Impact of New Population Estimates on Health and Vital Statistics

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Abstract

Changes in Statistics Canada's annual population estimates, introduced in 1993, have an impact on a wide range of social, economic and demographic indicators. Any indicator that relies on population estimates will be affected by the new figures. This article describes the adjustment and examines its impact on health and vital statistics rates.

With rare exceptions, all rates decrease as the denominators are adjusted upward. For example, accident rates, suicide rates, and age-specific fertility rates based on the adjusted population are lower than those previously calculated. The extent of the adjustment, however, depends on the geographic and demographic characteristics of the population at risk. Analysts whose work concentrates on special subgroups for whom the adjustment is particularly great (such as young adult men) may wish to pay closer attention to the new population figures. Although the new rates are lower than before, underlying trends and patterns over time or across subcategories are quite similar.

The revised series incorporates estimates of net census undercoverage, and for the first time, includes non-permanent residents. In 1991, net census undercoverage and non-permanent residents together amounted to about one million persons, or 3.6% of the revised Canadian population of 28,120,100.

Keywords: *demography, health statistics, population estimates, vital statistics*

Introduction

In 1993, Statistics Canada made changes to its annual population estimates, which have an impact on a wide range of social, economic and demographic indicators. Revised back to 1971, the new series [1,2] differ from previously released estimates in the following ways: they include non-permanent residents; they account for net census undercoverage; and the reference date for the annual estimates is July 1 instead of June 1 (see *Definitions*).[a]

The adjustment corrects four deficiencies in health and vital statistics rates previously calculated with unadjusted populations:

C *The rates were too high*, because the denominators underestimated the populations at risk. The numerators of health and vital statistics rates generally include non-permanent residents and persons missed in the census.

C *The differences in rates between age groups or across regions were biased*, because the degree of underestimation varies by geographic and demographic characteristics of the population. For example, the adjustment for young adult men is higher than for other age-sex categories. The same can be said for divorced men when the population is considered by marital status. Rates focusing on these groups are affected more than others.

C *The differences in rates over time were biased*, because the level of underestimation varies from year to year. For example, the number of non-permanent residents is sensitive to Canada's immigration policies. In 1989, the number of non-permanent

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[a] *Another new component, introduced at the same time as the revised population series, covers returning Canadians — Canadian citizens and landed immigrants who emigrated, but who subsequently returned to Canada to re-establish permanent residence.*

residents increased as 120,000 refugee claimants were granted visas permitting them to reside temporarily in Canada. As well, net undercoverage varies from one census to the next. In particular, net census undercoverage for Canada's total population increased sharply in 1986 to 2.7%, about one percentage point higher than in 1971, 1976, and 1981.

C *Changing the reference date of the annual population estimates* from June 1 to July 1 better reflects the mid-year population.

Statistics Canada produces two types of annual population figures: postcensal and intercensal estimates. Postcensal estimates are based on the previous census, and take into account changes to the population due to births, deaths, and migration since the census reference date. Intercensal estimates reconcile these estimates with the results of the next census once they become available. Most of the following analysis is based on final postcensal estimates for 1992 and on final intercensal estimates for the period 1983 to 1991.

The first section of this article describes the population adjustment and how it affected estimates of the 1991 benchmark population. Tables 1 and 2 present the adjustments for 1971, 1991, and 1992 for Canada, the provinces and territories, and for Canada by age group and sex, respectively.

The second section examines the impact of the adjustment on selected health and vital statistics rates. Not all indicators are examined, and not necessarily the principal ones. Rather, examples have been chosen to illustrate the effect of population adjustment from different perspectives. It is hoped that analysts will be able to draw conclusions in their own area of expertise. Examples have also been chosen to study the impact of differences in underestimation by province (hospital separation rates), by age (age-specific fertility rates), and over time (suicide rates and teenage pregnancy rates). Finally, the analysis includes cause-specific mortality rates, for which the information available on population underestimation is not cause-specific. An international comparison of summary vital rates is included to show how Canada's ranking among selected developed countries changed as a result of the adjustment.

Definitions

Adjusted population: Population estimates that take into account net census undercoverage and non-permanent residents. Estimates that do not take these elements into account are referred to as *unadjusted population estimates*.

Benchmark population: The population at the start of an intercensal period. For unadjusted estimates, it corresponds to the census counts of that year projected to July 1; for adjusted population estimates, it is the adjusted population as of July 1 of that year.

Population at risk: The denominator in health and vital rates.

Population estimate: The population of a region for a specific reference date. *Postcensal estimates* are based on the previous census, and take into account changes to the population since the census reference date due to births, deaths, and migration. *Intercensal estimates* reconcile these estimates with the results of the next census once they become available.

World Standard Population: Used internationally, a fictitious population of 100,000 persons with a given age composition. Health and vital rates for populations with different age structures can be compared when they are standardized to this population.

Census division: Administrative geographic areas established by provincial law (for example, divisions, counties, regional districts, regional municipalities). In Newfoundland, Manitoba, Saskatchewan, and Alberta, where provincial law does not provide for such administrative areas, census divisions have been created by Statistics Canada in co-operation with the provinces.

