Canadian Studies in Population

Official Journal of the Canadian Population Society
Vol. 43, No. 1–2 (Spring/Summer) 2016

Demographic Trends in Canada and Australia

Special issue dedicated to Graeme Hugo

Guest editors Peter McDonald and Rod Beaujot

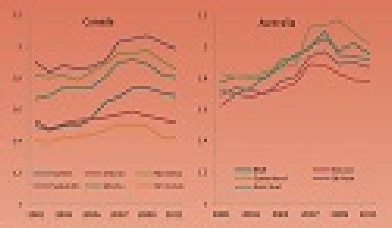


Figure 9. Total fertility rates in the upper provinces and states, Canada and Australia, 2001–2011.

McDonald and Beaujot: A comparison of fertility in Canada and Australia, 1926-2011

A publication of the Population Research Laboratory, University of Alberta

Canadian Studies in Population

Official Journal of the
Canadian Population Society

Editor
Frank Trovato, University of Alberta

Assistant to the Editor
Cindy Owre, University of Alberta

Special Issue

Demographic trends in Canada and Australia: Special issue dedicated to Graeme Hugo

Guest Editors
Peter McDonald, The Australian National University
Rod Beaujot, Western University (London ON)

Vol. 43, No. 1–2 (Spring/Summer) 2016

Population Research Laboratory, University of Alberta

ISSN 0380-1489
Frank Trovato, Editor
Cindy Owre, Assistant Editor

Canadian Studies in Population (*CSP*) is indexed in the *Web of Science*, the largest and most comprehensive citation index available. All articles published in *CSP* since 2009 are indexed and abstracted in the Social Sciences Citation Index, Journal Citation Reports/Social Sciences Edition, and in Current Contents/Social and Behavioral Sciences.

The *CSP* journal is posted online at http://www.canpopsoc.ca/publications/journal/.

Canadian Studies in Population was founded by Dr. P. Krishnan, Professor Emeritus at the University of Alberta, and is published with the financial support of the Society of Edmonton Demographers, Population Research Laboratory, Canadian Population Society, and the Department of Sociology, University of Alberta.

Funding for *Canadian Studies in Population* is provided by the Social Sciences and Humanities Research Council of Canada (SSHRC).

Contents

Special Issue on Canada and Australia

Graeme Hugo (1946 – 2015)

This special issue of *Canadian Studies in Population* is dedicated to the memory of Professor Graeme Hugo, who was a leading Australian population geographer. Dr. Hugo passed away on 19 January 2015 at the age of 68 after a brief battle with cancer. Graeme's untimely death is a great loss to the global community of population scholars and most of all to his family, former students, colleagues, and friends. He was loved and respected by all who knew him. Over his career, Professor Hugo made many significant scholarly contributions in a variety of demographic areas, especially international migration. His publications include 33 books, 187 refereed articles, 253 book chapters, 43 monographs, and numerous presentations at conferences and other professional venues.

On a personal note, I met Graeme in the early 1980s during his visit to Edmonton. At that time, he had been invited to the University of Alberta to give a series of lectures organized by Professor Leszek A. Kosinski of the geography department. Years later, in the autumn of 2013, Graeme revisited the University of Alberta in connection with an invitation by the Provost of the University, to give a series of presentations aimed at promoting collaborative research among scholars from Alberta and The University of Adelaide, Graeme's institution. It was truly a great pleasure to see Graeme after so many years. The idea of a special issue of *CSP* devoted to research featuring Canadian and Australian social demographic trends originated during this second visit.

I wish to thank Professors Peter McDonald of The Australian National University and Rod Beaujot, Western University, for their willingness to serve as guest co-editors of this special issue after the untimely passing of Dr. Hugo. This endeavour would not have been possible without their superlative collaboration and assistance. Their collegiality and support is gratefully appreciated.

Frank Trovato
Editor, *Canadian Studies in Population*

Canadian Studies in Population 43, no. 1–2 (2016): 1–4.

Introduction: Comparative demography of Australia and Canada

Roderic Beaujot
Western University, London (Canada)

Peter McDonald
The Australian National University, Canberra (AU)

In many regards, Australia and Canada are rather different, especially in climate and hemispheres. They also have important similarities, including being very large countries with extensive areas of very low settlement. Both were long inhabited by indigenous populations, which were overtaken during the period of European expansion and colonization. As parts of the British Empire, both countries were settled by people from the United Kingdom, but in Canada this only followed the New France era (1608–1760).

In terms of demographics, these similarities and differences have especially been examined on the side of immigration. In both countries, there was a long period during which governments sought to establish a white European population in a new world, and a similar timeframe in the 1960s when barriers to non-white immigration were removed and immigration became more diversified (see Richmond and Zubrzycki 1984). Asians are now the largest source of new arrivals in both countries.

The five articles in this special issue extend the potential for comparison between Australia and Canada through the treatment not only of immigration but also fertility/family and mortality/health. Given the similarities across the two countries, these comparisons provide insight into the socio-demographic dynamics of each country.

In economic terms, since 1962 the trend in gross national income per capita has been nearly the same in the two countries, but Canada has experienced more significant economic downturns and higher levels of unemployment (see Tables 6–8 of McDonald and Belanger in this volume). In policy terms, both countries are typically placed in the Anglo-Saxon model of "liberal welfare states," with more attention to promoting self-sufficiency, and a needs-based approach to addressing poverty.

In "A comparison of fertility in Canada and Australia, 1926–2011," Peter McDonald and Alain Belanger observe that fertility declined sooner in Australia, due probably in part to women's greater control over their own fertility, while Canada's fertility remained higher than in Australia in part due to higher childbearing in its province of Quebec until 1960. They observe that Australian women were able to vote as of 1902, while this did not occur until 1919 in Canada, and 1940 in Quebec. With the influence exerted by the Catholic Church on family policy not only in Quebec but also at the federal level, Canada lagged behind Australia with regard to the promotion of modern contraception.

It was only in 1969 that a 1892 provision in the Criminal Code was removed that had made it illegal to sell or advertise birth control in Canada.

After a long period during which fertility was higher in Canada, a cross-over occurred in the early 1960s, with fertility becoming higher in Australia than in Canada. This difference has persisted, with a Total Fertility Rate of 1.61 in Canada and 1.88 in Australia in 2011. The authors pursue various hypotheses, including differential fertility of foreign-born or indigenous populations, as well as economic and policy questions. The more stable economic conditions in Australia, and the lower unemployment, may have provided more security for young people to start families. While Quebec has had more supportive benefits in terms of childcare and parental leave, a new family support package introduced at the 2004 Australian election provided benefits Australia-wide. The authors conclude with an interesting graph (Figure 9) showing higher fertility variation across Canadian regions than is the case for Australia. This may be linked to higher variation across the regions of Canada, in both economic and policy terms.

The two papers on mortality in this volume provide an extensive summary of trends, patterns, and their interpretation over the periods 1907–2011 for Australia and 1921–2011 for Canada. In "Epidemiologic Transition in Australia: The last hundred years," Heather Booth, Leonie Tickle, and Jiaying Zhao note in particular that Australia was in advance of other countries in the early decades of the twentieth century, with an advantage of about four years in life expectancy compared with "many other Western countries," but that this advantage was lost by 1950. Their Figure 1 provides data for Australia, Canada, England and Wales, France, Japan, and United States for 1920–24 to 2010–13. In effect, Australia was at the top of this group in 1920–24, with an advantage of some four to six years compared with Canada, which was in second place for men and in third place for women. The trends converged over these six countries into the early 1970s, and then diverged once again, but over a smaller range. In 2010–13, Australia was once again ranked first for men, with Canada third, and Australia was ranked third (after Japan and France) for women, with Canada fourth. The differences between Australia and Canada have been small since 1950, less than 1.5 years for each gender. The paper addresses these comparative trends and the underlying cause-of-death patterns to locate Australian experience in the Epidemiologic Transition.

In "Trends, patterns, and differentials in Canadian mortality over nearly a century (1921–2011)," Robert Bourbeau and Nadine Ouellette emphasize the impact of the revolution in cardiovascular mortality that has increased the life expectancy of adults since 1970. As in other countries, life expectancy was not rising extensively in the 1960s, especially for men. The common wisdom at the time was that we would come to a plateau of life expectancy, with a maximum of some 72 to 75 years for both sexes combined. The first set of modern population projections by Statistics Canada, based on the 1971 Census, indicated that life expectancy would only rise from 76.1 for women and 69.2 for men in 1971 to 78.4 and 70.2, respectively, in 2001. The improvements in the cardiovascular area, along with improvements in accidental mortality and in various other areas, have implied that the 1971 projections—which were very accurate in predicting the 2001 overall population—underestimated the population aged 65+ by ten per cent. The Australian paper indicates that in 1946 to 1970, male life expectancy at age 65 declined slightly, from 12.2 to 12.0 years, while the Canadian paper indicates that male life expectancy rose very slightly, from 13.3 years in 1946 to 13.8 in 1970. Since these trends had been very constant, it was expected that the future would also see little change, and total life expectancy would reach a plateau, given that there was little room for gains at younger ages. These were the anticipations of mortality that were used in the mid-1960s when the Canadian Pension Plan was being established. In Australia also, the very sharp falls in deaths

from cardiovascular diseases at older ages that occurred continuously from the 1970s onwards were unexpected. That is, these projections failed to fulfill the anticipated the "aging at the top." In both countries, mortality reductions have especially occurred at ages 60+, and the 2011 life expectancy of males at age 65 has reached 19.0 in Canada and 19.2 in Australia, with that of females reaching 21.8 and 22.1, respectively.

In "Canada's immigration trends and patterns," Barry Edmonston follows the trends since 1851, including a systematic presentation of the numbers of immigrants and emigrants over five-year periods. Immigration has varied extensively over this period, including net emigration in 1861–1901 and in the 1930s, very strong immigration over the period 1901–14, and high immigration once again in the post-war period, but especially since 1989. Since the demographic transition has now run its course, immigration comprises a significant part of population change. The proportion foreign-born was 20.6 per cent in 2011, reasonably close to the peak level of 22 per cent reached in 1911–31 during and after the wave of arrivals of the early 20th century, which declined to 13.4 per cent in 1946. With the diversification of origins, the proportion from the United Kingdom among the foreign-born has declined from 44.3 per cent in 1951 to 7.9 per cent in 2011, while the proportion from Asia has increased from 1.8 to 30.0 per cent. In "Developments in Australian migration," David Smith, Dan Payne, Mathew Horne, and Debbie Claridge show similar trends in Australia in the post-war era, with the proportion of foreign-born rising from 10 per cent in 1947 to 25 per cent in 2011. At the end of the Second World War, the total population of Australia was seven million, and almost eight million migrants arrived in the ensuing 65 years. The proportion of the population with Anglo-Celtic (British and Irish) origins changed from 89.9% to 69.9% over the period 1947 to 1999. In comparison, the population of Canada in 1946 was 12.3 million, and 11.9 million migrants had arrived by 2011. In 2011, the population of Australia was 22.5 million, and that of Canada was 34.5 million.

