1.7%	1.3%	2.1%	1.8%	1.9%	1.4%
90-94	1.0%	1.0%	1.7%	0.8%	1.3%	1.2%
95-99	-0.1%	0.5%	1.4%	1.2%	0.8%	0.8%
65-94	2.1%	1.3%	2.4%	1.4%	2.3%	1.5%
65-74	2.8%	1.5%	2.0%	1.9%	2.7%	1.7%
75-89	2.2%	1.4%	2.7%	1.7%	2.2%	1.5%

(1) Improvement rates obtained using the corresponding 2013 exposures and populations as weights.
(2) 26th CPP Actuarial Report improvement rates for 2009-2014 are for Canada less Québec.

Chart 25 Average Annual Survivor Mortality Improvement Rates (Males)

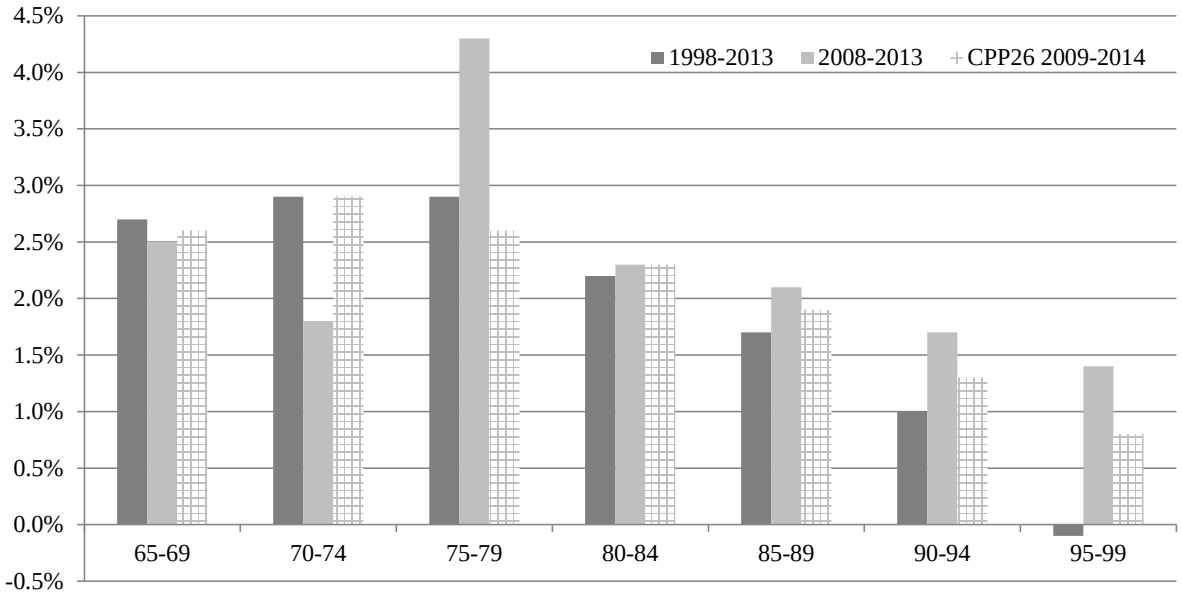
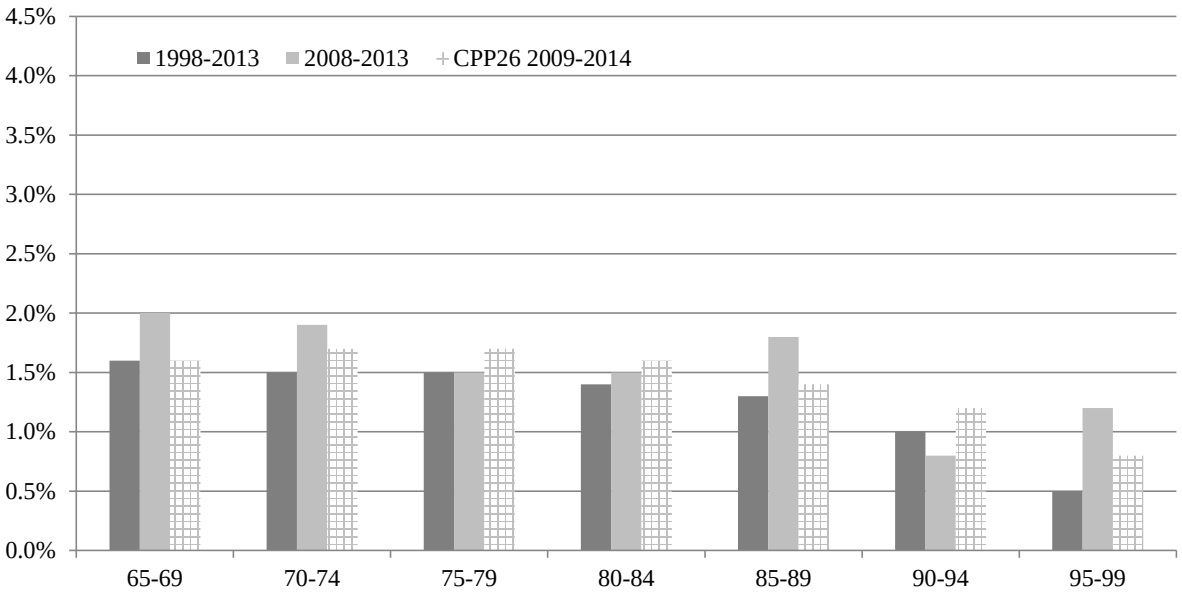


Chart 26 Average Annual Survivor Mortality Improvement Rates (Females)



2. Comparison with Population

Table 31 presents a comparison of survivor beneficiary mortality improvement rates with those of the population of Canada less Québec. Since population mortality statistics are only available through to year 2011, the last 15 and 5 years comparison periods have been set to 1996 to 2011 and 2006 to 2011. Over the period 1996-2011, male survivor beneficiary mortality improved at a lower rate than that the population at ages 75 and older, while for females, lower improvements in survivor beneficiary mortality relative to the population occurred at all ages. For the more recent period 2006-2011, survivors' mortality improvements have been generally lower than those of the population.

Table 31 Population and Survivor Average Annual Mortality Improvement Rates

Age Group	Males				Females			
	1996-2011		2006-2011		1996-2011		2006-2011	
	Survivor	Population[(1)]	Survivor	Population[(1)]	Survivor	Population[(1)]	Survivor	Population[(1)]
50-64	2.2%	1.9%	2.0%	2.2%	1.4%	1.7%	2.6%	1.9%
65-69	3.0%	2.8%	2.3%	2.7%	1.7%	1.9%	1.9%	2.2%
70-74	2.9%	2.9%	2.1%	3.0%	1.3%	1.8%	2.1%	2.2%
75-79	2.5%	2.7%	2.2%	3.0%	1.4%	2.0%	1.4%	2.0%
80-84	2.0%	2.6%	2.2%	2.3%	1.4%	2.0%	1.3%	1.7%
85-89	1.5%	1.8%	1.6%	2.4%	1.2%	1.5%	1.6%	2.5%
90-94	0.9%	1.1%	2.3%	1.9%	0.9%	1.0%	1.2%	1.2%
95-99	-0.4%	0.6%	-1.4%	1.6%	0.7%	0.6%	1.0%	1.2%
65-94	1.9%	2.4%	2.1%	2.6%	1.2%	1.7%	1.5%	1.9%
65-74	2.9%	2.9%	2.2%	2.9%	1.4%	1.9%	2.0%	2.2%
75-89	1.9%	2.4%	2.0%	2.6%	1.3%	1.8%	1.5%	2.1%

(1) Population mortality improvement rates are based on CHMD data for the period 1996 to 2011, using 2011 population as weights. Population mortality improvement rates are for Canada less Québec based on CHMD data for Canada and Québec. OCA calculations.

G. Survivors Period Life Expectancies

1. Comparison by Age and Sex

Table 32 shows period life expectancies (without future mortality improvements) of survivor beneficiaries based on the graduated mortality rates obtained for year 2013. For comparison, the table also shows the population life expectancies as projected under the 26th CPP Actuarial Report. At age 50, CPP survivor beneficiary life expectancies are lower than life expectancies of the general population by 2.0 years for males and 1.7 years for females. By age 80, the differentials fall to 0.8 and 0.5 of a year for males and females, respectively.

Table 32 Survivor Period Life Expectancies (2013)

Age	Males			Females		
	Survivor	Population[(1)]	Difference	Survivor	Population[(1)]	Difference
50	30.2	32.2	2.0	33.9	35.6	1.7
55	25.9	27.7	1.8	29.4	31.0	1.6
60	21.7	23.5	1.8	25.1	26.5	1.4
65	17.9	19.4	1.5	21.0	22.2	1.2
70	14.3	15.6	1.3	17.1	18.1	1.0
75	11.1	12.1	1.0	13.5	14.2	0.7
80	8.3	9.1	0.8	10.3	10.8	0.5
85	6.0	6.6	0.6	7.4	7.8	0.4
90	4.2	4.6	0.4	5.0	5.4	0.4

(1) As projected in 2013 in the 26th CPP Actuarial Report (Canada less Quebec).

The evolution of survivor period life expectancies at age 65 is presented in Table 33 and Charts 27 and 28. The difference in survivor life expectancy at age 65 between males and females reduced from a peak of 5.3 years in 1992 to 3.1 years by 2013. The difference in male life expectancies at age 65 between the population and survivors has hovered around 1.5 since 1991, while for females the difference increased gradually from 0.4 of a year in 1990 to 1.2 years in 2013.

Table 33 Survivor Period Life Expectancies at Age 65 (1990-2013)

	Males			Females			
Year	Survivor	Population[(1)]	Difference with Population	Survivor	Population[(1)]	Difference with Population	Difference with Males
1990	14.6	15.8	1.2	19.3	19.7	0.4	4.7
1991	14.3	15.8	1.5	19.1	19.8	0.7	4.8
1992	14.4	15.9	1.5	19.6	20.0	0.4	5.3
1993	14.3	15.9	1.6	19.3	19.8	0.5	5.0
1994	14.5	16.0	1.5	19.3	19.8	0.5	4.8
1995	14.8	16.1	1.3	19.3	19.9	0.6	4.4
1996	14.7	16.1	1.4	19.2	19.9	0.7	4.5
1997	14.9	16.3	1.4	19.3	20.0	0.7	4.4
1998	15.0	16.4	1.4	19.3	20.0	0.7	4.3
1999	15.1	16.5	1.4	19.5	20.2	0.7	4.4
2000	15.2	16.9	1.7	19.6	20.3	0.7	4.3
2001	15.6	17.1	1.5	19.7	20.5	0.8	4.1
2002	15.8	17.3	1.5	19.8	20.6	0.8	4.0
2003	15.8	17.4	1.6	19.8	20.7	0.9	4.0
2004	16.1	17.7	1.6	19.9	20.9	1.0	3.8
2005	16.4	17.9	1.5	20.0	21.0	1.0	3.7
2006	16.7	18.2	1.5	20.2	21.2	1.0	3.5
2007	16.6	18.2	1.6	20.2	21.3	1.1	3.6
2008	16.9	18.4	1.5	20.4	21.4	1.0	3.5
2009	17.0	18.7	1.7	20.6	21.7	1.1	3.6
2010	17.4	18.9	1.5	20.6	21.8	1.2	3.2
2011	17.4	19.1	1.7	20.8	21.9	1.1	3.4
2012	17.6	19.2	1.6	21.0	22.1	1.1	3.4
2013	17.9	19.4	1.5	21.0	22.2	1.2	3.1

(1) From 26th CPP Actuarial Report (Canada less Quebec).

Chart 27 Males Survivor Period Life Expectancy at Age 65 (1990-2013)

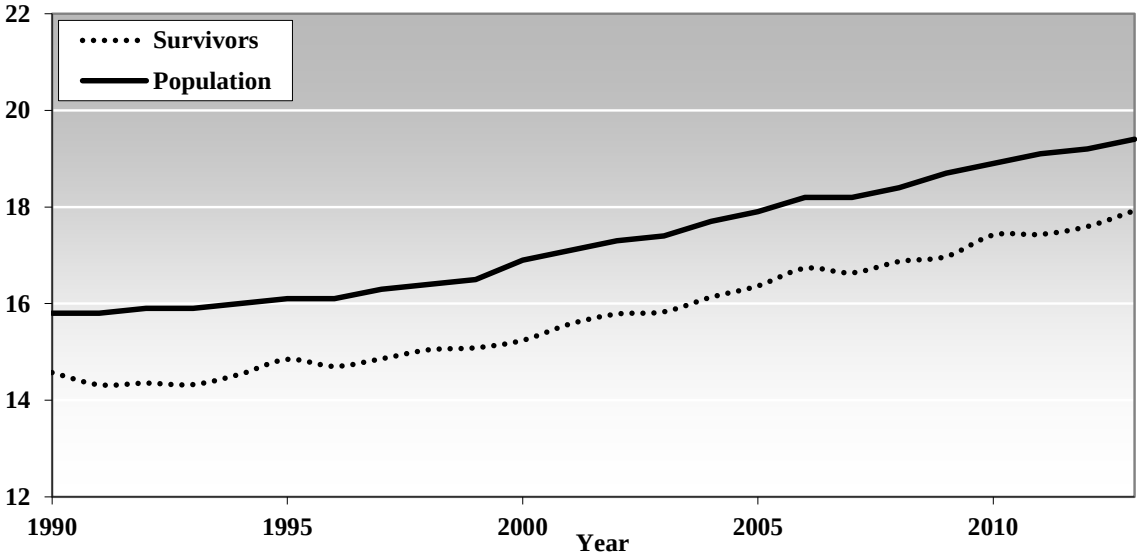
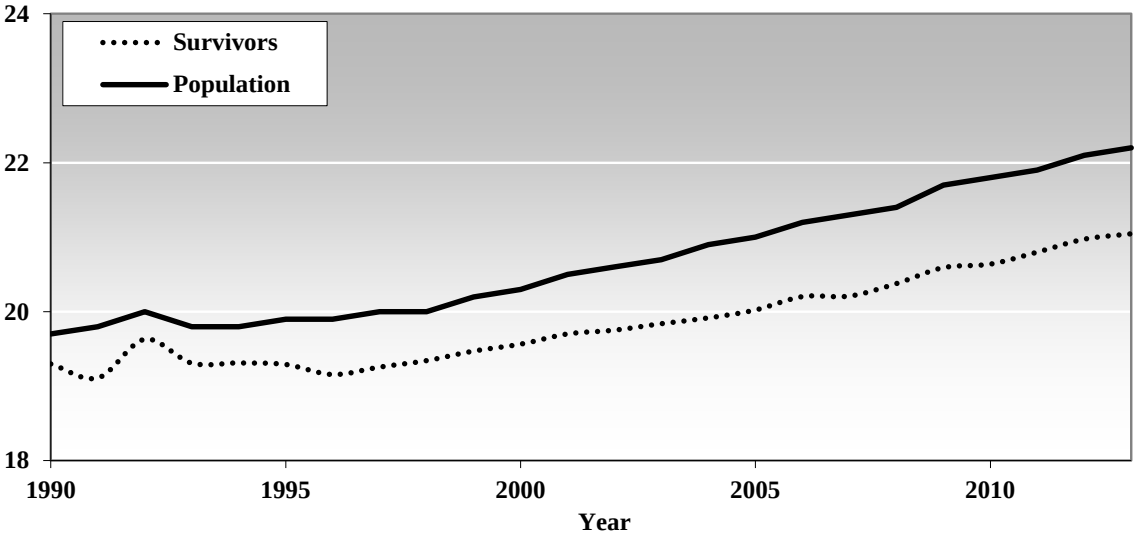


Chart 28 Females Survivor Period Life Expectancy at Age 65 (1990-2013)



V. CPP Disability Beneficiary Mortality

A. Introduction

This section presents the methodology and overall results of the study on the mortality of CPP disability beneficiaries. This section only covers the aggregate mortality experience of disability beneficiaries and does not cover mortality by duration of disability. A more detailed analysis of disability mortality by duration and cause was discussed in the OCA's Actuarial Study No. 9 (published in 2011) and an update to that more detailed analysis will be provided in a future study.

B. Disability Benefit Eligibility

A person is considered disabled if he or she is determined to be suffering from a severe and prolonged mental or physical disability. A disability is considered severe if by reason of it the person is regularly incapable of pursuing any substantially gainful occupation; a disability is considered prolonged if it is likely to be long-term and of indefinite duration or is likely to result in death.

A person who becomes disabled prior to age 65 and is not receiving a CPP retirement pension is eligible for a disability benefit provided that contributions have been made, at the time of disablement, for at least four of the previous six calendar years, counting years included either wholly or partly in the contributory period. Since 2008, contributors with 25 or more years of contributions to the Plan can meet the eligibility requirement with contributions in three of the last six years. Contributions must be on earnings that are not less than 10% of the YMPE rounded, if necessary, to the next lower multiple of $100.

C. Amount of Disability Pension

The amount of monthly benefit payable is the sum of a flat-rate portion ($465.84 in 2015) depending only on the year in which the benefit is payable and an earnings-related portion equal, when it commences, to 75% of the retirement pension under the Plan that would be payable at the onset of disability if the contributory period ended on that date and no actuarial adjustment applied. The automatic conversion of a disability benefit to a retirement pension at age 65 is based on the pensionable earnings at the time of disablement, price-indexed to age 65. In other words, the indexing from the time of disablement to age 65, which determines the initial rate of the retirement pension, is in line with increases in prices rather than wages. In the case that both a disability and survivor benefit are payable, the monthly amount of the disability benefit is reduced. The maximum monthly disability benefit in 2015 is $1,264.59.

D. Disability Mortality Experience for Year 2011

1. Beneficiaries

Historical data on the number of disability beneficiaries by age group and sex are presented in Table 34. The number of male beneficiaries has increased by 8% from about 156,000 in 1991 to 169,000 in 2011. Over the same period, the number of female beneficiaries almost doubled, increasing by 92% from about 99,000 in 1991 to 190,000 in 2011. The steeper increase in the number of female disability beneficiaries can be attributed to the increased labour force participation of females (and hence CPP benefit eligibility). In 2011, there were 359,000 disability beneficiaries in total (53% female) and the proportion of beneficiaries who were aged 50 and over was about 75% for both males and females. From 1991 to 2011 the average age of disability beneficiaries remained relatively stable for males at about 54 between 1991 and 2011 and slightly increased for females from 53.0 in 1991 to 54.1 in 2011. The number of beneficiaries for the year 2011 by individual age and sex is presented in Table 59 of the Annex.

Table 34 Disability Beneficiaries (1st July)

	Males					
	Number			Distribution		
Age Group	1991	2001	2011	1991	2001	2011
< 30	2,074	1,079	1,338	1%	1%	1%
30-34	4,390	3,112	2,719	3%	2%	2%
35-39	7,018	7,982	5,274	4%	5%	3%
40-44	10,668	13,769	10,168	7%	9%	6%
45-49	14,025	19,448	20,378	9%	12%	12%
50-54	21,639	28,332	31,130	14%	18%	18%
55-59	38,815	36,970	44,212	25%	23%	26%
60-64	57,532	46,952	53,685	37%	30%	32%
Total	**156,161**	**157,644**	**168,904**	**100%**	**100%**	**100%**
Average Age	**54.4**	**53.5**	**54.4**			

	Females					
	Number			Distribution		
Age Group	1991	2001	2011	1991	2001	2011
< 30	1,428	797	1,046	1%	1%	1%
30-34	3,296	3,111	3,048	3%	2%	2%
35-39	5,819	8,784	6,358	6%	6%	3%
40-44	8,439	14,790	12,503	9%	10%	7%
45-49	10,794	21,450	24,530	11%	14%	13%
50-54	15,687	29,445	37,009	16%	20%	19%
55-59	24,122	33,847	49,445	24%	23%	26%
60-64	29,528	37,589	55,950	30%	25%	29%
Total	**99,113**	**149,813**	**189,889**	**100%**	**100%**	**100%**
Average Age	**53.0**	**52.6**	**54.1**			

2. Deaths

Table 35 presents the number of disability deaths by age group and sex. Of the 9,700 observed deaths in 2011, 58% were males. Disability beneficiary deaths by individual ages for years 1991, 2001 and 2011 are presented in Table 60 of the Annex. Over the period 1990 to 2011 there were 206,000 observed deaths in total (64% from males). The median age at death of disabled males remained at about 57 in both 1991 and 2011, while for females it increased from 54 to 56 over the same period.

