

## MEMORANDUM

# on the <br> PROJECTION OF POPULATION STATISTICS <br> 1954 

Published by Authority of
The Right Honourable C. D. Howe, Minister of Trade and Commerce

> Propared in the Office of the
> SENIOR RESEARCH STATISTICIAN DOMINION BUREAU OF STATISTICS OTTAWA - CANADA

$$
F O R E W O R D
$$

The present memorandum is the third in a series of population projections made by the Dominion Bureau of Statistics. In general, the present projections attempt to show the future possibilities inherent in the trends of the past few years. Whether or not these trends will continue only time will tell. However, the importance of information concerning prospective population growth is so great that it justifies the calculation of estimates which may later require modification.

At the present time (Spring, 1954) Canada's crude birth rate shows signs of again moving upward from the relatively high level of the past three or four years. The levels of immigration have been high in the past few years but this is one field in which no one can tell what the future holds. For these and other reasons it has been necessary to allow for a wider range of assumptions than might be desired by users of these figures. Despite this it is hoped that the projections will give long range guidance to planners in government, business and social work in estimating Canada's future population by following through different sets of assumptions about the sizes of the population components involved.

Although the present trend towards more rapid increase of Canada's population may be a temporary phenomenon, it is noteworthy that the years since the last series of projections in 1949 have witnessed rather unusual stability in trends of the components of population. Births have remained at the high plateau of 27 or 28 per thousand population since the record high of 28.8 reached in 1947. Deaths, when considered by specific age and sex groups, show a surprising stability of trend over the past twenty years.

The present bulletin covers the period up to 1971. Certain changes have been made in the methods used, in particular for the estimation of deaths, where an attempt has been made to estimate separate death rates not only for each sex and age group, but also for each year from 1951 forward. For example, the death rate applied in 1961 to women who were 55 to 60 in the 1951 Census will not be the 1951 death rate of women 65 to 70 , but the (lower) rate which will prevail in 1961 if the decline in death rate for women of this age continues into the future at the same rate ( $1.1 \mathrm{p} . \mathrm{c}$. per year) as in the past. The effect of this is especially striking among infants, where the death rate is dropping rapidly. There can be no guarantee that this decline will take place, of course, but it seems more realistic to expect a continued decline than to expect that the lowest practical death rates have finally been achieved in Canada.

Despite such improved procedures the fact remains that there are no methods at present available to forecast with reasonable accuracy the forces at work determining population magnitudes and movements. For this reason, and because this calculation has not the same factual basis as other Bureau publications, this memorandum, like its predecessors, will not be given general distribution. It will be available only on request and for their own use to those interested in the subject.

The present projections have been prepared by T.G. Donnelly of the office of the Senior Research Statistician. Assistance and advice were given at different points by members of the Social Analysis Section, Census Division, and the Vital Statistics Section, Health and Welfare Division. The basic data arel from the 1951 Census (published and unpublished material), the DBS annual reports on Vital Statistics and the annual reports of the Department of Citizenship and Immigration.

## TABLE OF CONTENTS

Page
Foreword ..... i
Introduction ..... 1

1. The Present Situation ..... 1
2. Comparison with Previous Projections ..... 4
3. Assumptions ..... 5
4. Construction of Projections using Different Assumptions ..... 7
Table 1. Projections of the population by sex, assuming an annual net immigration of 40,000 after 1956, and high, medium and low birth rates, for Canada; 1956, 1961, 1966, and 1971. ..... 10
Table 2. Projections of the population by sex, assuming an annual net immigration of 75,000 after 1956, and high, medium and low birth rates, for Canada, 1956, 1961, 1966; and 1971. ..... 11
Chart I Birth rates per 1,000 population, Canada, 1926 - 1953 actual, 1954 - 1971 projected ..... 12

