The Urban Futures Institute
Research on Population, Community Change and Land Use

What Can You Expect?
Life Expectancy in Canada, 1921 to 2021

By David Baxter and Andrew Ramlo
July 1998

The Urban Futures Institute Report 25

The Urban Futures Institute, P.O. Box 11605, #1720 - 650 West Georgia Street, Vancouver, B.C., Canada V6B 4N9
Phone: 604-682-8323 **Fax: 604-687-6149**

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Research on Population, Community Change and Land Use in British Columbia

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Summary

What can you expect? On average, you can expect to live to (at least) the ripe old age of 80, assuming that you are the typical 35 year old Canadian. This is almost a decade longer than the 71 year life span that a person your age anticipated in 1921. One out of every eight males, and one out of every four females, under the age of fifty five today will live to have their 90th birthday party, compared to fewer than one out of 20 people a century ago.

Life expectancy in Canada has increased dramatically over the past seventy five years. A male born in 1921 had a life expectancy of 59 years, and a female of 61 years. A male born today can expect to live to age 75.6 and a female to 81.4. Life expectancy at birth for males has increased by 17 years, and for females by a full 20 years, over the past three quarters of a century, a 29% increase in life expectancy for males and a 33% increase for females.

It is not just life expectancy at birth that has increased: a 35 year old male can expect to live to the ripe old age of 77.3, and a female of the same age to 82.5. Some will die younger, some older, but on average this is what a 35 year old can expect. A 50 year old male can expect to live to 78.5 compared to the 73.9 years of his 1921 counterpart, and a 50 year old female today can expect to live to 83.2, compared to 74.6 year life span expected for a 50 year female old in 1921.

These are conservative estimates of life expectancy, as they are based on the assumption that today's 35 years olds will have the same probability of dying when they are 65 as today's 65 year olds have: today's 35 year olds will have 25 years of additional medical research to reduce the probability of dying in the future.

This means that today's oldest Baby Boomers (the 50 year olds) will be alive, and living in their homes, 30 to 35 years from now, and the last (and most numerous, today's 35 to 39 year olds) of the Baby Boomers will be doing the same thing in 45 to 50 years. In fact, the first of the post Baby Boom generation, today's 30 to 34 year olds, will be retiring (if they retire at 65) while the first of the Baby Boom generation are still alive, and living in their homes. Baby Boomers can expect to live long enough to be a problem not only for their children, but their grand children, and great grand children, too.

Life expectancy has increased over the past seventy five years as a result of overwhelming improvement in medical technology and knowledge. The big killers of the pre World War Two years - tuberculosis (the leading cause of death for women, and the second leading cause for men in the pre-War years); influenza, bronchitis and pneumonia; whooping cough, diphtheria, meningitis, appendicitis, measles, poliomyelitis, rheumatic fever, typhoid fever, epilepsy, ulcers, hernias and syphilis - all had disappeared from the leading causes of death lists, and almost disappeared as causes of death, in Canada by the 1980s.

The three major remaining barriers to further extending life expectancy are mortality due to accidents, violence and adverse affects (the cause of more than two thirds of deaths of young adults), cancers (the leading cause of death for in the 40 to 74 age group), and cardiovascular disease (the leading cause in the 75 and older age groups). As knowledge and technology, combined with life style changes, reduces these mortality rates, life expectancies will be further extended. If current trends continue, by 2021, life expectancy for males at birth will be in the range of 80 years, and for female in the range of 85 years.

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Everyone in Canada should be planning on reaching the age of 80; if people are old enough to actually be thinking about retiring, they should (on average) be planning to live until they are 85; and, because we all hope to live longer than the average and because life expectancy will increase, 90 is a good age to actually be planning to reach. Retirement planning, therefore, should be focused on preparing for 25 years of life after today's common retirement age of 65. Accumulating sufficient resources to support people for 25 years without working is going to be an overwhelming challenge for both individuals and pension plans. Increased life expectancies combined with the aging of Baby Boom Generation will increase the number of people 65 years of age and older in Canada's population from its current 12% (1 in 8) share to 23% (almost 1 in 4) by 2036.

The projection of a doubling of the share of our population that is 65 years of age and older has a number of significant implications. The most commonly discussed implications focus on what is called the dependency ratio. This ratio is the number of people aged 65 and older divided by the number of people of working age (15 to 64 years of age). Currently, there are 177 people 65 years of age and older per 1,000 people of working age in Canada: this will increase to the 380 per 1,000 by 2036, as the population 65 and older increases at more than twice the rate of the working aged population.

The fact that this ratio will increase is without question: the only question is the validity of the concept of dependency. Currently, there is a dependency relationship between 65 and older population and the working population: 45% of the households in Canada with household maintainers 65 years of age and older receive 80% or more of their household income from government transfers; spending on the 12% of the population that is in the 65 plus age group accounts for 39% of national heath care expenditures; and Canada Pension Plan contributions are already 15% below expenditures.

The OECD has warned that "Canada will be faced with sharp increases in tax burdens during the 2005 to 2040 period. Canadians will most likely have to choose between increasing tax rates and social security contributions or lower levels of social benefits". Canadians must collectively address the level of support from social services that will be appropriate given a more than doubling of the ratio of the number of people 65 and older to the number of people of working age. Some of this discussion will focus on redirection and reformation of social benefits programs such as pension plans (both public and private), health care, social services delivery systems, and other age related subsidy programs. This will involve evaluation of changes in both contribution requirements and benefits provided, and hence in the degree to which one generation is dependent on others.

As well, it will involve a redefinition of what "elderly" and hence "eligible for benefits" will mean. Increases in life expectancies have been matched with increases in fitness and health. Today's 70 year olds are a lot younger than the 70 year olds of 1971, and the 70 year olds of 2021 will be a lot younger than today's 70 year olds. This may mean moving from an age base to a functional base in eligibility tests, bringing changes in a wide range of programs from mandatory retirement to automatic seniors' benefits and discounts that kick in at a particular age.

Decisions about such changes would act to change the dependency relationship that is represented by the dependency ratio, rather than the ratio itself. Policies can also affect the ratio by changing the number of people 65 and older per 1,000 people of working age. With increasing life expectancies and levels of health, there is not much that can be done about the number of people 65 and older, so any attempts to reduce the elderly dependency ratio must focus on increasing the size of the working aged population. Increased births rates would bring such a change, but birth rates in Canada are heading in the opposite direction. Immigration policy does facilitate increases in the number of people of working age: two thirds of the annual immigrants to Canada are under the age of 35, younger than the youngest baby boomer. Without this immigration, the elderly dependency ratio in Canada would be 458 persons aged 65 and older per 1,000 of working age, compared to the 378 that current immigration levels will bring.

What Can You Expect?:
Life Expectancy in Canada, 1921 to 2026

By David Baxter and Andrew Ramlo

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I. Introduction

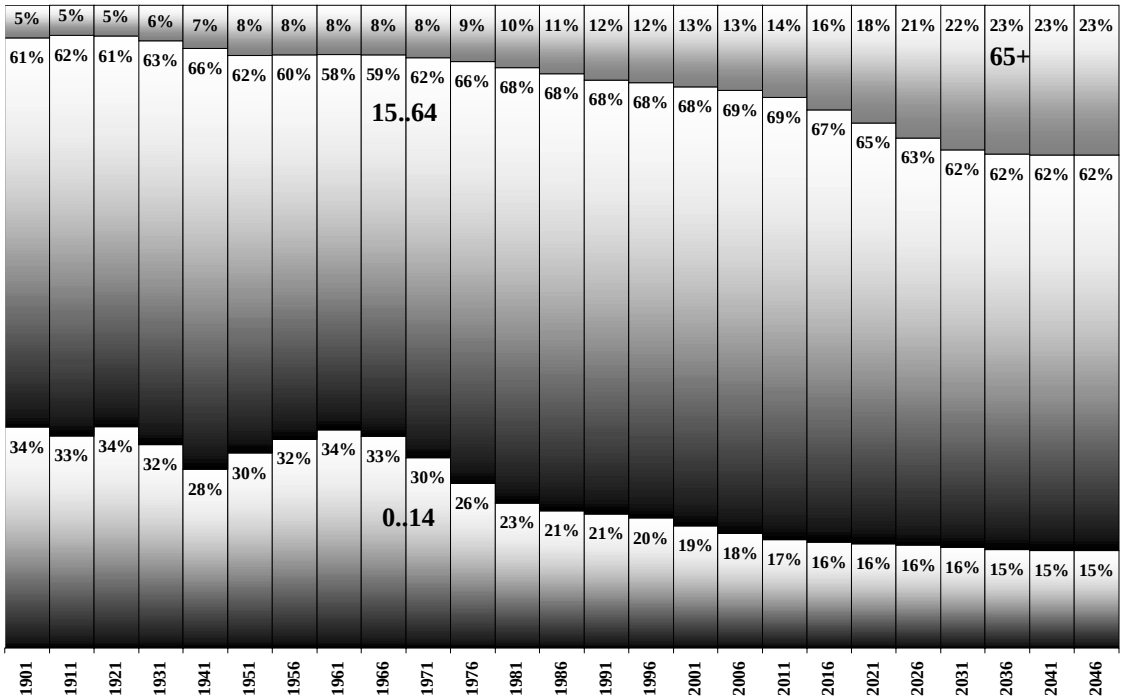
Explanations, like clothes, go in and out of fashion. For example, the post-World War Two Baby Boom generation is currently a fashionable explanation for almost everything that happens: given Baby Boomers' fascination with themselves, this will likely be the case for a while longer.

However, even for a Baby Boomer, a bit of humility is a good thing. It is true that the birth of the Baby Boom generation between 1946 and 1966 has played a significant role in shaping Canada's population and will continue to do so for some time into the future. But there is something that has had, and will have, a much more important role in shaping the characteristics of Canada's population than the birth of this "big generation".

What could possibly be more important than the birth of the Baby Boomers? It is the dramatic increase in life expectancies that has occurred over the past century. If life expectancies were at the same level as they were a century ago, the importance of the Baby Boom generation would have been, if you will excuse the pun, short lived, as they would have had an average life span of only 49 years, rather than the 80 years that they will actually have.

Increasing life expectancies over the past century have resulted in the constant aging of Canada's age profile. In 1901, one out of twenty people (5%) of Canada's population were 65 or older (Figure 1): today it is one out of every eight (12%). Today's long life expectancies are what will permit the Baby Boomers to live to their 65th birthday, and beyond, and hence to increase the percentage of Canada's population that is 65 and older to almost one out of four (23%) by 2036[1].

Figure 1: Population Age Distribution, Canada, 1901 to 2046



This report reviews the extent to which life expectancies have increased in Canada during the past century, considers the implications of these increases, and presents projections for how life expectancy might increase over the coming twenty five years. At first glance, this discussion may seem somewhat academic: upon reflection, it will be apparent that the consequences of increasing life expectancies are dramatic and widespread. For example, a realistic projection of life expectancy is an essential component of an individual's retirement planning and of pension plan management. The current urgent need to restructure the Canada Pension Plan is a result of its original underlying demographic premise assuming much shorter life expectancies than currently exist, and than are likely to exist in the future. The current boom in retirement planning, and in the investments that go into retirement portfolios, are a result of people seeking to build up sufficient resources to last them through their retirement years.

II. What is Life Expectancy?

Life expectancy is how many years an "average" person can expect to live given their current age. For example, life expectancy at birth is the estimate of the life span of the typical person at the time they are born. Today, a Canadian's life expectancy at birth is 78.4 years[2]: the typical person born today has a life expectancy to live to five months after their 78th birthday. Many will die before, many will die after, but the average person is expected to reach this age.

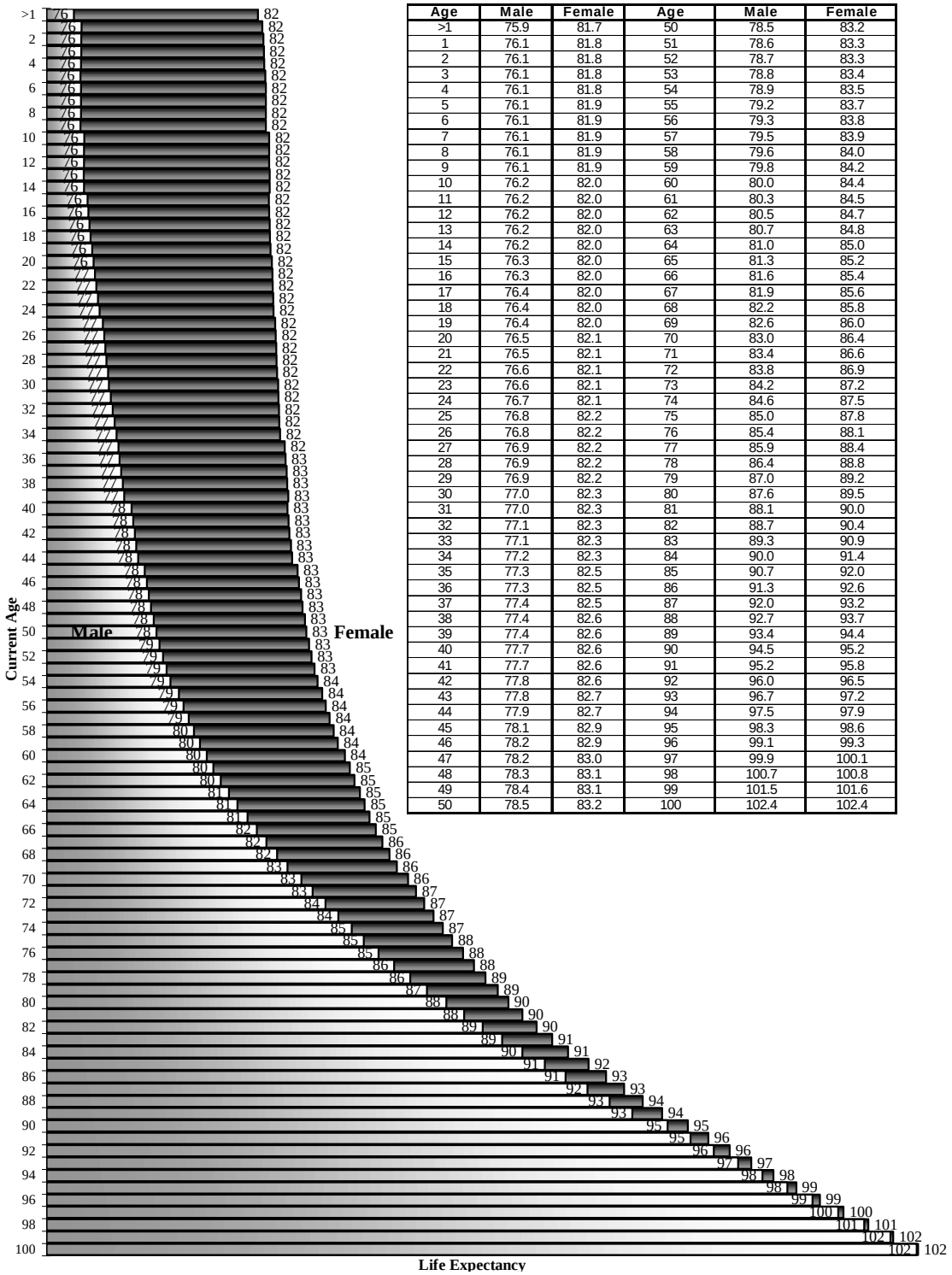
In fact, the average person born to day will likely be older than 78.4 when they die, as the method of calculating life expectancies under-estimates actual life expectancy in periods when life expectancies are increasing. The reason for this underestimation is that the mortality rates used to calculate life expectancies are today's rates: the chance of a person born today dying when they are 65 is assumed to be the same as the chance that today's 65 year old will not live to their 66th birthday. But just as today's 65 year olds are more likely to reach their 66th birthdays than the 65 year olds of the past, so too are the 65 year olds of the future likely to have a greater opportunity to see their 66th birthday than today's 65 year olds are. The person born today will have the benefit of the next 65 years of medical research to help them reach their 66 th birthday. As long as we listen to our fitness and health care providers and as long as medical technology finds new cures and "postponers", the probability of dying at a particular age in the future will be reduced, and hence life expectancies will increase. This means that current measures of life expectancy will underestimate how long, on average, we will live, and hence will underestimate, among many other things, our retirement planning needs.

Figure 2, which shows current (1996) life expectancies for males and females in Canada by age, is extremely useful in four main contexts. First, it shows what the life expectancy of the average person of your age and gender: find your age on either the chart or the table on Figure 2, then your gender, and, voila, there is your life expectancy. A thirty five year old male can expect to live to the ripe old age of 77.3, and a female of the same age to the age of 82.5. Some will die younger, some older, but on average this is what a 35 year old can expect: again, if mortality rates in older age groups continue to decline, average life spans will be longer than indicated by this table.

Second, note how life expectancies increase with age: the older you get, the longer you can expect to live. A male born today can expect to live to the age of 75.9 (a female to 81.7), but a 35 year old male can expect to live to 77.3. Today's 35 year old male has a life expectancy 1.4 years longer than that of a male born today. The reason is that the 35 year has already successfully avoided dying for 35 years, while the baby faces the risk of dying sometime during

the first 35 years of its life. Note however that this is not a “one for one” deal: surviving a year increases life expectancy, but by less than a year - we are all going to have to go sometime.