Although there was an increase in total male exposures (see Table 36) between 1991 and 2011, there was a decrease in the total number of male deaths over the same period (from 6,437 in 1991 to 5,590 in 2011). As will be discussed further (see Section E) this counterintuitive result can be linked to the relative prevalence of deaths due to neoplasms and how mortality rates due to neoplasms have decreased over that period.

For females, the increase in the number of deaths (from 2,552 to 4,106) is mainly linked to the historical increase in eligibility of females to the CPP disability benefit, resulting from their increased labour force participation. This increase due to eligibility more than offsets the impact of lower neoplasms related mortality for females.

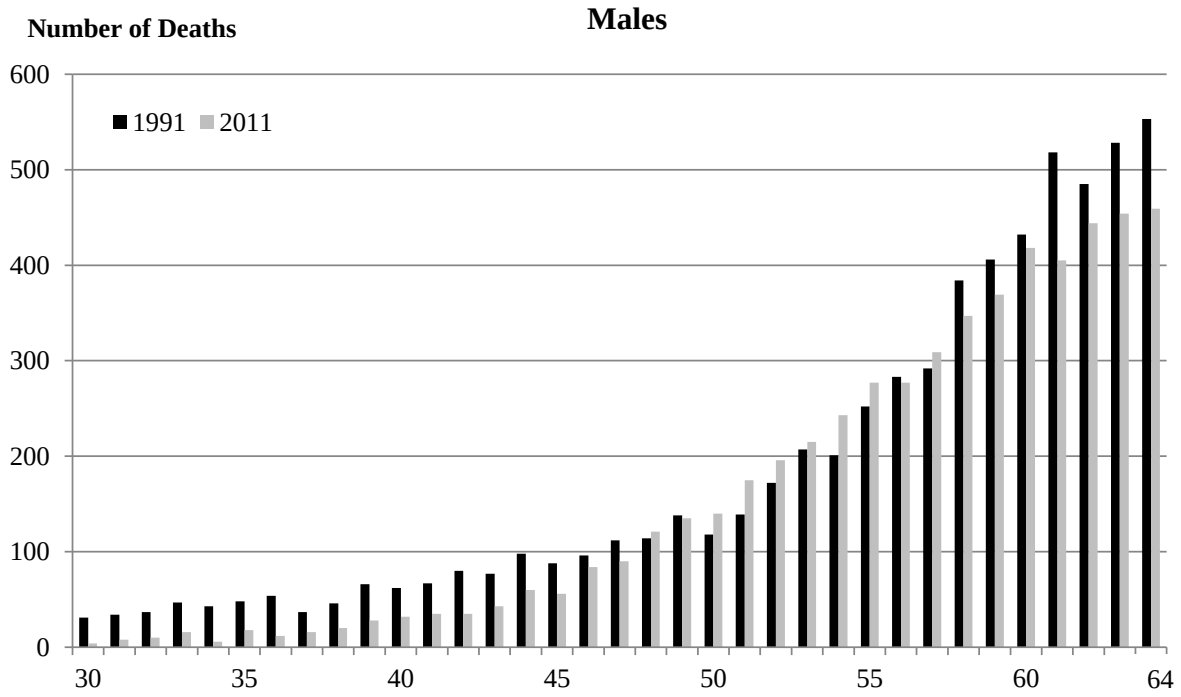
Table 35 Disability Deaths (1990-2011)

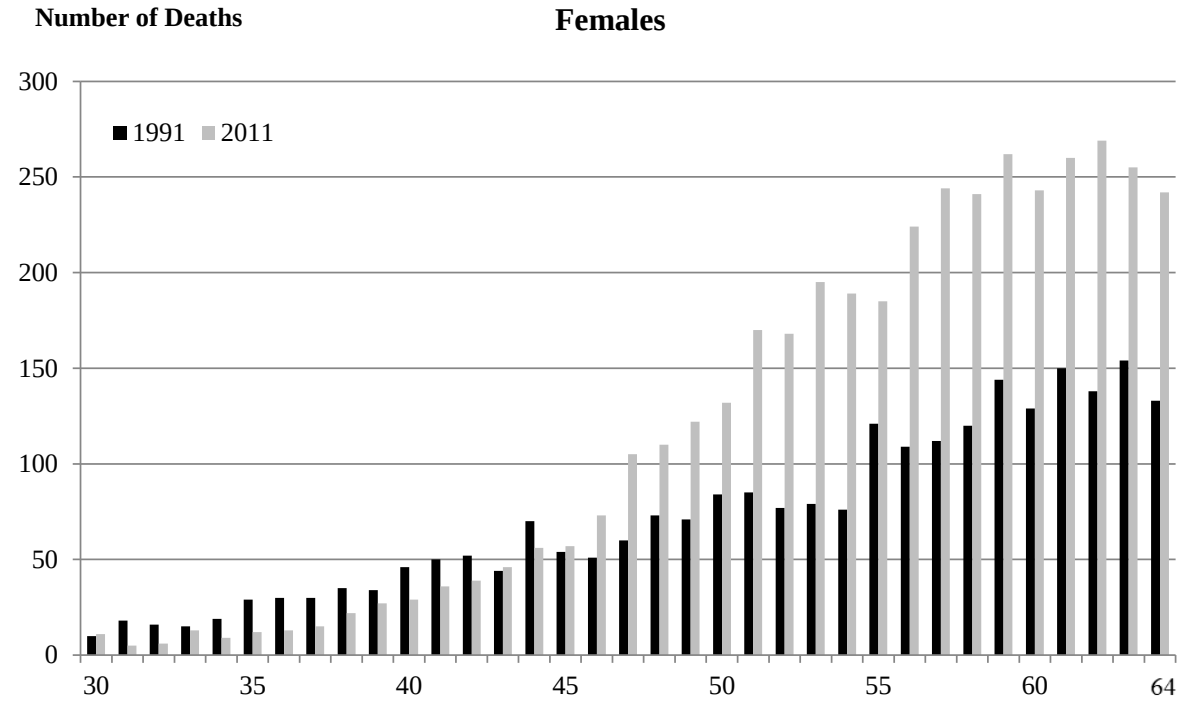
	Males						
	Number				Distribution		
Age Group	1990-2011	1991	2001	2011	1991	2001	2011
< 30	1,149	92	36	33	1%	1%	1%
30-34	2,482	192	71	44	3%	1%	1%
35-39	4,388	251	152	94	4%	3%	2%
40-44	7,325	384	325	205	6%	6%	4%
45-49	12,589	548	552	486	9%	11%	9%
50-54	21,123	837	931	969	13%	18%	17%
55-59	34,222	1,617	1,374	1,579	25%	26%	28%
60-64	47,634	2,516	1,809	2,180	39%	34%	39%
Total	**130,912**	**6,437**	**5,250**	**5,590**	**100%**	**100%**	**100%**
Median Age	**56.7**	**57.2**	**56.3**	**57.3**			

	Females						
	Number				Distribution		
Age Group	1990-2011	1991	2001	2011	1991	2001	2011
< 30	635	34	24	21	1%	1%	1%
30-34	1,408	78	58	44	3%	2%	1%
35-39	3,087	158	147	89	6%	4%	2%
40-44	5,952	262	284	206	10%	9%	5%
45-49	9,797	309	447	467	12%	14%	11%
50-54	14,389	401	691	854	16%	21%	21%
55-59	19,032	606	781	1,156	24%	24%	28%
60-64	20,604	704	852	1,269	28%	26%	31%
Total	**74,904**	**2,552**	**3,284**	**4,106**	**100%**	**100%**	**100%**
Median Age	**54.6**	**54.3**	**53.9**	**55.8**			

Chart 29 shows the change in the distribution of deaths by age and sex between 1991 and 2011. It illustrates that the median age at death for males has remained relatively stable while it has increased for females over the period. In 2011, the number of disability deaths peaked at age 64 for males and age 62 for females.

Chart 29 Distribution of Disability Deaths (Ages 30 and over, 1991 and 2011)





3. Exposures

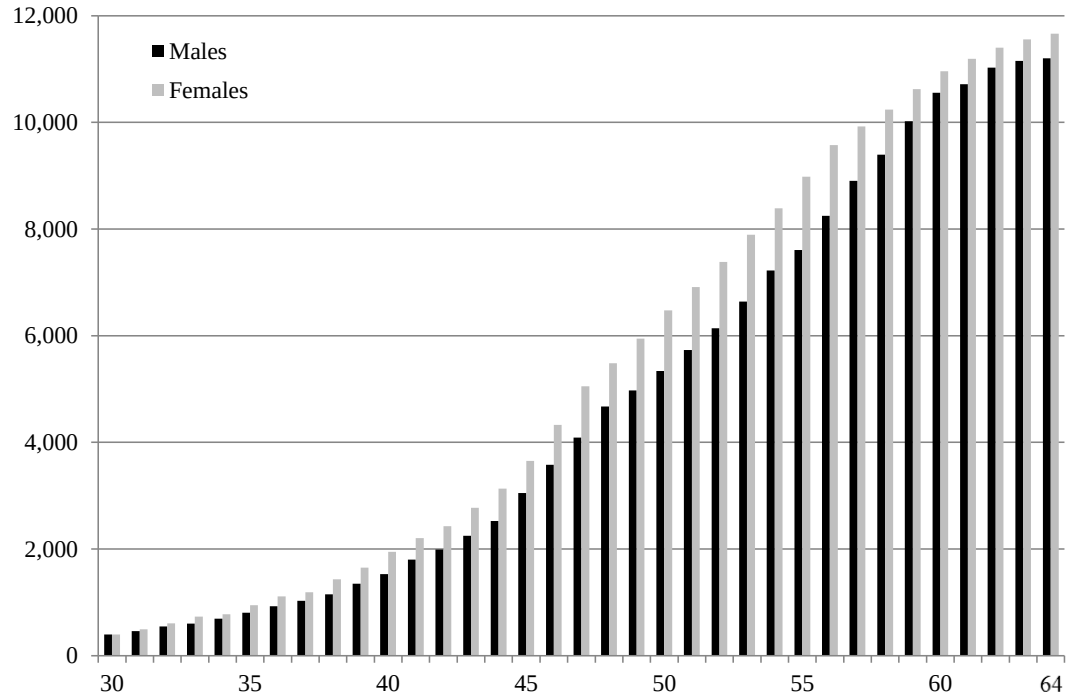
Table 36 and Chart 30 highlight the fact that in 2011, about 75% of the exposures were within the age groups of 50 and over for both males and females. Exposures of CPP disability beneficiaries by individual ages for the year 2011 are presented in Table 61 of the Annex.

Table 36 Disability Exposures (1990-2011)

	Males						
	Number				Distribution		
Age Group	1990-2011	1991	2001	2011	1991	2001	2011
< 30	34,175	2,045	1,082	1,325	1%	1%	1%
30-34	81,607	4,324	3,060	2,701	3%	2%	2%
35-39	164,802	6,947	7,989	5,261	4%	5%	3%
40-44	280,314	10,503	13,666	10,099	7%	9%	6%
45-49	423,637	13,896	19,466	20,360	9%	12%	12%
50-54	603,435	21,417	28,246	31,077	14%	18%	18%
55-59	888,792	38,505	37,046	44,176	25%	23%	26%
60-64	1,190,307	58,565	47,973	54,647	37%	30%	32%
Total	**3,667,069**	**156,202**	**158,528**	**169,647**	100%	100%	100%

	Females						
	Number				Distribution		
Age Group	1990-2011	1991	2001	2011	1991	2001	2011
< 30	25,599	1,376	794	1,037	1%	1%	1%
30-34	76,044	3,265	3,100	3,009	3%	2%	2%
35-39	168,667	5,749	8,693	6,327	6%	6%	3%
40-44	295,368	8,262	14,778	12,480	8%	10%	7%
45-49	444,151	10,601	21,387	24,461	11%	14%	13%
50-54	607,898	15,402	29,369	37,055	16%	20%	19%
55-59	794,467	23,795	33,830	49,339	24%	23%	26%
60-64	900,248	29,974	38,325	56,769	30%	26%	30%
Total	**3,312,441**	**98,425**	**150,276**	**190,478**	100%	100%	100%

Chart 30 DisabilityExposures (Ages 30 and over, 2011)



4. Disability Mortality Rates

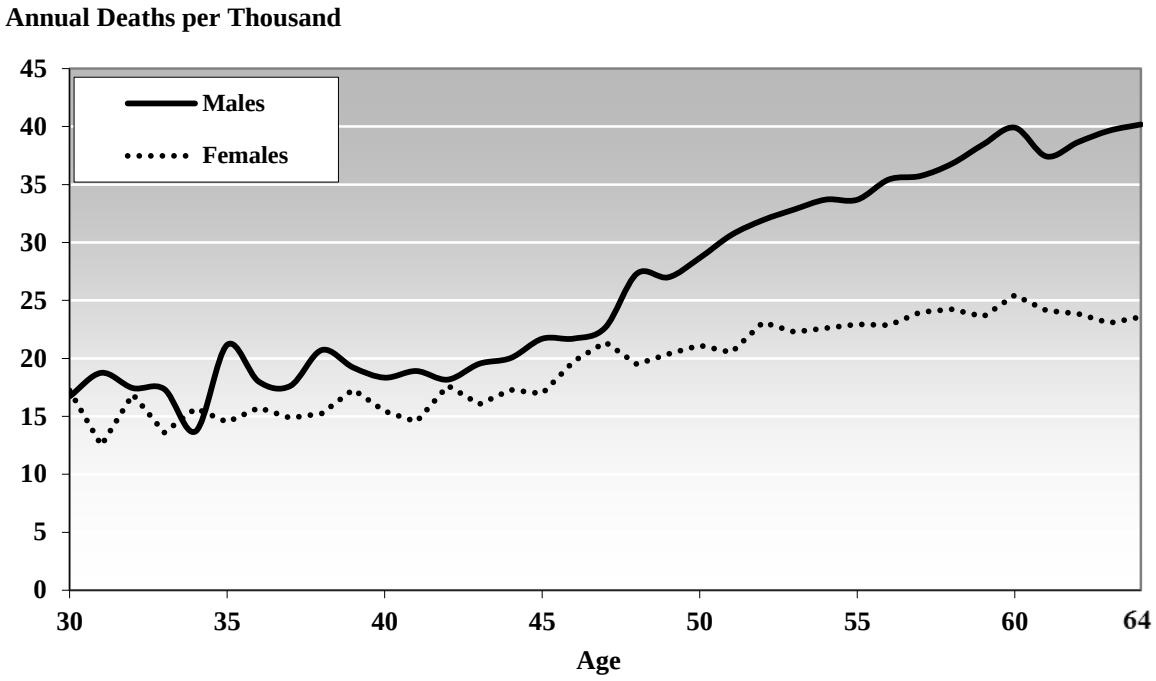
a) Crude Disability Mortality Rates by Age and Sex

The crude disability mortality rates for the year 2011 by age and sex are presented in Table 37. With a few exceptions at the younger ages, the ratio of females to males mortality rates is an indicator of the lower mortality experienced by females compared to males. The progression of the crude mortality rates for 2011 by age and sex is displayed in Chart 31. Males experience a higher level of mortality than females at nearly all ages, and the relative gap between the two sexes increases with age as the mortality rates of females increase at a much slower rate. Some of the differential between the sexes can be explained by the difference in the distribution of deaths by cause between males and females. For example, for females aged 20 to 49, the ratio of females to males mortality would be about 18% lower if the distribution of female deaths was similar to those for males. This results from female deaths being slightly more distributed toward neoplasms (with highest mortality) than for males. This is further explored in Section E below.

Table 37 Crude Disability Mortality Rates (2011)

Age	Annual Deaths per Thousand		Ratio
	Males	Females	Females to Males
30	16.7	17.2	1.03
35	21.2	14.5	0.68
40	18.3	15.4	0.84
45	21.7	16.9	0.78
50	28.7	21.1	0.74
55	33.7	22.9	0.68
60	39.9	25.5	0.64
64	40.2	23.6	0.59

Chart 31 Crude Disability Mortality Rates (2011)



b) Graduated Disability Mortality Rates by Age and Sex

The graduated disability mortality rates by age and sex and the corresponding ratios of females to males mortality for the year 2011 are presented in Table 38. Table 40 shows the graduated disability mortality rates by individual ages and sex for the year 2011. A life table based on no other decrement than CPP disability mortality by individual ages for the year 2011 is presented in Table 62 of the Annex. A comparison of crude and graduated disability mortality rates for both sexes is shown in Chart 32.

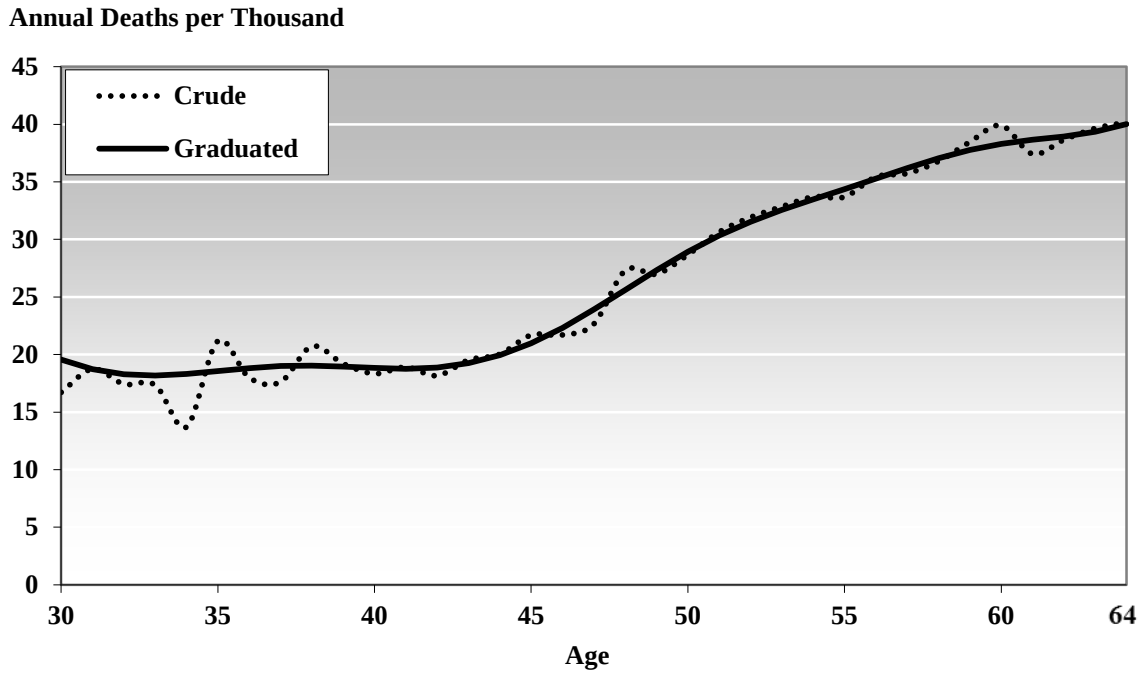
Male disability beneficiaries experience higher mortality than females, and the gap increases with age after age 44. Chart 33 and Table 40 illustrate the decreasing females to males mortality ratio at the middle to older ages. Up to age 45, female mortality ratios varies somewhat, with an average level of about 85% of male mortality. For ages 45 and above, the ratio of females to males mortality decreases steadily and reaches a low of 57% at age 64.