## I NTRODUCTION

## 1. The Present Situation

The years since the last set of projections have demonstrated an increased ability of the Canadian population to reproduce itself and at the same time to absorb population from foreign countries. The population has consistently outrun estimates of its future size. The long-term decline in birth rates which characterized most developed countries of the western world until. 10 or 20 years ago has not re-appeared in Canada as was expected after the wartime and post-war "baby boom ". The Canadian population as a whole increased by 11 p.c. during the 1931-1941 decade, as compared with 1.8 p.c. and 35 p.c. in the preceding two decades. The 194l-1951 decade was featured by a sharp reversal of this downward trend. Despite the fact that the changes in trends of births, marriages and immigration were for the most part concentrated in the latter half only of the 1941-1951 decade, the population rose by 19 p.c., or 22 p.c.:if Newfoundland is included.

Births
Birth rates have shown a marked recovery from the decline which was evident throughout the early part of the century. The recovery took place in several stages. The low point as given by crude birth rates, was reached in 1937 at 20 births per thousand population. It then climbed to 24 per thousand by 1943, maintained this for two years, and then jumped to nearly 29 per thousand in 1947 and settled at 28 per thousand thereafter. The current year 1954 gives. some indication that the rate has suddenly risen again, and a new high level may be achieved.

This increase has not been'shared equally by all ages of mothers. It has been most striking in the younger age groups, where the specific fertility rate reversed its long-term decline the earliest, 1936 or 1937. The intermediate child-bearing ages have had a smaller, but still considerable increase, but among women over forty years of age, there was only a slight increase in fertility whichoccurred sometime between 1941 and 1946. Thereafter, the decline in fertility re-appeared at the same rate as before. This latter feature is part of the disappearance of very large families in Canada as an important source of population.

Contributing to the size of the present birth rate are several factors, some of which are likely to remain important for some time and others which are, in a sense, artificially inflationary in that they increase the birth
rate at the present time but can be expected to become unimportant in the future. These latter are births which might have been expected to occur either in the past or in the future if recent changes had not taken place in the pattern of marriage and reproduction. During the war years, marriages were postponed or families were separated, and this delay meant that part or all of the family formation was set back from four to six years. Much of these "postponed" families will have been made up now except for high birth order children of such families, whose birth will take place at the present time. Thus a three-child family which might have had children in 1945, 1948, 1951 will be delayed until 1948, 1951, 1953. The deflation in the birth rate which occurred in 1945 was not compensated for until 1953.

From the other direction, there has been a movement towards accelerated family formation through earlier marriages and families. Even if there were no increase in family size, this trend will mean that children are being born sooner than if the trend had not appeared. The immediate effect of both the above features is to bring about an artificially large number of births at the present time.

These births "borrowed against the future" are evident from statistics. The proportion of teen-aged girls married increased 40 p.c. between 1941 and 1951, and for those $20-24$ the increase was 33 p.c., with small but significant increases at the other age groups. As a consequence the fertility rate for teen-age girls has risen sharply since the end of the war, and the children born now to mothers 20-24 and 25-29 are more likely. to be second, third, and fourth children than first children the way they were in the early 1940's. This picture too is somewhat blurred by the long-term decline in the numbers of children from very large families, which would influence the birth-order picture somewhat even in the younger aged mothers in that young mothers contribute births of relatively large order whenthe final family is to be large in size.

This latter factor tends to obscure the central issue as well, which is: what is the trend in the average size of completed Canadian families? The average size of family, insofar as it can be judged from available data, is increasing for families of a type which in the past would have remained small, and decreasing for families of a type which in the past would have been larger. The net effect of these two influences is apparently to widen the base of family formation, and also to bring about an increase in crude birth rate, since the influence of increasing numbers of small families exceeds the influence of the declining numbers of large families.

The number of marriages suddenly increased after 1945 to a record 134,000 in 1946. It declined to 124,000 in 1949 and then began to rise again, reaching the 1946 level again in 1953. However, this time it was marriages of young people which made up most of these. This marriage boom brought about a sudden increase in first children in 1947, of second children which reached a peak in 1949, and of third children reaching a peak in 1952. At present, there is a high rate of births of children of all but the very largest orders for mothers of nearly all ages. The growing exception to this is among mothers in the older child-bearing ages, about 35 or 40 in most provinces.