Figure 2: Life Expectancy by Age and Sex, Canada, 1996



Age	Male	Female	Age	Male	Female
>1	75.9	81.7	50	78.5	83.2
1	76.1	81.8	51	78.6	83.3
2	76.1	81.8	52	78.7	83.3
3	76.1	81.8	53	78.8	83.4
4	76.1	81.8	54	78.9	83.5
5	76.1	81.9	55	79.2	83.7
6	76.1	81.9	56	79.3	83.8
7	76.1	81.9	57	79.5	83.9
8	76.1	81.9	58	79.6	84.0
9	76.1	81.9	59	79.8	84.2
10	76.2	82.0	60	80.0	84.4
11	76.2	82.0	61	80.3	84.5
12	76.2	82.0	62	80.5	84.7
13	76.2	82.0	63	80.7	84.8
14	76.2	82.0	64	81.0	85.0
15	76.3	82.0	65	81.3	85.2
16	76.3	82.0	66	81.6	85.4
17	76.4	82.0	67	81.9	85.6
18	76.4	82.0	68	82.2	85.8
19	76.4	82.0	69	82.6	86.0
20	76.5	82.1	70	83.0	86.4
21	76.5	82.1	71	83.4	86.6
22	76.6	82.1	72	83.8	86.9
23	76.6	82.1	73	84.2	87.2
24	76.7	82.1	74	84.6	87.5
25	76.8	82.2	75	85.0	87.8
26	76.8	82.2	76	85.4	88.1
27	76.9	82.2	77	85.9	88.4
28	76.9	82.2	78	86.4	88.8
29	76.9	82.2	79	87.0	89.2
30	77.0	82.3	80	87.6	89.5
31	77.0	82.3	81	88.1	90.0
32	77.1	82.3	82	88.7	90.4
33	77.1	82.3	83	89.3	90.9
34	77.2	82.3	84	90.0	91.4
35	77.3	82.5	85	90.7	92.0
36	77.3	82.5	86	91.3	92.6
37	77.4	82.5	87	92.0	93.2
38	77.4	82.6	88	92.7	93.7
39	77.4	82.6	89	93.4	94.4
40	77.7	82.6	90	94.5	95.2
41	77.7	82.6	91	95.2	95.8
42	77.8	82.6	92	96.0	96.5
43	77.8	82.7	93	96.7	97.2
44	77.9	82.7	94	97.5	97.9
45	78.1	82.9	95	98.3	98.6
46	78.2	82.9	96	99.1	99.3
47	78.2	83.0	97	99.9	100.1
48	78.3	83.1	98	100.7	100.8
49	78.4	83.1	99	101.5	101.6
50	78.5	83.2	100	102.4	102.4

Third, note that males have shorter life expectancies than females, particularly in younger age groups. A female born today has a life expectancy of 81.7 years, 5.8 years longer than a male baby's 75.9 years. This difference declines with age: a 50 year old female has a life expectancy of 83.2 years, only 4.7 years more than a 50 year old male's 78.5 years life expectancy. By the time people reach 100 years of age, males and females have the same life expectancy of living to 102.4 years of age.

Finally, average life expectancies are just that: averages. Some people will die well before reaching the average, while others will live longer. Slightly more than one out of eight males and more than one in four women under the age of 55 will reach the age of 90 using today's mortality rates. A hundred years ago, less than one in 20 could expect to celebrate this milestone. About one in every six males and one in every three females aged 65 today will have a 90th birthday.

Everyone in Canada should be planning on reaching the age of 80; if people are old enough to actually be thinking about retiring, they should (on average) be planning to live until they are 85; and, because we all hope to live longer than the average and because the life expectancy for the older population will increase, 90 is a good age to actually be planning to reach. Retirement planning, therefore, should be focused on preparing for 25 years of life after today's common retirement age of 65. Accumulating sufficient resources to support people for 25 years without working is going to be an overwhelming challenge for both individuals and pension plans.

III. Why Do Females Have a Longer Live Expectancy than Males?

The reason that female life expectancies are greater than those of males of the same age is that males have higher mortality rates than females of the same age (an age specific mortality rate is the percentage of people in an age group dying in a year, generally expressed as the number of people dying per 100,000 people in the age group, Figure 3)[3].

Mortality rates are quite similar for males and females under the age of 15 (for example, in the 10 to 14 age group the rate for females is 19 deaths per 100,000 in the age group, while that for males is 16% higher at 22 deaths per 100,000) and 90 years of age and older (the 22,664 deaths per 100,000 rate for 90+ males is only 15% greater than the 19,703 per 10,000 for females)[4]. However, between these two ages the likelihood of a male dying in a year is dramatically higher than that for a female. In the 15 to 19 age group male mortality rates are 2.4 times greater than those for females, and in the 20 to 24 age group male mortality rates are more than three times higher than those for females. After the age of 24, while male mortality rates remain substantially higher than female rates, the difference gradually declines as old age is reached.

This difference in age specific mortality rates means that for males in any age group, there is always a greater likelihood that they will die before reaching the next age than there is for females of the same age. As a result, males have shorter life expectancies. The dramatic difference in mortality rates in the younger adult age groups creates the significant difference between male and female life expectancies at birth, as the greater likelihood that males will die as young adults not only shortens their individual life expectancies, but also brings down the average.

The major reason male mortality rates jump dramatically above those of females after the 15th birthday is in the high incidence of death caused by accidents, violence and other adverse effects (for example, suicide) for males. As Figure 4 shows, while male mortality rates due to accidents

and other adverse affects are higher than females in every age group, the greatest differences are between the ages of 15 and 74[5].

Figure 3: Mortality Rate (Deaths/100,000), by Gender, Canada, 1995

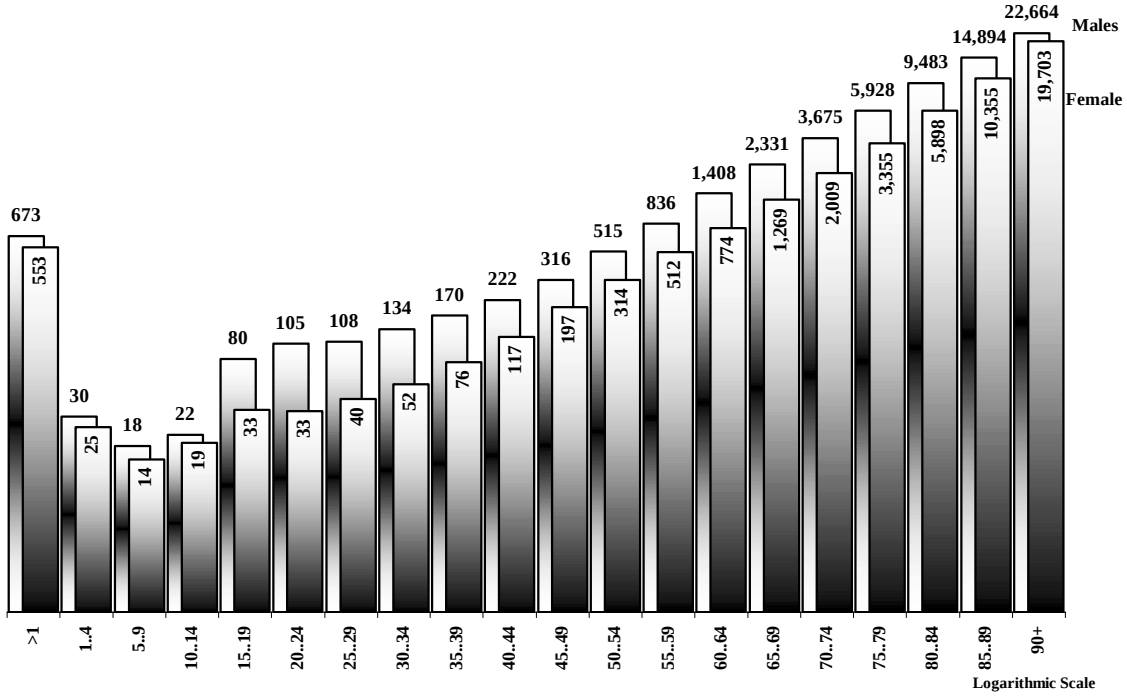
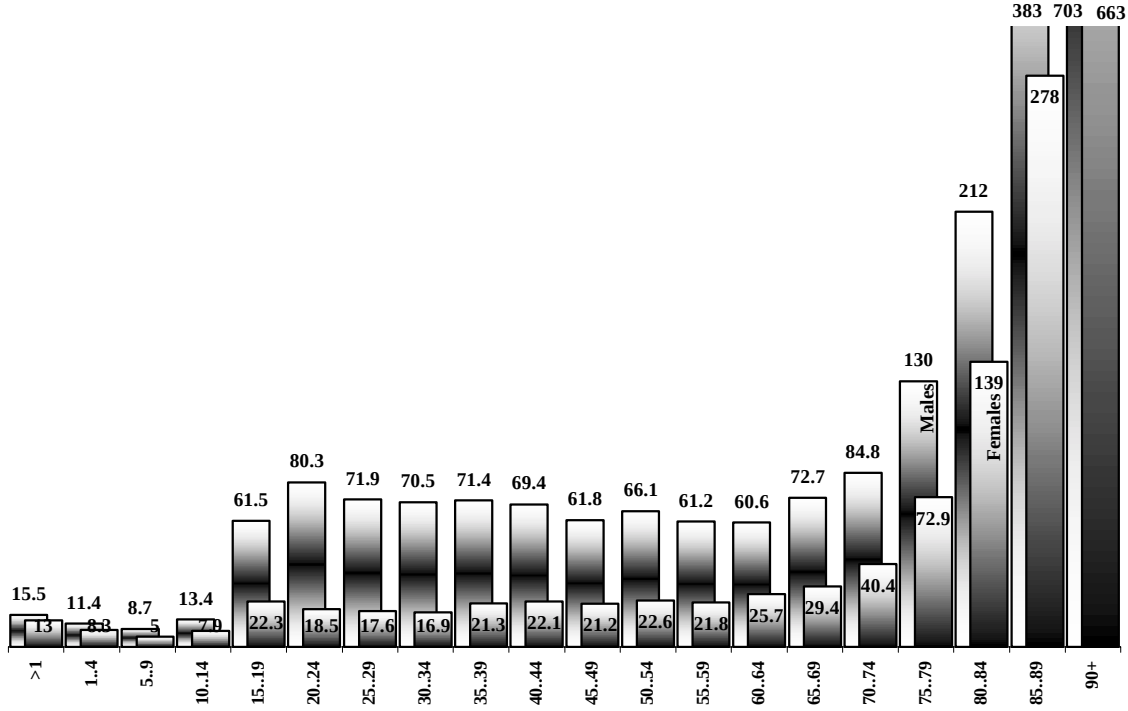


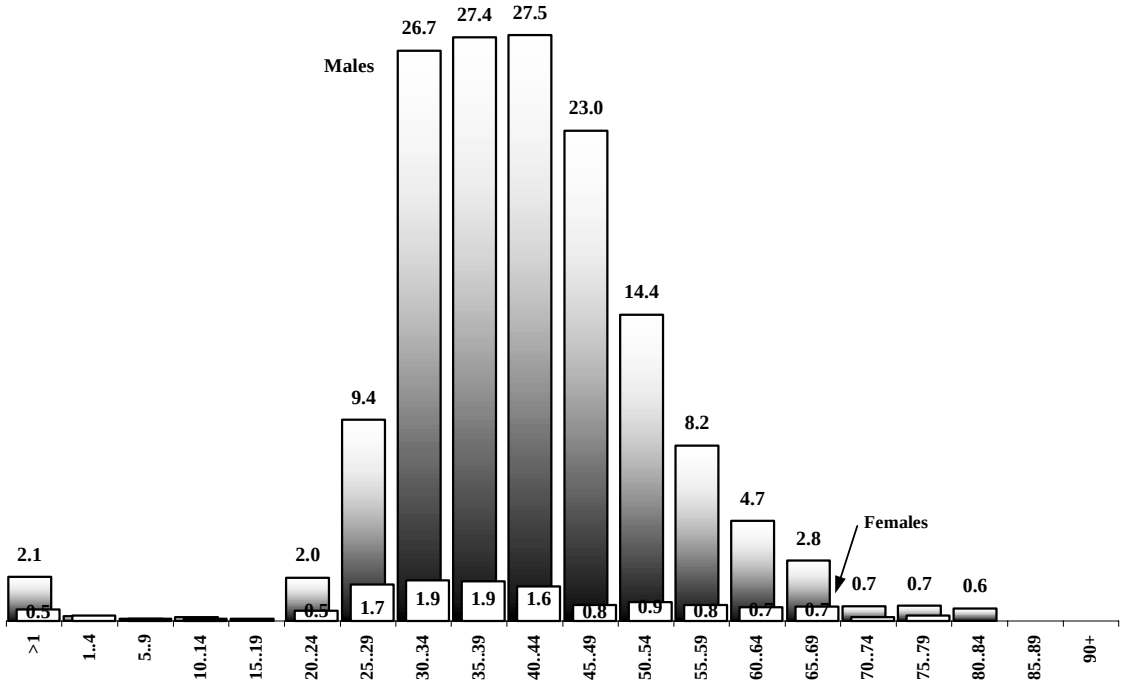
Figure 4: Mortality Rate (Deaths/100,000) Due to Accidents & Adverse Effects, by Gender, 1995, Canada



In the 20 to 24 age group, male mortality rates due to accidents, violence and other adverse effects are 4.3 times greater than those for females; between the ages of 25 and 44, the rates due to these causes for males are more than three times those for females. More than 85% of the differences in mortality rates for males and females in the ages of 15 to 24 are due to the difference in deaths due to accidents, violence and adverse affects: this drops to 45% for the 35 to 44 age groups.

Another cause contributing to the difference between male and female mortality rates in these younger age groups is death due to HIV infection (Figure 5)[6]. This is the second leading cause of death for young adult males, and the difference in its incidence between males and females is even more dramatic from that for accidents and adverse effects: the mortality rate due to HIV infection for males ages 30 to 44 is in the 27 per 100,000 range, a full 15 times the 1.8 per 100,000 rate for females in the same age group.

Figure 5: Mortality Rate (Deaths/100,000), Human Immunodeficiency Virus Infection, Canada 1995



The life cycle of causes of mortality shows both the similarities and the differences between male and female mortality causes (Figures 6 and 7)[7]. Accidents and adverse dominate both male and female mortality in the 1 to 34 age groups, accounting for two thirds of the deaths for females aged 20 to 24, and three quarters for males in the same age group. After the mid 30's, diseases of the circulatory system and cancers replaced accidents, violence and adverse affects as the leading causes of death. The greatest impact of cancers occurs in the 35 to 70 age groups: for example, cancers account for 56% of the female deaths, and 35% of the male's deaths, in the 50 to 54 age group. Diseases of the circulatory system account for a much greater share of deaths in older age groups for both males and females, becoming the leading cause of death for males in the 65 and older population and for females in the 75 and older population.