Table 38 Graduated Disability Mortality Rates (2011)

Age	Annual Deaths per Thousand		Ratio
	Males	Females	Females to Males
30	19.6	17.2	0.88
35	18.6	14.8	0.79
40	18.8	15.5	0.82
45	21.0	17.8	0.85
50	28.9	20.7	0.72
55	34.4	22.5	0.65
60	38.3	23.9	0.62
64	40.0	22.7	0.57

Chart 32 Crude and Graduated Disability Mortality Rates (2011)

Males



Females

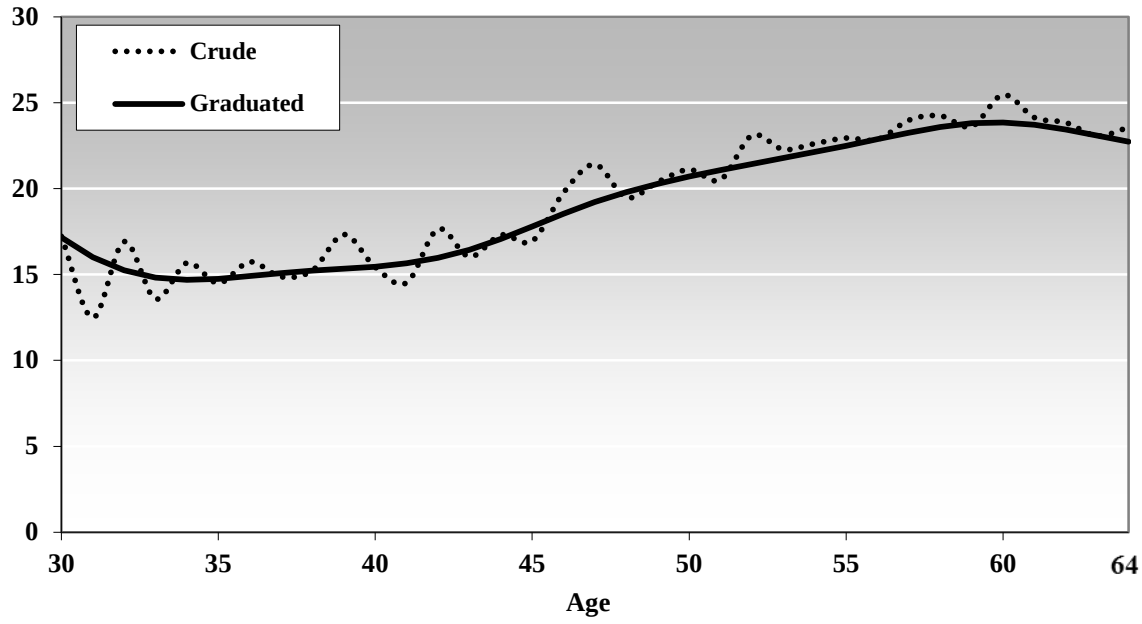
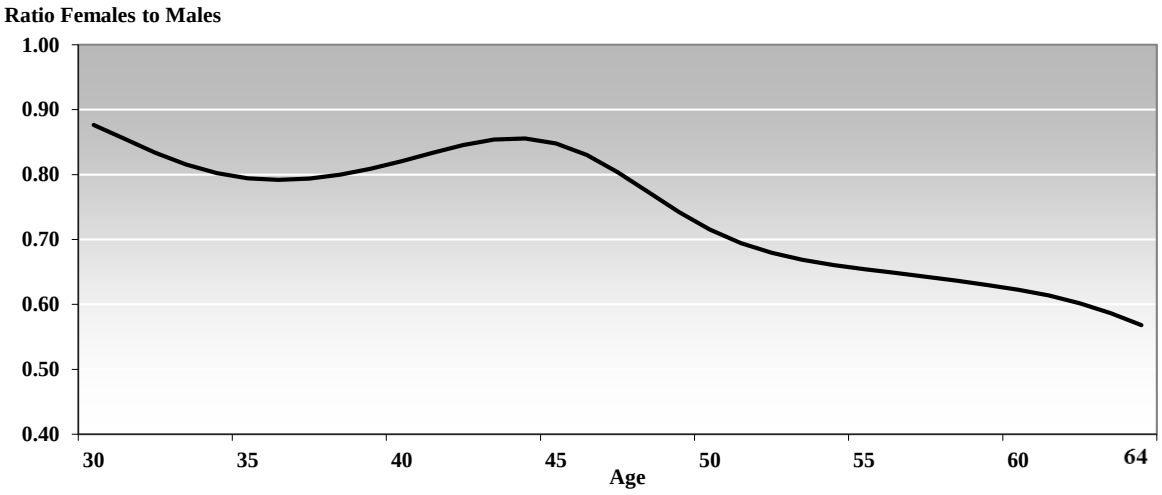


Chart 33 Ratio of Graduated Disability Mortality Rates (2011)



5. Comparison of Disability Beneficiary and Population Mortality

As expected, since receipt of the CPP disability benefit requires that the disability be severe and long-term and of indefinite duration or is likely to result in death, mortality of disability beneficiaries is much greater than that of the general population. As shown in Table 39, at 35 deaths per thousand for males and 23 deaths per thousand for females, mortality rates of disability beneficiaries aged 50 to 64 in 2011 are on average six times higher than that of the general population. For a 50 year old disability beneficiary, such level of mortality is about equal to that an individual aged 75 in the general population, as shown in Chart 34.

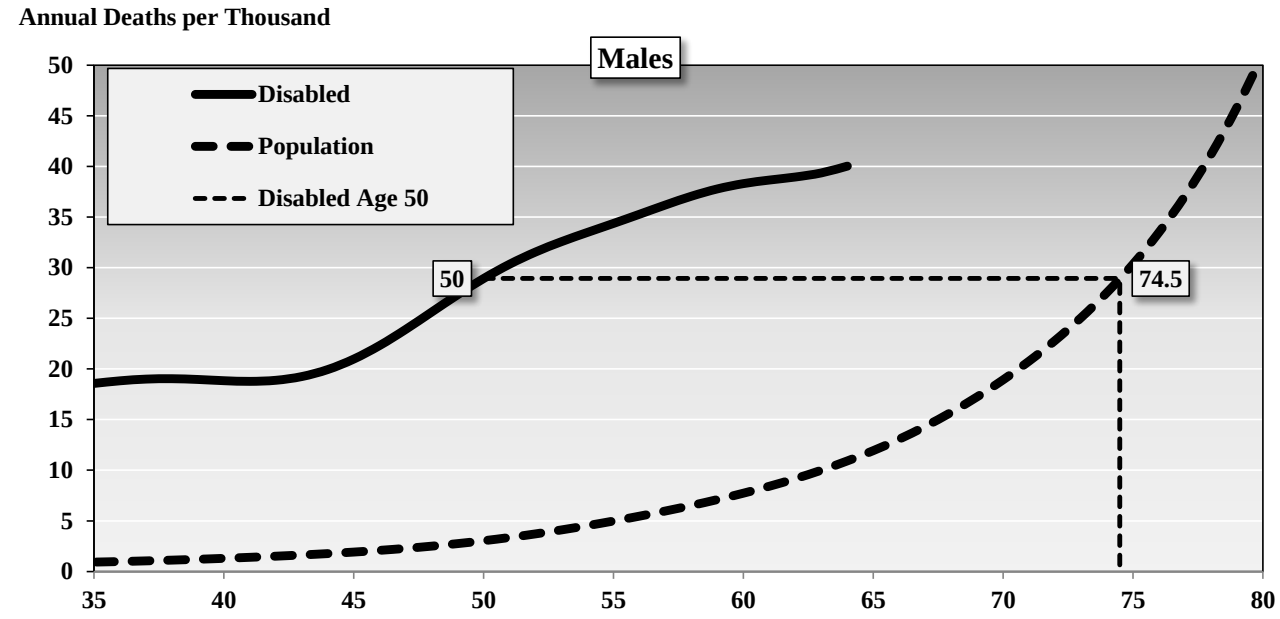
The ratios of disability to population mortality decrease from the youngest to the oldest ages. For example, for males in 2011, the ratio is 9.5 at age 50, 6.9 at age 55, and 3.7 at age 64. For females, the corresponding ratios are 9.9, 7.1, and 3.3. The disability to population mortality ratios are generally higher for females than males. Table 40 presents mortality ratios by individual ages and sex for the year 2011.

Table 39 Disability to Population Mortality Ratios (2011)

	Males			Females		
	Annual Deaths per Thousand			Annual Deaths per Thousand		
Age	Disability	Population[(1)]	Ratio	Disability	Population[(1)]	Ratio
40	18.8	1.3	14.5	15.5	0.8	19.9
45	21.0	1.9	10.9	17.8	1.3	13.7
50	28.9	3.0	9.5	20.7	2.1	9.9
55	34.4	5.0	6.9	22.5	3.2	7.1
60	38.3	7.7	5.0	23.9	4.7	5.1
64	40.0	10.9	3.7	22.7	6.9	3.3
50-64	35.1	6.0	5.8	22.6	3.8	5.9

(1) Derived from CHMD Canada and Québec Tables using the 2011 population as weights. Aggregate mortality for age group 50-64 standardized using 2011 population weights.

Chart 34 Disability and Population Mortality Rates (2011)



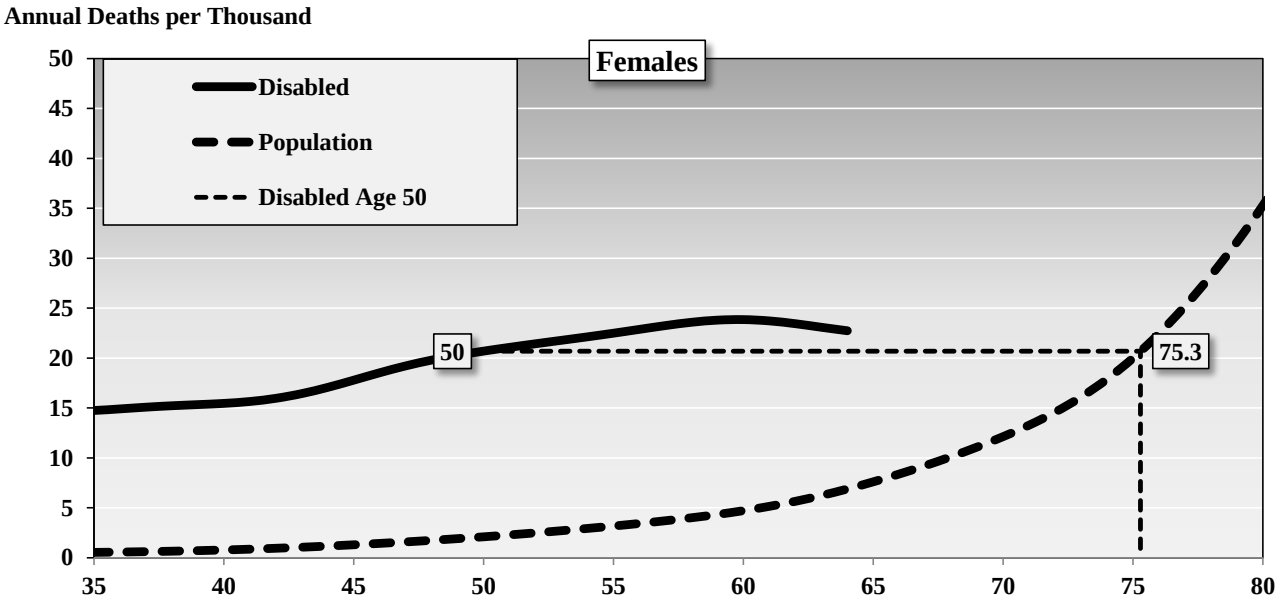


Table 40 Disability Mortality Rates and Ratios by Age and Sex (2011)

	Annual Deaths per Thousand				Mortality Ratios		
	Disability		General Population[1]		Disability/ Population		Disability Females /
Age	Male	Female	Male	Female	Male	Female	Males
20	39.4	32.7	0.7	0.3	56.3	110.9	0.83
21	37.9	32.3	0.7	0.3	51.5	105.0	0.85
22	35.9	31.3	0.8	0.3	47.3	98.5	0.87
23	33.7	29.9	0.8	0.3	43.6	91.6	0.89
24	31.4	28.2	0.8	0.3	40.3	84.2	0.90
25	29.0	26.3	0.8	0.3	37.2	76.6	0.91
26	26.6	24.3	0.8	0.4	34.4	68.8	0.91
27	24.4	22.3	0.8	0.4	31.7	61.2	0.91
28	22.5	20.4	0.8	0.4	29.2	54.0	0.91
29	20.8	18.6	0.8	0.4	27.0	47.4	0.89
30	19.6	17.2	0.8	0.4	25.1	41.8	0.88
31	18.7	16.0	0.8	0.4	23.6	37.2	0.86
32	18.3	15.2	0.8	0.5	22.5	33.7	0.83
33	18.2	14.8	0.8	0.5	21.5	31.1	0.82
34	18.3	14.7	0.9	0.5	20.8	29.2	0.80
35	18.6	14.8	0.9	0.5	20.0	27.7	0.79
36	18.8	14.9	1.0	0.6	19.1	26.3	0.79
37	19.0	15.1	1.0	0.6	18.1	24.9	0.79
38	19.0	15.2	1.1	0.7	16.9	23.3	0.80
39	19.0	15.3	1.2	0.7	15.7	21.6	0.81
40	18.8	15.5	1.3	0.8	14.5	19.9	0.82
41	18.8	15.6	1.4	0.9	13.4	18.3	0.83
42	18.9	16.0	1.5	0.9	12.5	16.9	0.85
43	19.2	16.4	1.6	1.1	11.8	15.6	0.85
44	19.9	17.1	1.8	1.2	11.3	14.6	0.86
45	21.0	17.8	1.9	1.3	10.9	13.7	0.85
46	22.3	18.5	2.1	1.4	10.7	12.9	0.83
47	23.9	19.2	2.3	1.6	10.5	12.1	0.80
48	25.6	19.8	2.5	1.7	10.2	11.4	0.77
49	27.3	20.3	2.8	1.9	9.9	10.6	0.74
50	28.9	20.7	3.0	2.1	9.5	9.9	0.72
51	30.3	21.1	3.4	2.3	9.0	9.2	0.69
52	31.5	21.4	3.7	2.5	8.5	8.6	0.68
53	32.6	21.8	4.1	2.7	7.9	8.0	0.67
54	33.5	22.1	4.5	2.9	7.4	7.5	0.66
55	34.4	22.5	5.0	3.2	6.9	7.1	0.65
56	35.3	22.9	5.5	3.4	6.5	6.7	0.65
57	36.2	23.3	6.0	3.7	6.1	6.3	0.64
58	37.1	23.6	6.5	4.0	5.7	5.9	0.64
59	37.8	23.8	7.1	4.3	5.3	5.5	0.63
60	38.3	23.9	7.7	4.7	5.0	5.1	0.62
61	38.7	23.7	8.4	5.1	4.6	4.6	0.61
62	39.0	23.4	9.2	5.7	4.2	4.1	0.60
63	39.4	23.1	10.0	6.2	3.9	3.7	0.59
64	40.0	22.7	10.9	6.9	3.7	3.3	0.57

(1) Derived from CHMD Canada and Québec Tables using the 2011 population as weights.

E. Disability Mortality Experience by Cause

In this section, statistics related to the mortality of CPP disability beneficiaries by cause of disability are discussed, specifically whether disabilities were caused by neoplasms or other causes.

1. Deaths by Major Causes

Chart 35 shows the distribution of deaths in 1991 and 2011 by main causes of disability, while Table 41 provides additional details by age group.

Regardless of gender and year, neoplasms are the most prevalent cause of disability among CPP disability deaths. For males, the proportion of deaths related to the cause of neoplasms was 36% in 1991 and 39% in 2011. In comparison, for females these proportions were much higher at 61% in 1991 and 52% in 2011.

Due to the fact that mental disorders have become more prominent (in terms of exposures, as shown in the next section), the proportion of deaths related to this cause of disability increased the most over the period 1991 to 2011, compared to all other causes of disability. In 1991, the proportion of male disability deaths, where the disability was caused by mental disorders, was 5% while it was 4% for females. By 2011, the proportions for both sexes increased significantly to 12%.

For circulatory disorders, the significant decrease in exposures between 1991 and 2011 explains why the proportion of deaths related to this cause of disability decreased the most over the period for both sexes. The proportion of male disability deaths related to circulatory disorders experienced the largest decline from 22% of deaths in 1991 to 11% in 2011. For females, the proportion of disability deaths related to the disorders decreased from 9% to 5% over the same period.

Chart 35 Disability Deaths by Cause (1991 and 2011)

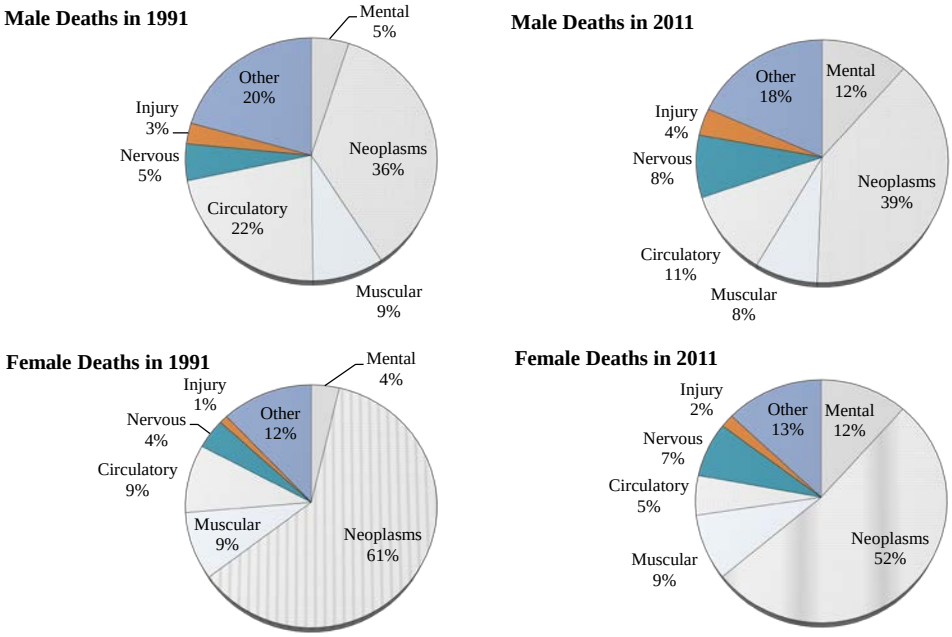


Table 41 Disability Deaths by Cause (1991 and 2011)

Age Group	2011 (Males)															
	Mental		Neoplasms		Muscular		Circulatory		Nervous		Injury		Other		All Causes	
	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%
<40	24	14%	89	52%	4	2%	7	4%	12	7%	8	5%	27	16%	171	100%
40-44	26	13%	109	53%	6	3%	11	5%	18	9%	6	3%	29	14%	205	100%
45-49	63	13%	236	49%	20	4%	29	6%	44	9%	9	2%	85	17%	486	100%
50-54	115	12%	442	46%	50	5%	64	7%	84	9%	29	3%	185	19%	969	100%
55-59	169	11%	656	42%	118	7%	150	9%	117	7%	59	4%	310	20%	1,579	100%
60-64	247	11%	654	30%	238	11%	366	17%	190	9%	92	4%	393	18%	2,180	100%
All	**644**	**12%**	**2,186**	**39%**	**436**	**8%**	**627**	**11%**	**465**	**8%**	**203**	**4%**	**1,029**	**18%**	**5,590**	**100%**

Age Group	1991 (Males)															
	Mental		Neoplasms		Muscular		Circulatory		Nervous		Injury		Other		All Causes	
	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%
<40	34	6%	163	30%	8	1%	15	3%	26	5%	21	4%	268	50%	535	100%
40-44	18	5%	159	41%	6	2%	32	8%	23	6%	15	4%	131	34%	384	100%
45-49	22	4%	269	49%	34	6%	63	11%	25	5%	11	2%	124	23%	548	100%
50-54	54	6%	363	43%	56	7%	159	19%	43	5%	24	3%	138	16%	837	100%
55-59	65	4%	665	41%	138	9%	399	25%	75	5%	39	2%	236	15%	1,617	100%
60-64	128	5%	692	28%	330	13%	740	29%	121	5%	70	3%	435	17%	2,516	100%
All	**321**	**5%**	**2,311**	**36%**	**572**	**9%**	**1,408**	**22%**	**313**	**5%**	**180**	**3%**	**1,332**	**21%**	**6,437**	**100%**

Age Group	2011 (Females)															
	Mental		Neoplasms		Muscular		Circulatory		Nervous		Injury		Other		All Causes	
	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%
<40	9	6%	110	71%	8	5%	3	2%	11	7%	3	2%	10	6%	154	100%
40-44	19	9%	139	67%	5	2%	2	1%	14	7%	2	1%	25	12%	206	100%
45-49	52	11%	288	62%	29	6%	16	3%	25	5%	7	1%	50	11%	467	100%
50-54	78	9%	540	63%	60	7%	28	3%	49	6%	12	1%	87	10%	854	100%
55-59	152	13%	595	51%	87	8%	69	6%	82	7%	23	2%	148	13%	1,156	100%
60-64	166	13%	477	38%	168	13%	98	8%	121	10%	25	2%	214	17%	1,269	100%
All	**476**	**12%**	**2,149**	**52%**	**357**	**9%**	**216**	**5%**	**302**	**7%**	**72**	**2%**	**534**	**13%**	**4,106**	**100%**

Age Group	1991 (Females)															
	Mental		Neoplasms		Muscular		Circulatory		Nervous		Injury		Other		All Causes	
	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%
<40	11	3%	200	74%	9	3%	10	4%	13	5%	1	0%	29	11%	270	100%
40-44	12	5%	197	75%	6	2%	12	5%	14	5%	3	1%	18	7%	262	100%
45-49	7	2%	240	78%	11	4%	14	5%	8	3%	1	0%	28	9%	309	100%
50-54	13	3%	282	70%	26	6%	23	6%	12	3%	1	0%	44	11%	401	100%
55-59	16	3%	368	61%	48	8%	69	11%	16	3%	8	1%	81	13%	606	100%
60-64	39	6%	268	38%	129	18%	105	15%	40	6%	14	2%	109	15%	704	100%
All	**95**	**4%**	**1,555**	**61%**	**229**	**9%**	**233**	**9%**	**103**	**4%**	**28**	**1%**	**309**	**12%**	**2,552**	**100%**

2. Disability Exposures by Cause

Chart 36 shows the distribution of exposures in 1991 and 2011 for the causes of disability of neoplasms and other than neoplasms. Table 42 provides additional details by age group.