The focus of the paper by David Smith and his colleagues is on the trends of the early part of the 21st century, including levels, composition, geographic distribution, and policy context. The authors treat migration and refugees as "the two sides of permanent migration to Australia," and they emphasize the growth of the temporary migrant category as a pathway to permanent settlement. An increasing share of permanent skilled migration is made up of persons who already have a temporary visa, reaching 55.4 per cent in 2014–15. The Migration Programme includes both skilled and family reunion migration, and these are the main pathways to permanent residence. The total numbers in the Migration Programme increased from 114,400 in 2003–04 to 190,000 for each of the years 2012–13 to 2014–15, with the skilled stream representing two-thirds and the family stream one-third. Skilled migration includes Points Tested Skilled Migration (56 per cent of the Skill stream in 2014–15), Employer Sponsored (37 per cent), and Business Innovation and Investment (5 per cent).

The Humanitarian Programme increased from 12,522 persons in 2002–03 to 13,768 in 2013–14. Of these, in 2013–14, 47 per cent had applied from offshore, 20 per cent from onshore, and 33 per cent were in the Special Humanitarian Programme.

Temporary migration includes the Working Holiday Maker programme for young adults, the skilled work visa of persons sponsored by businesses for up to four years, and student visas for people studying full-time. A Skilled Graduate Visa program was introduced in 2007, granting an 18-month work visa to former students who did not meet the criteria for points-tested migration. The visa was amended in 2013 and renamed the Temporary Graduate Visa, valid for up to four years but no longer a direct pathway to permanent skilled migration.

Barry Edmonston also discusses emigration, with an estimate of 3.8 million departures from Canada in the period 1946–2011, for a net gain of 8.1 million. Prior to 1931, emigrants were largely Canadian-born, while since 1981 they have been more likely to be foreign-born. Besides the demographic effects of immigration, Edmonston has an extensive analysis of the integration of (1) recent immigrants and (2) all immigrants on a variety of indicators, from language to income. For instance, the family income of immigrants of the past five years is about two-thirds or less that of the family income of Canadian-born, but homeownership rates reach similar levels after 20 years.

There is much more in these five articles, and it is a delight to have been involved in this special issue of *Canadian Studies in Population* on the comparative demography of Australia and Canada.

Reference

Richmond, A.H., and J. Zubrzycki. 1984. *Immigrants in Canada and Australia*. Downsview ON: Institute for Behavioural Research, York University.

Canadian Studies in Population 43, no. 1–2 (2016): 5–22.

A comparison of fertility in Canada and Australia, 1926–2011

Peter McDonald[1]
Alain Belanger

Abstract

This article compares the evolution of fertility in Canada and Australia since the early 20th century. Historically, in part because of the high fertility rates of Catholic French-Canadians, overall fertility was higher in Canada, but since the mid-sixties, fertility has been higher in Australia. This is especially noticeable among women aged 30+, but the observed difference is not a mere tempo effect, as completed fertility rates of the most recent cohorts are significantly higher in Australia. More generous family policies and a more robust economy could explain the maintenance of fertility close to replacement level in Australia, while Canadian indicators have been falling.

Keywords: fertility, Canada, Australia, Quebec, historical.

Résumé

Cet article compare l'évolution de la fécondité au Canada et en Australie depuis le début du XX^{e} siècle. Historiquement, en partie à cause de la forte fécondité des Canadiennes-Françaises catholiques la fécondité était plus élevée au Canada, mais depuis le milieu des années soixante, la fécondité est plus forte en Australie. Cette plus forte fécondité se remarque surtout chez les femmes de plus de 30 ans, mais on doit y voir plus qu'un effet de calendrier puisque la descendance finale des plus récentes cohortes est aussi nettement plus élevée en Australie. Des politiques familiales plus généreuses et une économie plus robuste pourraient expliquer le maintien d'une fécondité près du seuil de remplacement en Australie alors que les indicateurs canadiens faiblissent.

Mots-clés : fertilité, Canada, Australie, Quebec, historique.

Introduction

Throughout their histories, Canada and Australia have had many similarities, as described below. However, these countries have two obvious differences. First, Australia has no equivalent to the province of Quebec and is not bilingual. If Quebec's fertility trend was a mirror image of the trends in other provinces in Canada, this would not present a difficulty, but as we demonstrate in this article, the differences between fertility trends in Quebec and the other Canadian provinces go some way towards explaining the historical differences between the Canadian and Australian fertility trends—but only until 1960.

1. Corresponding author: Peter McDonald, Crawford School of Public Policy, College of Asia and the Pacific, The Australian National University, Canberra ACT 2011, Australia, e-mail: peter.mcdonald@anu.edu.au; and Alain Belanger, Institut national de la recherche scientifique, Centre Urbanisation Culture Société, Montreal.

The other obvious difference between the two countries is that Australia does not share a very long border with the United States; this proximity might promote similarities between Canada and the US, through border crossings or exchanges of population, or through the spread of cultural influences. For example, Canadians engage in sports that are similar to the range of sports that are popular in the United States—but not those that are popular in Australia. Nevertheless, patterns of fertility in Canada have differed very considerably from those in the United States (Belanger and Ouellet 2002; Sardon 2006, and McDonald and Moyle 2010). Around 2000, Canada's total fertility rate was about 25 per cent lower than that of the United States; in 2011 it was about 15 per cent lower. Furthermore, childbearing in the United States has occurred at much earlier ages than has been the case in Canada.

The main behavioural differences related to fertility have been summarized as follows:

> Unwanted pregnancies and births are more frequent in the United States, as is the use of abortion, while Canadian females use more effective contraceptive methods than Americans, partly because medical methods and sterilization are more accessible and less costly. Marriage takes place earlier and is more widespread in the United States, and a higher level of religious practice is indicative of a more traditional and less secularized society than in Canada (Belanger and Ouellet 2002: 107).

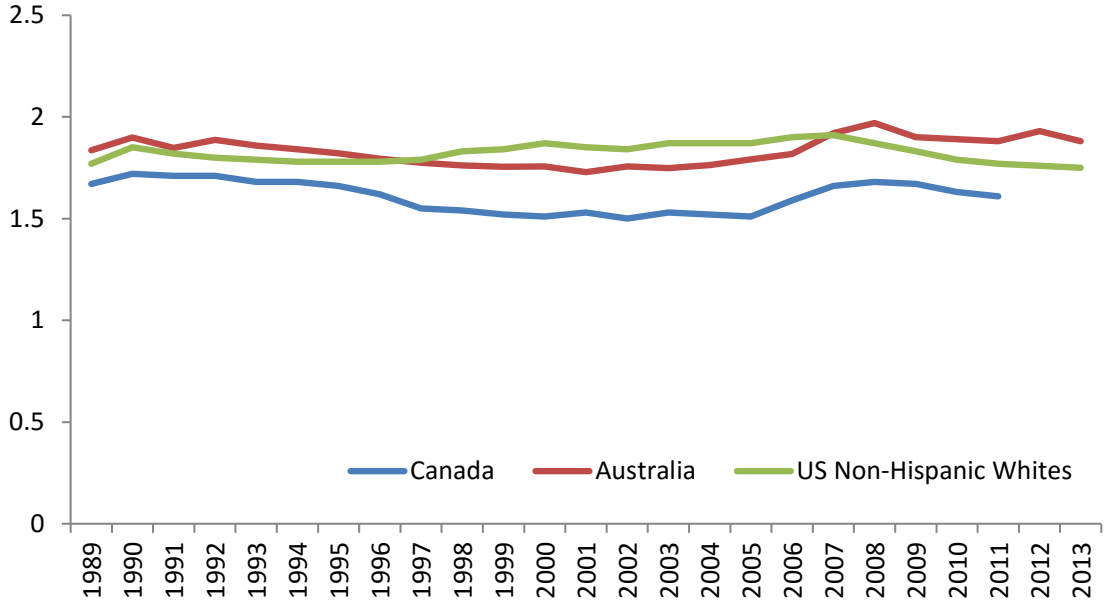


Figure 1. Total Fertility Rates, Canada, Australia and US Non-Hispanic Whites, 1989–2013.

On all of the behavioural dimensions cited in this statement, Australia is similar to Canada and unlike the US (McDonald and Moyle 2010); yet, in terms of the total fertility rate, over the past 25 years, Australia's fertility has been closer to that of Non-Hispanic Whites in the US than it has been to Canada's rate (Figure 1). Thus, while these behavioural dimensions may explain the recent difference in fertility between Canada and the United States, they do not explain the difference between Canada and Australia. Australia has all the same behavioural dimensions as Canada in relation to contraception, timing of the commencement of childbearing, and religious practice, but it achieves a higher fertility rate. This paper sets out to examine what other factors may be involved in the contemporary difference in fertility between Australia and Canada. Before doing this, however, the paper reviews the trends in fertility in the two countries over a longer time span.