Census metropolitan area (CMA): A CMA is delineated around an urban area (the "urbanized core") having a population of at least 100,000. CMAs are comprised of census subdivisions (CSDs) that meet at least one of the following criteria: 1) the CSD falls completely or partly inside the urbanized core; 2) at least 50% of the employed labour force **living** in the CSD **works** in the urbanized core; or 3) at least 25% of the employed labour force **working** in the CSD **lives** in the urbanized core.

Table 1

Underestimation* of the population, Canada, provinces and territories, 1971, 1991 and 1992

	1971		1991		1992	
	Number	Rate† %	Number	Rate† %	Number	Rate† %
Canada	**432,813**	**1.97**	**1,015,170**	**3.61**	**1,012,440**	**3.55**
Newfoundland	10,209	1.92	12,235	2.11	13,770	2.36
Prince Edward Island	1,131	1.00	1,357	1.04	1,419	1.08
Nova Scotia	9,868	1.24	18,708	2.04	19,847	2.15
New Brunswick	9,194	1.43	25,473	3.40	26,363	3.50
Quebec	123,367	2.01	223,263	3.15	212,846	2.97
Ontario	153,732	1.96	500,807	4.78	489,623	4.60
Manitoba	11,589	1.16	24,897	2.24	26,127	2.34
Saskatchewan	7,863	0.84	20,629	2.05	21,842	2.17
Alberta	41,998	2.52	65,288	2.51	69,657	2.63
British Columbia	61,627	2.74	117,887	3.49	126,257	3.63
Yukon	586	3.09	1,273	4.37	1,307	4.32
Northwest Territories	1,649	4.52	3,353	5.47	3,382	5.40

Source: *Demography Division, Population Estimates Section, Statistics Canada*

* *Underestimation includes net census undercoverage and non-permanent residents. The data are as of June 1 for 1971 and as of July 1 for 1991 and 1992.*

† *The level of underestimation divided by the population adjusted for underestimation.*

Table 2

Underestimation* of the population, by sex and age group, Canada, 1971, 1991 and 1992

	1971		1991		1992	
	Number	Rate† %	Number	Rate† %	Number	Rate† %
Males	**257,502**	**2.33**	**580,020**	**4.16**	**579,891**	**4.10**
0-4	11,990	1.27	26,831	2.68	23,502	2.32
5-14	21,597	0.92	48,695	2.46	44,959	2.26
15-19	27,004	2.45	34,835	3.54	32,386	3.28
20-24	56,557	5.67	97,830	9.16	88,801	8.34
25-34	64,983	4.26	214,845	8.28	221,571	8.55
35-44	36,669	2.77	90,463	4.02	95,625	4.15
45-54	18,653	1.62	29,727	1.96	33,590	2.09
55-64	11,787	1.36	19,627	1.64	21,778	1.81
65 and over	8,262	1.05	17,167	1.27	17,679	1.27
Females	**175,311**	**1.60**	**435,150**	**3.07**	**432,549**	**3.01**
0-4	13,894	1.54	24,259	2.55	20,360	2.11
5-14	22,529	1.00	52,058	2.76	52,478	2.76
15-19	25,676	2.41	39,297	4.18	37,027	3.93
20-24	43,725	4.41	82,118	7.88	77,984	7.53
25-34	30,115	2.07	127,413	5.03	132,868	5.27
35-44	15,430	1.23	51,224	2.29	51,904	2.27
45-54	8,441	0.72	17,034	1.14	19,378	1.22
55-64	7,287	0.82	16,095	1.31	15,432	1.25
65 and over	8,214	0.85	25,652	1.38	25,118	1.31

Source: *Demography Division, Population Estimates Section, Statistics Canada*

* *Underestimation includes net census undercoverage and non-permanent residents. The data are as of June 1 for 1971 and as of July 1 for 1991 and 1992.*

† *The level of underestimation divided by the population adjusted for underestimation.*

The last section of the article presents alternative strategies for studies that require population estimates for which adjustments are not available.

New population estimates

The changes to Statistics Canada's population estimates involved two distinct processes: inclusion of non-permanent residents and adjustment of the population for net census undercoverage. *The combined level of non-permanent residents and net census undercoverage is referred to here as population* ***underestimation***. In 1991, this amounted to about one million persons, or 3.6% of the revised Canadian population of 28,120,100.

The adjustment for **non-permanent residents** results from expansion of the census universe in 1991.[1] For the first time, the census included the following groups: persons claiming refugee status, persons holding a student visa (for all types of educational institution beginning with elementary school), persons holding a work permit, persons holding a special permit issued by the minister of Citizenship and Immigration, and non-Canadian-born dependants of these individuals. Although non-permanent residents have permission to reside in Canada only temporarily, they participate in the socioeconomic fabric of Canadian society: they are eligible for health care and child tax benefits; their children attend schools; they are consumers, and so on. Furthermore, the United Nations

Data sources for adjustment

Non-permanent residents

The census universe was expanded in 1991 to include non-permanent residents, who numbered about 223,000. Estimates of non-permanent residents for other years were developed from the Visitors Immigration Data System (VIDS) obtained from Citizenship and Immigration. The VIDS file provides information since 1981 on the number of *permits* authorizing temporary residence in Canada. A methodology was developed to derive the number of persons this represents and their demographic characteristics. In particular, it accounts for persons holding more than one permit and estimates the number of dependants who do not have permits (such as preschoolers and seniors). For years before 1981, estimates of the total number of non-permanent residents were derived from information on student authorizations and work permits available from the Education, Culture and Tourism Division of Statistics Canada.