In terms of exposures, disabilities caused neoplasms are not as prominent as they were in terms of deaths. This is attributed to the high proportion of neoplasm cases that die within a duration on benefits of less than two years (refer to Table 15 on page 47 of Actuarial Study No. 9).

Mental disorders became the most prominent in terms of exposures from 1991 to 2011. In 1991, the proportion of disability exposures related to mental disorders was 11% for males and 15% for females. In 2011, the corresponding proportions more than doubled to 27% for males and 32% for females.

Disability caused by muscular disorders (i.e. related to the musculoskeletal system and connective tissue) decreased the most with respect to exposures. For males, the decrease in the proportion of exposures related to muscular disorders was 31% to 21% over the period 1991 to 2011. For females, the corresponding decrease was from 40% to 27% over the same period.

Chart 36 Disability Exposures by Cause (1991 and 2011)

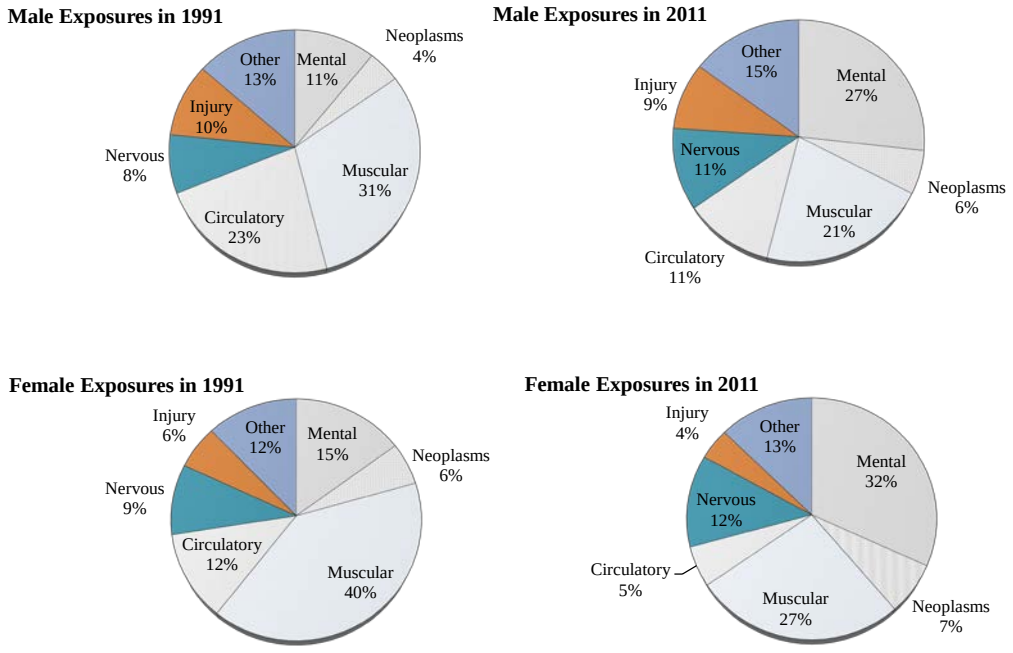


Table 42 Disability Exposures by Cause (1991 and 2011)

Age Group	2011 (Males)															
	Mental		Neoplasms		Muscular		Circulatory		Nervous		Injury		Other		All Causes	
	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%
<40	4,180	45%	514	6%	761	8%	320	3%	1,158	12%	1,177	13%	1,176	13%	9,287	100%
40-44	3,898	39%	467	5%	1,351	13%	458	5%	1,309	13%	1,119	11%	1,496	15%	10,099	100%
45-49	7,135	35%	1,040	5%	3,429	17%	1,131	6%	2,401	12%	2,030	10%	3,194	16%	20,360	100%
50-54	9,068	29%	1,723	6%	6,217	20%	2,744	9%	3,483	11%	3,017	10%	4,825	16%	31,077	100%
55-59	10,686	24%	2,825	6%	10,041	23%	5,431	12%	4,720	11%	3,661	8%	6,812	15%	44,176	100%
60-64	10,526	19%	3,304	6%	14,316	26%	9,026	17%	5,468	10%	4,220	8%	7,786	14%	54,647	100%
All	**45,494**	**27%**	**9,875**	**6%**	**36,116**	**21%**	**19,111**	**11%**	**18,540**	**11%**	**15,224**	**9%**	**25,288**	**15%**	**169,647**	**100%**

Age Group	1991 (Males)															
	Mental		Neoplasms		Muscular		Circulatory		Nervous		Injury		Other		All Causes	
	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%
< 40	2,676	20%	537	4%	2,620	20%	600	5%	1,842	14%	2,902	22%	2,138	16%	13,316	100%
40-44	2,006	19%	409	4%	2,852	27%	961	9%	1,277	12%	1,674	16%	1,325	13%	10,503	100%
45-49	2,246	16%	574	4%	4,167	30%	2,069	15%	1,413	10%	1,755	13%	1,672	12%	13,896	100%
50-54	2,645	12%	932	4%	6,737	31%	4,468	21%	1,771	8%	2,133	10%	2,730	13%	21,417	100%
55-59	3,470	9%	1,841	5%	12,596	33%	9,989	26%	2,524	7%	3,057	8%	5,029	13%	38,505	100%
60-64	3,949	7%	2,489	4%	19,133	33%	17,621	30%	3,340	6%	3,819	7%	8,213	14%	58,565	100%
All	**16,992**	**11%**	**6,782**	**4%**	**48,106**	**31%**	**35,709**	**23%**	**12,165**	**8%**	**15,340**	**10%**	**21,107**	**14%**	**156,202**	**100%**

Age Group	2011 (Females)															
	Mental		Neoplasms		Muscular		Circulatory		Nervous		Injury		Other		All Causes	
	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%
<40	4,268	41%	751	7%	1,389	13%	314	3%	1,577	15%	493	5%	1,581	15%	10,373	100%
40-44	4,819	39%	824	7%	2,185	18%	423	3%	1,898	15%	539	4%	1,792	14%	12,480	100%
45-49	9,148	37%	1,662	7%	5,087	21%	940	4%	3,418	14%	1,056	4%	3,150	13%	24,461	100%
50-54	12,751	34%	2,720	7%	8,828	24%	1,756	5%	4,798	13%	1,541	4%	4,660	13%	37,055	100%
55-59	15,019	30%	3,556	7%	13,891	28%	2,786	6%	5,914	12%	2,004	4%	6,170	13%	49,339	100%
60-64	14,635	26%	3,711	7%	19,162	34%	4,100	7%	5,921	10%	2,422	4%	6,818	12%	56,769	100%
All	**60,640**	**32%**	**13,224**	**7%**	**50,540**	**27%**	**10,319**	**5%**	**23,527**	**12%**	**8,056**	**4%**	**24,17**	**13%**	**190,478**	**100%**

Age Group	1991 (Females)															
	Mental		Neoplasms		Muscular		Circulatory		Nervous		Injury		Other		All Causes	
	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%
<40	2,354	23%	588	6%	2,574	25%	457	4%	1,997	19%	889	9%	1,531	15%	10,390	100%
40-44	1,846	22%	512	6%	2,535	31%	415	5%	1,355	16%	574	7%	1,025	12%	8,262	100%
45-49	2,108	20%	691	7%	3,727	35%	850	8%	1,307	12%	711	7%	1,208	11%	10,601	100%
50-54	2,356	15%	990	6%	6,242	41%	1,624	11%	1,341	9%	859	6%	1,992	13%	15,402	100%
55-59	3,019	13%	1,320	6%	10,627	45%	3,233	14%	1,584	7%	1,260	5%	2,752	12%	23,795	100%
60-64	3,011	10%	1,486	5%	13,642	46%	5,154	17%	1,700	6%	1,478	5%	3,502	12%	29,974	100%
All	**14,693**	**15%**	**5,587**	**6%**	**39,346**	**40%**	**11,733**	**12%**	**9,285**	**9%**	**15,771**	**6%**	**12,010**	**12%**	**98,425**	**100%**

3. Comparison of Disability and Population Mortality by Cause

In this section, statistics related to mortality rates of CPP disability beneficiaries are shown for two separate broad causes of disability: 1) causes specifically related to neoplasms, and 2) all other causes combined. As revealed in Table 43 and Chart 37, disabilities caused by neoplasms are associated with the highest mortality rates among beneficiaries. Although neoplasms represented only about 7% of all causes of CPP disabilities in 2011, they accounted for 45% of all disability deaths that year. In 2011, for the age group 50 to 64, male mortality related to neoplasm-caused disabilities is about 230 deaths per thousand as opposed to 6 per thousand in the general population. For all other causes of disability, the male mortality rate for the same age group is 23 deaths per thousand. The same trends can be observed for female disability beneficiaries, except that the mortality rates are lower compared to males.

For neoplasms, since most deaths related to this cause of disability occur in the early years (within the first two years of disability), the mortality rates decline after about age 52 for females and 55 for males, since after those ages the duration of disability increases (refer to Actuarial Study No. 9 Table 20) as the associated probability of surviving increases. For the other than neoplasms causes of disability, mortality tends to increase continuously by age, but remains significantly lower than that of neoplasm-related mortality for both sexes. For the age group 50 to 64, the mortality rate for other than neoplasms causes of disability is about 3 to 4 times that of the population, compared to between 38 and 43 times for neoplasms. For both neoplasms and other than neoplasms causes of disability, female mortality is lower than for that of males at all ages.

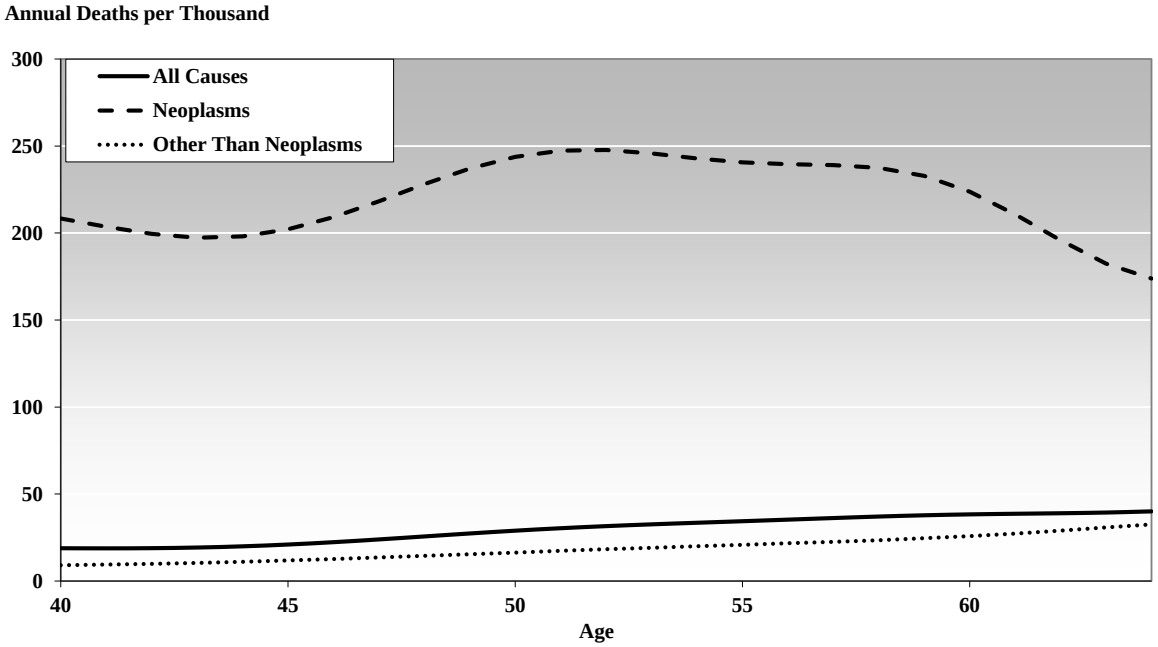
Table 43 Disability to Population Mortality Ratios by Cause (2011)

	Males						
	Annual Deaths per Thousand				Mortality Ratio		
Age	Neoplasms	Other Than Neoplasms	All Causes	Population	Neoplasms	Other Than Neoplasms	All Causes
40	208.4	9.0	18.8	1.3	160.3	6.9	14.5
45	202.1	11.8	21.0	1.9	105.3	6.1	10.9
50	243.8	16.4	28.9	3.0	80.2	5.4	9.5
55	240.6	20.9	34.4	5.0	48.3	4.2	6.9
60	223.8	25.8	38.3	7.7	28.9	3.3	5.0
64	173.9	32.5	40.0	10.9	15.9	3.0	3.7
50-64	229.5	22.7	35.1	6.0	38.0	3.8	5.8

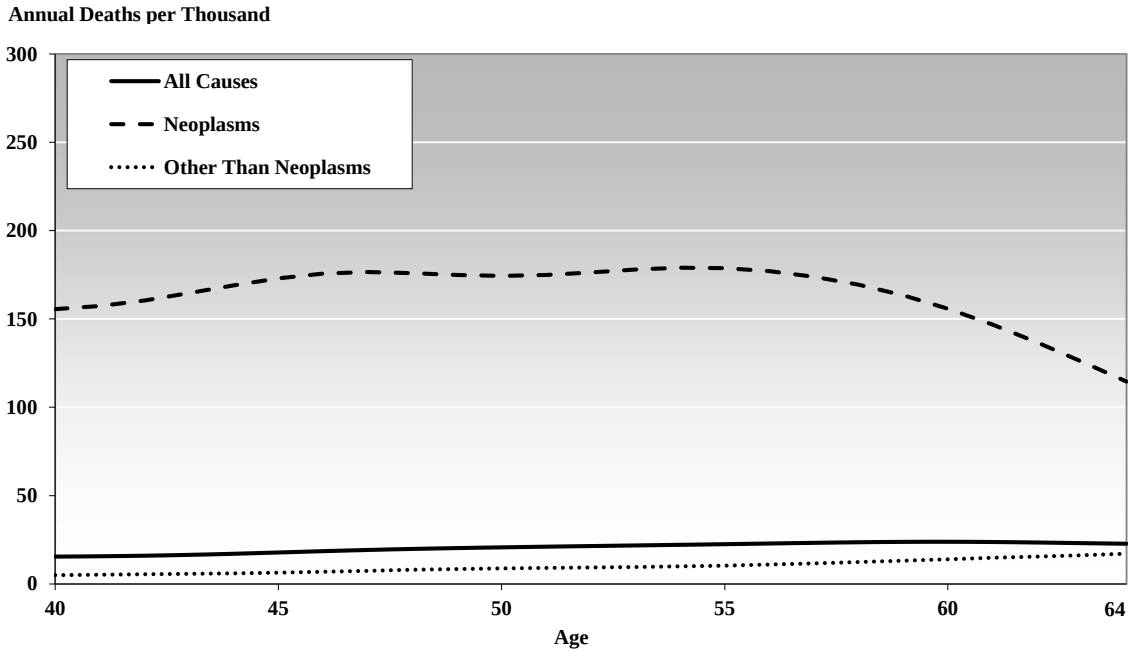
	Females						
	Annual Deaths per Thousand				Mortality Ratio		
Age	Neoplasms	Other Than Neoplasms	All Causes	Population	Neoplasms	Other Than Neoplasms	All Causes
40	155.6	5.0	15.5	0.8	200.5	6.4	19.9
45	173.0	6.4	17.8	1.3	133.5	5.0	13.7
50	174.4	8.8	20.7	2.1	83.3	4.2	9.9
55	178.7	10.3	22.5	3.2	56.3	3.3	7.1
60	155.8	14.0	23.9	4.7	33.1	3.0	5.1
64	114.6	17.1	22.7	6.9	16.6	2.5	3.3
50-64	163.6	11.9	22.6	3.8	42.8	3.1	5.9

Chart 37 Disability Mortality Rates by Cause (2011)

Males



Females



F. Disability Mortality Improvement Rates by Cause

The annual mortality improvement rates for disability beneficiaries over the last 15 and 5 years periods of 1996 to 2011 and 2006 to 2011 are shown in Table 44. The improvement rates at younger ages (below 50, not shown) should be interpreted with caution due to low exposures and greater variation of results.

Over the more recent 5 years, all causes of disability mortality improvement rates were generally higher than over the last 15 years, but nonetheless remained generally lower than the rates of the population. For the age group 50-64 and both sexes, the all causes of disability annual mortality improvement rates were 0.8% over the last 15 years, while over the more recent 5 years period they were higher at 1.5% for males and 1.6% for females. The mortality improvement rates of the population, ages 50-64, over the last 15 years were 1.9% and 1.7% for males and females, respectively, and increased to 2.2% and 2.0% over the last 5 years.

Over the last 15 years, for each age group shown, mortality improvement rates related to neoplasms causes of disability are greater than the rates for other disability causes and are generally similar to those of the population. The significant mortality improvements related to neoplasms causes over the period helps to explain the observed decrease in the number of male deaths between 1991 and 2011, as a high proportion of disability deaths come from this cause as discussed earlier.