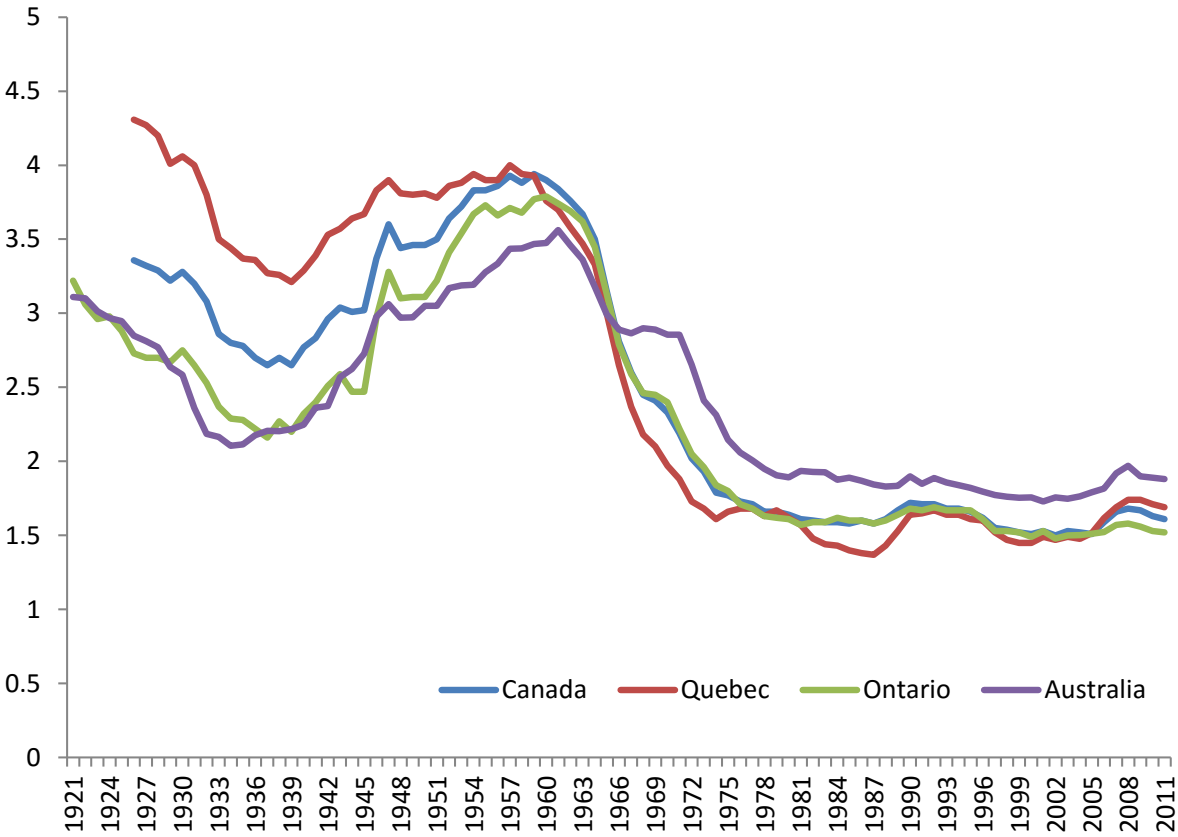


Figure 2. Total Fertility Rates, Australia, Canada, Quebec and Ontario, 1921–2011.

Fertility in Canada and Australia, 1926 to 1960

Figure 2 shows the total fertility rates in Canada and Australia from 1926 to 1960. The graph also shows fertility in the Canadian provinces of Quebec and Ontario. Data for Australian states are not shown because the variation in fertility rates across states has tended to be small, while the difference between these two Canadian provinces was around 1.5 births per woman in the latter half of the 1920s. The high fertility in Quebec in the first half of the 20th century explained most of the difference in fertility between Canada and Australia at that time, but it did not explain all of the difference. As the figure shows, fertility in Ontario until the baby-boom was the same as it was in Australia. Australia and Ontario were very similar in cultural terms; both populations were composed of a large proportion of first or second generations of European immigrants, mostly originating from the United Kingdom. Yet, some of the difference between the two countries was due to higher fertility in Canadian provinces other than Ontario. During the 1930s depression, fertility fell more in Australia than in Canada, and a wider difference opened up between the two countries. Also, Australian fertility during the depression a reached its low point more rapidly than was the case in Canada. The fall in fertility in Ontario during the depression mirrored that of Canada as a whole, and so a gap opened up between Australia and Ontario. As commodity exporters, both Canada and Australia were hit badly and early and about equally by the depression, with unemployment rising in both countries to higher levels than was the case in the United States.

The more rapid fall in fertility in Australia during the depression could possibly reflect more effective use of contraception in Australia at that time. While comparative information for Canada is not readily available, Hera Cook has demonstrated that Australian women had much greater control over their own fertility and thus much greater sexual and reproductive autonomy within marriage from the 1890s to the 1960s than did women in England (Cook 2000). Helen Moyle has also demonstrated that between 1880 and 1920, Australian women were very likely to be using female methods of contraception, often homemade methods (Moyle 2015). She also argues that this was symptomatic of wider autonomy among Australian women that, for example, led to very early female suffrage. Australian women on the whole were able to vote from 1902, and women in the state of South Australia from 1895. Women overall were able to vote in Canada only from 1919, but not until 1940 in Quebec. Also, from 1892, in Canada it was illegal to sell or advertise for sale "any medicine, drug or article intended or represented as a means of preventing conception" (Section 192 of the 1892 Canadian Criminal Code). These provisions in the Canadian criminal code were only put aside in 1967, when Pierre Elliott Trudeau as Minister of Justice proclaimed that the state had no business in the bedrooms of the nation. This was not the case in Australia; indeed, around 1900, large city pharmacies had women's sections, staffed by women, where contraceptives were sold, and discreet advertisements (subject to lewdness criteria) were published in newspapers (Moyle 2015). This explanation, however, has less force if applied to a comparison of fertility in Australia and Ontario, unless access and use of contraception in Ontario was better than it was in other Canadian provinces. Also, in the 1930s and 1940s, the Australian fertility rate was always close to that of the United States—which, as described above, was not renowned for its access to contraception.

Table 1. Percentage of the population living in agglomera-tions with 20,000 or more inhabitants, 1920–1960, Canada, Australia, and the United States

Country	1920	1930	1940	1950	1960
Canada	34	39	41	47	53
Australia	49	49	54	59	66
United States	42	47	47	51	59

Source: United Nations, Department of Social Affairs. 1969. *Growth of the World's Urban and Rural Population, 1920–2000*. Population Studies No. 44. New York: United Nations, Table 45.

Prior to 1950, Canada was less urbanized than either Australia or the United States (Table 1), and it is well known that during the fertility transition in Western countries, the fertility rates of farmers remained higher longer. This compositional explanation of the differences in Figure 2 before 1950 is in accordance with the fact that Ontario was much more urbanized than provinces such as Alberta, Saskatchewan, and Manitoba. However, the levels and trends of urbanization are very similar for Ontario and Quebec from 1921 to 1961, not in accordance with the large differences in fertility (Statistics Canada nd). However, Krull and Trovato (2003) argue that outside of Montreal and Quebec City, Quebec remained very rural until the Second World War. About the high fertility in Quebec prior to 1950, they say:

> Delayed modernization, therefore, can be attributed to the provincial Government's dedication to the Church's ideology and its vision of Quebec as a rural religious society. The influence of the Roman Catholic Church cannot be over-emphasized (Krull and Trovato 2003: 197).

They say that through its control over education and the social policies of the Quebec Government, the Church promoted a pro-natalist agenda, encouraged early marriage and large families, discouraged liberal ideologies, and interpreted feminism as a threat to national survival.

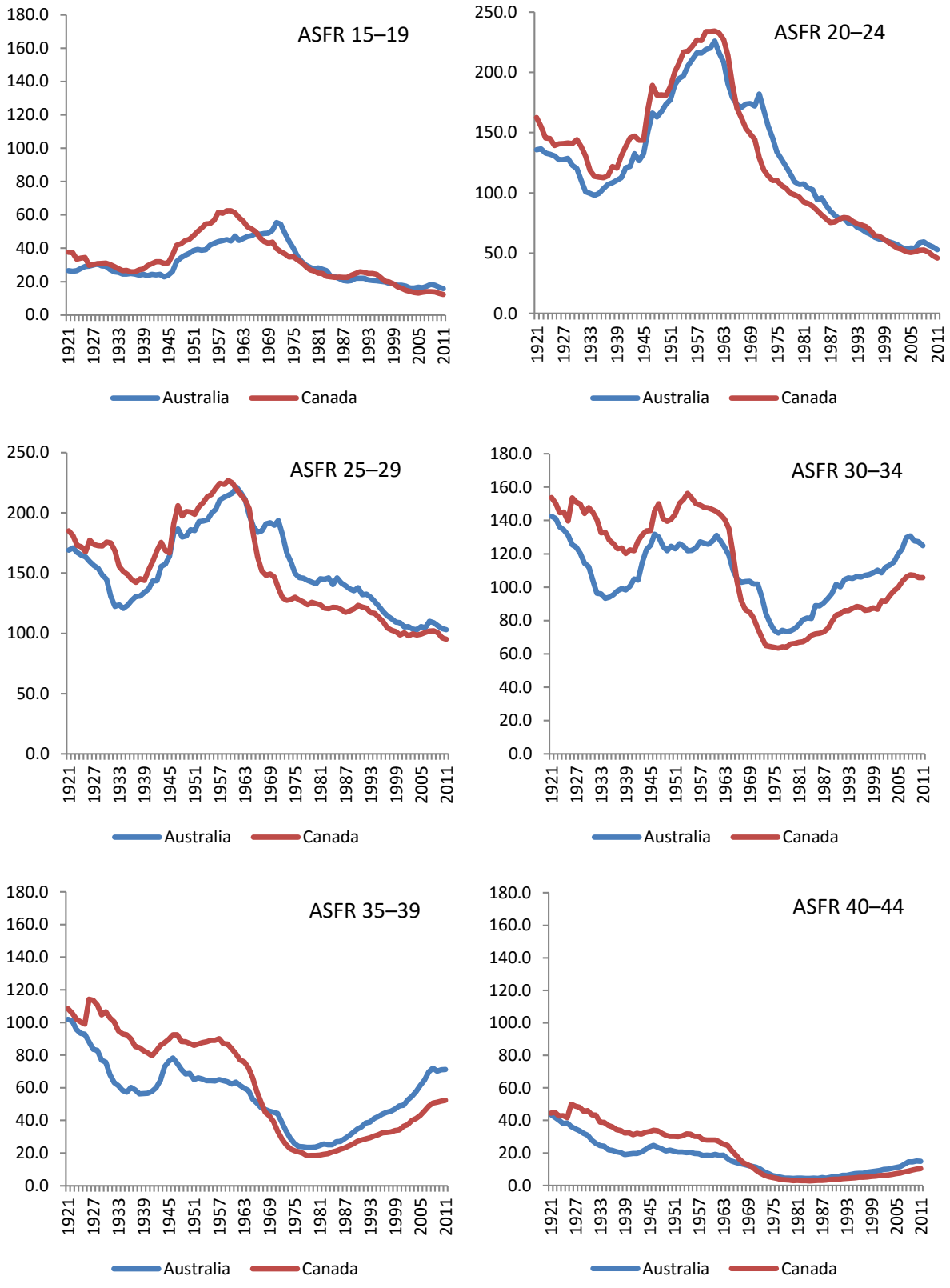


Figure 3. Age Specific Fertility Rates, Canada and Australia, 1921–2011.