Despite the large number of births of low birth order since the war, the proportion of births of moderately large birth order has been maintained. For Canada as a whole, birth orders of higher than sixth have been declining percentagewise, and those lower than sixth generally increasing. The picture varies from province to province, with Quebec maintaining the percentage up to ninth children, and falling off rapidly after that.

Deaths
The study of death rates reveals the effect of the improvement which has been made in medical care, public health, and nutrition habits. Mortality rates at all ages are falling, apparently at a constant percentage rate annually in a given age-sex group. Women not only live longer than men now; the gap between men and women is increasing. For females, the age-specific death rates are decreasing at all ages, especially the younger age groups. For males, the decrease is most rapid in the $0-4$ groups, but after the age of 50 or 55, little or no improvement has been effected in the last few decades.

Among children, the death rate is declining at a rate of lp.c. per year for those under one day old with the percentage increasing to 4 p.c. for those 1 month old, and to 7 p.c. at all ages between one and five years. With these rates, there are only half as many deaths under 5 years per 1,000 births as twenty years ago, which means that some 20,000 or 25,000 children each year now are surviving only because the conditions of twenty years ago do not prevail. The death rate for male children of under five years is 30 p.c. greater than that for females, or to put it another way, the male children's death rate in 1953 reached the same level that the female rate had reached five years previously.

In comparing adults for all ages groups over 45, mortality rates for women are 50 p.c. or 60 p.c. lower than for men of the same age, except for the older groups when, of course, mortality for both sexes approaches 100 p.c. In all such ages, it will take until the end of this century before men can hope to have the same mortality rates as women have achieved right now. Of course, in that time female rates can be expected to improve still more. At present, specific mortality rates for adult men in all except the most elderly groups are the same as those for women 10 years their senior, and by the end of the century the projections indicate that the gap will have widened to 15 years.

This approach of projecting present trends leads 20 an alternative method of deriving life tables. Present tables are derived solely from experience on current death rates, and therefore, implicitly assume that the present state of nutrition habits, public health, medical science, etc., will continue without improvements into the future. For this reason, the tables are somewhat conservative and their usefulness is somewhat restricted. It is possible to construct life tables which will be based on the assumption that the present rate of improvement will continue into the future. Tentative efforts in this direction lead to an addition to life expectancy of the order of five years. This as pect of the subject will not be expanded in this memorandum.

Immigration is the most variable of the quantities involved in population change. Net immigration is the quantity directly influencing the population size, and this will be the quantity used for projecting. Annual immigration was at the level of 400,000 for a short period before World War I, dropped to 50,000 in 1915, climbed to 150,000 in the late 1920 's dropped to 10,000 in the 1930 's and early 1940's, and climbed again after 1946 to its present plateau of some 150,000 a year.

Emigration changed this picture radically, as immigrants and native-born Canadians left the country, the immigrants in many cases leaving within a decade of their entry. As a total over the 1930's, for instance, there was a net emigration of 100,000 persons. From 1941 to 1951 there was a net increase of 170,000 immigrants, all of which was built up in the last four years of this decade. Despite this large-scale immigration, there was only a slight numerical increase in numbers of non-Canadian-born persons in 1951 over 1941 , and an actual decline (from 18 p.c. to 15 p.c.) in the proportion of non-Canadian-born persons over the decade. The reason for this apparent paradox is that many immigrants of earlier years are now in the ages of greatest mortality, and the numbers of current immigrants must exceed these 30,000 deaths annually before any net gain in number of immigrants can be recorded.

## 2. Comparison with Previous Projections

The differences between the present figures and past ones are indicated below.