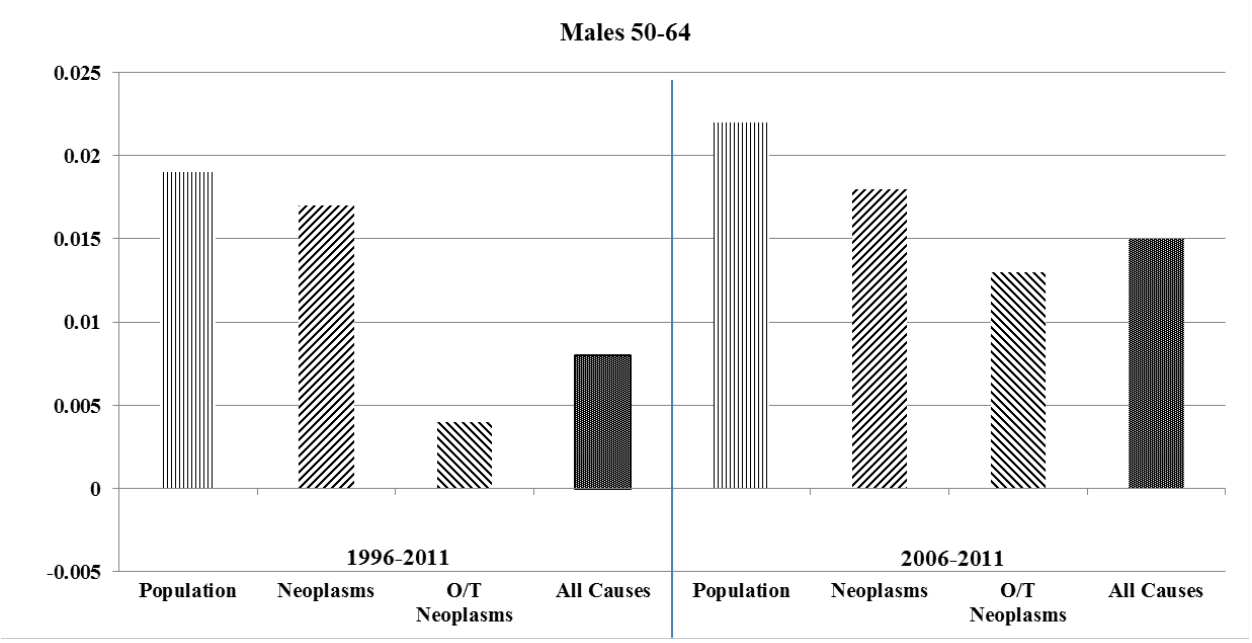
As shown in Table 44 and Chart 38, for the age group 50-64, which represents about 75% of disability beneficiaries, mortality improvement rates related to neoplasms causes of disability were higher than for the other causes. Over the last 15 years the average annual mortality improvement rate related to neoplasms for males was 1.7%, while it was 0.4% for other causes. In comparison, for females the average annual mortality improvement rate related to neoplasms was 2.0%, while a mortality deterioration of 0.3% related to other causes was observed. Over the more recent 5 years, the mortality improvement rates related to both neoplasm and other causes have increased, and to a greater extent for other causes.

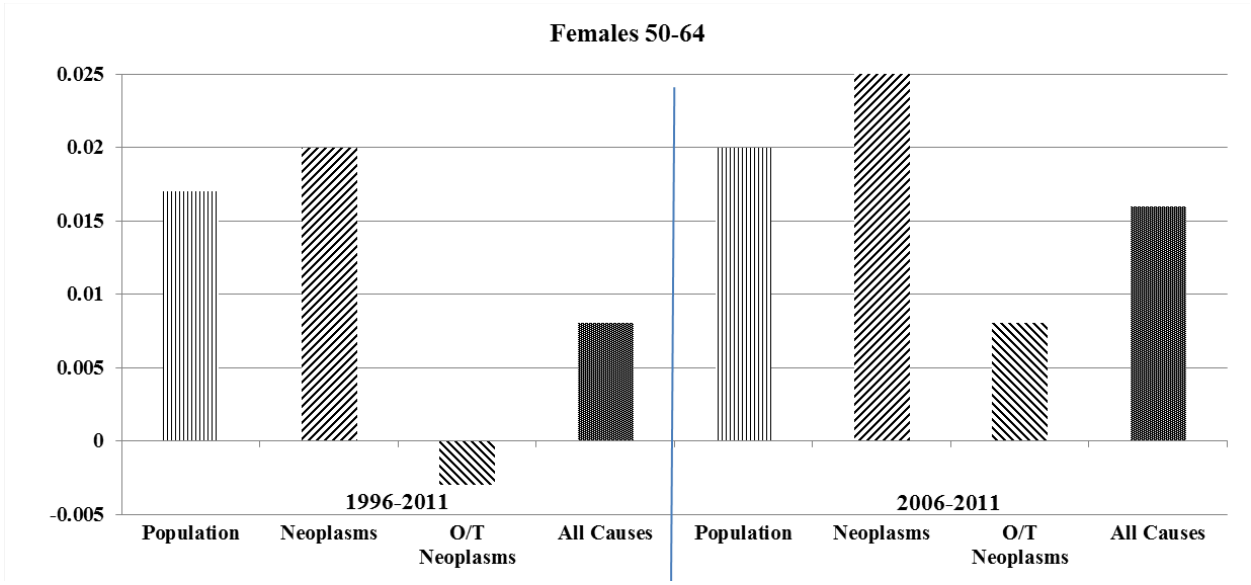
Table 44 Disability Average Annual Mortality Improvement Rates by Cause

	Males							
	1996-2011				2006-2011			
Age Group	Neoplasms	Other Than Neoplasms	All Causes	Population[(1)]	Neoplasms	Other Than Neoplasms	All Causes	Population[(1)]
50-54	2.5%	0.5%	1.4%	1.2%	1.2%	2.2%	1.8%	2.5%
55-59	1.9%	0.5%	1.1%	1.8%	3.1%	1.3%	1.2%	1.7%
60-64	0.8%	0.2%	0.4%	2.3%	0.7%	1.0%	0.9%	2.4%
50-64	1.7%	0.4%	0.8%	1.9%	1.8%	1.3%	1.5%	2.2%
	Females							
	1996-2011				2006-2011			
Age Group	Neoplasms	Other Than Neoplasms	All Causes	Population[(1)]	Neoplasms	Other Than Neoplasms	All Causes	Population[(1)]
50-54	2.5%	-0.4%	1.5%	1.1%	1.7%	0.9%	1.4%	1.4%
55-59	2.1%	-0.1%	1.1%	1.9%	2.3%	-1.1%	0.7%	1.5%
60-64	1.1%	-0.5%	0.2%	2.0%	3.5%	2.0%	2.6%	2.6%
50-64	2.0%	-0.3%	0.8%	1.7%	2.5%	0.8%	1.6%	2.0%

(1) Improvement rates obtained using standardized crude mortality rates by cause and using the 2011 exposures by age and cause as weights. Population mortality improvement rates are based on CHMD data for the period 1996 to 2011, using 2011 population as weights. Population mortality improvement rates are for Canada less Québec based on CHMD data for Canada and Québec. OCA calculations.

Chart 38 Disability Average Annual Mortality Improvement Rates by Cause





G. Probability of Disability Beneficiary Reaching Age 65

In the context of this mortality study and for comparative purposes only, the probability of a CPP disability beneficiary reaching age 65 from any given age strictly accounts only for mortality rates as a decrement, and therefore ignores recovery rates that are normally taken into account for such calculations in disability studies. The probabilities of survival to age 65 presented in this section are derived assuming that the disabled individual will be subject to the mortality rates of the given year throughout his/her life.

The evolution of the probabilities of reaching age 65 for a beneficiary aged 50, by cause of disability, and for an individual from the general population are presented in Table 45. In 2011, for both males and females disabled by neoplasms, the probability of reaching age 65 (3% for males, 9% for females) is significantly lower than for those disabled by other causes. These probabilities compare to a probability of over 90% than an individual aged 50 in the general population will reach age 65. Although the probability of surviving to age 65 for those affected by neoplasms is very low, it has nonetheless increased threefold for males and by four and a half times for females since the early 1990s. For those affected by causes other than neoplasms, the probability of reaching age 65 has remained relatively stable over the period 1990 through 2011 at around 70% for males and 84% for females.

Chart 39 compares the survival curves to age 65 for individuals aged 50 in the population to disability beneficiaries aged 50 who were affected by neoplasms and by causes other than neoplasms, based on the observed mortality levels in 2011. The chart clearly illustrates the much higher mortality risk associated with those affected by neoplasms.

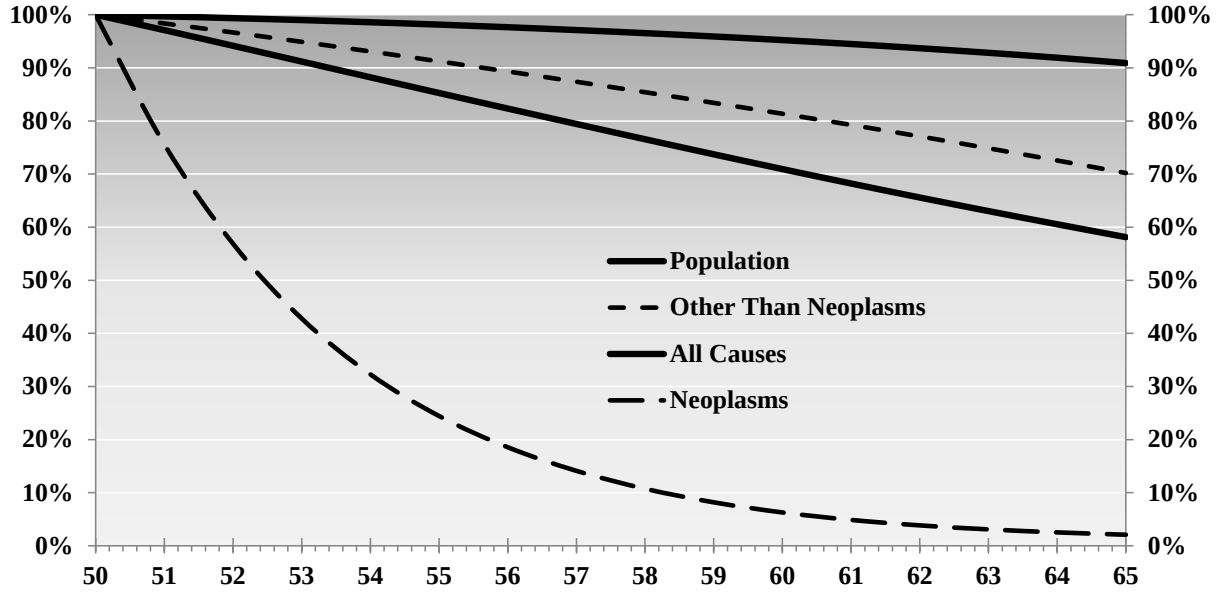
Table 45 Probability of a 50-Year Old Disability Beneficiary Reaching Age 65 (1991-2011)

	Males				Females			
Year	All Causes	Neoplasms	Other Than Neoplasms	Population[(1)]	All Causes	Neoplasms	Other Than Neoplasms	Population[(1)]
1991	54%	1%	67%	86%	69%	2%	84%	92%
1992	54%	1%	66%	86%	69%	2%	84%	92%
1993	56%	1%	68%	87%	71%	3%	85%	92%
1994	56%	1%	68%	87%	70%	2%	85%	92%
1995	56%	1%	68%	87%	70%	3%	84%	92%
1996	56%	1%	68%	88%	69%	2%	84%	92%
1997	57%	1%	69%	88%	70%	3%	84%	93%
1998	59%	1%	70%	88%	71%	4%	84%	93%
1999	57%	1%	68%	89%	71%	5%	83%	93%
2000	57%	1%	69%	89%	71%	4%	84%	93%
2001	58%	1%	70%	89%	71%	5%	83%	93%
2002	58%	1%	69%	89%	70%	5%	83%	93%
2003	57%	1%	69%	89%	70%	5%	83%	93%
2004	57%	2%	69%	89%	71%	5%	84%	93%
2005	58%	2%	70%	90%	70%	6%	83%	93%
2006	57%	2%	69%	90%	71%	6%	83%	94%
2007	57%	2%	69%	90%	70%	7%	82%	94%
2008	57%	2%	70%	90%	70%	7%	83%	94%
2009	57%	3%	70%	91%	71%	9%	83%	94%
2010	58%	2%	71%	91%	71%	8%	84%	94%
2011	59%	3%	71%	91%	71%	9%	84%	94%

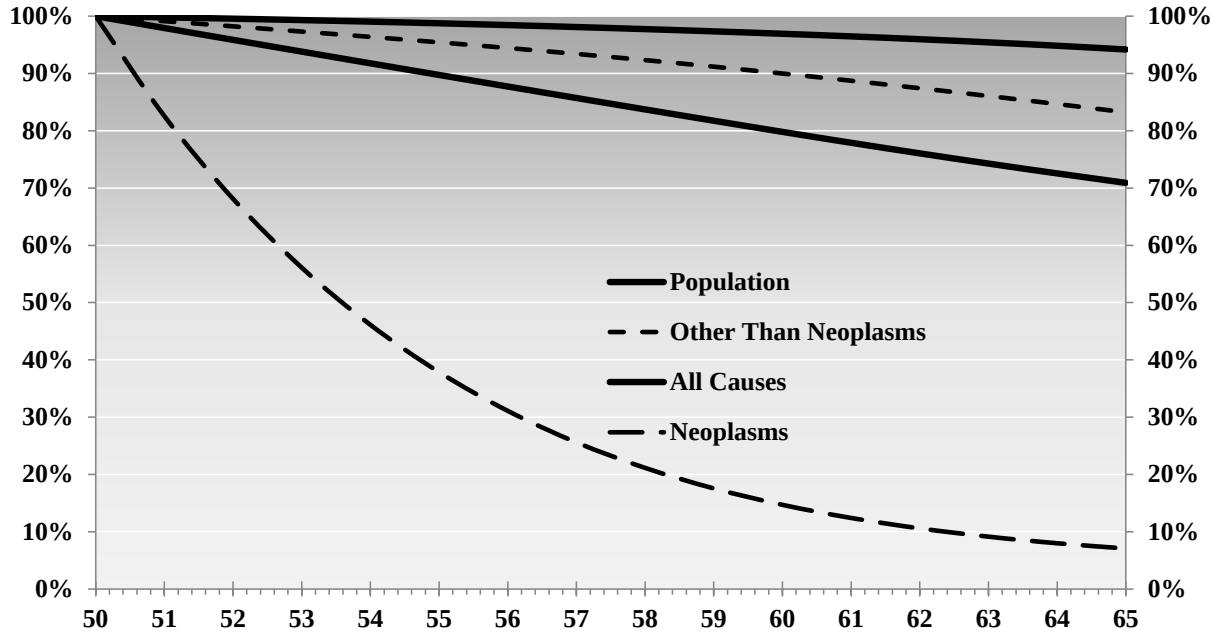
(1) Based on mortality rates from CHMD for Canada less Québec. OCA calculations.

Chart 39 Probability of 50-Year Old Reaching Age 65 (2011)

Males



Females



VI. Conclusion

The aging of the Canadian population has increased substantially since the inception of the CPP in 1966. Over the last two decades, life expectancy at age 65 of CPP retirement beneficiaries increased by 2.5 years, reaching 20.5 years in 2013. More than half of this increase (1.5 years) occurred in the most recent decade. These results are directly linked to the significant reduction in mortality rates that has occurred at the older ages (75 to 89) within the past two decades. As the distribution of deaths moves towards older ages in the future, the trend of mortality improvements shifting toward the older ages is expected to continue, in turn leading to additional increases in life expectancy at age 65.

In general, for both sexes, those with higher retirement pensions experience lower mortality compared to those with lower retirement pensions. However, for both sexes, mortality differences by level of pension reduce as age increases. Over the last two decades, the difference between the life expectancies at age 65 of retirement beneficiaries receiving the maximum pension and those receiving pensions of less than 37.5% of the maximum has remained relatively stable at around 2 years for males and 1.5 years for females.

The mortality of survivor beneficiaries is significantly higher than that of the general population, possibly due to the stress resulting from losing one's spouse. In 2013, the excess survivor mortality at age 65 is 31% for males and 34% for females. After age 65, mortality above that of the general population gradually reduces. Although the overall mortality of survivor beneficiaries is much higher than for retirement beneficiaries, the same trends in increased life expectancy at age 65 and mortality improvement rates can be observed for both. In 2013, a 65 year old survivor beneficiary is expected to live for another 19.5 years, or about one year less than for a retirement beneficiary of the same age.

As expected, since receipt of the CPP disability benefit requires that the disability be severe, long-term and of indefinite duration or is likely to result in death, the mortality of disability beneficiaries is significantly higher than for the general population. At 35 deaths per thousand for males and 23 deaths per thousand for females, mortality rates of disability beneficiaries aged 50 to 64 in 2011 are on average six times higher than those of the general population. For a 50 year old disability beneficiary, such level of mortality is about equal to the mortality of an individual aged 75 in the general population.

Although neoplasms represented only about 7% of all CPP disabilities in 2011, they accounted for 45% of all disability deaths that year. In 2011, for the age group 50 to 64, male mortality related to neoplasm disabilities was about 230 deaths per thousand or about 38 times greater than the mortality of the general population (6 deaths per thousand). For all other causes of disability, the male mortality rate was 23 deaths per thousand or about 4 times greater than the mortality of the general population. The same trends can be observed for female disability beneficiaries, except that the mortality rates are lower.

Notwithstanding the high level of mortality of disability beneficiaries, annual mortality improvements rates for disability beneficiaries (all causes), are, lower than for the general population, but have nonetheless been observed at levels of 0.8% and 1.5% per year over the last 15 and 5 years, respectively. Specifically, disability mortality related to neoplasms has improved at levels similar to that of the general population. All these mortality improvements have in turn resulted in the probability of a 50 year old male disability beneficiary reaching age 65 (considering mortality only) increasing from 51% to 59% over the period 1990 to 2011, while for female beneficiaries, the corresponding increase was from 66% to 71%. This compares to the probability of a 50 year old reaching age 65 in the general population of over 90% in 2011.