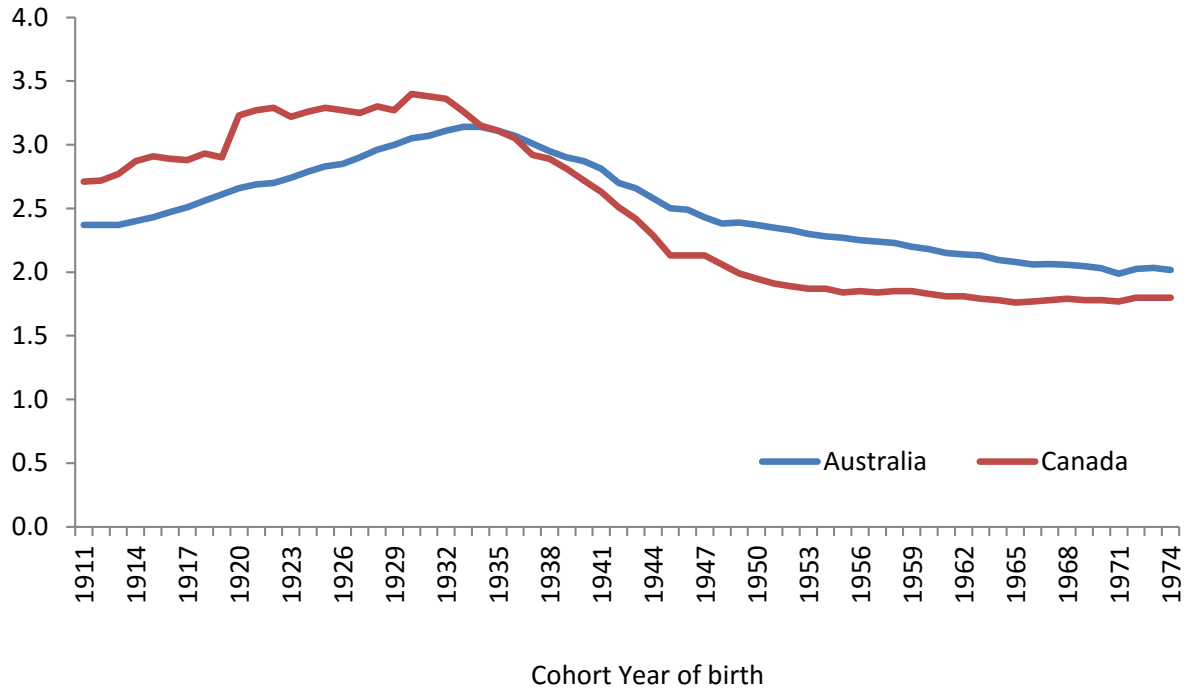


Figure 4. Completed-cohort fertility, Canada and Australia, years of birth of cohorts of women, 1911–74.

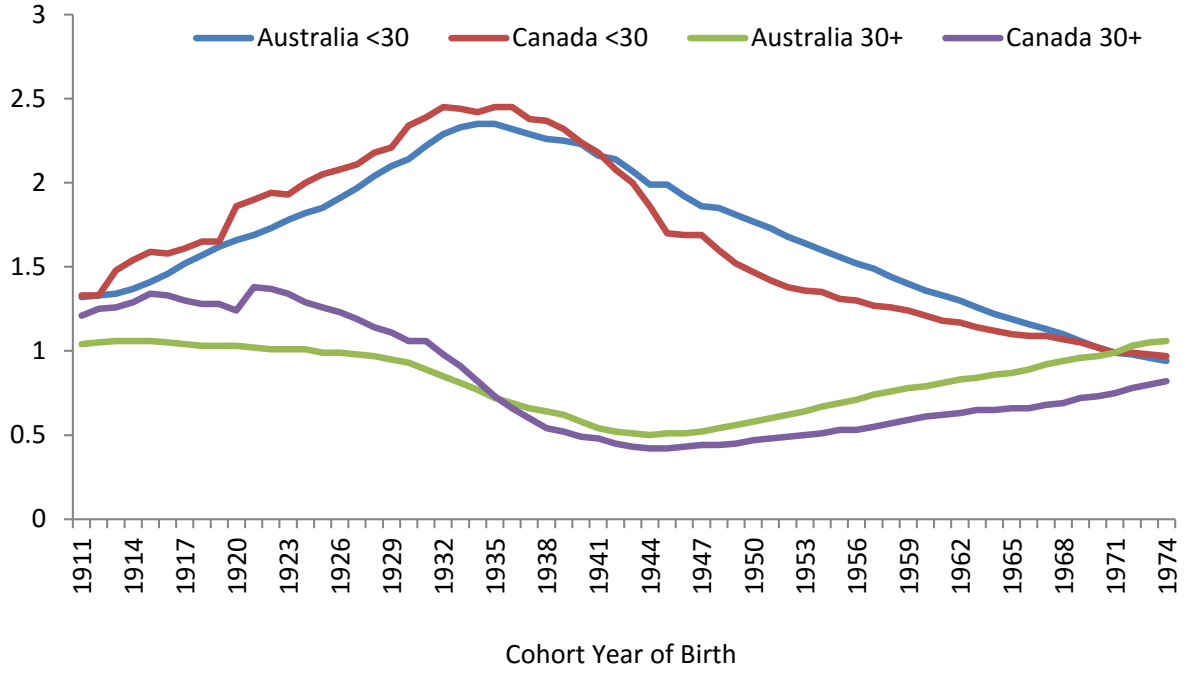


Figure 5. Cohort fertility ages 15–29 and 30–49, Canada and Australia, years of birth of cohorts of women, 1911–74.

Table 2. Parity distributions of completed-cohort fertility, Canada and Australia, 1929 and 1959/1961 birth cohorts

	Cohort-completed fertility: Parity distributions			
	1929 birth cohort		1959 birth cohort	1961 birth cohort
Birth parity	Canada	Australia	Canada	Australia
0	6.6	9.5	17.3	14.9
1	7.2	9.3	17.8	12.4
2	11.9	24.8	39.0	38.2
3	8.6	23.4	18.4	22.6
4+	65.7	33.0	3.8	8.8
Total	100.0	100.0	100.0	100.0
Average number of births	3.27	3.00	1.85	2.15

Sources: Canada, derived from data published in the Human Fertility Database; Australia, derived from an unpublished database of Australian fertility compiled by Peter McDonald and Rebecca Kippen (2011). 1929 is the first year for which Canadian data are available and 1959 is the last year. Data for Australia were not available for 1959, and so 1961 is used for comparison.

In the 1950s, during the baby-boom period, fertility rose by more in Ontario than in Australia, such that by the end of the 1950s, the fertility rates for Ontario, Quebec, and Canada as a whole were very similar, all being above the Australian level by about 0.5 births per woman. The baby-boom peak fertility was higher and occurred slightly earlier in Canada (3.91 in 1959) than in Australia (3.56 in 1961). Comparing the age-specific fertility rates of the two countries from 1921 to 1960 (Figure 3), fertility was higher in Canada than in Australia at all ages, but the difference was especially marked at the older ages (age 30+). The broad differences were not due to tempo effects; Figure 4 shows that completed-cohort fertility in Canada was higher than in Australia up to the cohort of women born in 1934, and the differences for the early cohorts were similar to those for period total fertility before 1960. Figure 5, using cohort data, confirms that the differences between Australia and Canada were more pronounced at age 30+ for the early cohorts. Finally, data on the completed-cohort fertility parity distributions for the 1929 birth cohort of women in the two countries (Table 2) indicate that Australian women were much more likely to stop at two or three children than was the case for Canadian women.

In summary, it is not possible to be definitive about why Canada's fertility was higher than that of Australia in the period prior to 1960. In the pre-baby boom years, in proximate terms, it may have been that Australian women had more control over their own fertility, as described above, or it may have been that Canadian couples wanted to have more children, or that the Canadian population was more rural than that of Australia—or, in the case of Quebec, that high fertility resulted from the control that the Catholic Church had over the people and the government. Explanations in this regard need to deal with the wide differences in fertility across the Canadian provinces, and why fertility in Ontario was much closer to that of Australia than it was to other Canadian provinces. In line with the argument made above about contraception in Australia, McInnis (1991) observed that control of fertility within marriage was adopted at a comparatively early point by women in Ontario. However, fertility was higher in other provinces of Canada, both because they were more rural and because of the influence of the Catholic Church in Quebec. For the baby-boom period, the interesting question is why fertility in Ontario lost its association with the fertility trend in Australia during the 1950s and moved to the fertility levels prevailing in other provinces of Canada (see Figure 2).

Fertility in Canada and Australia since 1960

From 1960 to 1980, fertility fell sharply in both countries: in Canada, from 3.9 births per female in 1960 to 1.64 in 1980 and, in Australia, from 3.47 to 1.89. In this period, Canadian fertility fell farther and faster than it did in Australia. The resultant positive gap in Australia's favour of about 0.25 births per woman in 1980 was maintained in broad terms in subsequent years, the gap being 0.27 in 2011. Two specific trends in this period stand out. The first is the almost meteoric fall of fertility in Quebec, from 3.93 in 1959 to 1.66 in 1975. The second is the flattening out, mid-decline, of Australian fertility between 1966 and 1971 (Figure 2).

Krull and Trovato (2003) attribute the meteoric fall in fertility in Quebec to a process of modernization and secularization that, at least initially, was associated with the Liberal Government elected in 1960 and with the rapid secularization of the society and development of a welfare state that characterized the province of Quebec under the Quiet Revolution. This corresponded with the rise of second-wave feminism, which resulted in dramatically increased levels of women's education and participation of married women in the labour force. Of course, these changes were occurring at the same time in other places, including other provinces of Canada and in Australia, but the changes were more rapid in Quebec—which was, before the Quiet Revolution, trailing far behind on most socioeconomic indicators. The more rapid fall in Quebec may have been due to a more intensive move away from marriage and early childbearing (Langlois et al. 1992; Krull and Trovato 2003), although fertility fell sharply at all ages from 1960 onwards. By 1980, Quebec had the lowest fertility under age 25 of all of the Canadian provinces (99.8 per 1,000, compared with 118.4 for Canada as a whole). Abortion and sterilization rates were high for Quebec at this time (Krull and Trovato 2003).

In Australia between 1966 and 1971, age at first birth remained at a low level longer than was the case in other countries. This has been attributed to an increase in sexual activity among young single people that was not accompanied by ease of access to contraception or abortion. Teenage fertility hit its peak in Australia in 1970, ten years after the peak in Canada (Figure 3). First marriage rates for those at young ages (18, 19, and 20) hit their peak around 1970 for both those pregnant at marriage and those not pregnant (Carmichael 1988; Carmichael and McDonald 2003). At this time, being married before age 20 was a way for men to avoid conscription, and this has been proposed as a reason for the observed trend (Withers 1979). However, Figure 3 shows that fertility rates at ages 20–24, 25–29, and 30–34 also rose or levelled off in this short period in Australia, before plunging from 1971 onwards. Another speculative reason for the levelling off of fertility is that Australian Catholics, under the aegis of Irish Catholicism, may have been (temporarily) conservative in adopting the contraceptive pill and abortion, an attitude given impetus in 1968 by the publication of the papal encyclical *Humanae Vitae*.