Net census undercoverage

After each census, Statistics Canada conducts studies to measure the quality of the data collected. The most important of these is the Reverse Record Check (RRC), designed to estimate the number of persons not enumerated in the census but who were part of the census universe. *Undercoverage* is considered to be the largest source of error. The RRC, first undertaken in 1966, consists of a number of tracing procedures applied to a sample of persons, all of whom should have been enumerated. This sample is drawn from five sources: persons enumerated in the previous census; persons born since the previous census; landed immigrants who entered Canada since the previous census; non-permanent residents at the time of the census (for 1991 only); and persons not enumerated in the last census. Undercoverage in 1991 was estimated at about 950,000 (3.4% of the adjusted population).

In 1991, Statistics Canada introduced the Overcoverage Study, which checked samples of persons enumerated in 1991 to determine if they were counted more than once, or if they were not part of the census universe. *Overcoverage* in the 1991 Census was estimated at about 150,000 persons (0.6% of the adjusted population). *Net census undercoverage* is the difference between undercoverage and overcoverage.

Estimates of net census undercoverage for the total population of the provinces and the territories and for the population of Canada by age group and sex were derived directly from these two coverage studies. Statistical techniques were used to distribute these estimates by finer demographic and geographic detail.

For censuses before 1991, information on undercoverage was limited to the results of the RRC. Net census undercoverage for 1971 to 1986 was estimated by applying to the RRC results for those years the ratio of overcoverage and undercoverage observed in 1991. With very few exceptions, undercoverage exceeds overcoverage at all levels of demographic and geographic disaggregation.

has recommended that countries include non-permanent residents in their population counts.[3] For years other than 1991, information on non-permanent residents was derived from Citizenship and Immigration's administrative files on visitors to Canada.

The adjustment for **net census undercoverage** takes into account persons missed in the census, counted more than once, or counted when they are not part of the census universe (for example, diplomats or visitors). With few exceptions, persons missed in the census exceed the last two groups. After the 1991 Census, Statistics Canada estimated a rate of net census undercoverage of 2.8%.[4] For censuses before 1991, information is available only on persons missed; no information is available on persons overcounted or counted in error. Their numbers were estimated from a model using all available data on census coverage. *Note that only the population estimates take into account net census undercoverage – the census counts themselves are not adjusted* (See *Data sources for adjustment*).

Canada joins two other countries that incorporate estimates of net census undercoverage in their population estimation programs: Australia[5] since 1976, and the United Kingdom[6]since 1981.The United States considered adjusting the counts for the 1980 census and again for the 1990 census. In each case, however, a decision was taken not to adjust. See the references for more information on the adjustment issue as it has evolved in Canada[7-10] and the United States[11-14] over the last 15 years.

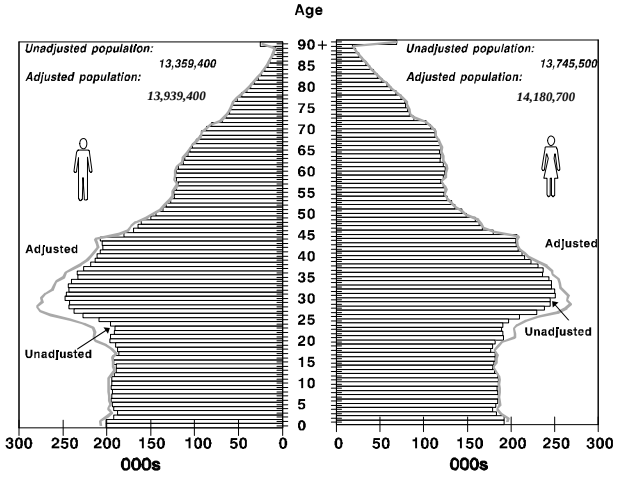
Regions

Adjusted population estimates are available for large geographic regions: provinces and territories (from 1971), and census divisions and census metropolitan areas (from 1986). Among the provinces, Ontario's population in 1991 was affected the most, in terms of both numbers and rates (Table 1). About half of non-permanent residents are in Ontario,[15] and in 1991, this province had one of the highest rates of net census undercoverage (3.6%). By contrast, Prince Edward Island has few non-permanent residents, and the rate of net census undercoverage was very low (0.9%).

Age and sex

The adjustment for underestimation is larger within age and sex categories than across provincial and territorial boundaries. Differences in the age-sex structure of the Canadian population before and after adjustment are most noticeable for young adults (Chart 1 and Table 2). Net census undercoverage was highest for men (7.9%) and women (5.3%) aged 20 to 29. The impact of including non-permanent residents is also greatest for young adults. While 20- to 29-year-olds accounted for about 16% of male and female Canadians in 1991, their representation among non-permanent residents was more than twice as great – 34%.