VII. Annex – Detailed Tables by Year, Age and Sex

Table 46 Retirement Beneficiaries by Age and Sex (1st July)

	Males				Females		
Age	**1993**	**2003**	**2013**		**1993**	**2003**	**2013**
60	23,924	36,397	55,253		23,541	39,280	60,327
61	29,751	40,547	66,817		28,262	43,940	71,737
62	34,177	44,599	74,279		31,474	48,043	79,487
63	36,597	46,235	80,528		33,867	49,181	84,883
64	39,240	49,799	86,901		36,059	52,184	92,004
65	76,415	86,591	137,468		59,468	79,583	139,284
66	74,634	82,951	142,155		58,296	75,689	143,670
67	72,827	82,399	117,793		57,475	74,283	117,189
68	69,742	79,221	109,056		56,110	71,339	107,277
69	66,902	76,172	108,642		53,753	68,154	106,064
70	63,992	75,801	103,863		51,297	67,587	101,396
71	62,070	73,944	93,926		49,770	65,758	91,724
72	57,832	72,149	88,525		46,084	63,735	86,989
73	54,892	68,000	81,669		43,302	60,830	80,467
74	43,330	62,881	77,619		34,026	56,722	76,206
75	40,469	59,996	72,768		31,266	54,847	71,683
76	38,510	55,664	67,166		29,249	51,957	66,611
77	36,498	51,966	64,597		27,421	49,819	64,138
78	34,999	47,806	59,917		26,113	47,172	60,428
79	31,384	43,727	55,658		23,375	44,180	56,273
80	27,709	40,082	52,913		20,253	41,004	54,141
81	23,643	36,678	49,304		17,396	38,367	51,313
82	20,240	32,442	46,017		15,016	34,110	48,402
83	17,706	28,654	41,042		13,144	30,965	44,659
84	14,705	21,048	35,657		11,029	23,229	40,017
85	12,689	18,375	31,864		9,385	20,363	37,195
86	10,027	15,840	27,468		7,744	17,950	33,367
87	7,870	13,679	23,433		6,039	15,631	30,085
88	6,498	11,819	19,702		4,730	13,759	26,672
89	5,095	9,412	16,281		3,684	11,438	23,315
90	3,918	7,353	13,215		2,635	9,021	19,890
91	2,825	5,389	10,547		2,037	6,939	16,754
92	1,848	4,002	8,193		1,371	5,355	13,141
93	1,139	3,020	6,088		801	4,003	10,601
94	695	2,082	3,629		546	2,956	6,912
95	439	1,541	2,690		317	2,046	5,261
96	177	958	1,790		171	1,560	3,774
97	42	628	1,277		39	962	2,707
98	0	379	870		0	617	1970
99	0	237	546		0	336	1363
100	0	135	322		0	233	825
101	0	87	163		0	120	526
102	0	42	93		0	79	341
103	0	15	52		0	34	156
104	0	12	26		0	18	92
105+	0	6	26		0	12	113
Total	**1,145,450**	**1,490,760**	**2,137,808**		**916,545**	**1,445,390**	**2,231,429**

Table 47 Retirement Deaths by Age and Sex (2013)

	Males						Females				
Age	**0-37.5%**	**37.5-75%**	**75-100%**	**100%**	**ALL**		**0-37.5%**	**37.5-75%**	**75-100%**	**100%**	**ALL**
60	61	90	133	42	326		71	67	47	5	190
61	101	115	193	75	484		100	96	69	14	279
62	119	148	263	98	628		116	102	92	15	325
63	140	207	274	102	723		172	126	96	18	412
64	177	237	336	109	859		200	170	128	15	513
65	303	501	674	157	1,635		440	316	233	19	1,008
66	373	569	784	198	1,924		505	400	266	31	1,202
67	340	518	676	212	1,746		436	338	236	27	1,037
68	329	492	632	279	1,732		433	328	193	37	991
69	324	505	694	312	1,835		522	363	259	51	1,195
70	327	500	644	417	1,888		521	400	255	58	1,234
71	299	483	763	432	1,977		569	384	239	52	1,244
72	342	513	784	438	2,077		588	396	240	47	1,271
73	317	530	755	512	2,114		609	368	260	56	1,293
74	334	472	792	547	2,145		647	430	267	51	1,395
75	336	530	829	543	2,238		651	446	254	52	1,403
76	325	490	823	629	2,267		687	405	284	61	1,437
77	279	492	953	638	2,362		743	517	323	53	1,636
78	327	553	1,013	730	2,623		744	482	354	62	1,642
79	329	537	989	723	2,578		899	510	353	78	1,840
80	321	554	1,085	935	2,895		861	569	367	94	1,891
81	336	543	983	966	2,828		921	538	373	98	1,930
82	337	546	1,061	1,142	3,086		1,015	617	417	125	2,174
83	322	515	1,039	1,235	3,111		1,084	610	462	111	2,267
84	290	492	1,008	1,268	3,058		1,131	648	410	128	2,317
85	319	482	1,005	1,292	3,098		1,159	605	463	148	2,375
86	275	471	987	1,277	3,010		1,126	639	481	163	2,409
87	274	429	939	1,238	2,880		1,192	681	485	124	2,482
88	246	407	850	1,104	2,607		1,276	652	492	138	2,558
89	235	387	852	951	2,425		1,176	613	474	110	2,373
90	198	349	815	873	2,235		1,225	692	505	117	2,539
91	204	347	748	849	2,148		1,157	627	427	96	2,307
92	144	252	648	746	1,790		1,047	571	434	142	2,194
93	122	228	480	679	1,509		922	543	373	114	1,952
94	95	136	308	404	943		628	393	327	80	1,428
95	64	140	251	390	845		522	339	254	59	1,174
96	52	85	215	269	621		460	272	221	77	1,030
97	46	56	151	179	432		348	205	176	59	788
98	52	53	109	159	373		286	163	139	49	637
99	22	41	77	112	252		176	135	79	43	433
100	15	27	52	56	150		143	66	57	24	290
101	9	23	25	49	106		84	67	39	13	203
102	8	11	12	18	49		53	47	23	16	139
103	7	8	12	10	37		35	27	19	2	83
104	2	2	7	4	15		23	19	13	9	64
105+	3	6	6	6	21		26	20	17	2	65
Total	**9,480**	**15,072**	**26,729**	**23,404**	**74,685**		**27,729**	**17,002**	**11,975**	**2,943**	**59,649**

Table 48 Retirement Exposures by Age and Sex (2013)

	Males						Females				
Age	**0-37.5%**	**37.5-75%**	**75-100%**	**100%**	**ALL**		**0-37.5%**	**37.5-75%**	**75-100%**	**100%**	**ALL**
60	4,769	12,241	24,565	11,543	53,118		14,641	20,221	19,793	3,186	57,841
61	6,627	15,260	30,726	13,787	66,400		18,951	24,352	24,101	3,864	71,268
62	7,483	17,107	34,580	14,546	73,716		21,920	26,835	26,192	3,912	78,859
63	8,451	18,683	37,726	15,253	80,113		24,382	28,679	27,747	3,925	84,734
64	9,846	20,045	40,827	15,889	86,607		28,111	30,829	28,640	3,859	91,440
65	20,787	33,556	60,064	21,337	135,744		47,272	46,664	39,406	4,848	138,190
66	20,886	33,969	60,603	24,849	140,306		49,214	47,215	39,760	5,474	141,663
67	17,952	28,464	49,374	23,118	118,908		42,609	38,871	31,882	5,088	118,450
68	16,208	25,547	44,097	23,648	109,501		39,606	34,961	27,844	5,248	107,658
69	15,509	24,594	42,060	25,969	108,132		39,434	34,030	26,706	5,539	105,709
70	14,437	22,933	39,230	26,941	103,541		38,635	32,033	24,783	5,532	100,984
71	13,041	20,637	35,059	25,766	94,504		36,331	29,163	21,858	4,827	92,179
72	11,820	18,966	32,301	24,834	87,922		35,176	27,043	19,829	4,546	86,594
73	11,297	17,284	29,593	23,879	82,053		33,636	25,199	17,742	4,216	80,793
74	10,257	16,087	28,103	23,224	77,671		32,122	23,670	16,446	4,015	76,253
75	9,327	14,804	26,440	22,211	72,782		30,753	22,012	15,293	3,743	71,802
76	8,405	13,423	24,480	21,403	67,711		29,172	20,495	13,922	3,462	67,051
77	7,611	12,600	23,473	20,945	64,630		28,214	19,349	13,306	3,272	64,141
78	6,887	11,443	21,959	19,861	60,150		27,033	18,233	12,318	3,019	60,603
79	6,265	10,242	20,679	18,864	56,050		25,608	16,825	11,409	2,776	56,617
80	5,616	9,113	18,796	19,421	52,947		24,577	15,924	10,926	2,724	54,151
81	5,064	8,220	16,698	19,664	49,647		23,483	14,800	10,432	2,809	51,524
82	4,610	7,533	15,234	18,926	46,303		22,110	13,953	9,876	2,786	48,726
83	4,225	6,551	13,337	17,322	41,435		20,605	12,670	8,911	2,602	44,789
84	3,594	5,447	11,554	15,470	36,066		18,729	11,381	7,865	2,393	40,368
85	3,078	4,677	10,183	14,234	32,173		17,371	10,294	7,380	2,254	37,299
86	2,621	4,010	8,632	12,425	27,689		15,717	9,229	6,672	2,007	33,624
87	2,251	3,422	7,605	10,554	23,833		14,310	8,362	5,997	1,756	30,424
88	1,827	2,901	6,625	8,655	20,008		12,751	7,245	5,502	1,490	26,987
89	1,528	2,389	5,589	6,946	16,452		11,188	6,387	4,790	1,207	23,572
90	1,202	2,005	4,776	5,434	13,417		9,634	5,433	4,039	1,001	20,107
91	1,003	1,634	3,794	4,415	10,846		8,210	4,577	3,303	887	16,977
92	776	1,261	2,840	3,559	8,437		6,445	3,618	2,674	769	13,506
93	544	930	2,002	2,721	6,198		5,016	2,949	2,118	613	10,695
94	350	580	1,210	1,627	3,768		3,328	1,934	1,458	429	7,150
95	252	418	884	1,200	2,754		2,446	1,469	1,109	359	5,384
96	162	280	622	844	1,907		1,752	1,011	814	295	3,872
97	140	191	420	562	1,313		1,229	761	628	213	2,831
98	112	140	261	411	924		872	562	444	174	2,053
99	65	82	170	250	567		584	376	284	140	1,383
100	33	56	98	149	336		364	258	169	83	874
101	27	38	38	79	181		218	155	110	51	535
102	22	23	25	31	101		156	92	71	26	345
103	13	14	16	14	57		70	60	38	12	179
104	4	7	11	5	28		36	35	22	6	99
105+	9	12	6	5	32		45	45	25	5	121
Total	**266,993**	**449,820**	**837,369**	**582,794**	**2,136,976**		**864,067**	**700,260**	**554,634**	**111,444**	**2,230,405**

Table 49 Retirement Mortality Rates by Age, Sex and Level of Pension (2013)

	Males Annual Deaths per Thousand						Females Annual Deaths per Thousand				
Age	**0-37.5%**	**37.5-75%**	**75-100%**	**100%**	**ALL**		**0-37.5%**	**37.5-75%**	**75-100%**	**100%**	**ALL**
60	13.4	6.7	5.3	4.2	6.1		4.4	3.1	2.3	2.3	3.0
61	14.6	7.9	6.2	5.0	7.2		5.2	3.6	2.8	2.8	3.7
62	15.4	9.3	7.1	5.8	8.3		6.0	4.2	3.4	3.4	4.4
63	16.0	10.8	8.0	6.5	9.5		6.9	4.8	4.0	3.9	5.3
64	16.4	12.6	9.2	7.1	10.7		7.8	5.7	4.7	4.3	6.1
65	17.4	15.5	10.2	6.8	11.9		9.3	7.0	4.4	4.1	7.0
66	17.8	16.4	11.8	8.4	13.1		9.9	8.0	5.6	5.1	8.0
67	18.6	17.5	13.3	9.8	14.4		10.7	8.9	6.6	6.1	8.9
68	19.7	18.8	14.8	11.2	15.7		11.6	9.9	7.7	7.0	9.9
69	21.0	20.2	16.4	12.7	17.2		12.6	10.9	8.7	8.0	10.9
70	22.5	21.9	18.2	14.3	18.8		13.7	12.0	9.9	9.1	12.0
71	24.3	23.8	20.2	16.1	20.7		14.9	13.2	11.1	10.2	13.2
72	26.3	26.0	22.4	18.1	22.7		16.2	14.5	12.5	11.4	14.5
73	28.5	28.3	24.8	20.3	24.9		17.6	16.0	14.0	12.8	16.0
74	30.9	30.9	27.4	22.6	27.4		19.3	17.7	15.7	14.4	17.7
75	33.7	33.7	30.1	25.3	30.1		21.3	19.6	17.7	16.2	19.6
76	37.0	37.0	33.3	28.3	33.3		23.5	21.9	20.0	18.3	21.9
77	40.7	40.7	36.9	31.8	36.9		26.1	24.5	22.6	20.7	24.5
78	45.1	45.1	41.1	35.9	41.1		29.0	27.4	25.5	23.4	27.4
79	50.0	50.0	45.9	40.5	45.9		32.3	30.7	28.9	26.5	30.7
80	55.6	55.6	51.3	45.7	51.3		36.1	34.4	32.7	29.9	34.4
81	62.0	62.0	57.5	51.8	57.5		40.3	38.6	37.1	33.9	38.6
82	69.3	69.3	64.6	58.6	64.6		45.1	43.4	42.0	38.5	43.4
83	77.5	77.5	72.5	66.4	72.5		50.5	48.8	47.6	43.6	48.8
84	86.4	86.4	81.2	75.0	81.2		56.5	54.8	53.9	49.4	54.8
85	96.2	96.2	90.8	84.5	90.8		63.2	61.6	61.0	55.9	61.6
86	106.8	106.8	101.2	94.8	101.2		70.9	69.4	69.2	63.3	69.4
87	118.4	118.4	112.6	106.3	112.6		79.8	78.4	78.4	72.0	78.4
88	131.4	131.4	125.3	119.1	125.3		90.1	88.8	88.8	82.1	88.8
89	146.0	146.0	139.7	133.7	139.7		102.0	101.0	101.0	93.9	101.0
90	162.3	162.3	155.8	150.0	155.8		115.7	114.8	114.8	107.5	114.8
91	180.0	180.0	173.4	168.0	173.4		130.9	130.3	130.3	122.6	130.3
92	198.9	198.9	192.2	187.2	192.2		147.3	147.1	147.1	139.2	147.1
93	218.7	218.7	211.9	207.6	211.9		165.0	165.0	165.0	156.9	165.0
94	239.3	239.3	232.6	229.1	232.6		183.5	183.5	183.5	175.4	183.5
95	261.0	261.0	254.4	251.8	254.4		202.5	202.5	202.5	194.5	202.5
96	283.6	283.6	277.1	275.8	277.1		221.7	221.7	221.7	213.9	221.7
97	307.1	307.1	300.9	300.9	300.9		240.6	240.6	240.6	233.2	240.6
98	330.8	330.8	324.9	324.9	324.9		260.7	260.7	260.7	253.8	260.7
99	354.6	354.6	349.1	349.1	349.1		281.8	281.8	281.8	275.5	281.8
100	378.3	378.3	373.3	373.3	373.3		303.6	303.6	303.6	298.1	303.6
101	401.9	401.9	397.5	397.5	397.5		326.1	326.1	326.1	321.4	326.1
102	425.3	425.3	421.5	421.5	421.5		349.0	349.0	349.0	345.4	349.0
103	448.2	448.2	445.2	445.2	445.2		372.2	372.2	372.2	369.7	372.2
104	470.7	470.7	468.6	468.6	468.6		395.5	395.5	395.5	394.4	395.5
105	492.7	492.7	491.4	491.4	491.4		418.8	418.8	418.8	418.8	418.8
110	594.3	594.3	594.3	594.3	594.3		528.8	528.8	528.8	528.8	528.8
115	668.4	668.4	668.4	668.4	668.4		612.8	612.8	612.8	612.8	612.8
120	700.0	700.0	700.0	700.0	700.0		650.0	650.0	650.0	650.0	650.0

Table 50 Life Table of Retirement Beneficiaries (All Levels, 2013)

	Males					Females			
Age	l_x	1,000 q_x	d_x	$\mathring{e}_x$		l_x	1,000 q_x	d_x	$\mathring{e}_x$
60	100,000	6.1	611	23.12		100,000	3.0	299	26.45
61	99,389	7.2	716	22.26		99,701	3.7	368	25.53
62	98,673	8.3	821	21.41		99,333	4.5	442	24.62
63	97,852	9.5	928	20.59		98,891	5.3	521	23.73
64	96,924	10.7	1,034	19.78		98,370	6.1	603	22.85
65	95,890	11.9	1,139	18.99		97,767	7.0	687	21.99
66	94,751	13.1	1,243	18.21		97,080	8.0	772	21.14
67	93,508	14.4	1,345	17.45		96,308	8.9	856	20.31
68	92,163	15.7	1,448	16.69		95,452	9.9	943	19.49
69	90,715	17.2	1,558	15.95		94,509	10.9	1,032	18.67
70	89,157	18.8	1,677	15.22		93,477	12.0	1,125	17.88
71	87,480	20.7	1,807	14.50		92,352	13.2	1,222	17.09
72	85,673	22.7	1,945	13.80		91,130	14.5	1,325	16.31
73	83,728	24.9	2,088	13.11		89,805	16.0	1,439	15.54
74	81,640	27.4	2,236	12.43		88,366	17.7	1,565	14.79
75	79,404	30.2	2,394	11.77		86,801	19.6	1,705	14.05
76	77,010	33.3	2,564	11.12		85,096	21.9	1,862	13.32
77	74,446	36.9	2,749	10.48		83,234	24.5	2,036	12.60
78	71,697	41.1	2,948	9.87		81,198	27.4	2,222	11.91
79	68,749	45.9	3,155	9.27		78,976	30.7	2,422	11.23
80	65,594	51.3	3,367	8.69		76,554	34.4	2,632	10.57
81	62,227	57.5	3,579	8.13		73,922	38.6	2,853	9.93
82	58,648	64.6	3,787	7.60		71,069	43.4	3,084	9.30
83	54,861	72.5	3,976	7.09		67,985	48.8	3,317	8.70
84	50,885	81.2	4,133	6.60		64,668	54.8	3,546	8.12
85	46,752	90.8	4,244	6.14		61,122	61.6	3,766	7.57
86	42,508	101.2	4,300	5.71		57,356	69.4	3,979	7.03
87	38,208	112.6	4,301	5.29		53,377	78.4	4,183	6.52
88	33,907	125.3	4,249	4.90		49,194	88.8	4,370	6.03
89	29,658	139.7	4,144	4.53		44,824	101.0	4,525	5.57
90	25,514	155.8	3,976	4.18		40,299	114.8	4,628	5.14
91	21,538	173.4	3,735	3.86		35,671	130.3	4,648	4.74
92	17,803	192.2	3,421	3.57		31,023	147.1	4,564	4.37
93	14,382	211.9	3,048	3.30		26,459	165.0	4,364	4.04
94	11,334	232.6	2,636	3.05		22,095	183.5	4,055	3.74
95	8,698	254.4	2,212	2.83		18,040	202.5	3,654	3.47
96	6,486	277.1	1,797	2.62		14,386	221.7	3,189	3.22
97	4,689	300.9	1,411	2.43		11,197	240.6	2,694	3.00
98	3,278	324.9	1,065	2.26		8,503	260.7	2,217	2.79
99	2,213	349.1	772	2.11		6,286	281.8	1,771	2.60
100	1,441	373.3	538	1.97		4,515	303.6	1,371	2.42
101	903	397.5	359	1.85		3,144	326.1	1,025	2.26
102	544	421.5	229	1.73		2,119	349.0	740	2.12
103	315	445.2	140	1.63		1,379	372.2	513	1.98
104	175	468.6	82	1.54		866	395.6	343	1.86
105	93	491.4	46	1.46		523	418.8	219	1.75
110	2	594.4	1	1.15		23	528.8	12	1.34
115	0	668.5	0	0.99		0	612.8	0	1.11
120	0	700.0	0	0.80		0	650.0	0	0.85

Table 51 Life Table of Retirement Beneficiaries (Less than 37.5%, 2013)

	Males					Females			
Age	l_x	1,000 q_x	d_x	$\mathring{e}_x$		l_x	1,000 q_x	d_x	$\mathring{e}_x$
60	100,000	13.4	1,344	21.56		100,000	4.4	440	25.81
61	98,656	14.6	1,436	20.85		99,560	5.2	515	24.92
62	97,220	15.4	1,498	20.15		99,045	6.0	590	24.04
63	95,722	16.0	1,532	19.46		98,455	6.9	674	23.19
64	94,190	16.4	1,546	18.77		97,781	7.8	764	22.34
65	92,644	17.4	1,613	18.07		97,017	9.3	901	21.51
66	91,031	17.8	1,617	17.38		96,116	9.9	953	20.71
67	89,414	18.6	1,663	16.69		95,163	10.7	1,021	19.91
68	87,751	19.7	1,726	16.00		94,142	11.6	1,095	19.12
69	86,025	21.0	1,803	15.31		93,047	12.6	1,174	18.34
70	84,222	22.5	1,895	14.62		91,873	13.7	1,258	17.57
71	82,327	24.3	1,999	13.95		90,615	14.9	1,347	16.81
72	80,328	26.3	2,111	13.28		89,268	16.2	1,443	16.05
73	78,217	28.5	2,227	12.63		87,825	17.6	1,548	15.31
74	75,990	30.9	2,349	11.98		86,277	19.3	1,667	14.58
75	73,641	33.7	2,482	11.35		84,610	21.3	1,799	13.85
76	71,159	37.0	2,631	10.73		82,811	23.5	1,948	13.14
77	68,528	40.7	2,791	10.12		80,863	26.1	2,111	12.45
78	65,737	45.1	2,963	9.53		78,752	29.0	2,287	11.77
79	62,774	50.0	3,140	8.95		76,465	32.4	2,474	11.11
80	59,634	55.7	3,319	8.40		73,991	36.1	2,669	10.46
81	56,315	62.1	3,494	7.87		71,322	40.3	2,874	9.83
82	52,821	69.3	3,662	7.35		68,448	45.1	3,086	9.22
83	49,159	77.5	3,808	6.86		65,362	50.5	3,298	8.64
84	45,351	86.4	3,920	6.40		62,064	56.5	3,504	8.07
85	41,431	96.2	3,986	5.96		58,560	63.2	3,700	7.52
86	37,445	106.8	3,999	5.54		54,860	70.9	3,888	6.99
87	33,446	118.4	3,960	5.14		50,972	79.8	4,066	6.49
88	29,486	131.4	3,873	4.76		46,906	90.1	4,226	6.01
89	25,613	146.0	3,739	4.41		42,680	102.1	4,355	5.55
90	21,874	162.3	3,549	4.07		38,325	115.7	4,434	5.13
91	18,325	180.0	3,299	3.77		33,891	130.9	4,435	4.73
92	15,026	198.9	2,988	3.48		29,456	147.3	4,339	4.37
93	12,038	218.7	2,632	3.22		25,117	165.0	4,143	4.04
94	9,406	239.4	2,251	2.99		20,974	183.5	3,849	3.74
95	7,155	261.0	1,868	2.77		17,125	202.5	3,468	3.47
96	5,287	283.6	1,499	2.57		13,657	221.7	3,027	3.22
97	3,788	307.1	1,163	2.39		10,630	240.6	2,558	3.00
98	2,625	330.8	868	2.23		8,072	260.7	2,105	2.79
99	1,757	354.6	623	2.08		5,967	281.8	1,681	2.60
100	1,134	378.3	429	1.95		4,286	303.6	1,301	2.42
101	705	401.9	283	1.83		2,985	326.1	973	2.26
102	422	425.3	179	1.72		2,012	349.0	702	2.12
103	243	448.2	109	1.62		1,310	372.2	488	1.98
104	134	470.7	63	1.53		822	395.6	325	1.86
105	71	492.7	35	1.46		497	418.8	208	1.75
110	2	594.4	1	1.15		22	528.8	12	1.34
115	0	668.5	0	0.99		0	612.8	0	1.11
120	0	700.0	0	0.80		0	650.0	0	0.85