Table A. Various Estimates of the Future Population of Canada by Decades (in millions)

|  | 1951 | 1961 | 1971 |
| :---: | :---: | :---: | :---: |
| Hurd and MacLean (J.C.P. \& E.S.A., 1939) $1 \%$ | 13.0 | 14.3 | 15.4 |
| DBS Bulletin No. F-4 Estimate B 1/ <br> Estimate D I/ | 12.7 | 13.5 | 13.9 |
|  | 12.9 | 14.0 | 14.6 |
| 1949 Revision Estimate $12 /$ | 13.9 | 15.4 | 16.6 |
| Estimate $112 /$ | 14.1 | 15.8 | 17.0 |
| 1954 Revision (Low Birth, Low Immigration) 3/ | 14.0 | 17.7 | 20.8 |
|  | 14.0 | 18.0 | 22.7 |

$1 /$ Excluding Newfoundland and the Territories which amounted to .4 million in the 1951 Census.
2 / Ten provinces, including Newfoundland but not Territories (. 025 million).
3/ Ten provinces plus Territories.

The interest in these figures lies in the way they illustrate the relative importance of the changed conditions of birth and immigration since 1941 when estimate B was constructed, 1944 when estimate D was constructed, and 1949 when estimates $I$ and II were made. This can be illustrated by comparing the figures for 1971 . The 2.4 million difference between Estimate $D$ and Estimate II was composed of .5 million for Newfoundland, 1.2 million for extra births, . 4 for additional immigration not expected in 1944, and the rest for other reasons.

The 5.7 million difference between Estimate II and the new high projection of 22.7 is composed of 4.1 million for additional births, 1.3 million for additional immigrants, and the rest for other reasons. This birth difference is strikingly high, but even if we compare Estimate II with the current low birth rate estimate, there is a 2.7 million difference for additional births.

It should be understood that past projections were all made on the basis of the best information available at the time they were made. The additional births and immigrants which have been added in these current revisions are stricly recent additions which could not be inferred from any data available at the time earlier projections were made.

## 3. Assumptions

In making these projections, it was necessary to make assumptions about future trends of births, deaths and immigration. Death rates are sufficiently stable in their trends thus only one estimate of these was felt necessary. With respect to the other two factors, it was felt advisable to present alternatives to the user, three alternative birth rates, and two alternatives of net immigration levels. No implication is intended that any of the six estimates resulting from these will equal the population which may be experienced in the future, or even that the true population will be between the lowest and highest of the estimates. However, the assumptions are made to cover a wide range of eventualities, and it will be explained how the user can get an idea of what results will occur through using levels of immigration rates and birth rates other than those used here. It might be thought that high levels of births and immigration will be sure to occur together, or that low levels of the two factors would go together, thus eliminating the need for some of the alternatives given here. However, presenting projections in the form given will be found helpful for constructing projections with alternative birth and immigration rates.

Perhaps the best way of presenting the assumptions behind the projections is to give the arguments in support of alternative assumptions.

High Birth Rate (i.e., a slight decline from the present high level of 28 births per 1,000 population, to begin after 1954 and bring the rate to 26 per thousand by 1971). Unlike the U.S. rate, the Canadian crude birth rate has been sustained during the immediate past. Admittedly, this high birth rate is a sharp departure from historical precedent, but there is every reason to believe that precedent has been broken. Economic conditions relative to those in the past, are such as to encourage confidence in the future, Family Allowances may influence the situation, and marriage rates to date show no signs of declining to lower levels. Currently Canada's crude birth rate is among the highest of all the developed countries of the world and it does not seem credible that it
could sustain for long a rate much higher than it is now, so that the assumption of a slight decline from its present level as an average over the years is not unreasonable. It might be mentioned that, for the short run, present indications in 1954 show that the number of births will exceed the 426,000 expected in the projections for 1954.

Low Birth Rate (i.e., a large decline from 28 per 1,000 population beginning after 1954, and bringing the rate to 19 per 1,000 by 1971). We are assuming that the present birth rate is artificially inflated as described previously. There are decreasing numbers of women growing into child-bearing ages, because they are the persons born in the 1930's when the birth rate was falling. The fertility rate has already fallen among women in the older childbearing ages, and the importance of very large families in contributing numbers of children to the country is declining rapidly.