Counter to the period before 1960, from 1980 onwards (and for birth cohorts from 1936 onwards), Australian fertility has remained higher than that of Canada (Figures 1–4). Initially, this was due to a slower decline of fertility at younger ages in Australia than in Canada, but from the 1990s onwards, the difference has been due almost entirely to higher fertility in Australia above age 30 (Figures 3 and 5). This is in sharp contrast to the explanation for the growing fertility gap between Canada and the USA occurring at the same time, where most of that gap is explained by higher fertility of American women before age 30 (Belanger and Ouellette 2006).

Looking at cohort fertility, we note that completed fertility is below 2 children per woman for all cohorts of Canadian women born after 1949, while it has never fallen below that level in Australia. The figures for the most recent cohort having completed its fertility are 1.8 children per woman in

Canada, which is about 10 per cent lower than the Australian completed fertility rate of 2.0 children per woman for the cohort born in 1974. The gap between Canadian and Australian fertility can therefore not be attributed to a tempo effect. For birth cohorts of women born around 1960, the proportion of women with completed family sizes of three or more in Australia was about ten percentages points higher than in Canada (Table 2). This difference is probably larger for more recent cohorts. It is to the differences in this contemporary period that we now turn.

Explaining the contemporary difference in fertility in Canada and Australia

According to social demographic theory (Leridon 2014; Keyfitz 1987; Lesthaeghe 2010; Lesthaeghe and Surkyn1988; Preston 1987), fertility can be influenced by many factors, including: urbanisation, industrialisation, the state of the economy and employment; economic expectations; culture, religion, and cultural background; education; the social-economic role of women, gender equity, and women's agency; the potential for social mobility; the cost of housing; the direct and indirect costs of children; the relative income of young men (Easterlin 1973; Makunovich 1996); knowledge of and access to means of fertility control; the diffusion of values; and psychological perceptions of the value of children. In comparing the fertility trends of two countries, therefore, we may expect to find that differences in these factors will explain the differences between the two countries—although, given the wide range of potential theoretical explanations and their complexity, it is very unlikely that definitive explanations of the differences are possible.

Above, attention was drawn to the conundrum that in the past 25 years, Australia's fertility rate has been much closer to that of the United States than to that of Canada, despite the fact that behaviours related to marriage, contraception, and religion are similar in Australia and Canada and *unlike* behaviours (on average) in the United States. Between Canada and Australia, there are many other striking similarities besides these behavioural similarities. Both countries are federations of former British colonies, and both are parliamentary democracies along the lines of the Westminster model. Canada's federation was created in 1867 and Australia's in 1901. As in the United States, both have a states' house, the senate, but the Canadian senate is appointed while the Australian senate is elected. Both countries have a small but important indigenous population, and both countries are well-known as nations of immigrants and their descendants (see Edmonston, and Smith et al. in this volume). Their migration histories are similar over the past 100 years, and during their history they have applied similar policy approaches to migration, with an emphasis in the past 20 years on skilled migration.

In broad terms, levels of immigration to the two countries have been similar across time, and the peaks and troughs in immigration have occurred at about the same times. Prior to the Second World War, a high proportion of immigrants to both countries were British, but migration from the rest of Europe expanded after the war. The almost exclusive preference for migrants of European origin ended in both countries in the late 1960s, and since that time, both have experienced considerable migration from Asia, especially from China and India. Thus, it could be said that both countries experienced similar cultural influences from immigrants at much the same times; both were very British in orientation until the Second World War, taking on Southern, Eastern, and Western European influences from 1950 to 1970 and Asian influences from 1970 onwards. While at present, the two largest sources of immigrants to Australia are India and China, in recent years the proportion of all immigrants that has Asian origins has been higher in Canada than in Australia because of the continued large inflows to Australia from the United Kingdom and New Zealand. Canada also experiences moderate migration from Latin America and the Caribbean, sources that are small in the

case of Australia. Both countries experience moderate levels of migration from North Africa and the Middle East. Migration between Canada and Australia is small. At least nominally, the largest religious group in each country is Catholic, with the Catholic proportion being higher in Canada than in Australia, but today, both are very secular societies. According to the Canadian household survey, the proportion of the population declaring no religion was 23.9 per cent in 2011. This is very similar to the proportion of 24.4 per cent declaring no religion among those who answered the religion question in the 2011 Census of Australia.

In 2014, the Australian Total Fertility Rate (TFR) was 1.84 births per woman, 1.86 for Australian-born women and 1.77 for non-Australian-born women. Thus, immigrant fertility had little impact on the national fertility rate. The TFR for the major immigrant groups did not differ significantly from the national rate: 1.76 for United Kingdom–born, 1.94 for New Zealand–born, 2.00 for India-born, and 1.63 for China-born women. The lower rate for the China-born women was explained entirely by their lower fertility in the age range 15–24, at which ages many Chinese women included in the population are students living in Australia temporarily, and thus very unlikely to give birth. At ages 25 years and over, the fertility of the China-born in Australia is exactly the same as that of native-born women (ABS 2015).

Table 3. Total fertility rates in Montreal, Toronto, and Vancouver 2006–11 by visible minority group, immigrants and Canadian-born

Group	Canada	Montreal	Toronto	Vancouver
Visible minority				
White	1.61	1.53	1.42	1.33
Chinese	1.28	1.45	1.27	1.09
South Asian	1.82	2.16	1.82	1.63
Arab	2.73	3.02	1.94	2.24
Black	1.85	1.86	1.74	1.79
Others	1.59	1.70	1.48	1.38
Immigrants	1.86	2.15	1.73	1.48
Canadian-born	1.59	1.46	1.36	1.28
Total	1.66	1.64	1.51	1.35

Source: Authors' calculations using the 2011 Canadian National Household Survey.

In terms of total fertility rates, we observe larger differences between Canadian ethno-cultural groups. Using the own-children method and the Canadian National Household Survey of 2011, we estimate the Canadian TFR at 1.66 children per woman, comprising 1.59 for Canadian-born women and 1.86 for immigrant women (see Table 3). Earlier Canadian studies suggest that when other individual characteristics are taken into account, the average fertility of all women not born in Canada is not higher than that of Canada-born women, except for the most recent immigrants (Belanger and Gilbert 2007; Gebremariam and Beaujot 2010). Thus, part of the difference between immigrant and Canadian-born women can be explained by a tempo effect resulting from the disrupting effect of the immigration process on immigrant fertility. Yet, in terms of total fertility rates, differences in fertility between immigrants and natives appear more important in Canada than in Australia.

This can be due to differences in the composition of the immigrants of each country. Using the same data set and method, we estimate the TFR of Canadian women by visible minority groups. While the fertility of Chinese women is very low at 1.28 children per woman, the TFR of South-Asian (1.82), Black (1.85), and especially Arab women (2.73) is much higher than for White women (1.61). Also, according to Caron-Malenfant and Belanger (2006), the larger differences between visible minority and religious groups remain even when a control is made for other individual characteristics.

The conclusion can be drawn that the impact of immigrant fertility on the overall level of fertility in Canada can perhaps be larger in Canada than in Australia, but it would explain a higher overall fertility level in Canada, not the opposite. Thus, we can conclude that the recent difference in fertility between Canada and Australia is not due to immigrant fertility—or, stated differently, the fertility of Australia-born women is much higher than that of Canada-born women. Because the indigenous populations in both countries are small in number, the fertility difference between the two countries cannot be explained by the effects of indigenous fertility.

Table 4. Total fertility rates (TFR) in Ontario, British Columbia, New South Wales, and Victoria in 2011, and in Sydney and Melbourne in 2013

Province/State	TFR in 2011
Ontario	1.52
British Columbia	1.42
New South Wales	1.95
Victoria	1.85
City	TFR in 2013
Sydney (2013)	1.85
Melbourne (2013)	1.74

In geographic terms, both countries have enormous land areas, most of which is largely uninhabited. Their populations are highly clustered into a relatively small number of cities. Canada's population is concentrated in the south, and most of its population lives within 200 kilometres of the US border. In Australia, most of the population lives within 100 kilometres of the coastline. In the list of the world's most liveable cities published by The Economist Intelligence Unit (2015), the top ten most liveable cities include four Australian cities and three Canadian cities. These cities, particularly Sydney and Melbourne in Australia and Toronto and Vancouver in Canada, are highly cosmopolitan, with residents from almost all countries of the world. Thus, there may be an expectation of similar levels of fertility in these cities. Tables 3 and 4, counter to the expectation, show that fertility is much higher in the two Australian states than it is in the two Canadian provinces, and that it is much higher in the largest Australian cities than in the largest Canadian metropolitan areas.

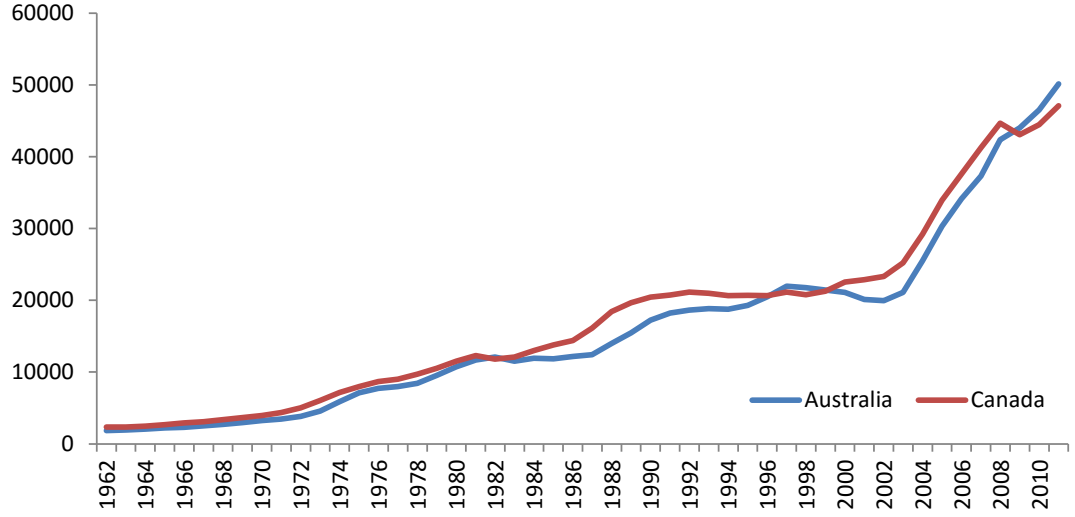


Figure 6. Gross National Income per capita (atlas method, current USD), Canada and Australia, 1962–2011.

Source: World Bank data, World Development Indicators.