Table 52 Life Table of Retirement Beneficiaries (37.5% to 75%, 2013)

	Males					Females			
Age	l_x	1,000 q_x	d_x	$\mathring{e}_x$		l_x	1,000 q_x	d_x	$\mathring{e}_x$
60	100,000	6.7	669	22.24		100,000	3.1	311	26.48
61	99,331	7.9	787	21.39		99,689	3.6	362	25.56
62	98,544	9.3	914	20.55		99,327	4.2	415	24.65
63	97,630	10.9	1,059	19.74		98,912	4.9	480	23.75
64	96,571	12.6	1,215	18.95		98,432	5.7	560	22.86
65	95,356	15.6	1,483	18.19		97,872	7.0	688	21.99
66	93,873	16.4	1,540	17.47		97,184	8.0	773	21.14
67	92,333	17.5	1,617	16.75		96,411	8.9	857	20.31
68	90,716	18.8	1,704	16.04		95,554	9.9	944	19.49
69	89,012	20.2	1,802	15.34		94,610	10.9	1,033	18.67
70	87,210	21.9	1,911	14.64		93,577	12.0	1,126	17.88
71	85,299	23.8	2,032	13.96		92,451	13.2	1,223	17.09
72	83,267	26.0	2,161	13.29		91,228	14.5	1,326	16.31
73	81,106	28.3	2,294	12.63		89,902	16.0	1,440	15.54
74	78,812	30.9	2,432	11.98		88,462	17.7	1,567	14.79
75	76,380	33.7	2,575	11.35		86,895	19.6	1,707	14.05
76	73,805	37.0	2,729	10.73		85,188	21.9	1,864	13.32
77	71,076	40.7	2,895	10.12		83,324	24.5	2,038	12.60
78	68,181	45.1	3,073	9.53		81,286	27.4	2,225	11.91
79	65,108	50.0	3,257	8.95		79,061	30.7	2,425	11.23
80	61,851	55.7	3,442	8.40		76,636	34.4	2,635	10.57
81	58,409	62.1	3,624	7.87		74,001	38.6	2,856	9.93
82	54,785	69.3	3,798	7.35		71,145	43.4	3,087	9.30
83	50,987	77.5	3,949	6.86		68,058	48.8	3,321	8.70
84	47,038	86.4	4,066	6.40		64,737	54.8	3,550	8.12
85	42,972	96.2	4,134	5.96		61,187	61.6	3,770	7.57
86	38,838	106.8	4,148	5.54		57,417	69.4	3,984	7.03
87	34,690	118.4	4,108	5.14		53,433	78.4	4,188	6.52
88	30,582	131.4	4,017	4.76		49,245	88.8	4,374	6.03
89	26,565	146.0	3,878	4.41		44,871	101.0	4,530	5.57
90	22,687	162.3	3,681	4.07		40,341	114.8	4,632	5.14
91	19,006	180.0	3,422	3.77		35,709	130.3	4,653	4.74
92	15,584	198.9	3,099	3.48		31,056	147.1	4,569	4.37
93	12,485	218.7	2,730	3.22		26,487	165.0	4,369	4.04
94	9,755	239.4	2,335	2.99		22,118	183.5	4,059	3.74
95	7,420	261.0	1,937	2.77		18,059	202.5	3,657	3.47
96	5,483	283.6	1,555	2.57		14,402	221.7	3,192	3.22
97	3,928	307.1	1,206	2.39		11,210	240.6	2,698	3.00
98	2,722	330.8	901	2.23		8,512	260.7	2,219	2.79
99	1,821	354.6	646	2.08		6,293	281.8	1,773	2.60
100	1,175	378.3	445	1.95		4,520	303.6	1,372	2.42
101	730	401.9	293	1.83		3,148	326.1	1,027	2.26
102	437	425.3	186	1.72		2,121	349.0	740	2.12
103	251	448.2	113	1.62		1,381	372.2	514	1.98
104	138	470.7	65	1.53		867	395.6	343	1.86
105	73	492.7	36	1.46		524	418.8	219	1.75
110	2	594.4	1	1.15		23	528.8	12	1.34
115	0	668.5	0	0.99		0	612.8	0	1.11
120	0	700.0	0	0.80		0	650.0	0	0.85

Table 53 Life Table of Retirement Beneficiaries (75% to 100%, 2013)

	Males					Females			
Age	l_x	1,000 q_x	d_x	$\mathring{e}_x$		l_x	1,000 q_x	d_x	$\mathring{e}_x$
60	100,000	5.3	533	23.35		100,000	2.3	232	27.11
61	99,467	6.2	617	22.48		99,768	2.8	282	26.17
62	98,850	7.1	701	21.61		99,486	3.4	335	25.25
63	98,149	8.1	790	20.76		99,151	4.0	392	24.33
64	97,359	9.2	898	19.93		98,759	4.7	462	23.42
65	96,461	10.2	981	19.11		98,297	4.4	436	22.53
66	95,480	11.8	1,124	18.30		97,861	5.6	544	21.63
67	94,356	13.3	1,251	17.51		97,317	6.6	642	20.75
68	93,105	14.8	1,376	16.74		96,675	7.7	740	19.88
69	91,729	16.4	1,504	15.99		95,935	8.7	838	19.03
70	90,225	18.2	1,641	15.24		95,097	9.9	941	18.20
71	88,584	20.2	1,789	14.52		94,156	11.1	1,049	17.37
72	86,795	22.4	1,943	13.81		93,107	12.5	1,163	16.56
73	84,852	24.8	2,103	13.11		91,944	14.0	1,287	15.77
74	82,749	27.4	2,266	12.43		90,657	15.7	1,425	14.98
75	80,483	30.2	2,427	11.77		89,232	17.7	1,578	14.21
76	78,056	33.3	2,599	11.12		87,654	20.0	1,750	13.46
77	75,457	36.9	2,787	10.48		85,904	22.6	1,939	12.72
78	72,670	41.1	2,988	9.87		83,965	25.5	2,144	12.01
79	69,682	45.9	3,198	9.27		81,821	28.9	2,365	11.31
80	66,484	51.3	3,413	8.69		79,456	32.7	2,599	10.63
81	63,071	57.5	3,628	8.13		76,857	37.1	2,848	9.97
82	59,443	64.6	3,838	7.60		74,009	42.0	3,110	9.34
83	55,605	72.5	4,030	7.09		70,899	47.6	3,376	8.73
84	51,575	81.2	4,189	6.60		67,523	53.9	3,641	8.14
85	47,386	90.8	4,301	6.14		63,882	61.0	3,899	7.57
86	43,085	101.2	4,358	5.71		59,983	69.2	4,151	7.03
87	38,727	112.6	4,359	5.29		55,832	78.4	4,376	6.52
88	34,368	125.3	4,307	4.90		51,456	88.8	4,571	6.03
89	30,061	139.7	4,200	4.53		46,885	101.0	4,733	5.57
90	25,861	155.8	4,030	4.18		42,152	114.8	4,840	5.14
91	21,831	173.4	3,786	3.86		37,312	130.3	4,861	4.74
92	18,045	192.2	3,468	3.57		32,451	147.1	4,774	4.37
93	14,577	211.9	3,089	3.30		27,677	165.0	4,565	4.04
94	11,488	232.6	2,672	3.05		23,112	183.5	4,242	3.74
95	8,816	254.4	2,242	2.83		18,870	202.5	3,822	3.47
96	6,574	277.1	1,822	2.62		15,048	221.7	3,336	3.22
97	4,752	300.9	1,430	2.43		11,712	240.6	2,818	3.00
98	3,322	324.9	1,079	2.26		8,894	260.7	2,319	2.79
99	2,243	349.1	783	2.11		6,575	281.8	1,853	2.60
100	1,460	373.3	545	1.97		4,722	303.6	1,434	2.42
101	915	397.5	364	1.85		3,288	326.1	1,072	2.26
102	551	421.5	232	1.73		2,216	349.0	773	2.12
103	319	445.2	142	1.63		1,443	372.2	537	1.98
104	177	468.6	83	1.54		906	395.6	358	1.86
105	94	491.4	46	1.46		548	418.8	230	1.75
110	2	594.4	1	1.15		24	528.8	13	1.34
115	0	668.5	0	0.99		0	612.8	0	1.11
120	0	700.0	0	0.80		0	650.0	0	0.85

Table 54 Life Table of Retirement Beneficiaries (100%, 2013)

	Males					Females			
Age	l_x	1,000 q_x	d_x	$\mathring{e}_x$		l_x	1,000 q_x	d_x	$\mathring{e}_x$
60	100,000	4.2	416	24.51		100,000	2.3	231	27.68
61	99,584	5.0	500	23.61		99,769	2.8	282	26.75
62	99,084	5.8	578	22.73		99,487	3.4	335	25.82
63	98,506	6.5	639	21.86		99,152	3.9	391	24.91
64	97,867	7.1	691	20.99		98,761	4.3	422	24.00
65	97,176	6.8	662	20.14		98,339	4.1	400	23.10
66	96,514	8.4	810	19.28		97,939	5.1	499	22.20
67	95,704	9.8	939	18.43		97,440	6.1	590	21.31
68	94,765	11.2	1,063	17.61		96,850	7.0	679	20.43
69	93,702	12.7	1,191	16.81		96,171	8.0	770	19.58
70	92,511	14.3	1,327	16.02		95,401	9.1	865	18.73
71	91,184	16.1	1,472	15.24		94,536	10.2	964	17.90
72	89,712	18.1	1,625	14.48		93,572	11.4	1,070	17.08
73	88,087	20.3	1,786	13.74		92,502	12.8	1,186	16.27
74	86,301	22.6	1,954	13.02		91,316	14.4	1,314	15.47
75	84,347	25.3	2,134	12.31		90,002	16.2	1,457	14.69
76	82,213	28.3	2,330	11.61		88,545	18.3	1,618	13.92
77	79,883	31.8	2,543	10.94		86,927	20.7	1,796	13.17
78	77,340	35.9	2,774	10.28		85,131	23.4	1,990	12.44
79	74,566	40.5	3,018	9.64		83,141	26.5	2,200	11.73
80	71,548	45.7	3,273	9.03		80,941	30.0	2,424	11.03
81	68,275	51.8	3,533	8.44		78,517	33.9	2,663	10.36
82	64,742	58.6	3,795	7.87		75,854	38.5	2,917	9.70
83	60,947	66.4	4,046	7.33		72,937	43.6	3,179	9.07
84	56,901	75.0	4,268	6.81		69,758	49.4	3,443	8.46
85	52,633	84.5	4,445	6.33		66,315	55.9	3,705	7.88
86	48,188	94.8	4,570	5.86		62,610	63.3	3,966	7.31
87	43,618	106.3	4,635	5.43		58,644	72.0	4,224	6.77
88	38,983	119.1	4,644	5.01		54,420	82.2	4,471	6.26
89	34,339	133.7	4,590	4.62		49,949	93.9	4,691	5.78
90	29,749	150.0	4,463	4.26		45,258	107.5	4,863	5.32
91	25,286	168.0	4,248	3.92		40,395	122.6	4,952	4.90
92	21,038	187.2	3,939	3.61		35,443	139.2	4,933	4.52
93	17,099	207.6	3,550	3.33		30,510	156.9	4,785	4.17
94	13,549	229.1	3,104	3.07		25,725	175.4	4,512	3.85
95	10,445	251.8	2,630	2.84		21,213	194.5	4,126	3.56
96	7,815	275.8	2,155	2.62		17,087	213.9	3,654	3.30
97	5,660	300.9	1,703	2.43		13,433	233.2	3,133	3.06
98	3,957	324.9	1,286	2.26		10,300	253.8	2,614	2.84
99	2,671	349.1	932	2.11		7,686	275.5	2,117	2.64
100	1,739	373.3	649	1.97		5,569	298.1	1,660	2.45
101	1,090	397.5	433	1.85		3,909	321.4	1,256	2.28
102	657	421.5	277	1.73		2,653	345.4	916	2.13
103	380	445.2	169	1.63		1,737	369.7	642	1.99
104	211	468.6	99	1.54		1,095	394.4	432	1.86
105	112	491.4	55	1.46		663	418.8	278	1.75
110	3	594.4	2	1.15		29	528.8	15	1.34
115	0	668.5	0	0.99		0	612.8	0	1.11
120	0	700.0	0	0.80		0	650.0	0	0.85

Table 55 Survivor Beneficiaries by Age and Sex (1st July)

	Males				Females		
Age	**1993**	**2003**	**2013**		**1993**	**2003**	**2013**
< 50	9,392	10,330	7,546		48,849	42,456	28,544
50	1,036	1,564	1,458		5,168	5,650	5,132
51	1,059	1,666	1,665		5,441	6,023	5,570
52	1,138	1,743	1,908		5,919	6,519	6,278
53	1,109	1,906	2,110		6,120	7,050	6,942
54	1,214	2,110	2,393		6,708	8,076	7,586
55	1,219	2,377	2,569		7,113	9,031	8,474
56	1,294	2,680	2,798		7,587	10,235	9,253
57	1,435	2,413	3,007		8,254	9,353	9,836
58	1,557	2,424	3,263		8,972	9,509	10,998
59	1,644	2,687	3,596		9,534	10,750	11,619
60	1,781	2,852	3,651		10,676	11,528	12,290
61	1,972	2,731	3,847		11,900	11,921	13,045
62	2,063	2,884	4,085		12,929	12,744	14,063
63	2,210	2,882	4,421		13,983	13,100	15,040
64	2,107	3,030	4,730		14,866	14,084	16,448
65	2,237	3,099	5,208		16,017	14,787	18,115
66	2,359	3,186	5,861		17,346	15,407	20,319
67	2,455	3,481	5,105		18,705	16,811	18,394
68	2,423	3,602	5,049		19,970	17,551	18,367
69	2,523	3,579	5,455		20,840	18,384	20,210
70	2,430	3,872	5,667		21,915	20,172	21,015
71	2,527	4,009	5,492		23,300	21,749	20,982
72	2,413	4,283	5,511		23,336	23,032	22,396
73	2,403	4,130	5,497		24,177	24,240	22,367
74	2,004	4,054	5,507		20,823	24,947	23,249
75	1,982	4,056	5,530		20,609	26,298	24,387
76	1,980	4,093	5,523		20,872	27,247	24,541
77	1,805	4,136	5,756		20,724	28,406	25,808
78	1,952	3,915	5,783		20,984	29,265	26,321
79	1,805	3,782	5,754		19,847	29,438	26,768
80	1,655	3,606	5,921		18,216	29,420	28,075
81	1,434	3,505	5,661		16,283	29,902	28,626
82	1,287	3,175	5,845		14,362	28,347	29,138
83	1,163	2,979	5,319		12,912	27,478	28,999
84	944	2,227	5,043		11,089	22,206	28,113
85	845	2,065	4,682		9,485	20,436	27,894
86	672	1,879	4,319		7,686	19,027	26,691
87	522	1,619	3,950		5,933	16,992	25,657
88	434	1,439	3,462		4,484	15,585	23,874
89	321	1,220	3,084		3,391	13,527	21,990
90	246	976	2,554		2,403	10,967	19,642
91	164	729	2,057		1,482	8,469	17,397
92	117	593	1,633		1,011	6,499	14,151
93	73	417	1,339		583	5,019	11,901
94	57	273	825		351	3,611	7,996
95	36	208	585		193	2,548	6,202
96	15	142	398		106	1,761	4,685
97	9	80	301		52	1,082	3,313
98	6	45	201		24	620	2,505
99	3	37	122		15	405	1,707
100+	9	42	153		10	416	2,485
Total	**75,540**	**130,812**	**193,199**		**603,555**	**790,080**	**875,398**

Table 56 Survivor Deaths by Age and Sex (1993, 2003 and 2013)

	Males				Females		
Age	**1993**	**2003**	**2013**		**1993**	**2003**	**2013**
< 50	26	28	24		107	88	52
50	4	8	4		13	16	11
51	3	4	10		25	23	11
52	6	13	7		24	30	26
53	15	12	12		32	25	30
54	7	15	11		33	41	31
55	10	20	15		46	40	37
56	13	15	18		52	59	29
57	22	15	19		53	56	59
58	20	17	29		66	52	63
59	36	20	27		73	68	86
60	21	38	41		105	93	87
61	31	34	48		114	125	97
62	41	33	54		110	102	101
63	37	56	56		153	134	125
64	67	56	67		190	154	133
65	48	57	94		225	190	172
66	70	70	85		224	221	223
67	77	61	86		277	250	219
68	78	90	95		303	267	236
69	96	93	98		381	293	293
70	94	132	108		421	365	301
71	123	140	161		456	418	368
72	121	157	147		535	463	412
73	130	182	193		642	571	461
74	114	205	201		591	628	514
75	117	236	196		614	732	593
76	128	237	234		643	800	621
77	137	260	270		811	960	759
78	153	249	285		843	1,155	832
79	169	291	268		935	1,254	1,007
80	157	304	330		937	1,275	1,065
81	143	318	398		892	1,527	1,195
82	152	333	438		843	1,542	1,412
83	143	312	450		884	1,678	1,589
84	133	234	487		868	1,541	1,703
85	118	264	511		840	1,637	1,795
86	104	284	526		705	1,668	2,100
87	107	274	516		665	1,769	2,236
88	75	251	480		542	1,785	2,350
89	72	230	490		442	1,729	2,345
90	48	210	469		323	1,569	2,554
91	37	172	459		264	1,401	2,417
92	43	138	364		160	1,143	2,372
93	20	98	333		119	994	2,161
94	13	114	207		88	838	1,708
95	11	86	168		36	656	1,441
96	7	50	147		32	482	1,212
97	4	36	90		17	338	995
98	2	17	95		7	240	827
99	2	16	59		3	141	566
100+	4	25	81		7	183	1,022
Total	**3,409**	**6,610**	**10,061**		**17,771**	**33,809**	**43,054**

Table 57 Survivor Exposures by Age and Sex (1993, 2003 and 2013)