Figure 6: Leading Causes of Death by Age Groups, Percent of All Causes, Males, Canada, 1995

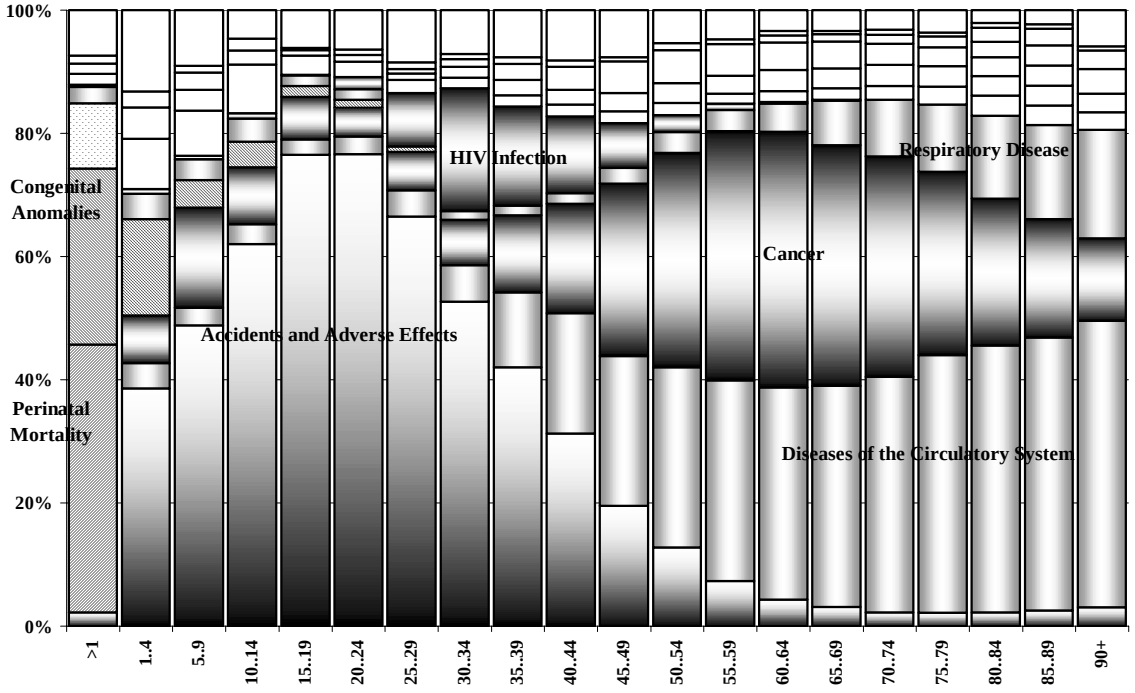
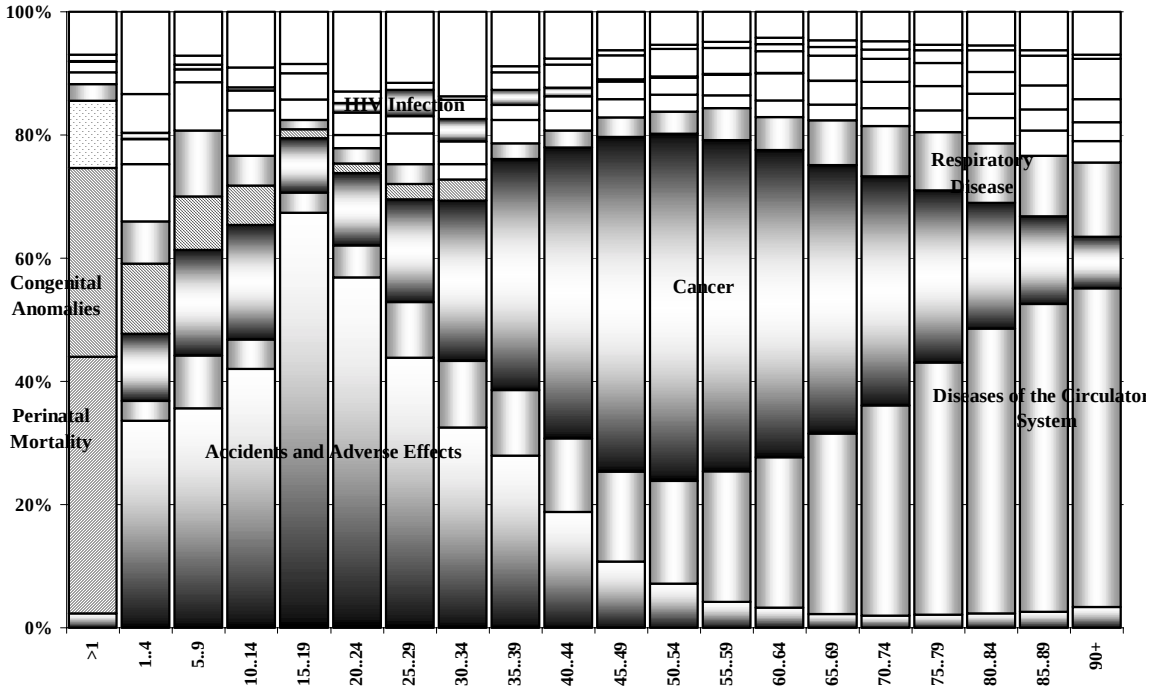


Figure 7: Leading Causes of Death by Age Groups, Percent of All Causes, Females, Canada, 1995



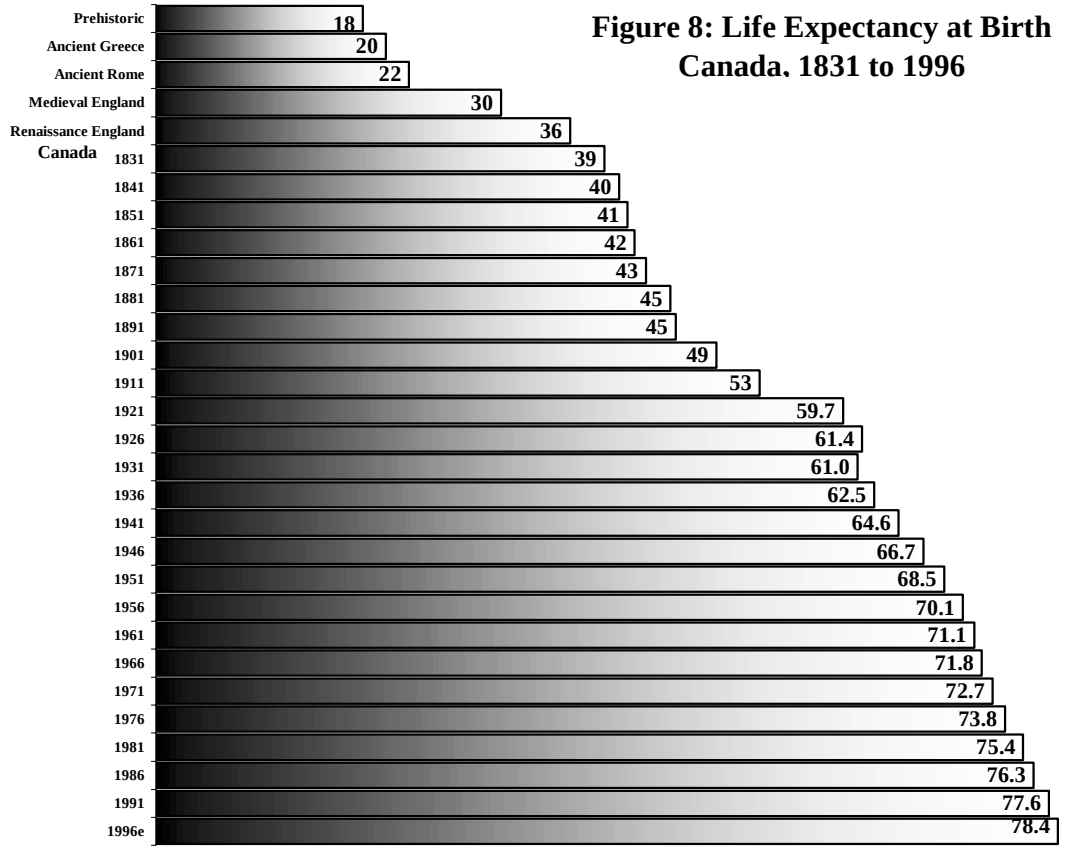
IV. How Has Life Expectancy in Canada Changed?

Having noted that females have a longer life expectancy than males, it is also important to note that, first, life expectancies for both males and females have increased dramatically over the past century, and, second, that male life expectancies are now increasing faster than those for females. Figure 8 shows the pattern of increases in life expectancy at birth that have occurred since Prehistoric times. The values for the pre-1921 period are based on a large number of sources, and should be regarded only as general indicators relative changes in life expectancy[8]. The values for 1921 and after, in contrast, are from detailed life tables produced every five years for Canada and its provinces by Statistics Canada[9]. It is the changes that have occurred in this past seventy five year period that will be the focus of the discussion in this report.

a. The Long Run Perspective

Over the milleniums of human existence life expectancy has increased dramatically. Dating of archeological remains estimates that in the late prehistoric period (pre - 1500 B.C.) life expectancies were in the range of 18 years. The reduced violence and stability that accompanied the development of urban communities (polis) in Ancient Greece (around 500 B.C.) meant a reduction in mortality due to both greater security and the emergence of formal medical research and public health awareness. While these had a substantial impact on the lives of people once they reached adulthood, they did little to reduce the mortality rates in childbirth, of babies and children, and hence had only a modest impact on average life expectancies, which were estimated to be approximately 20 years.

Figure 8: Life Expectancy at Birth
Canada, 1831 to 1996



The extension of urban civilization and trade from the Grecian to the Roman era (300 B.C. to 300 A.D.) was accompanied by modest increases in life expectancy. Aqueducts, military protection, trade, and, perhaps most importantly, the cumulative increase in medical and public health knowledge, meant that life expectancy at birth in Ancient Rome averaged 22 years, compared to the 20 years that had prevailed in Ancient Greece.

After Europe's Dark Ages, a thousand years later, in Medieval England (12th to 14th Century), while safety and public health conditions were, by today's standards, at best rudimentary, they were better than they were during the Roman and Grecian eras. The invention of the printing press, of spectacles, the development of the mercantile class, and political organization that focused slightly more on professional war rather than general terror, all led to a revival in learning in medicine that, by the end of the 14th century, was expressed in reductions in adult mortality, and a consequent increase in life expectancy at birth increased to a span of 30 years.

Continuing improvements in social organization, in research, knowledge, and communication, and public health standards contributed to increases in life expectancy continued through the Renaissance (15th to 17th Century), with its average life expectancy at birth of 36 years, and into the era of European colonization. Medical advances during this period included application of a scientific approach to anatomy, surgery and conduct of childbirth (1500s); invention of the clinical thermometer and microscope, and understanding of the circulatory system (1600s), advances in surgical practice, obstetrics and ophthalmology, and the use of drugs, herbs and vitamins to treat oedema, smallpox, and scurvy (1700s). By the time of the beginning of independence from this colonization in the 19th century, life expectancies in reached 40 years.

But regardless of these advances, from at least 300 B.C. to the 1700s A.D., there was the Plague, which, even in the 18th century, wiped out half the population of some European cities. The disappearance of the plague in the 19th century coincides public health measures that limited the presence of rats (and hence their fleas) in communities, but it is impossible to say what actually caused its decline, as it was not until 1914 that it was shown that the Plague was transmitted by rodents' fleas. Turning to estimates of life expectancy in Canada, a person born in Canada in 1831 could expect to live to 39 years of age: a person born seventy years later could expect to live a full decade longer, to 49 years of age. Most of this 10 year increase between 1831 and 1901 came at the end of the period (between 1891 and 1901). This shows the cumulative impact of advances in medical science during the 19th century, which included the discovery of the process of antiseptic surgery (1864), of anthrax vaccine (1882), of the micro-organisms that cause tetanus, cholera, and diphtheria (1884), of diphtheria serum (1893), and of the value of using surgical gloves (1890).

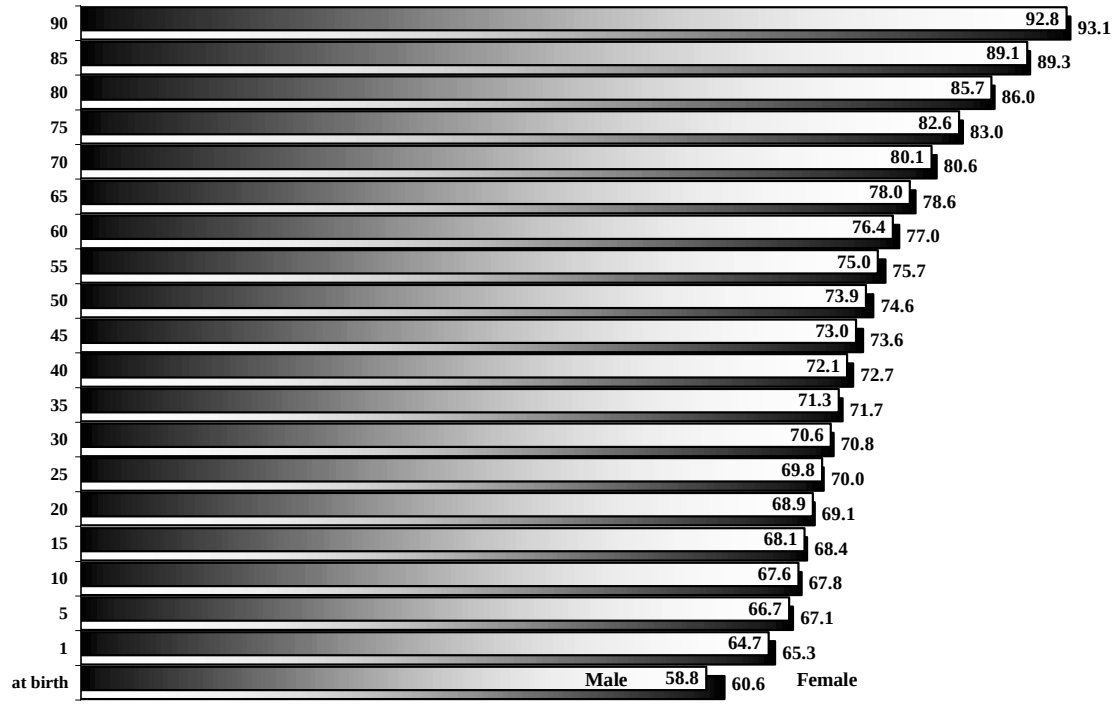
Within the next two decades, from 1901 to 1921, there was another full decade increase in life expectancy at birth in Canada, from 49 years in 1901 to 59 years in 1921. By 1921, when the first comprehensive life tables were prepared for Canada, life expectancy at birth was 59.7 years (58.8 for males and 60.6 for females). While it is often assumed that all of the big increases in life expectancy happened in past centuries, such, in fact, has not been the case: between 1921 and 1996, life expectancy at birth in Canada has increase by almost 20 years. This is the same magnitude of increase over a 75 year period as that which happened in the 90 years between 1831 and 1921. The increases in life expectancy during this most recent period have overwhelmingly been the result of applications of medical and public health technology to preventative and curative medicine, including use of antibiotics, anti-poliomyelitis vaccines, anti-viral drugs, and major surgery including organ transplants.

For example, in Canada in 1921 tuberculosis was the leading cause of death for females between the ages of 15 and 44, and the second most significant cause (following accidents, violence and adverse effects) for males in this age group. There were 4,800 deaths due to TB in Canada in 1921, 80% of which were to people in the under 50 population. Since 1971, tuberculosis has not made the list of leading causes of death for either males or females in this age group, with only 120 cases reported in Canada in 1995, 80% of which were in the 65 plus population.

b. Life Expectancy in Canada, 1921 to 1996

A male born in Canada in 1921 had a life expectancy of 58.8 years and a female had one of 60.6 years (Figure 9): a male born in 1996 had a life expectancy of 75.6 and a female had a life expectancy of 81.4 years (Figure 10). Over the past seventy-five years, life expectancy at birth in Canada for a male has increased by 16.8 years, and that for a female by 20.8 years (Figure 11). A girl born today can expect to live 33% longer than one born in 1921, and a boy born today can expect to live 28% longer than his 1921 counterpart.

Figure 9: Life Expectancy, Males and Females, Canada, 1921



In 1921, male and female life expectancies at each age were quite similar: then, as now, female life expectancies at every age were greater than those for males of the same age, but the difference was not great, usually less than 1%[10]. In 1996, both male and female life expectancies are much longer than they were in 1921, and there is a much greater difference between them.

It is tempting to dismiss increases in life expectancy as simply being the result of reducing infant mortality (the changes in causes of death are discussed in the following section). In fact, life expectancy in Canada has increased in every age group: today's ninety year old male can expect to live to 94.5, 1.7 years more than his 1921 counterpart (life expectancy of 92.8 years). Similarly, life expectancy for a 90 year old female today is to live to 95.2 years of age, compared to the 93.1 years of age of her 1921 counterpart: the life expectancy of a ninety year old female has increased by 2 years over the past three-quarters of a century.