On this basis, the experience of the two decades of 1920 and 1930 (which included both prosperity and depression) will re-assert itself, and this low projection reproduces the same constant rate of decline as was experienced then, beginning, however, from the 1954 high level. By 1970, at this rate, we would achieve the same low crude birth rate as reached in 1937.

Medium Birth Rate (i.e., beginning at 1954 to decline continuously to a level of 23 births per 1,000 by 1971). This is half-way between the preceding two, and the justification for this level is that there is much to be said for both of the preceding arguments.

High Immigration (i.e., the net immigration of 125,000 a year since 1951 will dectine only slightly by 1956. After that, an average of 75,000 a year can be achieved over the long run until 1971). Canada has never maintained a sustained high net immigration, and therefore, it. was felt that present abnormally high rates cannot be used as realistic ratesfor the long run. Immigration policy may prove sensitive to any changes in the rate of economic growth of the country, and tne single net immigration rate used for the years after 1956 is understood to average out possible fluctuations in the year-to-year rate. It requires not only a stable high level of economic activity, but an actually expanding economy before immigrants can be absorbed with ease.

Further, many immigrants do leave the country after some years, to return home or to go to another country. After a few years of the present immigration rate, there may be a tendency to increased emigration to the United States and it will require an increased total number of immigrants to offset this emigration and leave a stable net immigration. A level of 75,000 a year net for such a long period is high indeed compared with the record of the past, even considering that this constant number will seem smaller in the future relative to the larger population of the country at that time which will be called on to absorb this number of immigrants.

Low Immigration Rate (i.e., the same as high immigration until 1956 and after that an average until 1971 of 40,000 a year net). This is still a substantial average, considering that any cessation in the rate of economic expansion in Canada of any size until 1971 might bring about a policy of temporary reduction in large-scale immigration, and that a much larger figure than 40,000 would be required in other years to bring about this 40,000 as an average.

The user of these statistics will have to judge for himself whether Canada's growth until 1971 will be of such a type as to support an over-all high level or over-all low level of net immigration over the period.

## 4. Construction of Projections using Different Assumptions

By ordinary interpolation one can construct projections using other assumptions as to birth rates and future immigration levels. The only additional data required are in the following tablei on the estimated number of survivors of the 1951 Census population and of net immigrants entering after this date which were used in constructing the final table. Survivors of children born since 1951 may be found by subtracting the appropriate figures here from the final totals.

Table B. Estimated Numbers of Survivors of Net Immigrants and of the 1951 Population since 1951, Excluding Children Born to those Persons, (in thousands).


As an example, suppose it is desired to assume an immigration rate of 100,000 per year until 1971. Since the low figure corresponds to 40,000 and the high to 75,000 per year, to extrapolate we would take for 1971 , $60(1,614)-25(1,101) / 60-25$, or 1.98 million surviving net immigrants. To find the total effect, by including the extra children which may be expected because of these additional immigrants, we would perform this same extrapolation on total population, at any desired birth rate level.

## Alternative Birth Rates

This is a matter of considerable importance for the immediate future at least, because the birth rate shows indications of surpassing the rate of 28 per 1,000 population set for 1954 in all birth rate levels. It is conceivable that there could be as many as 100,000 more infants of under five years in 1956 than indicated in the high birth rate projections, and 200,000 additional births in each of the succeeding five-year periods. These figures would be equivalent to a birth rate some 10 per cent higher than those used in these projections. Numbers corresponding to other levels of birth rates may be estimated by the same methods as indicated above for immigration rates.