Chart 1
Adjusted and unadjusted population of Canada, by age and sex, 1991



Source: *Demography Division, Population Projections Section, Statistics Canada*

Population projections

Population projections are doubly affected by the adjustment for underestimation. First, the base population is increased. Second, the rates used to project the population (fertility, mortality, and in some cases, migration) decrease because of the larger populations at risk.

In addition to adjusting for the level of future populations, the new projections address the problems caused by differential underestimation by age and sex. To a large extent, the age and sex distribution of the

base population determines the demographic structure of future populations. When one age group (cohort) is highly underestimated relative to the others, the imbalance follows this cohort throughout the projection period. For example, a large underestimation of men aged 25 to 29 in 1991 would be reflected in the male population aged 50 to 54 projected for 2016.

Impact on health and vital statistics

Any indicator that relies on population estimates will be affected by the adjustment. Therefore, series of indicators based on unadjusted population estimates should be recalculated.

With rare exceptions, all rates will decline as the denominators are adjusted upward. The extent of the decline depends on the geographic and demographic characteristics of the population at risk. Yet although the new rates are lower, the underlying trends and patterns over time or across subcategories are quite similar after adjustment. In fact, in many cases, researchers will find that the adjustment does not have much impact on their results. On the other hand, work concentrating on special subgroups for whom underestimation was particularly high may be more noticeably affected. A few examples from health and vital statistics illustrate this point.

Differences by province: hospital separation rates

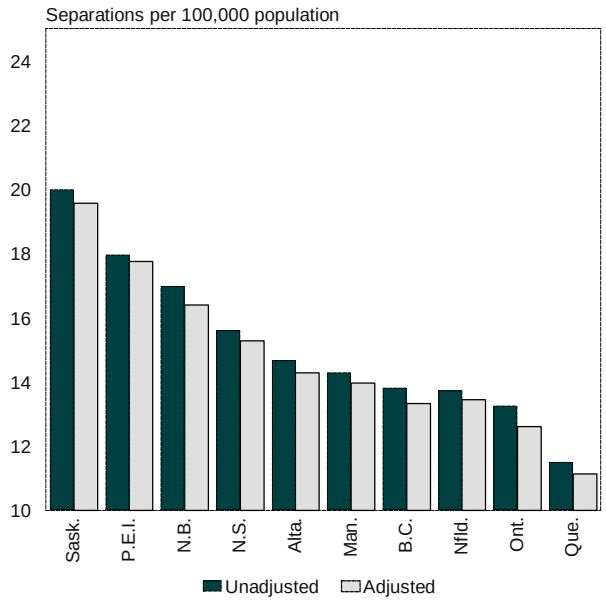
Although health and vital statistics rate for provinces and territories all decrease with adjustment, the impact is not uniform. Hospital separation rates for 1991-92 (separation refers to the discharge or death of an inpatient) demonstrate how this can happen (Chart 2).[16] The effect is smallest for Prince Edward Island, as underestimation in this province was very low. Conversely, hospital separation rates decline the most for New Brunswick and Ontario, where underestimation was highest. Nonetheless, the adjustment does not affect the general pattern: Saskatchewan and the three Maritime provinces continue to have the highest hospital separation rates, and Ontario and Quebec, the lowest.

Differences by age: age-specific fertility rates

While the adjustment has relatively minor effects on summary provincial and international statistics (see *International comparisons of summary vital rates*), the effect on age-specific rates is more pronounced.

Chart 2

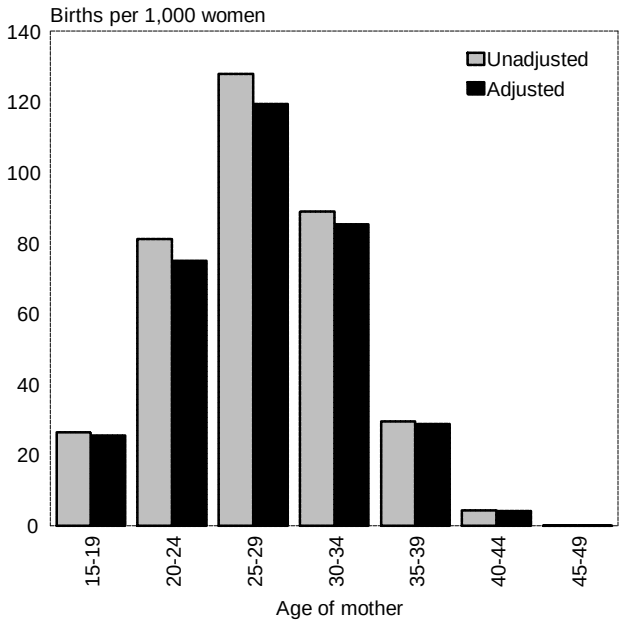
Hospital separation rates, Canada and provinces, 1991-92



For example, the largest percentage drop in 1992 fertility rates occurs among women aged 20 to 24 – from 81.2 to 75.1 births per 1,000 women (Chart 3).[17] This is attributable to the high underestimation for this age group (7.5%), compared with all women aged 15 to 49 (4.1%).