Figure 10: Life Expectancy, Males and Females, Canada, 1996

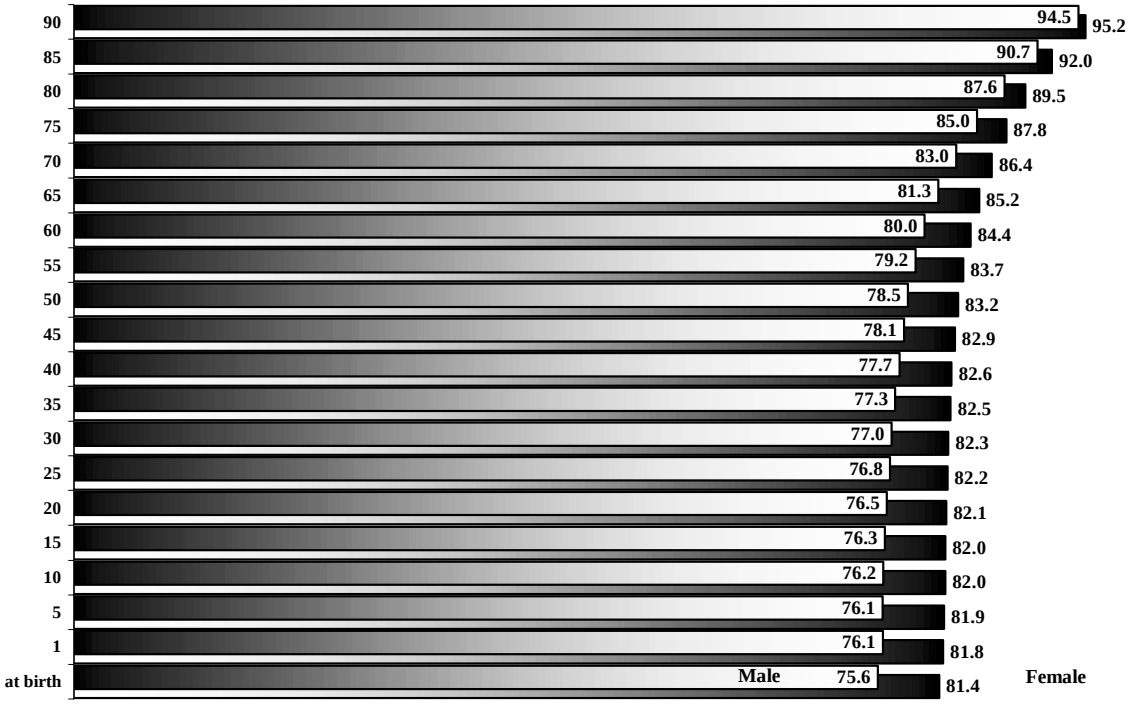
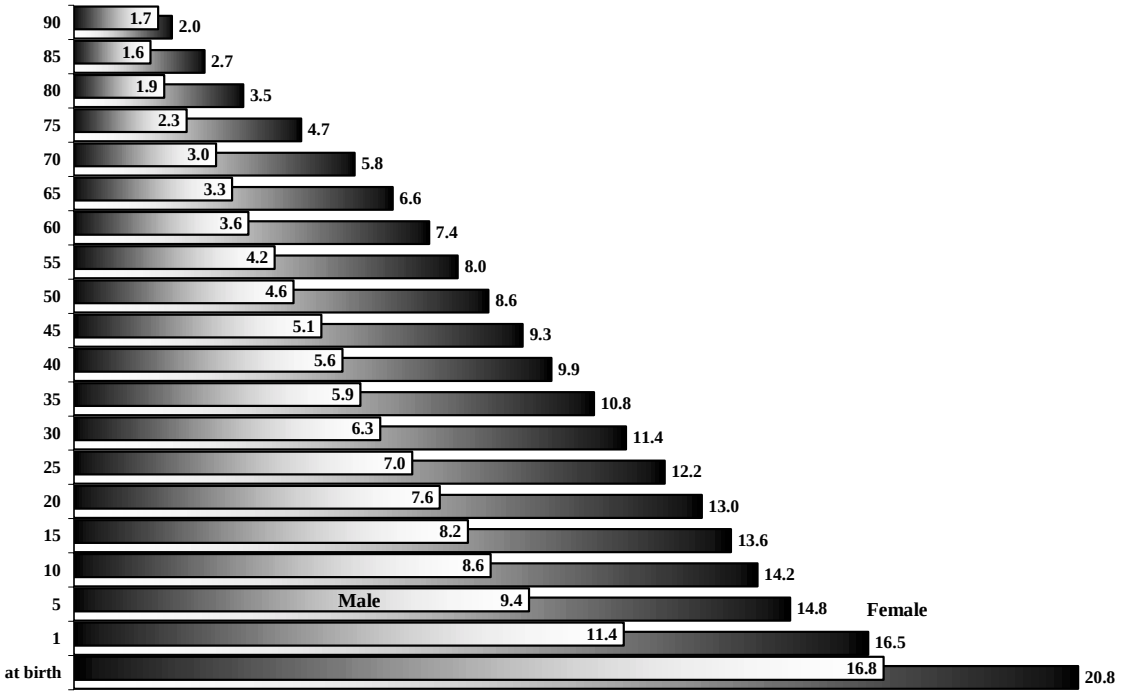


Figure 11: Increase in Life Expectancy in Years, Canada, 1921 to 1996



Reducing mortality rates at each age has a cumulative impact on life expectancies: not only is one's chance of reaching the next birthday increased, but so are the chances of reaching all of the subsequent birthdays. Thus the life expectancy of, for example, 65 year olds, increased by much

more than those for 90 year olds over the past 75 years. A 65 year old male in Canada today can expect to live to age 81.3: this is 3.3 years longer than the expectancy of 1921's 65 year old male to live to age 78.0. Today's 65 year old female can expect to live to age 85.2, 6.6 years longer than the 78.6 years of age that a 65 year old female in 1921 could expect to reach. To put it in its most dramatic format, the remaining number of years of life that a 65 year old male can expect to live has increased from 13.0 to 16.3 (a 25% percent increase) and the number of years of life remaining for the typical 65 year old female increased from 13.6 to 20.2 years (a 48% increase).

What about the front edge of the Baby Boom, today's 50 year olds? What might they expect? A 50 year woman today has a life expectancy to live to age 83.2 (another 33.2 years, compared to only 24.6 more years in 1921, a 35% increase), and a 50 year old male has a life expectancy to reach age 78.5 (another 28.5 years, 20% more than the 23.9 more years that his 1921 counterpart could have expected). Today's 35 year olds, the most typical age in Canada's population and hence the typical Baby Boomers, can expect to live for another 45 years. A 35 year old male today has a life expectancy of 77.3 years, 6 years longer than the 71.3 years of life that a 35 year old in 1921 could expect. Today's 35 year old female can expect to live to 82.5 years of age, 10.8 years more than the 71.7 years that her 1921 counterpart could expect.

This means is that today's oldest Baby Boomers will be alive, and, by and large, living in their homes, 30 to 35 years from now, and the last (and most numerous) of the Baby Boomers will be doing the same thing in 45 to 50 years. In fact, the first of the post Baby Boom generation, today's 30 to 35 year olds, will be retiring (if they retire at 65) while the first of the Baby Boom generation are still alive, and living in their homes. Baby Boomers can expect to live long enough to be a problem not only for their children, but their grand children, and great grand children, too.

Note that the changes in life expectancy at every age group over the past seventy five years have been much greater for women than for men, and that the differences are greatest in the under 60 age groups. For females, each age group under the age of 55 has experienced increases of more than 10% in life expectancy over this 75 year period (Figure 12). For examples, a newborn female's life expectancy increased by over 20 years (a 34% increase) from 60.6 in 1921 to over 81 years by 1996; the life expectancy of a typical 35 year old female increased by almost 11 years (a 15% increase) from 71.7 to 82.5 years of age; the life expectancy of the typical 50 year old female increased by 8.6 years (an 11% increase); and, the life expectancy of a typical 80 year old female increased by 3.5 years (a 4.1% increase). It is these changes that have made female life expectancies at all ages significantly greater from those of males.

Although female rates increased more dramatically over this period, the male rates have generally followed similar patterns, with the younger age groups' life expectancies growing faster than those of the older age groups (Figure 13). A newborn male's life expectancy has increased from 60.6 years in 1921 to 81.4 years by 1996, an addition of 12.8 years (29%) to a newborn's life expectancy. Increasing from 71.3 to 77.3 years between 1921 and 1996, the life expectancy of a typical 35-year-old male today is 8.4% greater than that of his 1921 counterpart, while that of the typical 50 year old male increased by 4.6 years (6%), from 73.9 to 78.5 years of age. The typical 80-year-old male can now expect to live to be 87.6 years of age, 1.9 more years than the 85.7 years the typical 80 year old male was expected to live in 1921. Even at this age, the increase in life expectancy over the past 75 years for females were double that for males.

Figure 12: Life Expectancy, Females, Canada, 1921 and 1996

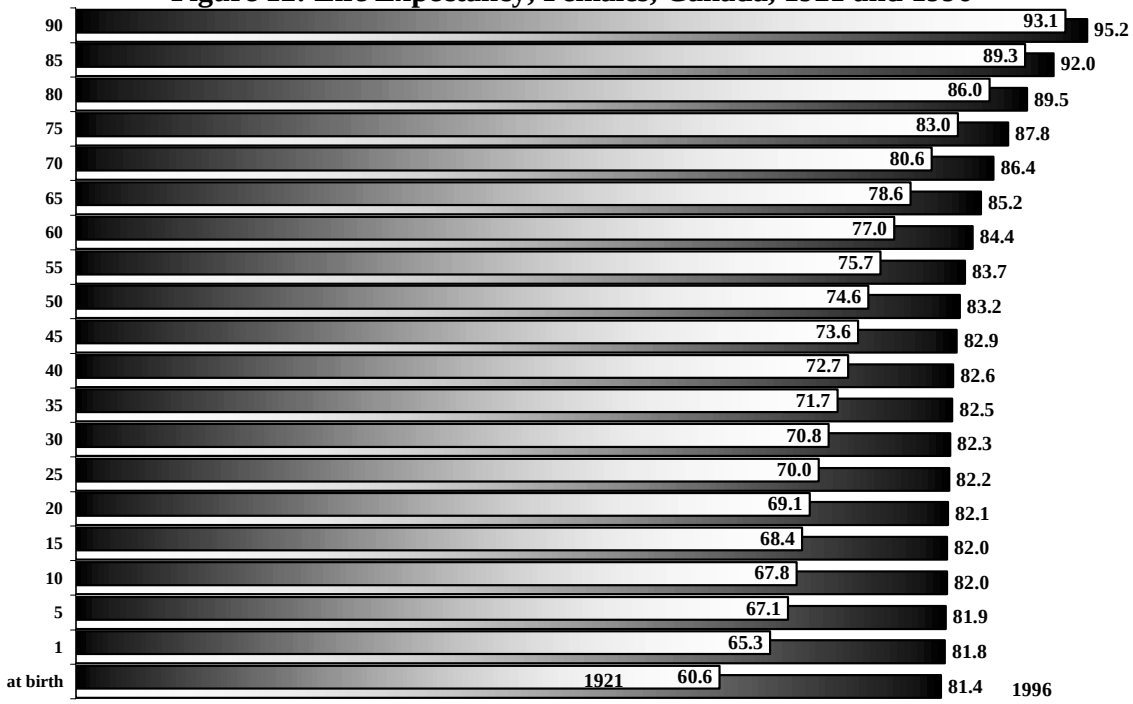
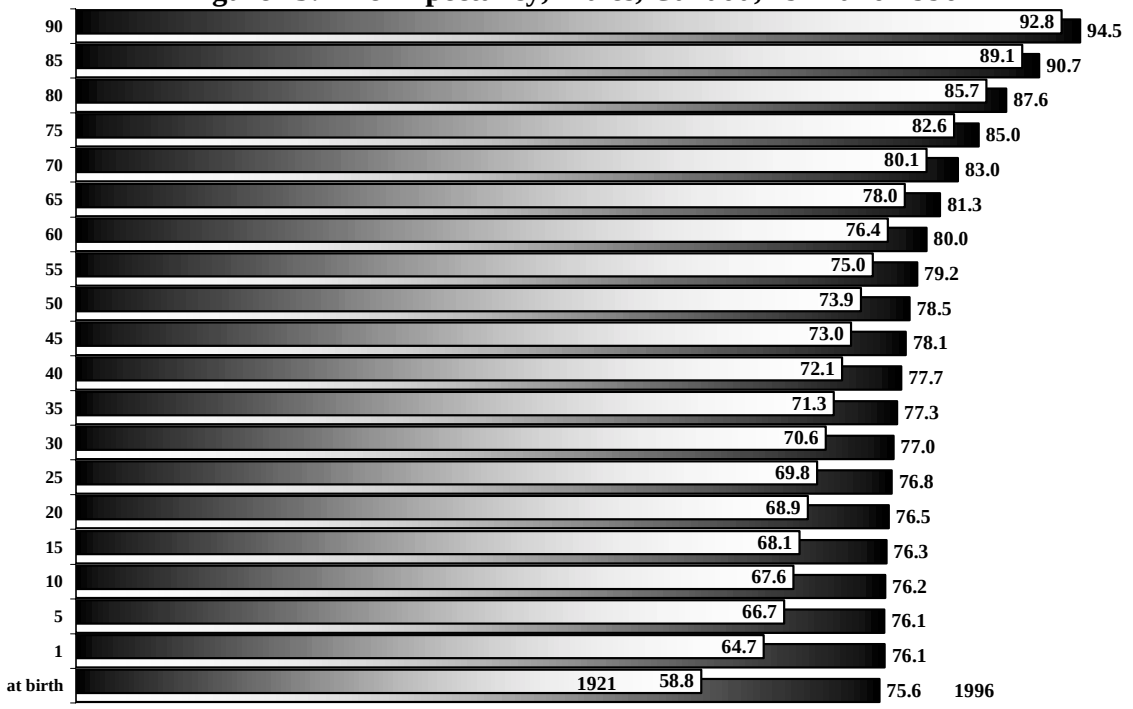


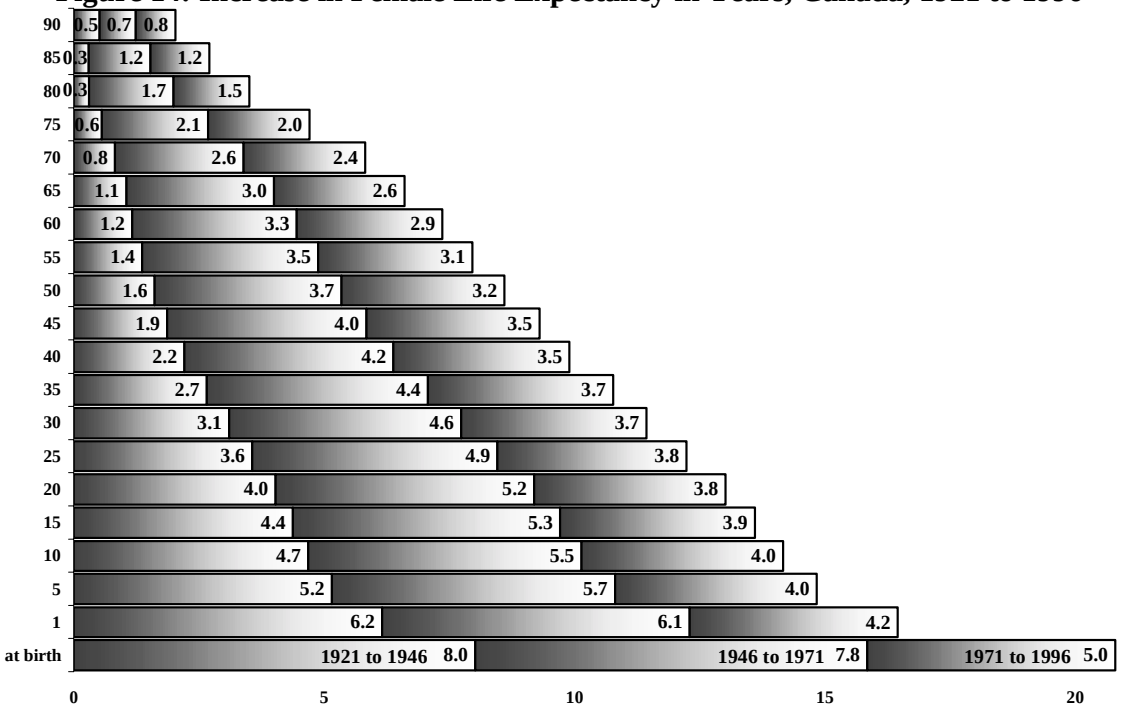
Figure 13: Life Expectancy, Males, Canada, 1921 and 1996



c. Patterns of Change in Life Expectancy in Canada During the Past 75 Years

Within the 1921 to 1996 period, there has been a different pattern of increase in life expectancies for females and males (Figures 14 and 15). The greatest increase in life expectancy at birth for females was from 1921 to 1946, when female life expectancy at birth increased by 8.0 years (13%) from 60.6 to 68.6 years (Figure 14). The increase from 1946 to 1971 was of a similar magnitude, a 7.8 years (12%) increase from 68.6 to 76.5; the increase from 1971 to 1996 was not as significant, adding only 5.0 years (a 6% increase).

Figure 14: Increase in Female Life Expectancy in Years, Canada, 1921 to 1996



While the 1921 to 1946 period marked the greatest increase in life expectancy at birth for women, it was not the period of greatest increase in life expectancy for women out of their infancy. The greatest increase in life expectancy for women 1 year of age and older occurred between 1946 and 1971. In this period, life expectancies for 5 year old females increased by 5.7 years (compared to the 5.2 years added from 1921 to 1946, and the 4.0 years added from 1971 to 1996). Similarly, the life expectancy for 35 year old females increased by 2.7 years between 1921 to 1946 and 3.7 years between 1971 and 1996: between 1946 and 1971 the increase was 4.4 years. The life expectancy for 50 year old females increased 3.7 years between 1946 and 1971 (compared to increases of 1.6 and 3.2 years between 1921 and 1941, and 1971 and 1996, respectively), and those for women in the 75 year old group increased by 2.1 years between 1946 and 1971, compared to the addition of 0.8 and 2.0 years over the other two periods.

A different picture emerges for males: the period of greatest increase in life expectancy for males at birth is a tie between the 1921 to 1946 and 1971 to 1996 periods, when 6.2 years were added to male babies life expectancies (Figure 15). In all other age groups, however, the past twenty-five years have been overwhelmingly the most significant in terms of increases, with greater increases in male life expectancies between 1971 and 1996 than in the preceding half century.