## Projections of Separate Areas

The difficulty in making provincial projections arises from the fact that we cannot "project" the development of oil or other natural resources,
which can completely change the pattern of interprovincial movement in a very few years. The larger provinces are the more stable. However, the situation in Ontario and Quebec is complicated by the fact that recent immigrants have been largely settling here, whereas in the future either these immigrants or future immigrants may find it to their advantage to settle elsewhere. Generally speaking, Ontario has constituted one-third of the country including Newfoundland in population in the past, and Quebec from 26 p.c. to 29 p.c. If the past percentage composition of the country is projected into the future by graphical methods, the following picture emerges... There seems to be too much irregular movement within the Maritime and Prairie Provinces to warrant separate projections here.

Table C. Projected Percentage Composition of the Population of Four Provinces and Two Regions, excluding Yukon and N.W. Territories, 1951, 1961; 1971.

|  | 1951 | 1961 | 1971 |
| :---: | :---: | :---: | :---: |
| Newfoundland | 2.58 | 2.6 | 2.6 |
| Maritime Provinces | 8.99 | 8.5 | 8.1 |
| Quebec | 29.01 | 29.1 | 29.2 |
| Ontario | 32.88 | 3.4 .1 | 34.9 |
| Prairie Provinces | 18.21 | 16.8 | 15.5 |
| British Columbia | 8.33 | 8.9 | 9.7 |
|  | 100.00 | 100.0 | 100.0 |

These percentages may be applied to any of the six projections for 1961 and 1971 as desired, or to any other projection which may be constructed as described.

Projections of Households and Families
For many purposes, it is evidently the projections of households and families which will be of interest. Unfortunately, the Census of 1951 came at an inopportune time for this purpose. In 1951 there were large numbers of young married couples just getting settled in houses and apartments. Their family was not at its final size, as the large numbers of second, third and fourth children born since then indicate. The result of this is that the number of persons per household and persons per family were at their all-time low, a situation which is expected to change to a greater or less extent during the next few years. The number of persons per household (defined as structurally dis tinct living premises) has declined steadily from 5.23 in 1901 to 4.47 in 1941 and 4.07 in 1951. In the future, this figure can be expected to rise somewhat, but the exact amount will depend on the relative strengths of the different forces operating here. Tending to raise this figure we can discern: larger families, continuation of tenant relationships as a source of income to young families, lowering of death rate for aged persons.

Tending to decrease this figure, on the other hand are the large proportions of young married couples without final-sized families in the population, the effect of space limitations in modern houses on the capacity of the
premises to hold many persons other than the family itself, the modern conveniences of bachelor apartments in encouraging "one-person households" to be set up by persons at all ages, and the diminution of the housing shortage.

In this connection, the same influences are at work on families, which may be defined roughly as relatives living together. (See the 1951 Census for exact definitions of the terms household and family) A fairly stable 87 p.c. of the population lives in families, and for these persons, the number of persons per family has been dropping from 3.9 in 1941 to 3.7 in 1951. The important point for both households and families is that the decline in the 1941-1951 decade toor place in adult members (over 14 years) of the unit. That is, the family and household in 1941 and earlier were characterized by additional adult members. and these are no longer in the unit, but have moved elsewhere.

Provided conditions in the future do not bring a re-introduction of this living arrangement, any increase in the family or household sizé will be brought about by the increased number of children, and the number of adult members will remain stable or possibly even decline if the movement to thin-ning-out of adult members has not yet been completed.

The number of persons over 14 years of age per household was 2.8 and per family was 2.5 in 1951 (where this latter figure refers only to the 87 p.c. of persons who are in families, as explained above). These figures seem to be the most stable that can be found for projecting and the results of doing this are given below, where an intermediate birth rate has been used, as these projections are not sensitive to changes in this variable. The 1951 Census figure for Canada, excluding Yukon and Northwest Territories, is given for comparison.

Table D. Projected Numbers of Households and Families in Canada, 1951 to 1971

Table 1. Projections of the population by sex, assurning an annual net immigration of 40,000 after 1956, and high, medium and low birth rates,

Table 2. Projections of the population by sex, assuming an annual net immigration of 75,000 after. 1956, and high, medium and low birth rates,

$\square$
1
bIRTH RATE PER I,OOO POPULATION FOR CANADA