Both countries enjoy very high standards of living, but their economic fortunes remain dependent, as they have always been, upon the export of primary production (food and minerals), and the state of their economies fluctuates with the prices of the commodities that they produce. In their histories, the major trading partner for both countries was the United Kingdom, but today, the UK is only Canada's fourth-largest trading partner and Australia's sixth-largest. On the other hand, the USA is by far the largest of Canada's trading partners, accounting for more than 70 per cent of its trade. Canada and the United States signed a free-trade agreement in 1988. This is where proximity counts. Australia's trading partners are more diverse, but its leading partner is China, with the level of bilateral trade being more than twice that of the second country, Japan. Australia and China signed a free-trade agreement in 2015.

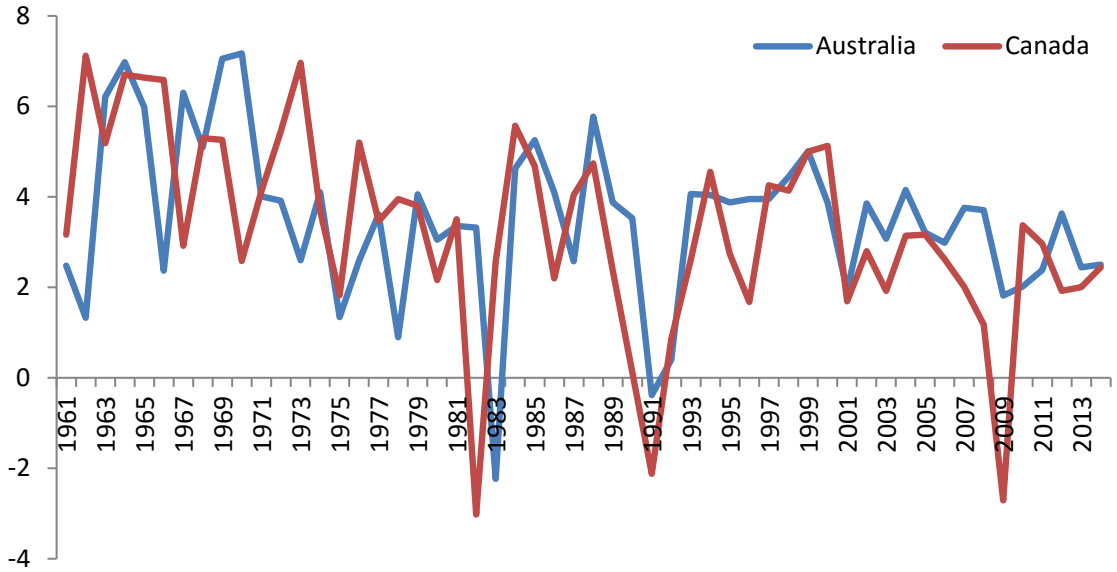


Figure 7. Rate of growth of Gross Domestic Product (%), Canada and Australia, 1961–2014.
Source: World Bank data, World Development Indicators.

Time series for three economic indicators in Canada and Australia are shown in Figures 6–8. The trend in gross national income per capita from 1962 onwards has been nearly the same in the two countries (Figure 6). The GDP growth rate has also followed a very similar course in the two countries, except for economic downturns in Canada in 1996 and 2009 that were not experienced in Australia. Also, the recessions circa 1981 and 1991 were more intense in Canada compared to Australia (Figure 7). Finally, the unemployment rate has been higher in Canada than in Australia for every year from 1991 to 2014, but the rates were very close until 2001. Following 2001, a gap opened up between the countries of about two percentage points, which widened during the global financial crisis but by 2014 had narrowed to less than one percentage point (Figure 8). The upward trend in Canada's fertility rate from 2005 to 2008 was reversed from 2009, the same year in which the unemployment rate surged upwards. Thus, there is some possibility that the more severe impact of the global financial crisis upon Canada may have led to a more pessimistic economic outlook among young people in Canada than was the case in Australia, and this could be considered as a potential explanation of very recent differences in fertility between the two countries. However, economic trends do not seem to explain the longer-term difference from 1980 onwards.

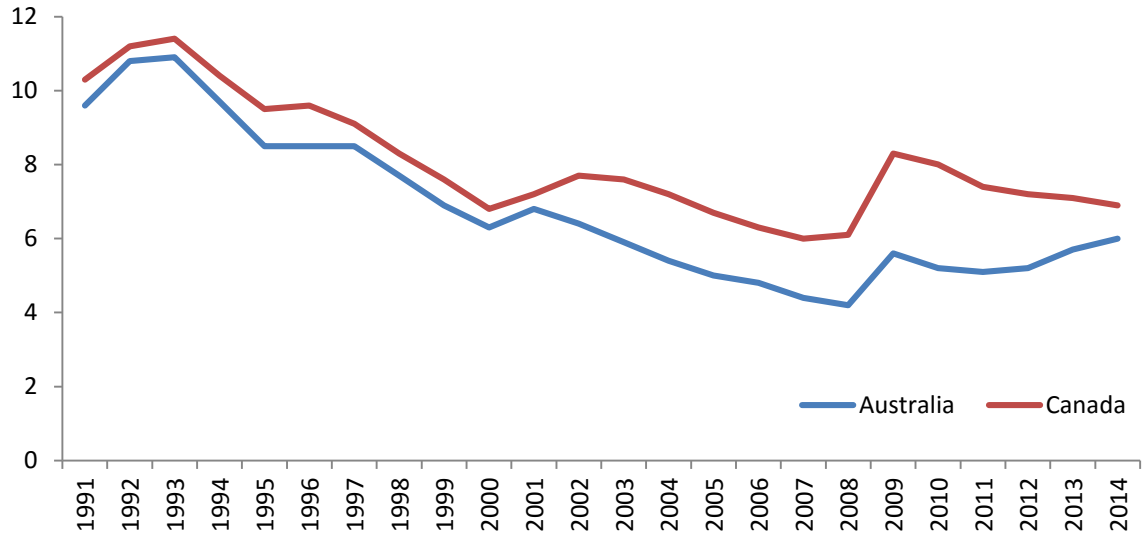


Figure 8. Unemployment rate (%), Canada and Australia, 1991–2014.
Source: World Bank data, World Development Indicators.

In relation to economic influences, Beaujot and Wang (2010) make an argument that fertility in Alberta rose from 2005 to 2008 because of strong job prospects for young people in the province. In the downturn in fertility in Canada after 2008, fertility fell more in Alberta than in any other province (Figure 9). In like manner, the Australian equivalents of Alberta—the 'resources states' of Western Australia and Queensland—followed much the same trend, with strong rises prior to the global financial crisis and strong falls from 2009 onwards. However, the benefits of the economic boom in Australia were more widespread; for example, they facilitated the Australia-wide economic stimulus package in 2008–09 that left Australia as the only advanced economy which did not experience negative economic growth at the time.

The most interesting trend in Figure 9, however, is the way in which fertility in Quebec was the same as that in Ontario up to 2005, but then increased substantially to 2008, while fertility in Ontario remained relatively flat. British Columbia followed the same trend as Ontario, but at an even lower level. Beaujot and Wang (2010) suggest that the rise in Quebec from 2005 was related to the introduction of a new range of family support policies specific to Quebec. The range of policies introduced in Quebec is detailed in Roy and Bernier (2007), and the effects of these policies upon fertility are described in Beaujot et al. (2013) and Beaujot (2013), the latter of which concludes:

> Quebec family policies have helped to increase fertility rates, promote more favourable attitudes toward child care, led to more people using child care in Quebec than the rest of Canada, improved people's satisfaction with child care, and allowed more women with young children to participate in paid work than the rest of Canada (Beaujot 2013: 1).

In Australia, a new family support package was introduced at the 2004 federal election that provided benefits Australia-wide (Heard 2006). In fact, it could be said that from 2005 onwards, Australia as a whole had the economic benefits of Alberta and the family policy benefits of Quebec. The increase in fertility in Australia after 2005 was driven by higher fertility among women in their thirties, effectively by better-educated women who had delayed their first births in an earlier time. Studies in Australia of the impacts of the new family policies upon fertility are essentially agnostic in their conclusions (Drago et al. 2010; Parr and Guest 2011), but they are plagued by the fact that it is

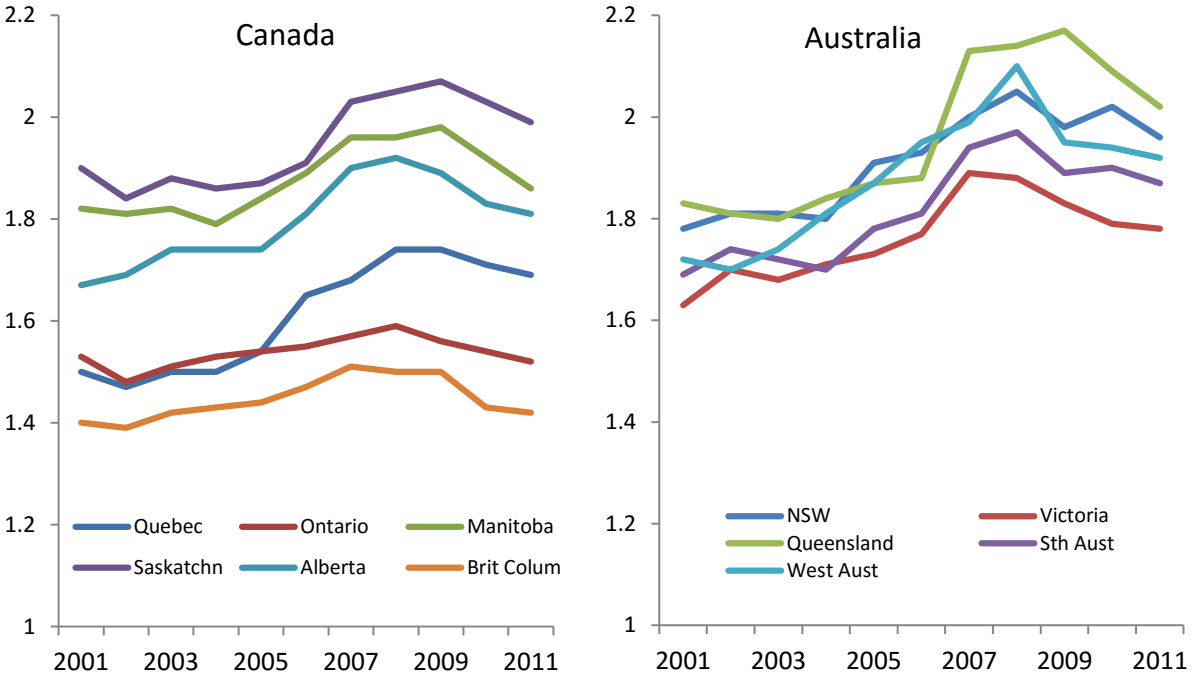


Figure 9. Total Fertility Rates in the larger provinces and states, Canada and Australia, 2001–11.

not possible to investigate the counterfactual of whether these women would have had the same level of fertility in the absence of these policies. Also, it is not easy to remove the effect of the improved economic circumstances for young people in the years in which the fertility rate rose. A detailed demographic analysis by McDonald and Kippen (2011) concluded that the increase in fertility was not due to higher fertility rates but to shifts in the composition of women by age, parity, and interval since previous birth. However, they also allude to the problem of the counterfactual: would fertility rates by age, parity, and interval since last birth have remained constant without the new family policies and the strong economy? In association with cutbacks in family policy in Australia (reduction of the 'baby bonus') and a downturn in the economy, fertility in the most recent years is falling again.