Figure 15: Increase in Male Life Expectancy in Years, Canada, 1921 to 1996

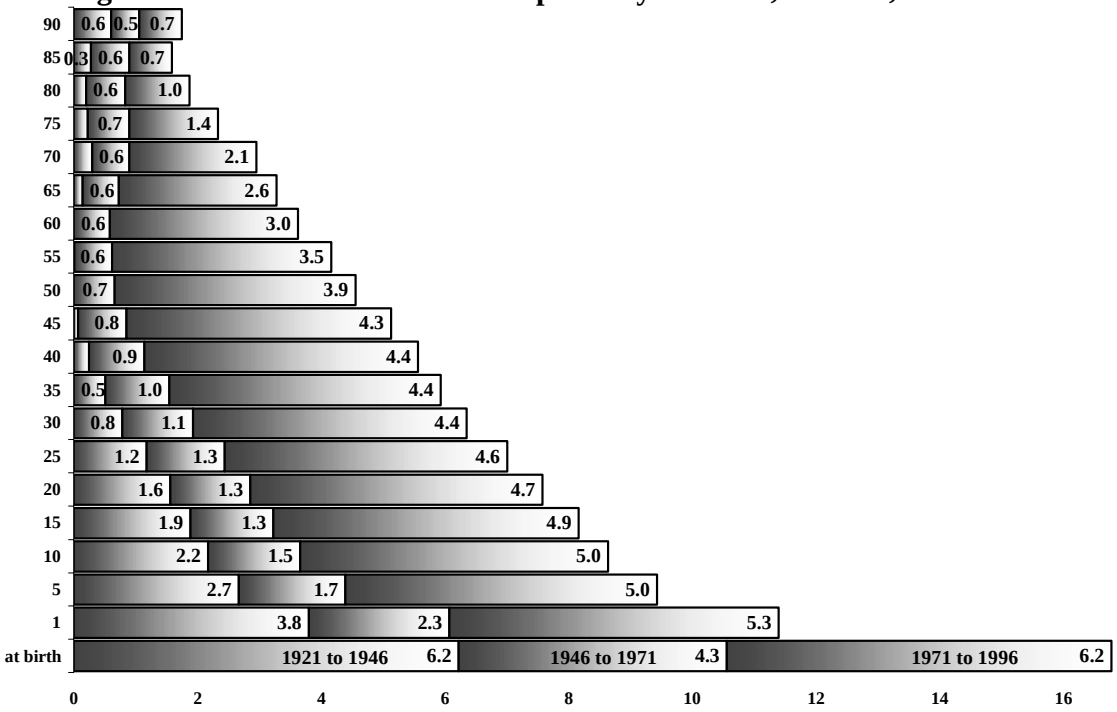
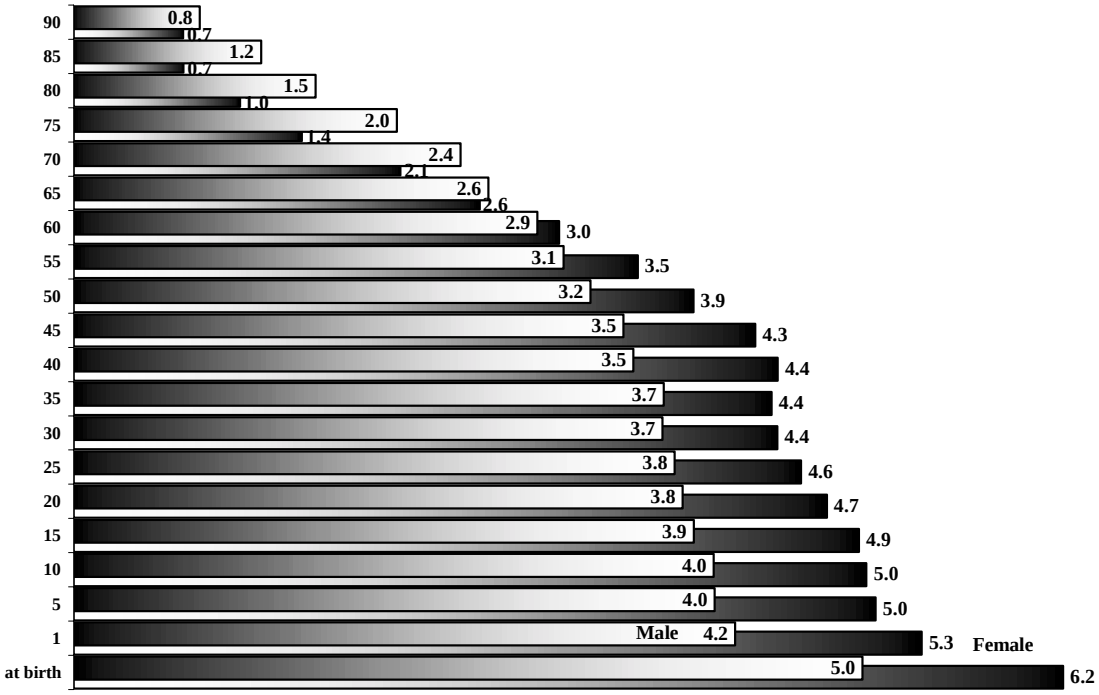


Figure 16: Increase in Life Expectancy in Years, Canada, 1971 to 1996



Life expectancies for 5 year old males increased 2.7 years between 1921 and 1946, 2.3 years between 1946 and 1971 (the period where the greatest increase in female expectancies were seen) and then by a whopping 5 years between 1971 and 1996. Life expectancy for a typical 35 year old male increased by 0.5 years between 1921 and 1946, with a doubling of this increase (1.1 years) between 1946 and 1971: between 1971 and 1996, the increase was 4.4 more years.

This pattern of significant increases in male life expectancies during the 1971 to 1996 is also seen in older age groups: life expectancy for a 50 year old male remained constant between 1921 and 1946, increased by only 0.7 years between 1946 and 1971, and then increased by almost 4 years between 1971 and 1996. Similarly, life expectancy for 75 year old males increased by 0.2 years between 1921 and 1946, 0.7 years from 1946 to 1971, and by 1.4 years between 1971 and 1996.

Not only is this most recent period the one where the greatest gains in male life expectancy have occurred, but it is also the only period of the three when male life expectancies increased faster than those for females of the same age in the under 65 population (Figure 16). Between 1971 and 1996, male life expectancy at birth increased by 6.2 years, compared to an increase of only 5.0 year for life expectancy at birth for a female. Increases for male life expectancies in the population aged 1 to 60 ranged from 5.2 additional years (1 year old males) to 3.0 years (60 year old males), while the comparable increases for females ranged from only 4.2 years (1 year old females) to 2.9 years (60 year old females).

In the 65 and older age groups, the longer term pattern of increases in female life expectancies exceeding those for males continued, but the margins of difference where much smaller. For example, between 1971 and 1996, the life expectancies for males aged 75 increased by only 1.4 years, compared to the 2.0 years increases for 75 year old females. In the 1946 to 1971 period, life expectancy for 75 year old women increased by 2.1 years, while that for males increased by only 0.7 years.

The result of this has been to narrow the gap between male and female life expectancies in the under 65 population that developed over the 1921 to 1971 period. Narrow, is, however, the operative word, as females under the age of 65 still have a life expectancy that is approximately 7% longer than that of males of the same age.

d. Why Did Life Expectancy Increase?

Life expectancies are, generally speaking, the inverse of mortality rates: life expectancy increases because mortality rates fall. A brief examination of the factors that reduced mortality rates over the past seventy five years shows the impact that medical technology, and life styles, have had, and might have in the future, on life expectancy. Note that, due to changes in data classification, the base year for examining changes in mortality by cause must be 1931[11] rather than 1921.

The declines in mortality rates in every age group over the past sixty-five five years have been dramatic. For example, a female born in 1931 was 26 times more likely to die during her first year of life than a new born female today: the mortality rate for women in this age group has fallen from 7,436 deaths per 100,000 women in the age group in 1931 to 285 per 100,000 in 1995 (Figure 17). A similar dramatic reduction was achieved for women in the 1 to 4 age group, with the 1931 mortality rate of 612 per 100,000 being 24 times the current rate of 25 per 100,000 women in the age group.

Figure 17: Age Specific Canadian Mortality Rates, Females, 1931 and 1995

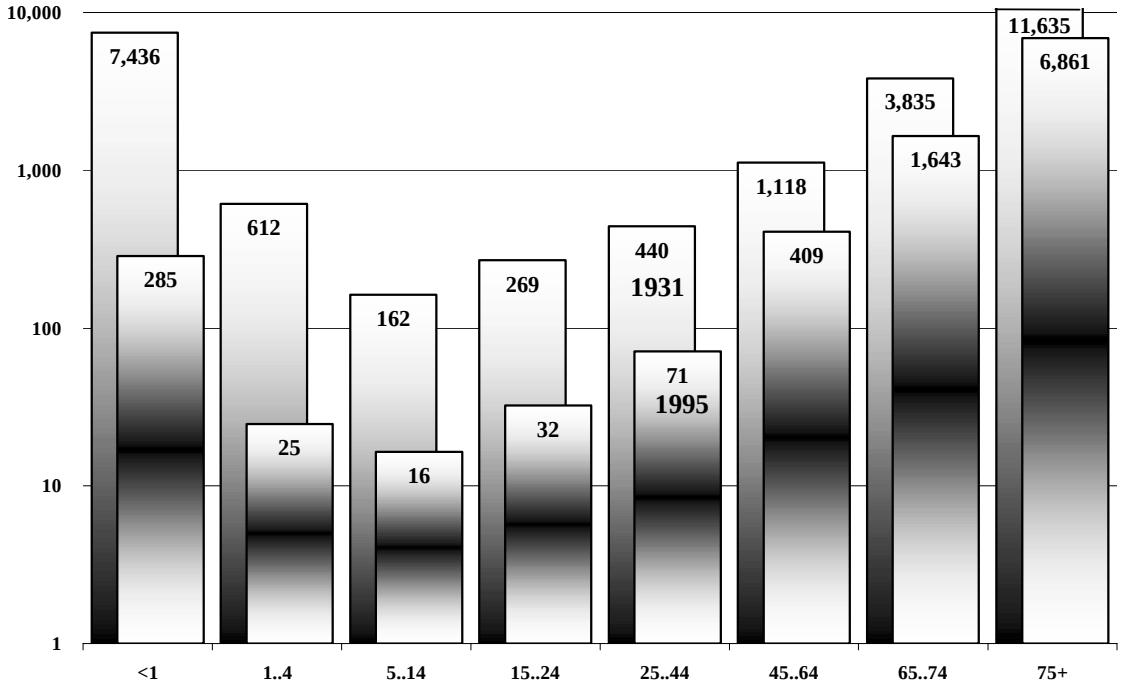
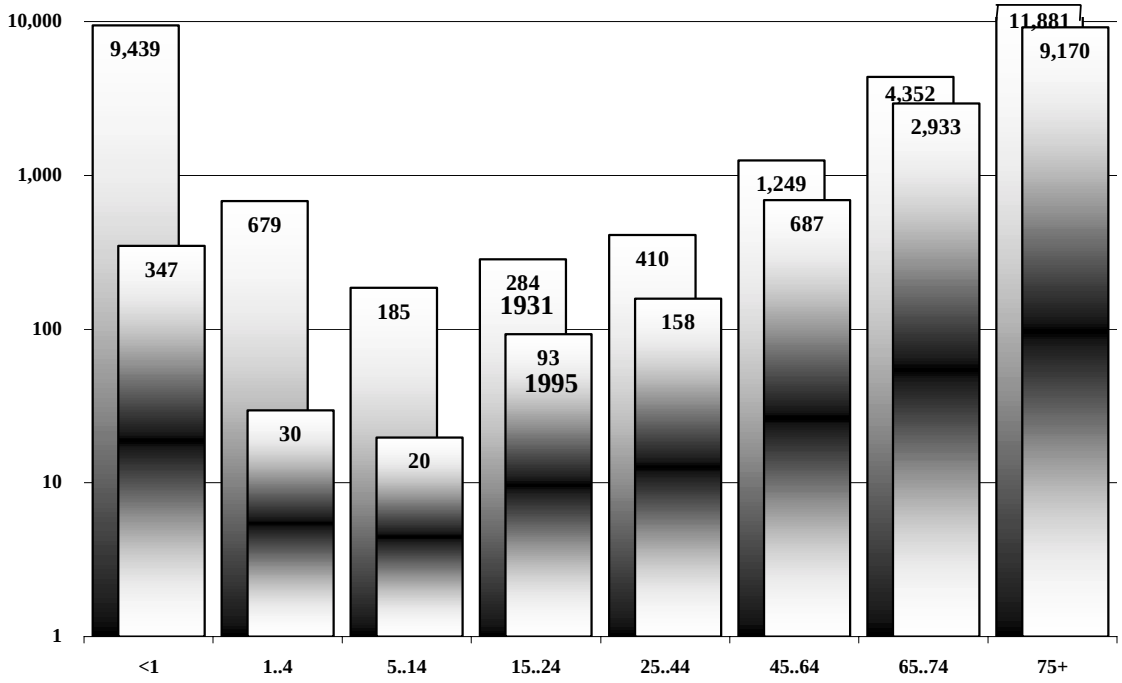


Figure 18: Age Specific Canadian Mortality Rates, Males, 1931 and 1995



While significant reduction in mortality rates have occurred in all older age groups, they have not been of the same magnitude as those for the under 5 year olds. A 5 to 14 year old woman was 10 more likely to die in 1931 than now (162 to 16 per 100,000), a 15 to 24 year old 8 times more likely (269 to 32 per 100,000), and a 25 to 44 year old 6 times more likely to die in 1931 than today (440 to 71 per 100,000). The differences in the older age groups are not nearly as great, with 1931's 45 to 64 year old women only 2.7 times as likely to die during a year as a 45 to 65 year old women today (1,118 to 409 per 100,000), a 65 to 74 year old women only 2.3 times more likely to die in 1931 as one today (3,835 to 1,643 per 100,000), and a women 75 and older only 1.7 times (11,635 to 6,861 per 100,000) more likely to die in 1931 as compared to today.

Thus mortality rates for young women today are only 4% to 10% of what they were in 1931, for women of working age they are 16% to 36% of what they were in 1931, and mortality rates for women 65 years of age and older they are about half of 1931's level.

There have also been significant reductions in the mortality rates for males in every age group over the past sixty five years. Figure 18 shows that, in the under 15 age groups, these reductions have been of the same magnitude as those for women. A new born male in 1931 was 27 times more likely to die before reaching the age of one than a new born male born today (9,439 deaths per 100,000 males under the age of 1 in 1931 compared to 347 per 100,000 today), a male aged 1 to 4 was 22 times more likely to die with in year than he is today, and a male aged 5 to 14 in 1931 was exposed to a mortality rate that was 9 times the rate for males in this age group today.

The change for males 15 years of age and older, while of significance, has been of nowhere near the magnitude that it has been for females. Males aged 15 to 24 had a mortality rate of 284 per 100,000 in 1931, 3 times that for their counterparts today. This dropping to one third of the 1931 rate must be compared to the drop to one eighth for females in the same age group. The mortality rate for women in the 25 to 44 age group today is 16% of what is was in 1921 - the rate for men in the same age group is 40% of what it was in 1931. By the time the 75 and older age group is reached, the rate for males today is only three quarters of its 1931 level, while the rate for women in the age group toady is 60% what it was in 1931.

A couple of observations from the mortality rate charts are appropriate before examining changes in the causes of death. First, mortality rates for males in all age groups in 1995 are above those for women, and are significantly higher in the 15 to 24 and 25 to 44 age groups. This means that the potential exists for reductions in male mortality rates (and hence increases in life expectancy) that exceed those for females of the same age simply as a function of the higher rates for males. Second, the rates in the younger age groups (1 to 4 and 5 to 15) are now at such a low level that any future reductions that might occur will likely be modest, and hence will not have a significant impact in increasing life expectancy. This means that any increases in life expectancy will have to come from reductions in mortality rates in the 15 and older population. Such reductions will be more dependent on major adult life style changes and significant developments in medical research and technology in order to achieve the same magnitude of change that occurred with significantly less effort in the past.

Examination of four causes of death - tuberculosis, accidents and adverse effects, cancer and circulatory disease - show why mortality rates have fallen in the past, and what might be required to have them continue to fall in the future. The impact that medical advancements can have on

death rates and life expectancy are illustrated by the change in the number of deaths due to tuberculosis since 1931 (Figures 19 and 20).