Chart 3

Age-specific fertility rates, Canada, 1992



Differences over time: suicide rates and teenage pregnancy rates

Vital statistics for a given year are rarely studied in isolation. Analysts are more interested in how they compare with previous years. Are rates increasing or decreasing? How does the trend for one age group compare with those of other ages, other regions?

Population underestimation has not been uniform over time. For provinces and territories, it has been much higher since 1986 than for the previous 15 years. As a result, rates calculated for the earlier years are less affected by the adjustment than those for more recent years. Two examples illustrate the impact of the adjustment on age-specific rates over a 10-year period: suicide rates for men aged 25 to 29 and teenage pregnancy rates.

Age-specific **suicide rates** of men aged 25 to 29 are among the highest.[18] The adjustment for population underestimation in 1992 was also greatest for this age group, reducing their suicide rate from 31.9 to 28.8 per 100,000. The difference between the unadjusted and adjusted rates increased from 2.0 suicides per 100,000 in 1983 to 3.1 by 1992 (Chart 4). This change is due to increasing population underestimation, which is the combined result of a steady rise in non-permanent residents between 1983 and 1989 and differential undercoverage over time. Net census undercoverage is greater after 1986 than before. Thus, the level of population underestimation is greater after 1986.

The revised teenage pregnancy rate for 1983 (40.9 pregnancies per 1,000 women aged 15 to 19) is 1.4 pregnancies lower than the unadjusted rate (42.3) (Chart 5).[19] Because undercoverage is lower for women aged 15 to 19 than for men aged 20 to 24, the impact of the adjustment on the teenage pregnancy rates is smaller than for the above suicide rates. Furthermore, because differential undercoverage over time for these women is also smaller, the main factor affecting the level of adjustment over time is the increase in non-permanent residents in 1989, when the gap between the adjusted and unadjusted rates increased sharply from about 1.4 to 1.7 pregnancies per 1,000 women.

Chart 4

Suicide rates, men aged 25 to 29, Canada, 1983 to 1992

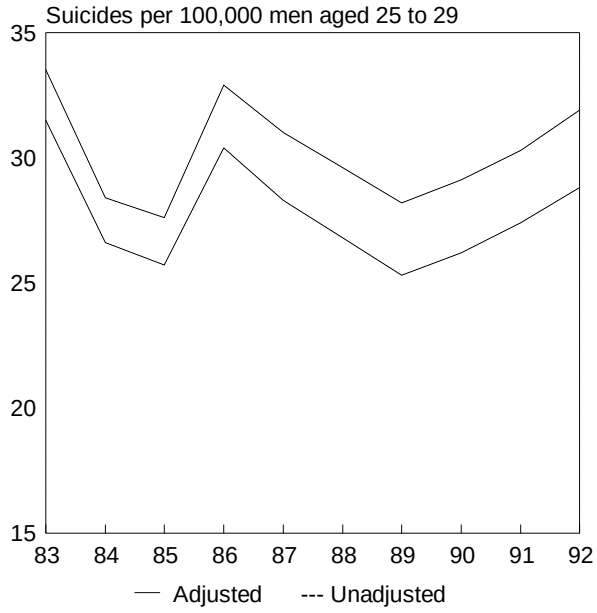
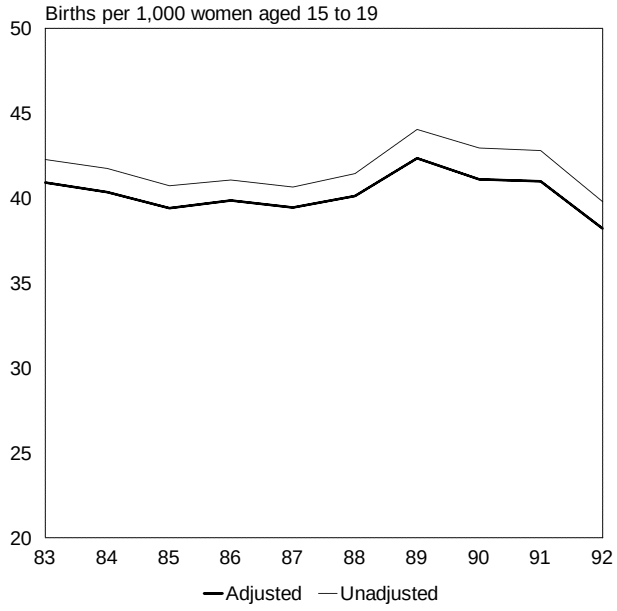