In the context of the discussion in the previous paragraph, it needs to be remembered that cross-sectional fertility rates can move up and down from year to year because of small shifts in the timing of births. We need to be careful not to over-interpret short-term movements; they serve as reminders to watch the longer-term trend and, in relation to fertility, the trend in cohort fertility.

Two other interesting observations can be drawn from Figure 9. The first is that the variation across provinces in Canada is much wider than the variation across states in Australia. In 2011, the ranges were 1.4 to 2.0 in Canada and 1.8 to 2.0 in Australia. A relative lack of variation in Australia is also confirmed by the relatively high fertility rate in the Australian Capital Territory (1.79 in 2012), a region in which women are highly educated on average and where labour force participation of women is very high by Australian standards but where standards of work-family provisions are led by the favourable benefits received by Australia civil servants. Furthermore, completed family size and desired number of children are relatively high for Australian women with university degrees (Arunachalam and Heard 2015; Heard and Arunachalam 2015). In Canada, the higher fertility in Manitoba and Saskatchewan can be explained by the higher proportion of Aboriginal population, with much higher fertility rates than non-Aboriginal, while in Alberta and Saskatchewan the positive economic horizon was provided as an explanation of higher fertility while the oil price remained high.

The other associated observation is that, at present, Canada's relatively low fertility compared with Australia is very largely the result of low fertility in Ontario and British Columbia. More than half (52.1 per cent) of Canadian women aged 25–44 years lived in these two provinces in 2011, so clearly, by weight of numbers, the low fertility of these two provinces leads to low fertility in Canada as a whole. Thus, the question raised at the beginning of the paper as to why fertility in Australia in recent times has been more like the fertility of Non-Hispanic whites in the United States than fertility in Canada seems to reduce to the question: why is fertility so low in British Columbia and Ontario?

The explanation of low fertility in these two provinces probably involves one or more of the following:

1. The capacity to combine work and family is lower for women in Ontario and British Columbia than it is in other provinces. This is effectively the argument made by Beaujot et al (2013), although they do not address Ontario and British Columbia specifically. Labour force participation rates are somewhat lower for women aged 30–44 years in these two provinces compared with Canada as a whole (based on the September 2015 Labour Force Survey results).
2. It may be that employment prospects for young people are more precarious in Ontario and British Columbia than in other provinces, but in fact, unemployment rates for young people aged 20–29 years are not very different in these two provinces than for Canada as a whole, and this is also the case in relation to the percentage of men (aged 25–54 years) working in temporary jobs (based on the September 2015 Labour Force Survey results).

Table 5. Distribution (in %) of the female population aged 15–49 by largest visible minority groups; Canada, Montreal, Toronto, and Vancouver, 2011

Female population	Canada	Montreal	Toronto	Vancouver
White	77.2	77.2	48.9	49.6
Visible minority				
Chinese	4.8	2.4	10.3	19.9
South-Asian	5.6	2.2	15.9	11.9
Arab	1.3	4.3	1.4	0.5
Black	3.4	6.3	8.0	1.0
Others	7.7	7.6	15.4	17.1
Total	100.0	100.0	100.0	100.0

Source: Authors' calculations using the Canadian National Household Survey of 2011.

3. The ethnic composition of Ontario and British Columbia may be associated with low fertility. Ontario and British Columbia, especially the cities of Toronto and Vancouver, are major Canadian concentrations of visible minorities, especially the Chinese, who have particularly low fertility. In 2011, visible minorities constituted half of Toronto's and Vancouver's female population aged 15–49 (Table 5). Moreover, 10.3 per cent and 19.9 per cent of Toronto's and Vancouver's female population, respectively, belong to the Chinese minority group. However, Toronto and Vancouver also count large South Asian populations, which have a somewhat higher fertility. Montreal has the same percentage of its population that belongs to a visible minority group as Canada as a whole, but its composition is very different. In particular, more fertile Arab and Black visible minority groups represent a larger share of its population, but still are less preponderant in Montreal than Chinese are in Toronto and Vancouver. The reasons for the persistently low fertility rates in Ontario and British Columbia require further investigation.

Conclusion

This paper compares fertility trends in Canada and Australia. The secular trends in fertility rates are similar in the two countries, in the sense that peaks and hollows appear at about the same time, but the amplitude of the changes is more important in Canada. The baby-boom was stronger in Canada, but the baby-bust, too. Historically, Canadian fertility was higher than Australian fertility, in part because of the strong influence of the Catholic Church on French Canadians. For the last half century, however, fertility is clearly higher in Australia than in Canada, and most of the difference can be explained by the higher fertility of Australian women beyond age 30. The recuperation due to postponement in childbearing appears larger in Australia than in Canada. Cohort-completed fertility rates for the most recent cohorts show a fairly large difference of 0.2 births per woman.

It is difficult to find explanations for the observed differences. Both Canadian-born and Canadian immigrants have lower fertility rates compared to their Australian counterparts, and fertility differentials by ethno-cultural groups cannot be the reason. It can rather be argued that the stronger Australian economy and labour market, as well as better family policy benefits in Australia, may be the source of its higher fertility compared to Canada.

References

ABS (Australian Bureau of Statistics). 2015. *Births, Australia, 2014*. Catalogue No. 3301.0. Canberra: ABS.

Arunachalam, D., and G. Heard. 2015. Australians' desire for children, in *Family Formation in 21st Century Australia*, edited by G. Heard and D. Arunachalam. Dordrecht: Springer.

Beaujot, R. 2013. Quebec's family policies benefit childbearing and work. Policy Brief 2: Population Change and Lifecourse Strategic Knowledge Cluster. London: Western University. www.pclc-cppv.ca

Beaujot, R., D. Ching, and Z. Ravanera. 2013. Family policies in Quebec and the rest of Canada: Implications for fertility, child care, women's paid work and child development indicators. *Canadian Public Policy* 39(2):221–39.

Beaujot, R., and J. Wang. 2010. Low Fertility in Canada: The Nordic Model in Quebec and the U.S. Model in Alberta. *Canadian Studies in Population* 37(3–4):411–43.

Belanger, A., and S. Gilbert. 2007. The fertility of immigrant women and their Canadian born daughters, in *The Changing Face of Canada: Essential Readings in Population*, edited by R. Beaujot and D. Kerr. Toronto: Canadian Scholars' Press, p.71–86.

Belanger, A. and G. Ouellet. 2002. A comparative study of recent trends in Canadian and American fertility, 1980–1999, in *Report on the Demographic Situation in Canada, 2001*, edited by A.P. Belanger. Cat. No. 91-209-XIE. Ottawa: Statistics Canada, Ministry of Industry, p. 107–36.

Carmichael, G. 1988. *With This Ring: First Marriage Patterns, Trends and Prospects in Australia.* Australian Family Formation Project Monograph 11. Canberra: Department of Demography, Australian National University.

Carmichael, G., and P. McDonald. 2003. Fertility trends and differentials, in *The Transformation of Australia's Population 1970–2030*, edited by S-K. Khoo and P. McDonald. Sydney: UNSW Press, p. 40–76.

Caron-Malenfant, E., and A. Belanger. 2006. The fertility of visible minority women in Canada, in *Report on the Demographic Situation in Canada, 2003 and 2004*. Cat. No. 91-209-XIE. Ottawa: Statistics Canada, Ministry of Industry, p. 79–94.

Cook, H. 2000. Unseemly and unwomanly behavior: Comparing women's control of their fertility in Australia and England from 1890 to 1970. *Journal of Population Research* 17(2):127–41.

Drago, R., K. Sawyer, K.M. Sheffler, D. Warren, and M. Wooden. 2010. Did Australia's Baby Bonus increase fertility intentions and births? *Population Research and Policy Review* 30(3):381–97.

Easterlin, R. 1973. Relative economic status and the American fertility swing, in *Family Economic Behavior: Problems and Prospects*, edited by E. Sheldon. Philadelphia: J.B. Lippincott, p. 170–227.

Gebremariam, W., and R. Beaujot. 2010. Fertility behaviour of immigrants in Canada: Converging trends. PSC Discussion Paper Series 24(5), Article 1. London: Western University.

Heard, G. 2006. Pronatalism under Howard. *People and Place* 14(3):12–25.

Heard, G., and D. Arunachalam. 2015. Fertility differentials, in *Family Formation in 21st Century Australia*, edited by G. Heard and D. Arunachalam. Dordrecht: Springer.

Keyfitz, N. 1987. The family that does not reproduce itself, in *Below-Replacement Fertility in Industrial Societies: Causes, Consequences, Policies*, edited by K. Davis, M.S. Bernstam, and R. Campbell. Supplement to *Population and Development Review,* vol. 12. New York: The Population Council, p. 139–54.

Krull, C., and F. Trovato. 2003. Where have all the children gone? Quebec's fertility decline, 1941–1991. *Canadian Studies in Population* 30(1):193–220.

Langlois, S., J-P. Baillargeon, G. Caldwell, G. Frechet, M. Gauthier, and J-P. Simard. 1992. *Recent Social Trends in Quebec, 1960–1990*. Frankfurt: Campus Verlag.

Leridon, H. 2014. Les théories de la fécondité. Paris: INED.

Lesthaeghe, R. 2010. The unfolding story of the second demographic transition. *Population and Development Review* 36(2):211–51.

Lesthaeghe, R., and J. Surkyn. 1988. Cultural dynamics and economic theories of fertility change. *Population and Development Review* 14(1):1–45.

Makunovich, D. 1996. A review of recent developments in the economics of fertility, in *Household and Family Economics*, edited by P. Menchik. Boston: Kluwer Academic Publishers, p. 91–150.

McDonald, P., and R. Kippen. 2011. *Forecasting Births*. Feature Article, ABS Catalogue No. 2051.0. Canberra: Australian Bureau of Statistics.

McDonald, P., and H. Moyle. 2010. Why do English-speaking countries have relatively high fertility? *Journal of Population Research* 27(4):247–73.

McInnis, R. 1991. Women, work, and childbearing: Ontario in the second half of the nineteenth century. *Social History* 24(48):237–62.

Moyle, H. 2015. The Fall of Fertility in Tasmania in the Late 19th and Early 20th Centuries. PhD diss., School of Demography, The Australian National University. hdl.handle.net/1885/16176.