Figure 19: Age Specific Canadian Mortality Rates, Tuberculosis, Males, 1931 to 1995

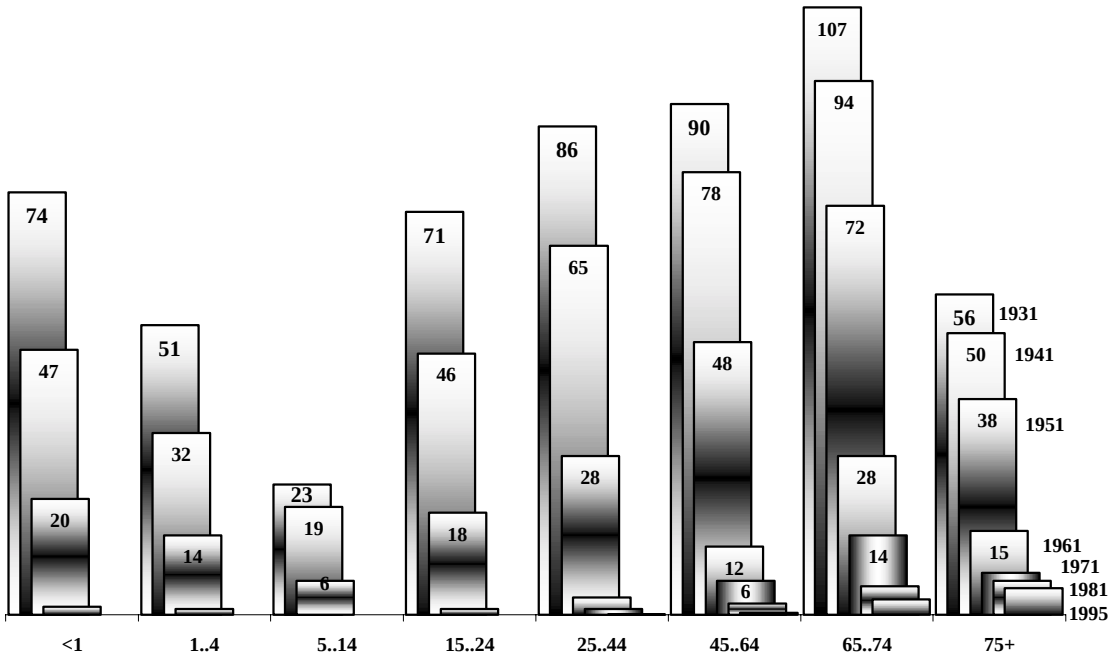
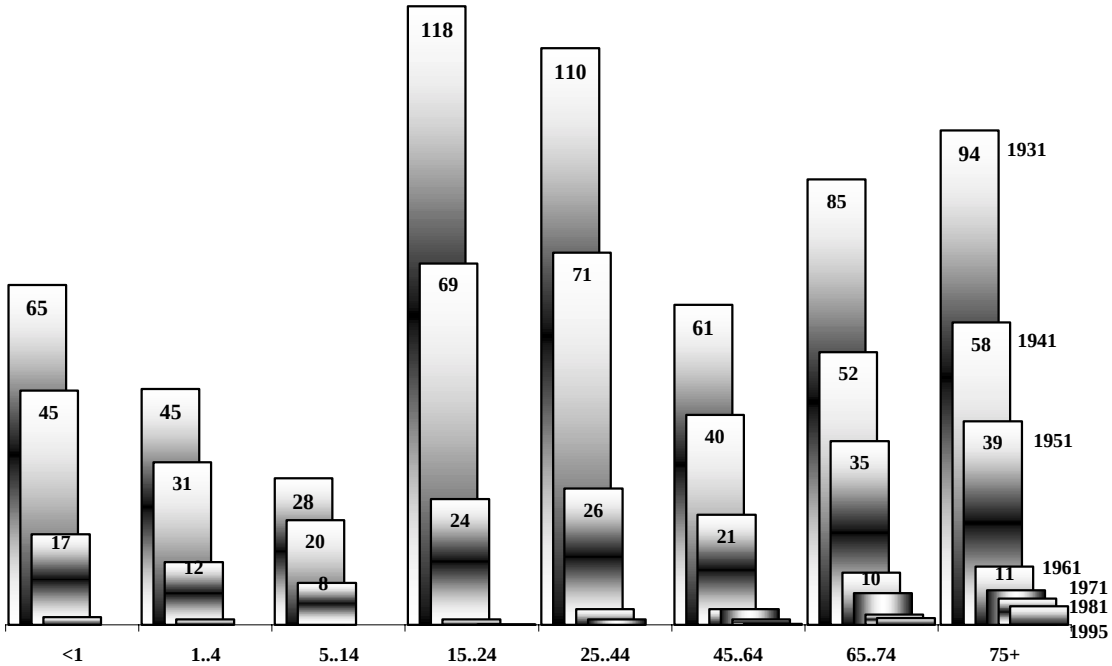


Figure 20: Age Specific Canadian Mortality Rates, Tuberculosis, Females, 1931 to 1995



As shown on Figure 19, tuberculosis was a significant cause of death for males in all age groups in 1931 – it was the second highest cause of deaths for males in the 5 to 14, 15 to 24 and 25 to 44 age group (following accidents and violence). By 1961, mortality due to tuberculosis was insignificant in these age groups, and by 1995 it was insignificant in all age groups. The under 1 age group saw male mortality rates due to tuberculosis fall from 74 deaths per 100,000 in 1931 to none in 1995. The 15 to 24 age group experienced similar reductions over this period, falling from 71 deaths per 100,000 in 1931 to none in 1995.

Female age specific mortality rates due to tuberculosis also fell dramatically between 1931 and 1995 (Figure 20). In 1931, tuberculosis was the leading cause of death for women aged 5 to 14, 15 to 24, and 25 to 44: mortality in the 15 to 24 age group due to this cause was 118 deaths per 100,000 women, and 110 per 100,000 in the 25 to 44 age group. By 1961, deaths of women under the age of 65 due to tuberculosis were insignificant in number; by 1995, there were only 6 deaths due to tuberculosis for women under the age of 65, compared to 3,425 in 1931.

A similar pattern of significant decline in mortality rates occurred for many other diseases. In the under 1 age group, immaturity as a cause of female deaths declined from 1,596 deaths per 100,000 females in 1931 to 46 in 1995, and from 1,993 per 100,000 for males to 58 per 100,000. Diarrhea and enteritis declined from 1,410 per 1000,000 for females and 1,993 per 100,000 for males to the range of 3 per 100,000; influenza, bronchitis and pneumonia from 1,093 per 100,000 for females and 1,360 per 100,000 for males to rates in the range of 20 per 100,000; whooping cough has fallen from the range of 200 per 100,000 to less than 1 per 100,000.

Other diseases that were major killers of children in 1931 – diphtheria, meningitis, appendicitis, measles, poliomyelitis, influenza, rheumatic fever – have disappeared from the list of leading causes of death for the 1 to 15 age groups, falling to below 1 death per 100,000 people by 1995. These diseases, as well as typhoid, epilepsy, ulcers, hernias and intestinal obstruction, syphilis and anemia, have all but disappeared from the list of leading causes of death for adults.

To a large extent, the dramatic reductions in mortality rates due to these causes are the result of medical discoveries during this century: antibiotics (for example, penicillin in 1928, streptomycin in 1943, neomycin in 1949, kanamycn in 1957, and gentamicin in 1964), vitamins, insulin, barbiturates, refinements in anesthetics, sulfa drugs (1941), anti-inflammatories, anticoagulants, and anti-epilepsy, anticancer and antiviral drugs.

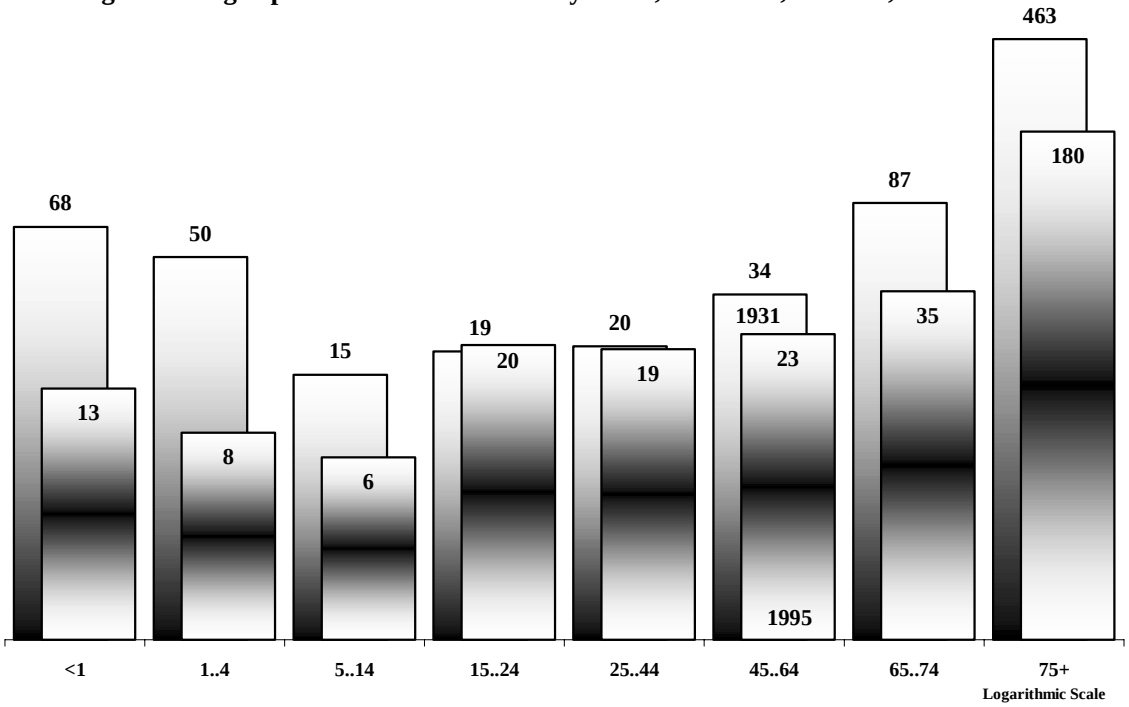
It was these “technological” factors that led to the dramatic increases in female life expectancies during the 1946 to 1971 period. While males life expectancies also benefited, the dominance of accidents, violence and adverse affects in male mortality rates (which did not decline substantially until after 1971) meant that male life expectancies did not increase as much as female expectancies did until after 1971.

While the mortality rates due to most causes declined dramatically over the past seventy five years, not all have. As a sweeping generalization, the greatest reductions were communicable diseases (which could be treated by drugs and public health) and in the surgically treatable categories. The ones that did not decline dramatically appear to be to a large extent life style and/or genetically related, including accidents, violence and adverse effects, circulatory disease and cancers. As these are now the leading causes of death, and hence of shortened life expectancy, a brief consideration of the change in their incidence over the past sixty five years illuminates the task ahead in reducing their impact on life expectancy.

Mortality rates due to accidents, violence and adverse effects for females declined for the younger and older age groups, but remained relatively constant throughout the middle age groups (Figure 21). The most dramatic decline in mortality rates for females due to accidents was seen in the 1 to 4 age group with an 84% reduction, falling from 50 per 100,000 people in 1931 to 8 by 1995. The under one age group saw a decline of 81%, (from 68 deaths per 100,000 in 1931 to 13 in 1995, and the 5 to 14 age group a 60% decline (from 15 deaths per 100,000 in 1931 to 6 by 1995). Similarly, the rate for the 65 to 74 and 75 and older age groups fell by 60% (from 87 per 100,000 to 35, and from 463 to 1800, respectively).

Within the working adult age groups, however, no significant declines occurred, with females aged 15 to 44 exposed to the same 20 per 100,000 risk of dying due to accidents and violence in 1995 as they were in 1931. In the 45 to 64 age group, a modest 33% decline occurred, from 87 per 100,000 to 23 per 100,000. The dominance of accidents and violence as a leading cause of death for younger adult females came about, therefore, by default, with other causes declining around the constant rate for this cause.

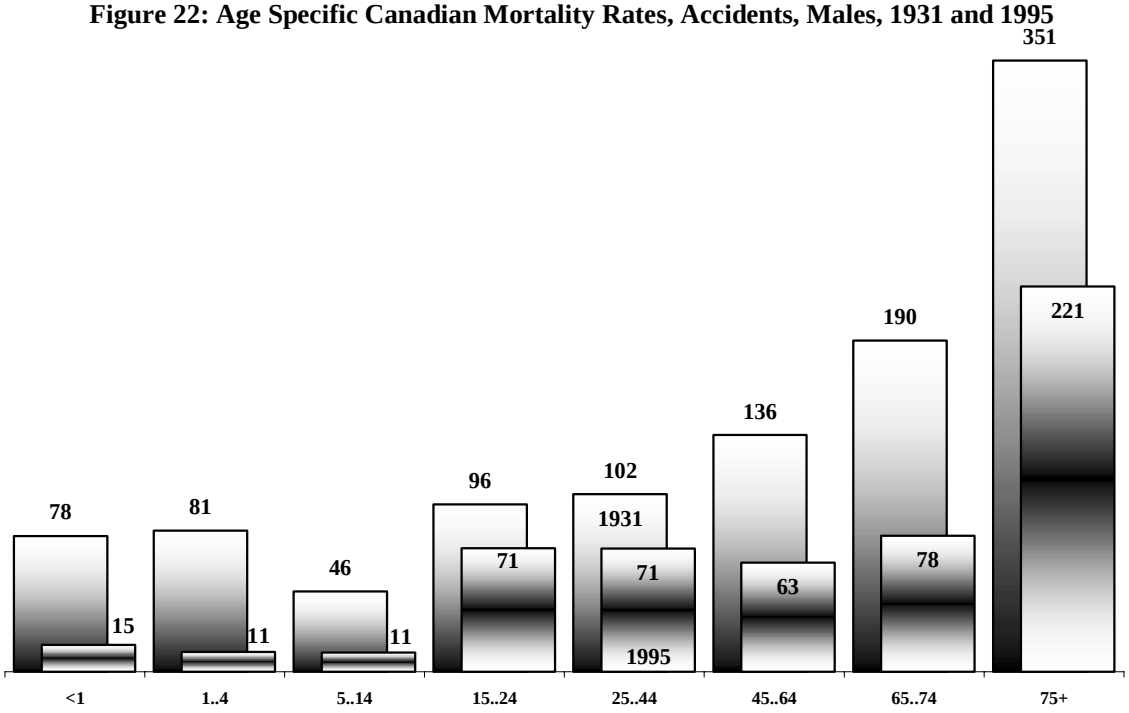
Figure 21: Age Specific Canadian Mortality Rates, Accidents, Females, 1931 and 1995



Unlike the situation for females, mortality rates for males due to this cause fell for all age groups between 1931 and 1995. Like the female rates, the largest reductions in death rates due to accidents were in the youngest and oldest age groups (Figure 22). The greatest decline was in the 1 to 4 age group, where the rate fell by 86% from 81 deaths per 100,000 in 1931 to 11 in 1995, followed by a 81% decline in the under 1 age group (from 78 per 100,000 to 15), and a 75% decline for the 5 to 14 age group (from 46 per 100,000 to 11). In the 65 to 74 age group, there was a 59% decline in the male mortality rate due to accidents and violence (from 190 per 100,000 to 78) and a 37% decline for the 75 and older age group (from 351 to 221). The declines in mortality rates for males of working age have been much more modest. The decline in the mortality rate for males aged 15 to 24 was only 16% (from 96 per 100,000 to 71), for males aged

25 to 44 was only 30% (from 102 per 100,000 to 71) and for males aged 45 to 64 by 54% (from 136 per 100,000 to 63).

Figure 22: Age Specific Canadian Mortality Rates, Accidents, Males, 1931 and 1995



These data show that mortality due to accidents, violence and adverse effects has fallen, and, given the difference between male and female rates, can fall further. The fact that there have not yet been significant declines for the rates for the working aged population indicates both the potential and the difficulty that further reductions will involve.

In contrast to the declines in mortality rates due to communicable diseases and accidents and violence are the increases in mortality rates due to cancer and cardiovascular disease. Since 1931 the mortality rate due to cancer for males has increased for the 45 and older age groups, while being generally insignificant and decreasing in the younger age groups (Figure 23). The mortality rates for the 15 to 24 group declined from 7 to 5 deaths per 100,000 people between 1931 and 1995, while the 25 to 44 group saw a decline from 25 to 20 deaths per 100,000 over the same period. In contrast, the mortality rates for males 45 years of age and older increased, by 30% in the 45 to 64 age group (from 202 per 100,000 in 1931 to 263 in 1995), by 40% in the 65 to 74 age group (from 763 per 100,000 to 1,065), and by 83% in the 75 and older age groups (from 1,186 per 100,000 to 2,180).

There has been a general, if modest decline in mortality rates for females due to cancers, particularly in the working adult stage of the life cycle (Figure 24). In 1931, the mortality rate due to cancer for females in the 25 to 44 age group was 53 per 100,000: the rate had fallen by 50% by 1995, to the level of 26 per 100,000. In the 45 to 64 age group, it had fallen by 18% (from 267 per 100,000 to 220), and the 65 to 74 age group by 3% (from 696 to 672 per 100,000). In the 75 and older age group, the female mortality rate due to cancer had increased by 21%, from 1,106 to 1,227 per 100,000 women in the age group.

While the 1931 to 1995 picture is one of declining mortality rates due to cancer for women, the one for the past twenty years is much different. Between 1976 and 1996, the mortality rate for cancers for men declined slightly (by about 1%), the rate for women has increased by 5%.