Chart 5

Teenage pregnancy rates, Canada, 1983 to 1992



Cause-specific mortality rates

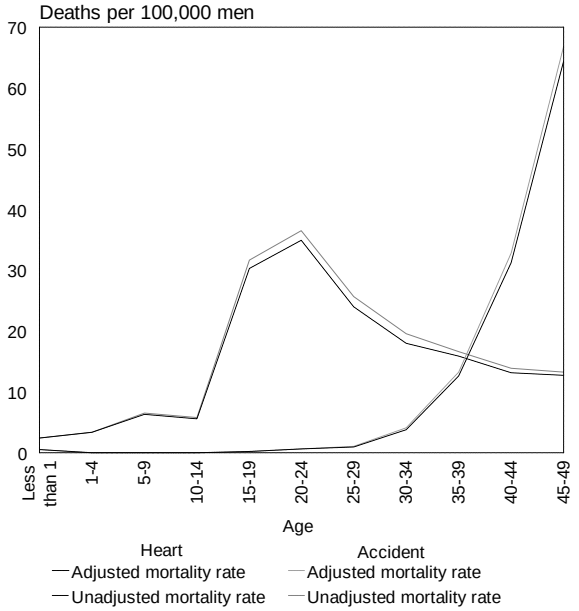
From a certain point of view, the adjustment affects all causes of death equally, as the adjustment factors for the populations at risk are not cause-specific. In effect, the percentage difference between unadjusted and adjusted age-specific mortality rates for each cause is equal to the corresponding underestimation rate. Thus, the crude death rate in 1992 *for each cause*

is lower by 3.6% after adjustment. Furthermore, age-sex-specific rates are lowered by the same percentage regardless of cause of death (for example, 3.3% for men aged 15 to 19; 7.5% for women aged 20 to 24).

To appreciate how the adjustment affects some causes of death more than others, the age patterns of cause-specific deaths and of population underestimation must be considered simultaneously. For example, **male age-specific rates** for two causes of death – ischaemic heart disease and motor vehicle accidents[18] – have very different age patterns (Chart 6). Despite the blanket adjustment across causes, the effect on the two sets of mortality rates differs. With motor vehicle accidents, the difference between adjusted and unadjusted rates is most evident for young men, whose population underestimation is highest, and who are also the group most likely to be involved in such accidents. At older ages, the small number of fatal accidents minimizes the impact of adjustment.

Chart 6

Age-specific mortality rates for ischaemic heart disease and motor vehicle accidents, men aged 0 to 49, Canada, 1992



In contrast, the adjusted and unadjusted rates of ischaemic heart disease appear similar at all ages. The mortality rates for ischaemic heart disease at younger ages are too low for the adjustment to produce a noticeable difference. On the other hand, for ages at which heart disease is most prevalent, population underestimation is low, so the adjustment has little effect.

Age-specific incidence rates for cancer

Canada is a world leader in cancer statistics through the Canadian Cancer Registry (formerly the National Cancer Incidence Reporting System),[b] which provides information on the incidence of newly diagnosed cancers. One of the fundamental statistics generated from cancer registry data is the **age-standardized incidence rate** (ASIR).[20] ASIRs are obtained by applying age-sex-specific rates of cancer incidence by site (or type) to a standard population, such as the World Standard Population, thereby permitting comparisons to be made among provinces or over time by allowing for the effect of differences in the age structure of different populations. The ASIRs for all cancers in Canada in 1989 (the latest year for which actual data were available at the time of this study) were 315 and 249 cases per 100,000 men and women, respectively. In 1989, the sites with the highest incidence rates for men were lung (67 cases per 100,000), prostate (56), and colorectal (43). The leading cancers for women in 1989 were breast (75 cases per 100,000), followed by colorectal (31) and lung (26) cancers.[21] These rates were calculated using the adjusted population.

Adjusting the population for underestimation decreases the1989 ASIR by 2.8% for men and by 2.4% for women. The impact by cancer site is closely related to the age structure of cancer patients. The effect is greatest for cancers that affect large proportions of patients under age 44: Hodgkin's Disease, cervix (women), melanoma, brain, and lymphoma (men)

[b] *The Canadian Cancer Registry is a national database on cancer incidence that integrates cancer statistics provided by the provincial and territorial cancer registries. It is managed at Statistics Canada under the direction of the Canadian Council of Cancer Registries, which includes representation from Statistics Canada, provincial and territorial cancer registries, Health Canada, the National Cancer Institute of Canada, and the Canadian Society of Epidemiology and Biostatistics.*

(Chart 7).For most other sites, cancer tends to develop later in life when population underestimation is much lower. The difference made by the adjustment for any type of cancer is not enough to affect the overall ranking of cancer incidence by site.