	Males				Females		
Age	**1993**	**2003**	**2013**		**1993**	**2003**	**2013**
< 50	9,187	10,166	7,469		46,895	41,856	28,403
50	1,038	1,552	1,469		4,911	5,560	5,094
51	1,029	1,650	1,643		5,219	5,954	5,538
52	1,100	1,730	1,902		5,551	6,434	6,255
53	1,115	1,889	2,115		5,844	6,970	6,883
54	1,162	2,080	2,345		6,388	7,934	7,585
55	1,194	2,332	2,558		6,810	8,936	8,373
56	1,310	2,657	2,791		7,263	9,983	9,178
57	1,378	2,400	2,996		7,924	9,202	9,901
58	1,511	2,429	3,280		8,589	9,431	10,914
59	1,637	2,671	3,552		9,185	10,584	11,578
60	1,720	2,808	3,658		10,146	11,331	12,265
61	1,920	2,737	3,872		11,362	11,782	13,094
62	2,033	2,808	4,064		12,422	12,452	13,948
63	2,131	2,895	4,403		13,355	12,939	14,978
64	2,077	2,977	4,725		14,266	13,936	16,442
65	2,178	3,085	5,220		15,400	14,620	18,186
66	2,293	3,234	5,772		16,580	15,305	20,037
67	2,400	3,417	5,115		18,089	16,525	18,419
68	2,369	3,554	5,098		19,276	17,425	18,510
69	2,436	3,632	5,456		20,221	18,258	20,033
70	2,434	3,831	5,612		21,173	19,783	20,941
71	2,453	3,997	5,515		22,642	21,496	21,170
72	2,389	4,217	5,480		22,931	22,879	22,129
73	2,345	4,123	5,512		23,305	23,946	22,441
74	1,974	4,052	5,485		20,411	24,802	23,328
75	1,969	4,064	5,516		20,335	26,034	24,265
76	1,943	4,078	5,584		20,444	26,969	24,662
77	1,810	4,116	5,754		20,524	28,163	25,745
78	1,920	3,909	5,811		20,690	29,020	26,426
79	1,785	3,760	5,802		19,736	29,239	26,921
80	1,631	3,645	5,902		18,142	29,316	27,959
81	1,439	3,518	5,736		16,155	29,752	28,742
82	1,279	3,226	5,800		14,399	28,514	29,308
83	1,166	2,920	5,436		12,910	27,089	29,035
84	959	2,252	5,064		11,180	22,237	28,336
85	835	2,080	4,757		9,507	20,576	27,978
86	673	1,901	4,347		7,702	19,015	26,898
87	543	1,634	4,007		6,004	17,171	25,852
88	435	1,472	3,548		4,580	15,769	24,136
89	326	1,233	3,087		3,434	13,599	22,222
90	253	994	2,601		2,434	11,099	19,864
91	170	757	2,152		1,542	8,593	17,591
92	129	586	1,709		1,014	6,649	14,557
93	79	435	1,341		607	5,123	11,981
94	55	289	846		354	3,711	8,272
95	33	215	600		204	2,617	6,369
96	17	144	439		112	1,790	4,776
97	9	85	305		55	1,118	3,495
98	5	50	209		25	664	2,581
99	4	38	128		15	417	1,751
100+	9	44	161		11	436	2,620
Total	**74,288**	**130,368**	**193,748**		**588,273**	**785,006**	**877,963**

Table 58 Life Table of Survivor Beneficiaries (2013)

	Males					Females			
Age	l_x	1,000	d_x	$\mathring{e}_x$		l_x	1,000 q_x	d_x	$\mathring{e}_x$
50	100,000	3.9	393	30.19		100,000	2.8	279	33.85
51	99,607	4.3	432	29.31		99,721	3.1	311	32.94
52	99,175	4.7	471	28.44		99,410	3.5	347	32.04
53	98,704	5.2	509	27.57		99,063	3.9	384	31.16
54	98,195	5.6	549	26.71		98,679	4.3	422	30.27
55	97,646	6.1	592	25.86		98,257	4.7	460	29.40
56	97,054	6.6	642	25.01		97,797	5.1	496	28.54
57	96,412	7.2	699	24.17		97,301	5.4	529	27.68
58	95,713	8.0	764	23.35		96,772	5.8	559	26.83
59	94,949	8.8	836	22.53		96,213	6.1	589	25.98
60	94,113	9.7	912	21.73		95,624	6.5	620	25.14
61	93,201	10.6	989	20.93		95,004	6.9	655	24.30
62	92,212	11.6	1,068	20.15		94,349	7.4	697	23.47
63	91,144	12.6	1,148	19.38		93,652	8.0	749	22.64
64	89,996	13.6	1,228	18.62		92,903	8.8	814	21.82
65	88,768	14.8	1,313	17.88		92,089	9.7	890	21.00
66	87,455	16.0	1,404	17.14		91,199	10.7	975	20.20
67	86,051	17.5	1,505	16.41		90,224	11.8	1,066	19.42
68	84,546	19.2	1,622	15.69		89,158	13.0	1,162	18.64
69	82,924	21.2	1,754	14.99		87,996	14.3	1,257	17.88
70	81,170	23.4	1,899	14.30		86,739	15.6	1,350	17.13
71	79,271	25.9	2,052	13.63		85,389	16.9	1,441	16.40
72	77,219	28.5	2,203	12.98		83,948	18.3	1,532	15.67
73	75,016	31.3	2,345	12.35		82,416	19.8	1,629	14.95
74	72,671	34.0	2,474	11.73		80,787	21.5	1,736	14.24
75	70,197	36.9	2,593	11.12		79,051	23.5	1,855	13.54
76	67,604	40.1	2,712	10.53		77,196	25.7	1,986	12.86
77	64,892	43.8	2,839	9.95		75,210	28.3	2,130	12.18
78	62,053	48.0	2,980	9.38		73,080	31.3	2,284	11.53
79	59,073	53.0	3,134	8.83		70,796	34.6	2,447	10.88
80	55,939	58.9	3,295	8.30		68,349	38.3	2,617	10.25
81	52,644	65.6	3,452	7.79		65,732	42.5	2,792	9.64
82	49,192	73.0	3,589	7.30		62,940	47.2	2,972	9.05
83	45,603	80.9	3,692	6.83		59,968	52.6	3,153	8.47
84	41,911	89.5	3,751	6.39		56,815	58.6	3,332	7.91
85	38,160	98.6	3,764	5.97		53,483	65.5	3,503	7.37
86	34,396	108.5	3,732	5.57		49,980	73.3	3,662	6.86
87	30,664	119.4	3,661	5.19		46,318	82.1	3,802	6.36
88	27,003	131.6	3,554	4.82		42,516	93.9	3,992	5.88
89	23,449	146.1	3,426	4.48		38,524	107.0	4,122	5.44
90	20,023	161.7	3,239	4.16		34,402	121.1	4,168	5.03
91	16,784	178.3	2,993	3.86		30,234	136.1	4,114	4.66
92	13,791	195.6	2,697	3.59		26,120	151.6	3,961	4.31
93	11,094	213.5	2,369	3.34		22,159	168.1	3,725	3.99
94	8,725	232.0	2,025	3.11		18,434	185.6	3,421	3.70
95	6,700	251.2	1,683	2.90		15,013	204.1	3,064	3.43
100	1,187	357.0	424	2.07		3,672	309.9	1,138	2.37
105	89	472.9	42	1.52		403	426.0	172	1.72
110	3	579.3	2	1.19		17	533.5	9	1.33
115	0	663.1	0	1.00		0	614.5	0	1.11
120	0	700.0	0	0.80		0	650.0	0	0.85

Table 59 Disability Beneficiaries by Age and Sex (1st July)

	Males				Females		
Age	**1991**	**2001**	**2011**		**1991**	**2001**	**2011**
20	14	0	0		5	0	0
21	38	3	6		21	2	3
22	74	21	11		26	12	13
23	104	34	39		51	19	30
24	152	56	91		97	30	58
25	169	108	152		88	78	86
26	251	145	151		188	103	119
27	348	185	245		216	119	183
28	423	224	274		315	187	231
29	501	303	369		421	247	323
30	654	370	403		485	395	404
31	764	475	452		566	467	494
32	860	569	563		629	563	603
33	965	706	613		718	769	750
34	1,147	992	688		898	917	797
35	1,175	1,059	813		936	1,197	941
36	1,276	1,390	946		1,111	1,460	1,113
37	1,424	1,615	1,016		1,164	1,753	1,188
38	1,519	1,909	1,136		1,305	2,099	1,450
39	1,624	2,009	1,363		1,303	2,275	1,666
40	1,793	2,298	1,517		1,423	2,556	1,959
41	1,905	2,566	1,840		1,546	2,680	2,210
42	2,095	2,660	1,996		1,700	2,926	2,418
43	2,287	2,960	2,230		1,759	3,131	2,798
44	2,588	3,285	2,585		2,011	3,497	3,118
45	2,416	3,315	3,009		1,848	3,813	3,641
46	2,485	3,654	3,630		1,926	4,099	4,348
47	2,779	3,923	4,052		2,173	4,335	5,091
48	2,972	4,109	4,768		2,423	4,516	5,500
49	3,373	4,447	4,919		2,424	4,687	5,950
50	3,567	4,842	5,409		2,618	4,945	6,515
51	3,828	5,035	5,699		2,883	5,366	6,892
52	4,176	5,574	6,124		3,161	5,827	7,359
53	4,832	6,056	6,644		3,425	6,263	7,931
54	5,236	6,825	7,254		3,600	7,044	8,312
55	5,964	6,548	7,568		4,026	6,213	9,037
56	6,732	6,699	8,261		4,423	6,236	9,657
57	7,543	7,341	8,939		4,762	6,865	9,881
58	8,693	8,006	9,446		5,207	7,321	10,306
59	9,883	8,376	9,998		5,704	7,212	10,564
60	10,918	8,934	10,620		6,038	7,451	10,967
61	11,618	9,076	10,656		6,068	7,724	11,215
62	11,795	9,543	10,958		6,088	7,681	11,468
63	12,275	10,104	11,081		5,994	7,822	11,483
64	10,926	9,295	10,370		5,340	6,911	10,817
Total	**156,161**	**157,644**	**168,904**		**99,113**	**149,813**	**189,889**

Table 60 Disability Deaths by Age and Sex (1991, 2001 and 2011)

	Males				Females		
Age	**1991**	**2001**	**2011**		**1991**	**2001**	**2011**
<20	0	0	0		0	0	0
20	1	0	0		2	0	0
21	0	0	0		0	1	0
22	3	1	0		0	1	0
23	3	4	1		1	0	3
24	4	9	4		2	1	1
25	7	3	9		4	3	0
26	7	2	3		6	2	1
27	24	6	2		7	1	2
28	17	8	6		7	3	7
29	26	4	8		5	12	7
30	31	8	4		10	11	11
31	34	14	8		18	15	5
32	37	13	10		16	3	6
33	47	15	16		15	14	13
34	43	21	6		19	15	9
35	48	19	18		29	23	12
36	54	24	12		30	27	13
37	37	24	16		30	33	15
38	46	46	20		35	34	22
39	66	39	28		34	30	27
40	62	43	32		46	47	29
41	67	66	35		50	48	36
42	80	60	35		52	62	39
43	77	78	43		44	63	46
44	98	78	60		70	64	56
45	88	91	56		54	77	57
46	96	93	84		51	73	73
47	112	109	90		60	90	105
48	114	112	121		73	116	110
49	138	147	135		71	91	122
50	118	147	140		84	105	132
51	139	157	175		85	131	170
52	172	194	196		77	123	168
53	207	196	215		79	160	195
54	201	237	243		76	172	189
55	252	216	277		121	143	185
56	283	264	277		109	145	224
57	292	290	309		112	159	244
58	384	292	347		120	165	241
59	406	312	369		144	169	262
60	432	353	418		129	157	243
61	518	356	405		150	168	260
62	485	382	444		138	168	269
63	528	350	454		154	186	255
64	553	368	459		133	173	242
Total	**6,437**	**5,250**	**5,590**		**2,552**	**3,284**	**4,106**

Table 61 Disability Exposures by Age and Sex (1991, 2001 and 2011)

	Males				Females		
Age	**1991**	**2001**	**2011**		**1991**	**2001**	**2011**
<20	2	0	0		2	0	0
20	12	0	0		6	0	0
21	37	4	5		18	1	3
22	70	19	13		28	8	12
23	104	33	38		49	20	29
24	140	59	88		85	35	58
25	170	106	148		94	75	81
26	246	144	165		161	98	123
27	334	179	227		223	122	182
28	415	227	286		303	179	230
29	513	311	355		407	255	320
30	628	366	400		480	380	396
31	766	468	462		558	464	496
32	862	576	547		633	577	606
33	970	724	600		720	763	735
34	1,099	926	692		874	917	776
35	1,165	1,093	806		947	1,184	947
36	1,271	1,369	929		1,076	1,423	1,110
37	1,393	1,614	1,027		1,165	1,764	1,191
38	1,497	1,868	1,152		1,269	2,048	1,430
39	1,621	2,045	1,348		1,293	2,274	1,650
40	1,764	2,283	1,530		1,406	2,537	1,945
41	1,873	2,539	1,800		1,527	2,674	2,205
42	2,057	2,681	1,993		1,646	2,942	2,427
43	2,286	2,931	2,250		1,732	3,122	2,772
44	2,523	3,231	2,527		1,952	3,503	3,130
45	2,406	3,345	3,048		1,843	3,791	3,654
46	2,488	3,661	3,577		1,893	4,079	4,325
47	2,732	3,902	4,092		2,140	4,314	5,052
48	2,965	4,114	4,671		2,336	4,516	5,484
49	3,305	4,444	4,972		2,390	4,687	5,945
50	3,517	4,790	5,340		2,563	4,940	6,476
51	3,746	5,061	5,733		2,822	5,379	6,914
52	4,190	5,561	6,142		3,099	5,781	7,381
53	4,775	6,084	6,638		3,371	6,301	7,895
54	5,188	6,749	7,224		3,547	6,968	8,389
55	5,924	6,583	7,609		3,970	6,254	8,980
56	6,663	6,760	8,249		4,336	6,240	9,573
57	7,488	7,351	8,902		4,722	6,855	9,923
58	8,601	7,907	9,396		5,131	7,252	10,241
59	9,829	8,445	10,020		5,637	7,229	10,622
60	10,904	8,913	10,554		6,024	7,441	10,960
61	11,629	9,082	10,715		6,045	7,679	11,190
62	11,800	9,569	11,025		6,068	7,743	11,399
63	12,283	10,115	11,151		5,998	7,807	11,558
64	11,949	10,293	11,201		5,841	7,656	11,662
Total	**156,202**	**158,528**	**169,647**		**98,425**	**150,276**	**190,478**

Table 62 Life Table of Disability Beneficiaries (2011)

	Males					Females			
Age	l_x	1,000 q_x	d_x	Temporary Complete Life Expectancy to Age 65		l_x	1,000 q_x	d_x	Temporary Complete Life Expectancy to Age 65
20	100,000	39.41	3,941	26.44		100,000	32.74	3,274	28.70
21	96,059	37.86	3,637	26.50		96,726	32.26	3,120	28.66
22	92,422	35.93	3,321	26.52		93,606	31.28	2,928	28.60
23	89,101	33.74	3,006	26.49		90,678	29.91	2,712	28.50
24	86,095	31.39	2,703	26.40		87,966	28.22	2,482	28.37
25	83,392	28.99	2,418	26.24		85,484	26.33	2,251	28.18
26	80,974	26.63	2,156	26.01		83,233	24.33	2,025	27.93
27	78,818	24.42	1,925	25.71		81,208	22.32	1,813	27.61
28	76,893	22.46	1,727	25.34		79,395	20.39	1,619	27.23
29	75,166	20.83	1,566	24.91		77,776	18.63	1,449	26.78
30	73,600	19.57	1,440	24.43		76,327	17.15	1,309	26.28
31	72,160	18.73	1,352	23.91		75,018	16.01	1,201	25.73
32	70,808	18.28	1,294	23.35		73,817	15.24	1,125	25.14
33	69,514	18.18	1,264	22.78		72,692	14.82	1,077	24.53
34	68,250	18.31	1,250	22.19		71,615	14.69	1,052	23.89
35	67,000	18.57	1,244	21.59		70,563	14.75	1,041	23.24
36	65,756	18.83	1,238	20.99		69,522	14.91	1,037	22.58
37	64,518	19.00	1,226	20.39		68,485	15.08	1,033	21.91
38	63,292	19.04	1,205	19.77		67,452	15.22	1,027	21.24
39	62,087	18.96	1,177	19.15		66,425	15.34	1,019	20.56
40	60,910	18.84	1,148	18.51		65,406	15.46	1,011	19.87
41	59,762	18.77	1,122	17.85		64,395	15.65	1,008	19.18
42	58,640	18.88	1,107	17.18		63,387	15.97	1,012	18.47
43	57,533	19.25	1,108	16.51		62,375	16.44	1,025	17.76
44	56,425	19.94	1,125	15.82		61,350	17.07	1,047	17.05
45	55,300	20.98	1,160	15.13		60,303	17.79	1,073	16.34
46	54,140	22.32	1,208	14.44		59,230	18.53	1,098	15.63
47	52,932	23.91	1,266	13.76		58,132	19.22	1,117	14.91
48	51,666	25.62	1,324	13.09		57,015	19.80	1,129	14.20
49	50,342	27.33	1,376	12.42		55,886	20.28	1,133	13.47
50	48,966	28.93	1,417	11.75		54,753	20.70	1,133	12.74
51	47,549	30.34	1,443	11.09		53,620	21.08	1,130	12.00
52	46,106	31.55	1,455	10.42		52,490	21.43	1,125	11.25
53	44,651	32.57	1,454	9.74		51,365	21.78	1,119	10.48
54	43,197	33.48	1,446	9.05		50,246	22.13	1,112	9.70
55	41,751	34.37	1,435	8.35		49,134	22.49	1,105	8.91
56	40,316	35.27	1,422	7.63		48,029	22.88	1,099	8.11
57	38,894	36.19	1,408	6.89		46,930	23.26	1,092	7.28
58	37,486	37.06	1,389	6.13		45,838	23.58	1,081	6.45
59	36,097	37.78	1,364	5.35		44,757	23.80	1,065	5.59
60	34,733	38.30	1,330	4.54		43,692	23.85	1,042	4.71
61	33,403	38.65	1,291	3.70		42,650	23.72	1,012	3.82
62	32,112	38.95	1,251	2.83		41,638	23.44	976	2.90
63	30,861	39.35	1,214	1.92		40,662	23.08	938	1.95
64	29,647	40.02	1,186	0.98		39,724	22.74	903	0.99

VIII. References and Acknowledgements

References:

Canada. Office of the Superintendent of Financial Institutions. *Canada Pension Plan Mortality Study, Actuarial Study No. 3.* Ottawa: Office of the Chief Actuary, 2003.

Canada. Office of the Superintendent of Financial Institutions. *Canada Pension Plan Mortality Study, Actuarial Study No. 5.* Ottawa: Office of the Chief Actuary, 2006.

Canada. Office of the Superintendent of Financial Institutions. *Canada Pension Plan Mortality Study, Actuarial Study No. 7.* Ottawa: Office of the Chief Actuary, 2009.

Canada. Office of the Superintendent of Financial Institutions. *Canada Pension Plan Experience Study of Disability Beneficiaries, Actuarial Study No. 9.* Ottawa: Office of the Chief Actuary, 2011.

Canada. Office of the Superintendent of Financial Institutions. *Old age Security Program Mortality Experience, Actuarial Study No. 11.* Ottawa: Office of the Chief Actuary, 2012.

Canada. Office of the Superintendent of Financial Institutions. *Mortality Projections for Social Security Programs in Canada, Actuarial Study No.12.* Ottawa: Office of the Chief Actuary, 2014.

Martikainen P, Valkonen T. Mortality after death of spouse in relation to duration of bereavement in Finland. J Epidemiol Community Health. 1996;50:264–8. doi:10.1136/jech.50.3.264. [PubMed Central free article].

Acknowledgments:

Service Canada provided statistics on the Canada Pension Plan.

The Canadian Human Mortality Database, Department of Demography, Université de Montréal, provided historical mortality data.

The co-operation and able assistance of Employment and Social Development Canada deserves to be acknowledged.

The following people assisted in the preparation of this study:

Assia Billig, Ph.D., F.S.A., F.C.I.A.
Patrick Dontigny, A.S.A.
Alain Guimond, A.S.A.
Sari Harrel, F.S.A., F.C.I.A.
Natacha Losier
Jean-Claude Ménard, F.S.A., F.C.I.A.
Michel Montambeault, F.S.A., F.C.I.A.
Louis-Marie Pommainville, F.S.A., F.C.I.A.