Figure 23: Age Specific Canadian Mortality Rates, Cancer, Males, 1931 and 1995

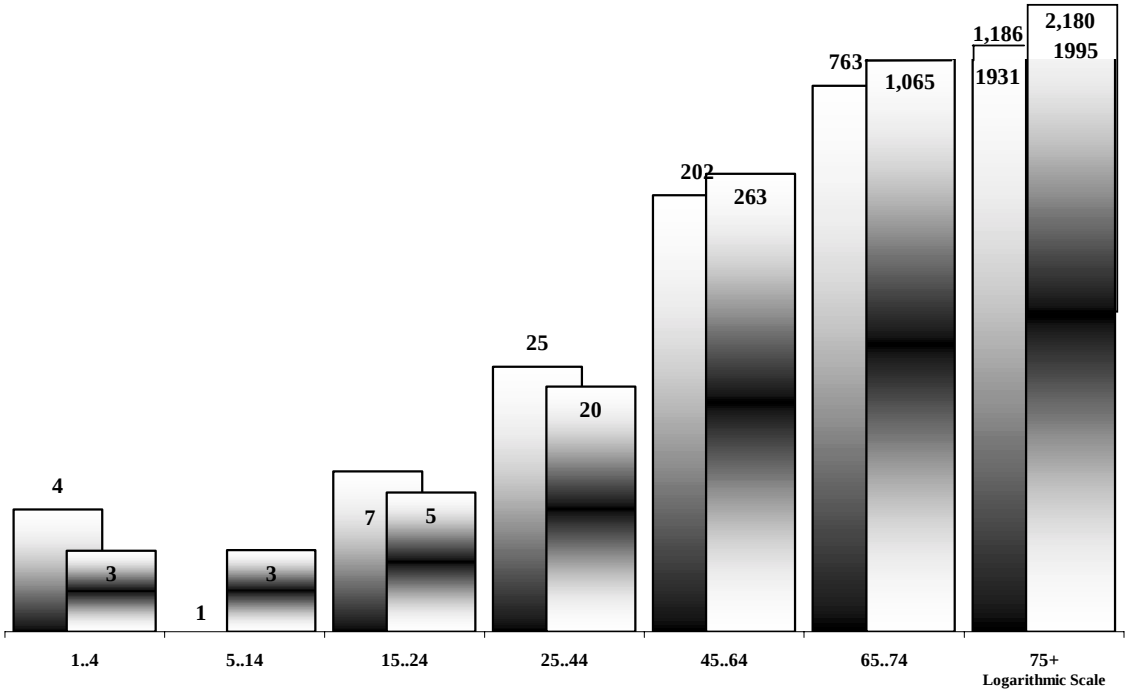
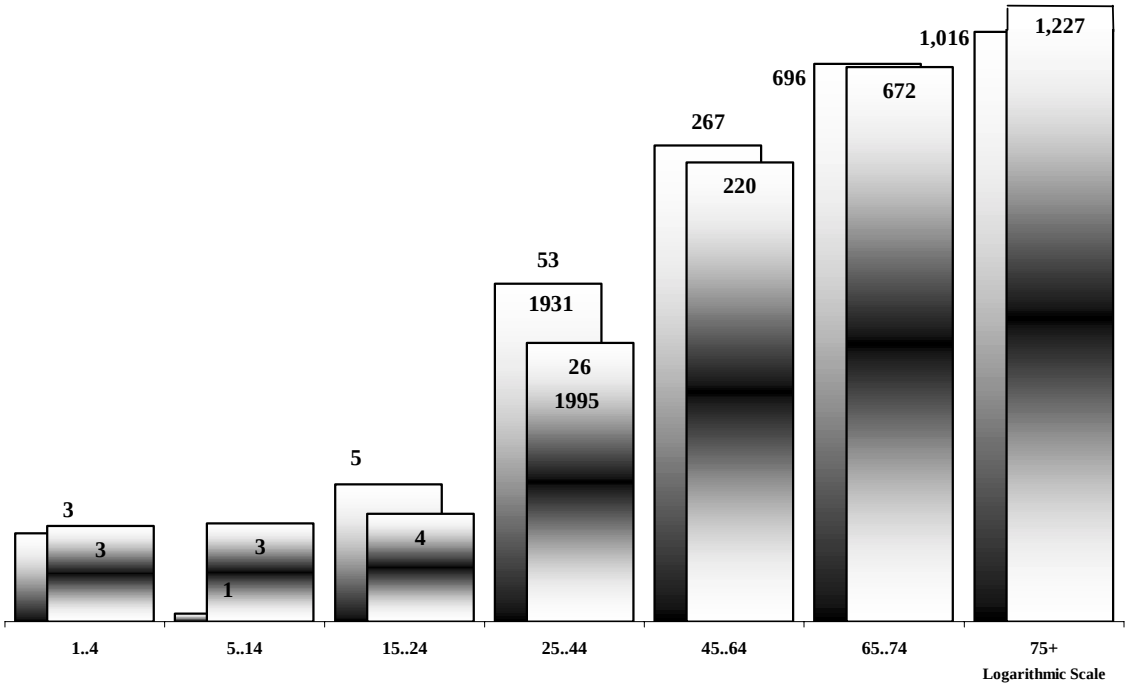
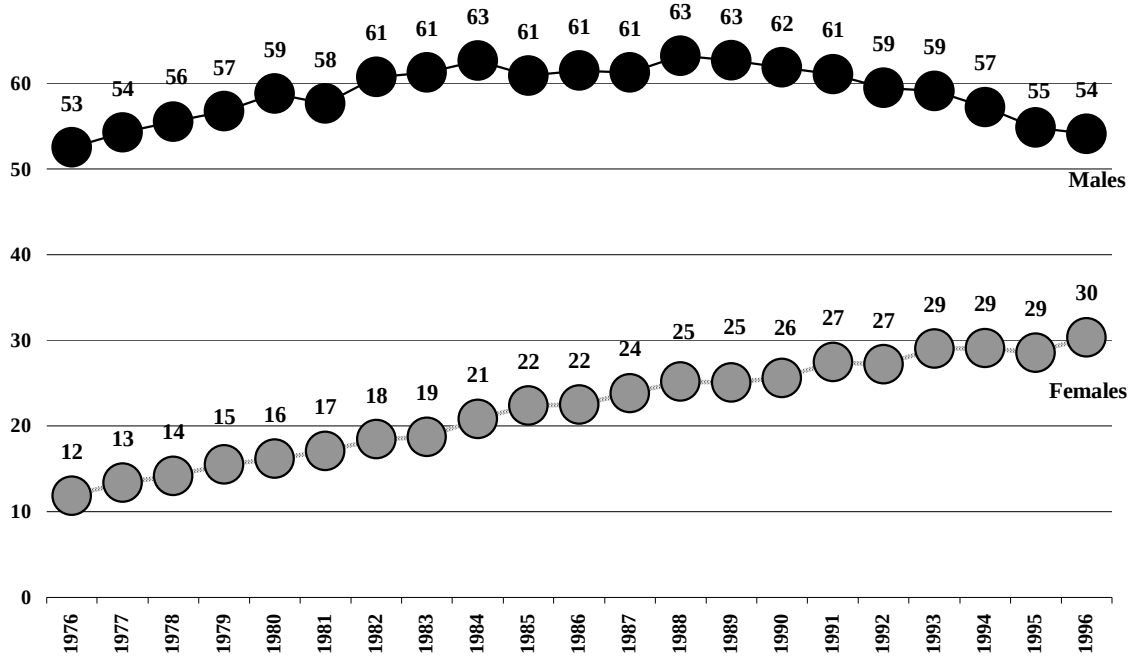


Figure 24: Age Specific Canadian Mortality Rates, Cancer, Females, 1931 and 1995



This overall increase is driven by a dramatic increase in female mortality due to lung cancer which increased by 156% from 1976 to 1996, from 12 deaths per 100,000 in 1976 to 30 per 100,000 in 1996 (Figure 25)[12]. Over the same period, the rates for males increased by only 3%, from 53 to 54 deaths per 100,000 people. The rates for females are still well below those for men, but as more females become smokers, and as young female smokers age, the gap will narrow as female mortality rates due to lung cancer climb to meet those of males. This in turn will bring about an increase in female mortality rates due to cancer in the older age groups, a reversal of the trend demonstrated over the 1931 to 1995 period

Chart 25: Age Standardized Mortality Rates, Malignant Tumors of the Respiratory System, Canada, 1976 to 1996 (Deaths/100,000)



Changes in mortality rates due to cardiovascular disease also demonstrate a difference between long term and short term patterns of change. In every age group, for both males and females, mortality rates due to cardiovascular disease were lower, in many cases substantially lower, in 1995 than they were in 1931 (Figures 26 and 27). Deaths due to cardiovascular disease have been virtually eliminated in the under 15 population of both males and females, and substantiality reduced in the working aged population (for example, by 56% for males, and 84% for females, in the 25 to 44 age group, and by 39% for males and 74% for females in the 45 to 64 age group). In spite of the declines in the mortality rate due to this cause in the 75 and older age group (from 5,247 to 3,990 per 100,000 males, a 24% reduction, and from 5,302 to 3,285 per 100,000 females, a 38% reduction), cardiovascular disease remains the leading cause of death in this oldest age group. This decline, however, has not been the result of a continuous trend, such as was demonstrated for tuberculosis, but rather as a result of the reversal of a pattern of increasing mortality rates due to cardiovascular disease over the 1931 to 1961 period, followed by subsequent significant declines in the 1961 to 1995 period.

Figure 26: Age Specific Canadian Mortality Rates, Cardiovascular Disease, Males, 1931 and 1995

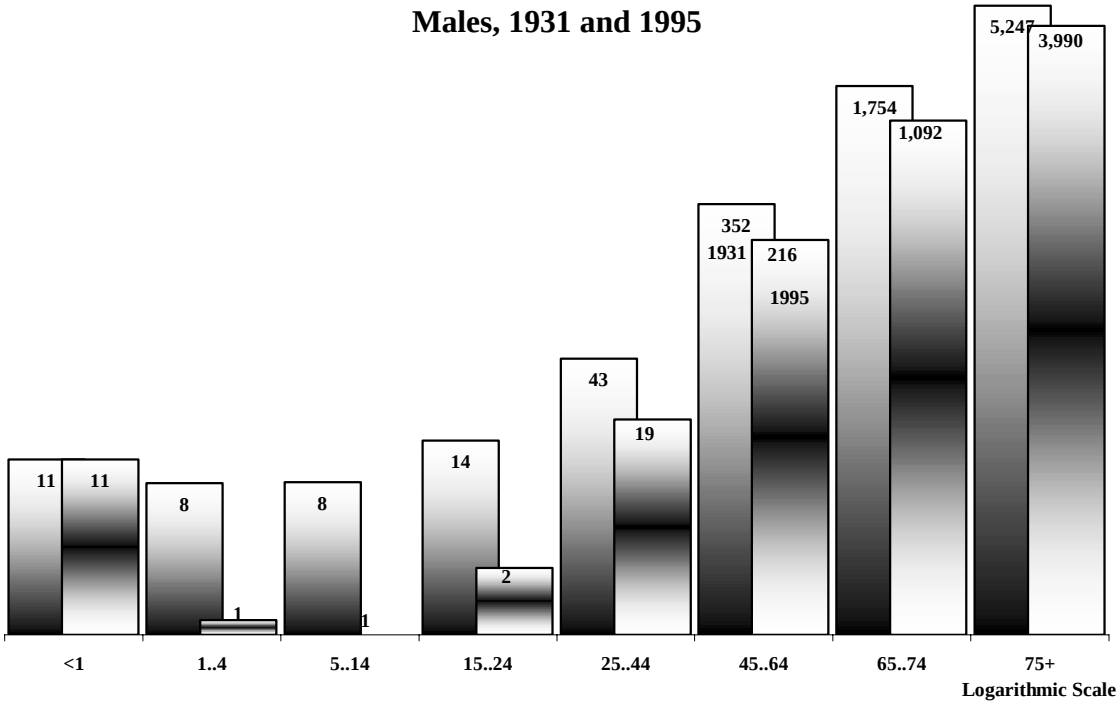
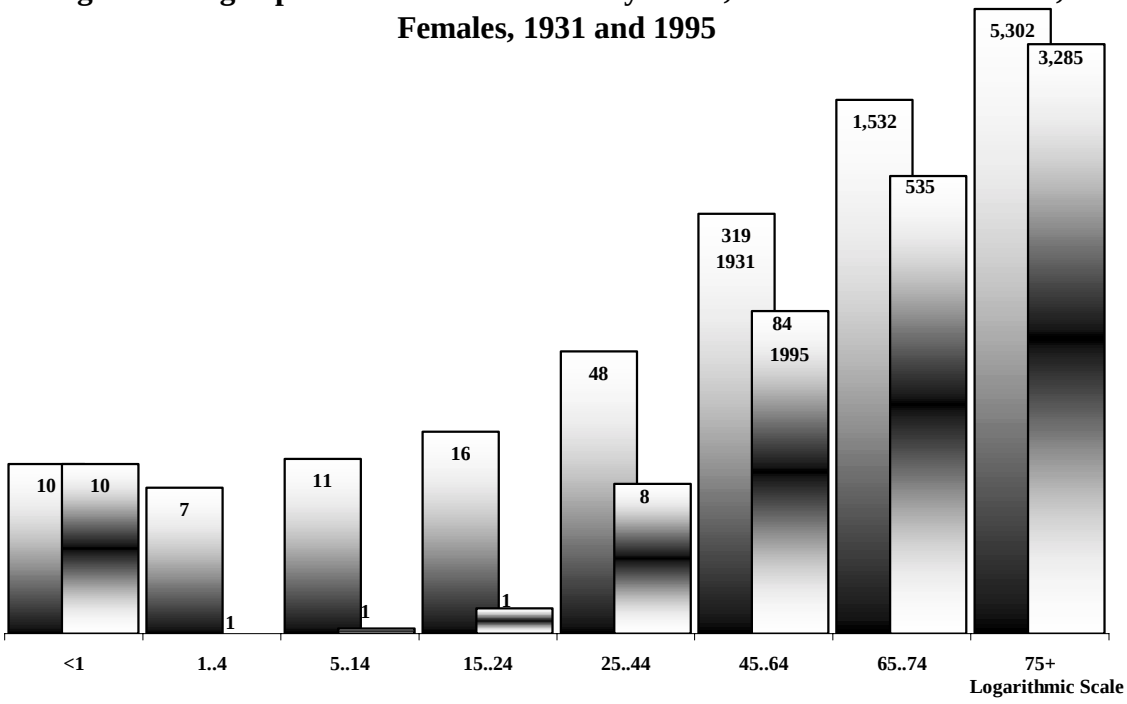


Figure 27: Age Specific Canadian Mortality Rates, Cardiovascular Disease, Females, 1931 and 1995



And finally, what about HIV infections? This was not a cause of death prior to 1986, and hence no long run trends can be presented to describe changes in mortality rates due to this cause. According to supplementary data, mortality rates due to this cause increased for all age groups from 1987 to 1996, and then declined, again in all age groups, between 1996 and 1997. At this point, it is hard to say what the long run holds for reduction in deaths due to HIV infections, beyond noting the recent decline, and the significant amount of research being carried out to both treat and cure this communicable disease.

The current major causes of mortality have, as was noted in Section III of this report, a distinct age specific pattern, with accidents, violence and adverse effects having their most significant impact on the younger population, followed by cancers with the older working age adult population, and cardiovascular disease in the older population. Given the relatively low level of mortality rates currently affecting the young population, major increases in life expectancy will not come from reduction of mortality rates in these age groups. As such reductions will have to focus on accidents, violence and adverse effects, they will require behavioral rather than medical solutions.

This means that the major increases in life expectancy in the future will come from reduction in the mortality of adults, particularly in the 35 and older age groups. This means a focus on cancer and cardiovascular disease. As with accidents, violence and adverse effect, a behavioral focus will have to apply to bring about reduction of mortality due to cancer (especially with respect to lung and skin cancer) and due to cardiovascular disease. Medical science, particularly in the realm of gene therapy, may provide "technological" solutions to these diseases, as it has for so many other diseases. Having said this, these reasons these remain as the leading causes of death is that they have been most resistant to solutions.

V. What Might the Future Hold?

Each day new technology and new knowledge about disease, and about health, offer the potential to extend not only life, but the quality of life: there is no question that, baring some unprecedented and unpredictable disaster, life expectancy in Canada will increase in the years to come. The question is merely how much life expectancy will increase? Precisely projecting the amount of increase that will occur means, implicitly or explicitly, projecting the contribution made to longevity by each and every medical and health advance in the future. This is not possible.

What is possible is to make assumptions about the magnitude of possible increases based on the trend in increases that have occurred in the past. Such a mathematical extrapolation does not model the effects of specific factors that will affect life expectancy, but rather describes the cumulative effect of individual factors based on trends that emerge from historical data.