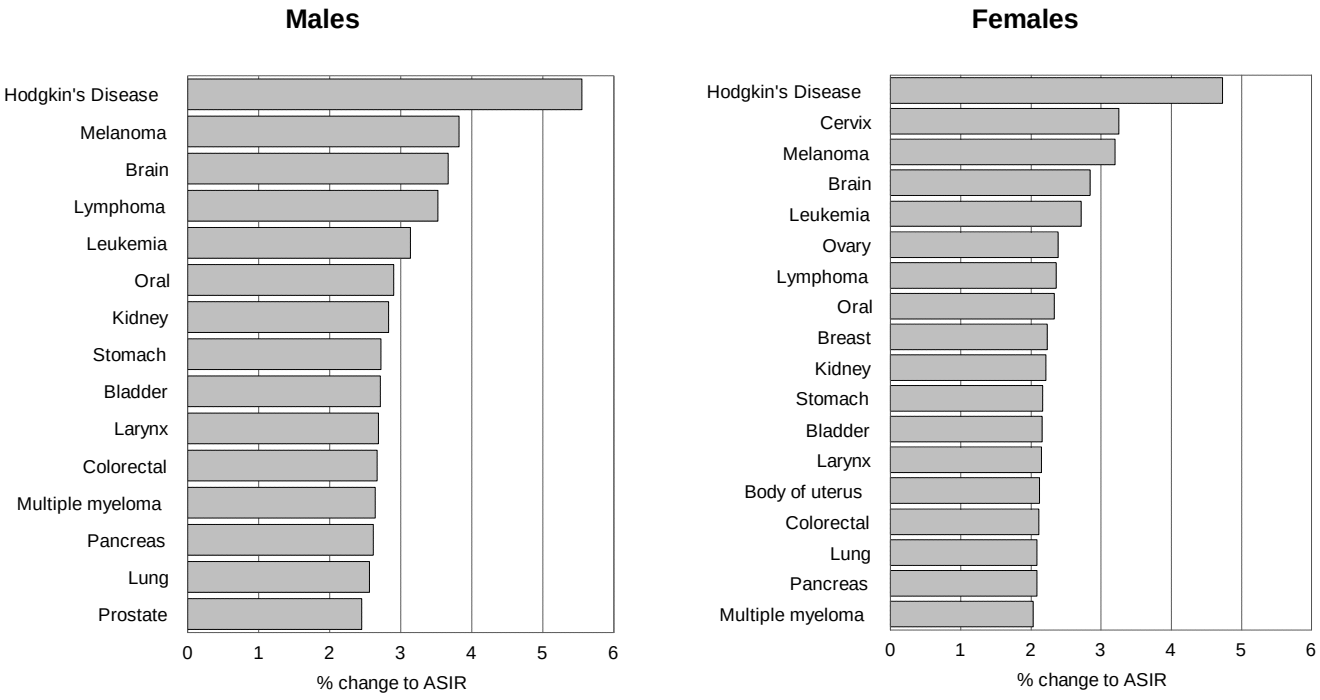
Average annual percent change in cancer incidence

The impact of the new population estimates is greatest on indicators of change such as the **average annual percent change** (AAPC) in cancer incidence rates (Table 3). This measure is calculated for each cancer site by fitting a regression model after logarithmic transformation of the ASIRs. The AAPC measures changes in cancer rates over time, while differential underestimation measures changes to population coverage over time. When the AAPC is small, the two can be quite comparable in terms of size, and at times, the change in underestimation can mask real changes in incidence rates.

The population adjustment lowered 1989 cancer incidence rates by 2.1% to 5.6%, depending on the site. In contrast, the effect on the AAPC over the period 1982 to 1989 was much larger, ranging from 4% (female kidney and lung cancers) to 140% (male multiple myeloma cancer) to infinity (male lung cancer, for which the adjusted AAPC is zero percent).

Chart 7

Impact of adjustment on ASIRs*, by cancer site and sex, Canada, 1989



** Age-standardized incidence rate; standardized to World Population.*

Table 3

Average annual percent change in age-standardized incidence rates (ASIR), by cancer site, Canada, 1982-1989

Site	Male		Female	
	Adjusted	Unadjusted	Adjusted	Unadjusted
	%		%	
All cancers	**0.50**	**0.72**	**0.33**	**0.50**
Oral	-1.40	-1.18	-1.28	-1.12
Stomach	-2.13	-1.92	-2.45	-2.30
Colorectal	0.45	0.66	-1.14	-0.99
Pancreas	-2.99	-2.80	-0.51	-0.36
Larynx	-0.89	-0.69	3.59	3.77
Lung	0.00	0.19	4.05	4.21
Melanoma	4.61	4.86	2.26	2.46
Breast	...	...	1.47	1.63
Cervix	...	...	-3.81	-3.60
Body of uterus	...	...	-1.82	-1.67
Ovary	...	...	-1.84	-1.67
Prostate	3.06	3.27	...	...
Testis	2.44	2.86	...	...
Bladder	-0.69	-0.48	-0.81	-0.65
Kidney	2.68	2.90	4.41	4.58
Brain	-0.33	-0.10	-0.71	-0.52
Hodgkins Disease	-2.27	-1.98	1.14	1.46
Multiple myeloma	0.15	0.36	0.11	0.25
Non-Hodgkins Disease	1.82	2.06	0.33	0.50
Leukemia	-1.36	-1.15	-1.14	-0.95

Note: ASIRs are based on the World Standard Population.
Source: *Canadian Cancer Statistics (see references) and calculations by author.*

For a given cancer site, the absolute value of the AAPC either increases or decreases with adjustment, depending on past trends. For sites in which the ASIR decreased between 1982 and 1989, such as the stomach, pancreas, and cervix (women), adjusting the population widened the gap between the ASIRs for these two years, and thus *the AAPC is larger than previously estimated.* Conversely, for cancer sites in which the ASIR increased between 1982 and 1989, such as melanoma,kidney, lung (women), and prostate (men), adjusting the population narrowed the gap, and thus *the AAPC is smaller than expected*. As well, the new series for colorectal cancer, cancer of the larynx, and Hodgkin's disease confirm that the gaps between the incidence rates for men and women are closing, though at a slower rate.