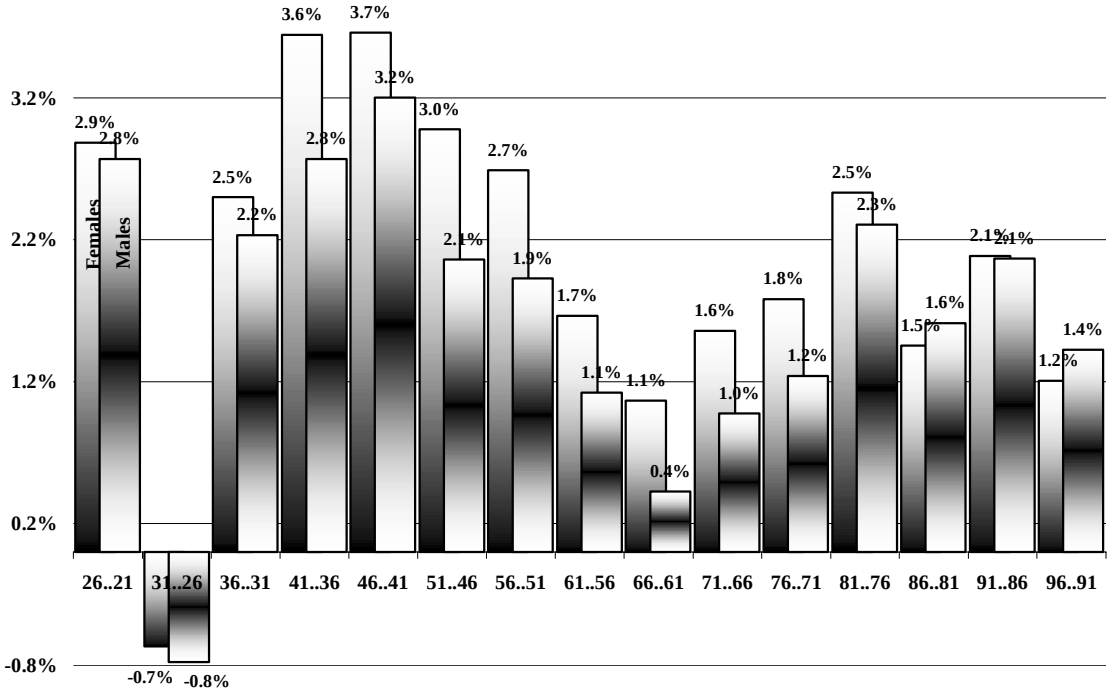
Two general conditions will apply to such projections. The first is the assumption that there will be increases in life expectancy in the future, as the future is seen as an extension of the past. The second is that the magnitude of the increases will diminish over time: as mortality rates are pushed down, it will become successively harder find new ways to push then down further. This was shown in the previous section: we will never again be able to get the gain in life expectancy

that resulted from the virtual elimination of TB as a cause of death because this cause of death has already been eliminated.

A general trend of a declining marginal increase in life expectancy for males and females is apparent in a graph of change in life expectancy at birth in Canada over the past seventy five years (Figure 28). While the post 1966 period shows a reversal for the slowing of increases in life expectancies that occurred from 1946 to 1996, there is nonetheless a long term trend line downward to the left from the 3% plus per five year period increases in life expectancies during the 1940s to the 1.5% to 2.0% increases that occurred during the late 1980s and 1990s.

We may assume that it will be harder and harder to extend life expectancies when the only significant mortality rates are in the population 50 years of age and older, and where cancers and circulatory diseases are the major killers. We must also be prepared to acknowledge that, as these become the major focus of medical and health research, they, as with TB, may become diseases of the past.

Figure 28: Percentage Increase in Life Expectancy, Male and Female, Canada, 1921 to 1996



There are a wide range of mathematical projections that could be used to extend the general trends of increases in age and sex specific life expectancies observed over the past seventy five years into the future. The projection technique used here follows the long run average trend of diminishing increments in life expectancies: doing so results in a estimate life expectancy at birth for a male in 2021 of 79.3 years, and for a female of 84.3 years (Figure 29). These represent increases of 3.5 years for males, and 3.3 years for females (Figure 30) over 1996's expectancies of 75.8 years (males), and 81.0 years (females).

Following this projection, a thirty five year old male would have a life expectancy of approximately 80 years in 2021. His female counterpart would have a longer life expectancy, projected to be to an age of 85 years. This represents an increase of 2.5 years for males aged 35, and of 2.8 years for females, between 1996 and 2021.

Figure 29: Mathematical Trend Projection, Life Expectancy, Males and Females, Canada, 2021

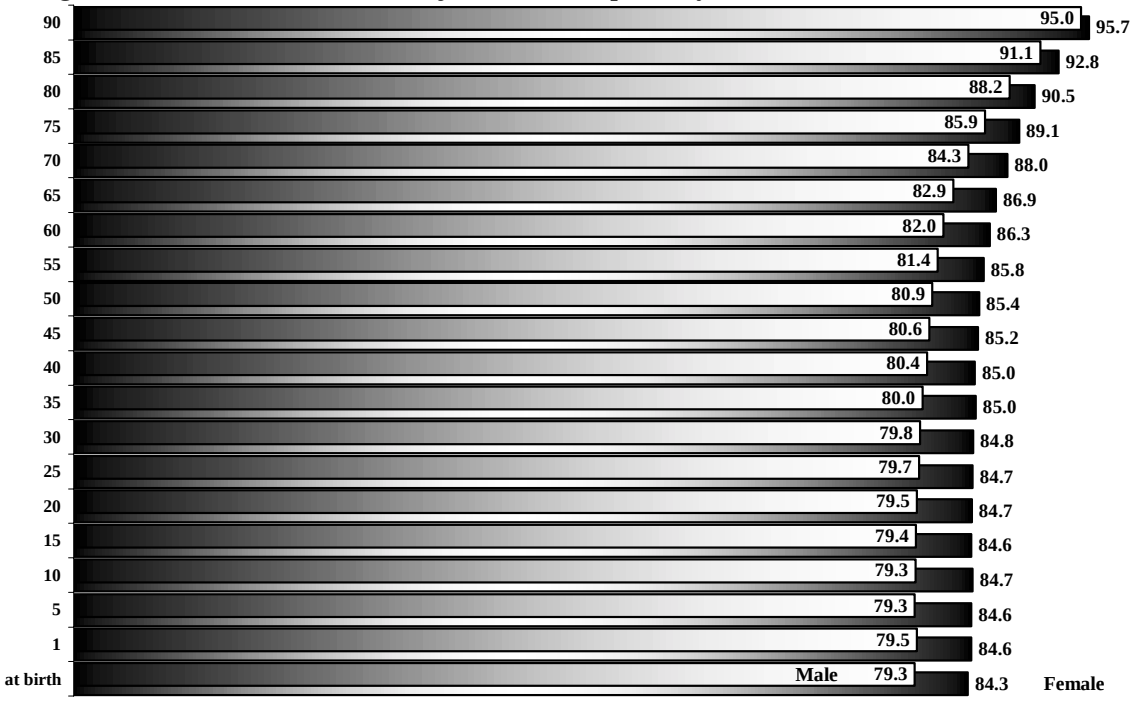
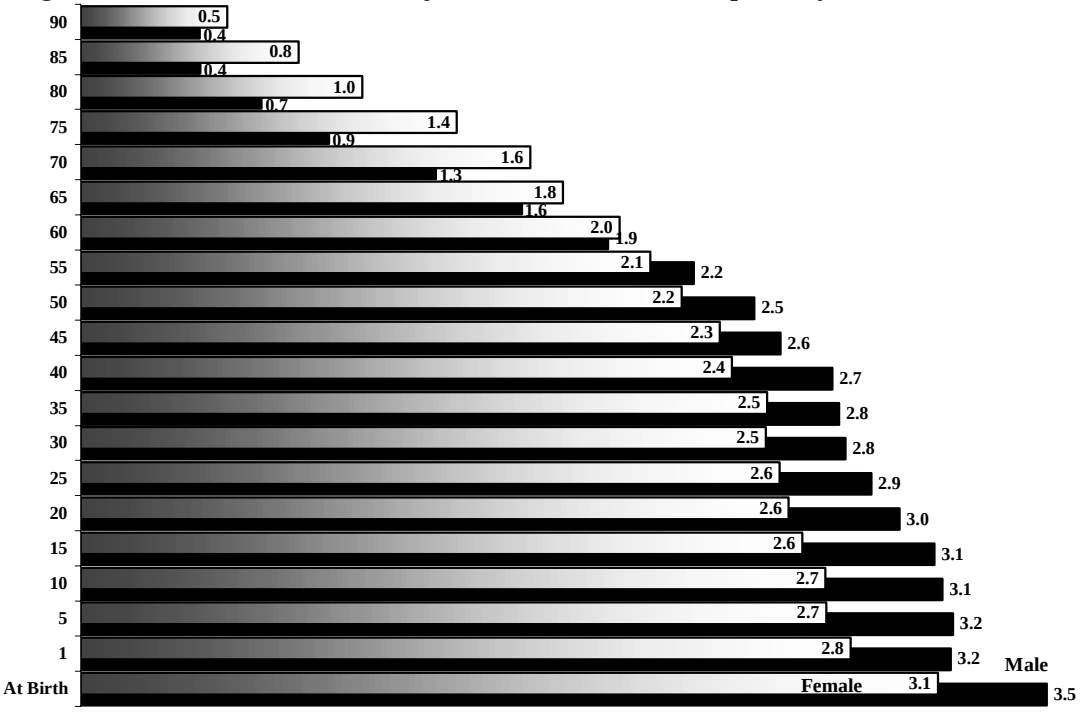


Figure 30: Mathematical Trend Projection, Increase in Life Expectancy, Canada, 1996 to 2021



Today's typical person, a 35 year old, will be 60 years old by 2021. They will have a life expectancy to live to be 82 years of age if they are males and 86.3 years of age if they are females. This represents a 2 year increase in life expectancy for 60 year old males, and 2.9 years increase for females aged 60 between 1996 and 2021.

Pursuing this projection, the front edge of the baby boom, someone who is 50 years old today, will have their 75th birthday in 2021. If they reach this milestone, accepting this projection, they would expect to live, on average, for another 10 years if they are males, and 14 more years if they are female, as 75 year old male's life expectancies in 2021 are projected to be to live to 85.9 years and to 89.1 years for females. Although these increases in life expectancy are much lower than those that have occurred over the past 75 years, and even over the past 25 years, they will nonetheless contribute to an increase in the average age of Canada's population, and to an increase in the share of Canada's population that is over any particular age.

In some senses, these projected life expectancies may be judged to be conservative, more descriptions of what life expectancies already are than what they might be in the future. The current life expectancy for a 50 year old male of 78.5 years is based on the assumption that when today's 50 year old is 75, they will have the same mortality rate as today's 75 year old. To the extent that today's 50 year olds are healthier than today's 75 year olds were when they were 50 years of age (in the early 1970s), today's 50 year old will have a lower mortality rate when they are 75 even without major medical breakthroughs in the future. As a result, the projected life expectancy to live to 80.9 for a 50 year old may be more of an acknowledgement of what is already the case for today's 50 year old, than a projection for the 50 year old of 2021, who, in turn will have a higher life expectancy.

If this is the case, then the projection that 23% of the country's population in 2036 will be 65 years of age and older presented on the first page of this report will be low, with the 23% share being attained sooner than anticipated.

VI. Conclusions and Implications

Increasing life expectancies have in the past, and will in the future, mean an increase in the relative size of Canada's older population, regardless of how one defines older. We have already experienced an increase in the percentage of the population 65 years of age and older from 5% in 1901 to 12% in 1996: this is projected to increase to 16% by 2016 and to 23% by 2036. The projection of a doubling of the share of our population that is 65 years of age and older has a number of significant implications.

The most commonly discussed implications focus on what is called the dependency ratio. This ratio is the number of people aged 65 and older divided by the number of people of working age (15 to 64 years of age). Currently, there are 177 people 65 years of age and older per 1000 people of working age in Canada: this will increase to the 380 per 1000 by 2036, as the population 65 and older increases at more than twice the rate of the working aged population[13].

That this ratio will increase is without question: the only question is the validity of the concept of concept of dependency. Currently, there is again no question that there is a dependency relationship between 65 and older population and the working population: 45% of the households in Canada with household maintainers 65 years of age and older receive 80% or more of their

household income from government transfers, spending on the 12% of the population that is in the 65 + age group accounts for 39% of the national heath care expenditure, and current Canada Pension Plan contributions are 15% below its current expenditures.

The OECD has warned that "Canada will be faced with sharp increases in tax burdens during the 2005 to 2040 period. Canadians will most likely have to chose between increasing tax rates and social security contributions or lower levels of social benefits"[14]. Clearly, Canadians must collectively address the level of support from social services that will be appropriate given a more than doubling of the ratio of the number of people 65 and older to the number of people of working age.

Some of this discussion will focus on redirection and reformation of social benefits programs such as pension plans (both public and private), health care, social services delivery systems, and other age related subsidy programs. This will involve evaluation of changes in both contribution requirements and benefits provided, and hence in the degree to which one generation is dependent on others.

As well, it will involve a redefinition of what "elderly" and hence "eligible for benefits" will mean. Increases in life expectancies have been matched with increases in fitness and health. Today's 70 year olds are a lot younger than the 70 year olds of 1971, and the 70 year olds of 2021 will be a lot younger than today's 70 year olds. This means that part of age related social services will involve a redefinition of "elderly', most likely moving from an age base to a functional one. In such a context, eligibility for an elderly benefit would be means and ability tested rather than simply chronologically tested. This would mean the end of every thing from mandatory retirement to automatic seniors' benefits and discounts at a particular age.

Decisions about such changes would act to change the dependency relationship that is represented by the dependency ratio, rather than the ratio itself. Policies can also affect the ratio by changing the number of people 65 and older per 1000 people of working age. With increasing life expectancies and increased levels of health in the adult population, there is not much that can be done about the number of people 65 and older, so any attempts to reduce the elderly dependency ratio must focus on increasing the size of the working aged population.

Increased births rates would bring such a change, but birth rates in Canada are actually heading in the opposite direction[15]. Immigration policy does facilitated increases in the number of people of working age: two thirds of the annual immigrants to Canada are under the age of 35, younger than the youngest baby boom. Without this immigration, the elderly dependency ratio in Canada would be 458 persons aged 65 and older per 1000 of working age, compared to the 378 that current immigration levels will bring.

These are some of the obvious discussions that will result for the dramatic growth that increasing life expectancies and the aging of the baby boom will bring. There are some less obvious ones. For example, housing markets have been, and will continue to be, affected by increasing life expectancies. In the (distant) past one generation followed another in the housing market. In those olden days, one could compare the number of people in one age group to those in the next older age group to see how many more dwelling units would be required. This is no longer (and has not been for decades) possible, as long life expectancies mean that there are now four generations in the housing stock. The fact that people are living longer (and healthier and more active lives) means that new housing must be produced to accommodate new household

formation as existing households remain in the market much longer. There will be no housing market meltdown as a result of the aging of the baby boom[16].

Perhaps the most important issues of increasing expectancy are the personal ones. We all should be planning on living to somewhere between the ages of 85 and 90. This means an entirely different attitude to growing, well, perhaps older is not the right word – more mature? The fundamental question that each of us will face is which side of the dependency relationship we wish to be on when we are 65, 75, and 85? Once we have picked a side, we must act accordingly.

Collectively, and individually, we must plan to have the resources to carry us forward 20 to 25 years after what is currently seen as retirement age. While retirement planning lies outside the topic of this report, and hence will not be discussed here, some suggestions are appropriate in closing. To have control and security during retirement, we would have to own our own homes free and clear of mortgage debt (so that we have somewhere to live where we can't be evicted). We would have to invest in something other than our homes so that we would have incomes to spend while we live in our homes. We would not count of having any substantial benefit from public sector support programs, because there will be so many more people chasing these benefits and relatively few paying for them. We would have to promote economic and labour force growth to expand the base of contributors to social programs. And we must put aside many bottles of red wine and port for those long winter nights.

[1] Data for 1901 to 1996 from Statistics Canada's Census of Canada, referenced years: projection for 2001 to 2046 from Statistics Canada's Medium Projection, custom tabulation prepared for The Urban Futures Institute.
[2] All 1996 life expectancies discussed in this report are estimates prepared by The Urban Futures Institute on the basis of preliminary data provided by Statistics Canada.
[3]Given the wide range of mortality rates, from 14 deaths per 100,000 females in the 5 to 9 age group to 22,664 per 100,000 males in the 90+ age group, it is necessary to plot the age spectrum of mortality rates on a logarithmic scale (Figure 3) to show all of the age groups on the same chart.
[4] Based on data from Statistics Canada's publication, The Leading Causes of Death at Different Ages, Canada, 1995.
[5] Based on data from Statistics Canada's publications, The Leading Causes of Death at Different Ages, Canada, 1995 and Deaths, 1995.
[6] Ibid.
[7] Ibid.
[8] Estimates for Canada, 1831 to 1911, from Statistics Canada publications, Demographic and Health Indicators, 1986, and Canadian Abridged Life Tables, 1871 to 1931.
[9] Data for 1921 to 1991 from Statistics Canada publications, Life Tables Canada and Provinces, for the referenced years; 1996 estimate by The Urban Futures Institute based on data provided by Statistics Canada.
[10] In the 1800's males under the age of 35 has a slightly longer life expectancy than females of the same age, showing the impact of childbirth mortality on women prior to the turn of the century.
[11] [11] Based on data from Statistics Canada's publications, The Leading Causes of Death at Different Ages, Canada, 1995; Deaths, 1995; Vital Statistics of Canada, 1931; Census of Canada, 1931, and Longevity and Historical Life Tables 1921 to 1981 (Abridged)
[12] Statistics Canada, Report on the Demographic Situation in Canada 1997, Table 22.
[13] For further discussion of projected dependency ratios, see The Urban Futures Institute publications, Immigration to Canada: Youth Tonic for an Aging Population (pages 9-10, and 35-46), and Just Numbers: Demographic Change and Immigration in Canada's Future (pages 11-20).
[14] Statistics Canada, "Implications of An Aging Society", Canadian Social Trends, Spring 1991, page 8.
[15] For further discussion of birth rates in Canada, see The Urban Futures Institute publication Babes in Lotusland: Births, Birth Rates, and Their Demand Implications in British Columbia, 1921 to 2021.
[16] For a discussion of the relationship between demographics and housing demand, see The Urban Futures Institute publication Demographics and the Future of Housing Demand in Canada: the Myth of the Vanishing Purchaser.