When adjustment factors are not available

The population estimates have been adjusted for basic geographic and demographic variables: age, sex, and marital status for the provinces and territories back to 1971; age and sex for census divisions and census metropolitan areas back to 1986. Analysis of these variables should be based on theadjusted population estimates. As a matter of policy, the Health Statistics Division uses the adjusted population counts for its standard data products and publications. This includes recalculation of existing time series.

Some research, however, may require population estimates for earlier dates or for a higher degree of disaggregation than is available from the adjusted estimates. Analysts who have traditionally used the quinquennial census data can continue to do so. The entire range of census products is available as before, unadjusted for net census undercoverage. The 1991 Census includes for the first time non-permanent residents. Those who continue to use the (unadjusted) enumerated population from the census make the assumption that there is no underenumeration, or at least no differential underenumeration (across time or categories).

International comparisons of summary vital rates

To a certain extent, some of the differences in international comparisons of statistics can be explained by differences in definitions or in the universe, or by varying degrees of data quality. This is becoming less of a problem as international organizations such as the United Nations and the World Health Organization develop standard criteria.

Five of Canada's summary vital statistics for 1992 are compared with those of selected developed countries (see below). Two of these, marriage and divorce rates, are crude rates pertaining to a country's total population. Adjusting Canada's population reduces marriage and divorce rates by 3.6%. The impact is greater on the total fertility rate (5.9% lower), because it is based on women of childbearing age, for whom population underestimation is higher. As well, changes to the population used to calculate life expectancies at birth translate into an additional 0.26 years for men and 0.17 years for women.

When the adjustments are made, Canada's fertility rate for women aged 20 to 24 falls from eighth to tenth in the international ranking. However, the impact of the adjustments on Canada's international ranking of its main demographic indicators is minimal. In fact, the rankings based on the adjusted population differ, at most, by one position from those based on the unadjusted population. Of the 18 countries, only Japan's life expectancies exceed those of Canada. Canada's divorce rate ranks third after the United States and the United Kingdom. Canada's marriage rate is among the lowest (thirteenth), while its total fertility rate ranks closer to the middle (eighth).

Vital statistics, selected countries, 1991

	Marriage rate	Divorce rate	Total fertility rate	Fertility rate ages 20-24	Life expectancy at birth	
	Marriages per 1,000 population	Divorces per 1,000 population	Number of children per woman	Births per 1,000 woman	Men	Women
					Years	
Australia	6.6	2.6	1.91	79.6[1]	73.9	80.0
Belgium	6.1	2.1	1.57	101.8[8]	72.7[1]	79.4[1]
Canada (adj, 1992)	**5.8**	**2.8**	**1.69**	**75.0**	**74.9**	**81.2**
Canada (unadj, 1992)	**6.0**	**2.9**	**1.79**	**81.1**	**74.6**	**81.0**
Denmark	6.0	2.5	1.68	70.7[4]	72.0[1]	77.7[1]
France	4.9	1.9[1]	1.77	75.8[1]	73.0	81.1
Germany	5.7	2.2[2]	1.35	..	..	..
Greece	6.1	0.6	1.40	131.6[7]	73.6[1]	78.6[1]
Ireland	4.8	..	2.18	65.8[1]	71.9[1]	77.4[1]
Italy	5.4	0.5	1.26	58.6[3]	73.2[3]	79.7[3]
Japan	6.0	1.4	1.51	44.3[1]	76.1	82.1
Luxembourg	6.7	2.0	1.64	63.0[4]	72.3[1]	78.5[1]
Mexico	7.6	0.6	3.29	224.2[6]	66.5	73.1
Netherlands	6.3	1.9	1.61	48.2[1]	73.7	79.8
New Zealand	6.8	2.6	2.18	101.2[1]	71.9	78.0
Portugal	7.3	1.1	1.42	90.0[2]	70.2[1]	77.3[1]
Spain	5.6	0.6[2]	1.28	65.8[5]	73.4[1]	80.1[1]
United Kingdom	6.8	2.9[1]	1.82	91.1[1]	72.9[1]	78.5[1]
United States	9.4	4.7	2.01[2]	115.4[2]	71.8[2]	78.6[2]

Note: The superscripts 1 to 8 refer to the yealatig

Alternatively, some analysts may wish to use the adjusted populations to calculate rates at aggregate levels, and then break these rates down into finer categories. This can be done in a number of ways:

- Apply the same population underestimation rates uniformly throughout the subcategories. This assumes that there is no differential underestimation among the subgroups.

- Develop assumptions on underestimation based on independent information or expert judgement.

- Use known or estimated marginal totals and apply them cross-sectionally to obtain detailed population underestimation rates. For example, subprovincial underestimation by age and marital status can be estimated from subprovincial underestimation by age, and provincial underestimation by age and marital status. This implies a certain relationship between the underestimation patterns of the two marginals.

Custom adjusted population estimates are available on a cost-recovery basis. Requests should be directed to the Demography Division, Statistics Canada, Room 1708, Main Building, Ottawa, Ontario, K1A 0T6; telephone (613-951-2320); fax (613-951-2307).

Acknowledgements

The author thanks Dr. Jane Gentleman, Ronald Raby, and Leslie Gaudette for their valuable suggestions and comments on an earlier version of this article.

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