Parr, N., and R. Guest. 2011. The contribution of increases in family benefits to Australia's early 21st century fertility increase: An empirical analysis. *Demographic Research* 25(6):215–44.

Preston, S.H. 1987. Changing values and falling birth rates, in *Below-Replacement Fertility in Industrial Societies: Causes, Consequences, Policies*, edited by K. Davis, M.S. Bernstam, and R. Campbell. Supplement to *Population and Development Review*, vol. 12. New York: The Population Council, p. 155–154.

Roy, L., and J. Bernier. 2007. *Family Policy, Social Trends and Fertility in Quebec: Experimenting with the Nordic Model.* Montreal: Government of Quebec.

Sardon, J-P. 2006. Fertility in the developed English-speaking countries outside Europe: Canada, United States, Australia and New Zealand. *Population* 61(3):301–28.

Statistics Canada. nd. Population, urban and rural, by province and territory. http://www.statcan.gc.ca/tables-tableaux/sum-som/l01/cst01/demo62a-eng.htm

The Economist Intelligence Unit. 2015. *2015 Global Liveability Ranking*. London: The Economist.

Withers, G. 1979. Economic influences on marriage behaviour: Australia 1954–1984. *The Economic Record* 55:118–26.

Canadian Studies in Population 43, no. 1–2 (2016): 23–47.

Epidemiologic Transition in Australia: The last hundred years

Heather Booth[1]
Leonie Tickle
Jiaying Zhao

Abstract

Mortality change in Australia since 1907 is analysed in the light of Epidemiologic Transition theory. Australia began the twentieth century in the second age of the Epidemiologic Transition, the Age of Receding Pandemics. Australia probably moved to the third, the Age of Degenerative and Man-Made Diseases before 1946, which is slightly in advance of most Western countries. Transition to the fourth, the Age of Delayed Degenerative Diseases, is clearly marked by a downturn, in about 1970, in circulatory disease mortality, concurrent with other Western countries.

Keywords: mortality, trends, decomposition, life expectancy, differentials. Australia.

Résumé

La théorie de la transition épidémiologique sert de base pour une analyse des changements de mortalité en Australie depuis 1907. Au début du XXe siècle, l'Australie était dans la deuxième phase de la transition épidémiologique, celle du recul des pandémies. Néanmoins, l'Australie entrait probablement avant 1946 dans la troisième phase, celle des maladies dégénératives, ce qui est légèrement en avance sur la plupart des pays occidentaux. La transition vers la quatrième phase, celle des maladies dégénératives retardées, est clairement marqué par un ralentissement depuis environ 1970 dans la mortalité par maladies circulatoires, en même temps que chez d'autres pays occidentaux.

Mots-clés : mortalité, tendances, décomposition, espérance de vie, écarts, Australie.

Introduction

Australia enjoys a life expectancy that is among the highest in the world. In 2011–13, life expectancy at birth among females was 84.3 years, and 80.1 years among males (ABS 2014a). The recently-released United Nations *World Population Prospects 2015* (UNPD 2015) shows that for life expectancy at birth in 2010–15, Australian males rank eighth internationally and Australian females rank tenth. The top five ranked countries for males are Hong Kong, Iceland, Switzerland, Italy, and Israel, and for females they are Hong Kong, Japan, Singapore, Italy, and Spain.

1. Corresponding author: Prof. Heather Booth, School of Demography, The Australian National University, Canberra ACT 2601, Australia, e-mail: heather.booth@anu.edu.au; Prof. Leonie Tickle, Faculty of Business and Economics, Macquarie University, Sydney; and Dr. Jiaying Zhao, School of Demography, The Australian National University.

This paper examines changing mortality in Australia since 1907, six years after the Commonwealth of Australia was created. The focus is at the national level, with some discussion of differentials. The theoretical framework of the analysis is the Epidemiologic Transition (Omran 1971; Olshansky and Ault 1986). As noted by de Looper (2015), the more recent Epidemiologic Transition in Australia has not been addressed as such, though studies of twentieth-century mortality decline there do exist (e.g., Taylor and Lewis 1998; Taylor et al. 1998; Booth 2003). This paper remedies the omission.

The paper is organized as follows. After a discussion of Epidemiologic Transition theory and a description of the data and methods employed, the paper examines trends in life expectancy at birth and at selected ages by sex. Cause of death, in conjunction with age, is then explored through a series of decompositions of temporal change in life expectancy over the course of the lengthy period considered. The following section addresses age patterns of change and focuses on infant mortality, the adolescent and young adult mortality hump, and old age mortality. The penultimate section presents geographic, indigeneity and socio-economic mortality differentials, and the paper concludes with a discussion of the findings in relation to Epidemiologic Transition theory.

Epidemiologic Transition theory

The theory of Epidemiologic Transition (Omran 1971, 1983) describes health changes during the process of modernisation as a series of three successive stages of transition or 'Ages'. The first is the 'Age of Pestilence and Famine', characterised by low and fluctuating life expectancy in the range 20–40 years. The second is the 'Age of Receding Pandemics' when life expectancy increases steadily from an average of about 30 years to 50 (Omran 1971) or 55 (Omran 1983) years, largely as a result of less frequent epidemics and the decline of infectious diseases; the underlying causes were primarily socio-economic, 'augmented by the sanitary revolution in the late nineteenth century and by medical and public health progress in the twentieth century' (Omran 1971, reprint p.753). The third 'Age of Degenerative and Man-Made Diseases' is characterised by a slow increase in life expectancy due to the balancing effects of the disappearance of infectious diseases and the rise of 'degenerative and man-made' or non-communicable diseases such as heart disease, stroke, cancers, and external causes. At the time of publication of the theory, the general consensus was that there was a limit to life expectancy which would soon be reached (see Meslé and Vallin 2011); for example, United Nations (1975) took this limit to be 75 years.

In response to renewed mortality decline from the 1970s, Olshansky and Ault (1986) proposed a fourth 'Age of Delayed Degenerative Diseases' characterised by the decline of cardiovascular and other non-communicable diseases at increasingly older ages, due to advances in medical technology and improved health programs. Rogers and Hackenberg (1987) also proposed a fourth 'hubristic' (or 'hybristic') stage giving prominence to the decline of social pathologies arising from individual behaviour and lifestyle, which are driven by 'hubris' or notions of excessive self-confidence and invincibility. These two proposed extensions of Omran's Epidemiologic Transition theory address different aspects of the same stage.[2] The Epidemiologic Transition theory has been criticised by Robine (2001) and by Meslé and Vallin (2006), particularly in regard to the distinction between the third and fourth Ages.

Omran (1971) defined three models of Epidemiologic Transition, in recognition of the differing dates of onset and speeds of transition among countries. The Classical or Western model applies to the populations of Europe and North America. Compared with this, the Accelerated model involves

2. Proposals of fifth and sixth stages exist; these are not considered.

a more rapid transition such as occurred in Japan. The Contemporary or Delayed model applies to the populations of developing countries.

While Epidemiologic Transition theory was developed to explain global patterns, it can be used in the study of mortality decline in individual countries (e.g., Caselli, Meslé and Vallin 2002; Lussier, Bourbeau and Choinière 2008). Several exceptions to the overall theory have been identified (Caselli, Meslé and Vallin 2002). A limitation is that Omran did not provide clear guidelines to determine when successive Ages begin and end (Mackenbach 1994). It has been argued that the approach is overly broad, and that there is a need to take greater account of how population subgroups experience epidemiologic transitions differently (Gaylin and Kates 1997).

The early years of the Epidemiologic Transition in the settler[3] population of Australia have been comprehensively documented by de Looper (2015) who notes that the Age of Pestilence and Famine was absent in Australia.[4] Though there was no shortage of epidemics in the second half of the nineteenth century, famine was almost entirely absent, and life expectancy was always above the defining threshold of 40 years for transition to the second stage (Omran 1971). Thus, the second Age of Receding Pandemics characterises the start of the 'truncated' Epidemiologic Transition in Australia, confirmed by life expectancies in the 1860s of 45 years for males and 49 years for females. Further, de Looper (2015) concluded that, although there was rapid mortality decline in the period 1885 to 1903, there was no evidence of transition to the third Age of Degenerative and Man-Made Diseases because the major causes of death (infectious diseases, non-communicable diseases, and external causes) declined proportionately. Commencing in 1907, this analysis therefore begins in the second Age of Receding Pandemics.

Data and methods

Data for international trends and comparisons of life expectancies are from the Human Mortality Database (HMD 2015). The analyses use five-year averages from 1920–24 to the present. For Australia, HMD covers 1921 to 2011, so that the first period is 1921–24.The countries for comparison are Canada, England and Wales, France, Japan, and the United States, selected on the basis of high income and either historical links and cultural similarities to Australia (Canada, England and Wales, United States) or recent leading-edge mortality experience (France, Japan). HMD data are also used for the examination of trends at specific ages.

Australian cause of death data are from the Australian Institute of Health and Welfare (AIHW) General Record of Incidence of Mortality (GRIM) books (AIHW 2015a), which contain mortality rates by five-year age groups for ages 0 to 84 and for the age 85+, from 1907 to 2012. Over this period, the International Classification of Diseases underwent numerous revisions (WHO 1992), leading to inconsistencies in cause of death classification and discontinuities in time series of data. These potential problems have been largely mitigated in this analysis by considering only the major cause of death categories. The six major causes of death employed are *infectious diseases, neoplasms, circulatory diseases, respiratory diseases, external causes*, and *'all other'* causes. Note that in the early part of the century,

3. The first British settlers arrived in Australia in 1788. Comprehensive mortality data have been compiled from 1856, when registration began, by de Looper (2015).
4. Smith (1980) and Gray (1985) suggest that the historic Indigenous population was stationary prior to settlement. Therefore, this population would not have been subject to the fluctuation defining the Age of Pestilence and Famine. Thus, neither the Indigenous nor settler population appears to have experienced Omran's first Age.

many 'all other' causes of death were indicated as 'ill-defined', but this classification was reduced to near zero by 1960 (Lancaster 1990).

The cause of death analysis uses standardized mortality rates and life expectancy decomposition. Standardized mortality rates are computed by sex and the six major causes of death, using the 1981 total Australian population (both sexes) by five-year age groups as the standard. Life expectancy decomposition uses the Arriaga (1984) method to attribute differences in life expectancy at birth to mortality change by age and major cause simultaneously. To facilitate discussion of the Epidemiologic Transition, decomposition analyses were conducted for four periods:[5] 1922–46, 1946–70, 1970–94, and 1994–2011. The periods were identified on the basis of internal consistency of patterns; that they are of roughly equal length assists in their comparison.

Trends in life expectancy

Australia in international context

Figure 1 compares historic male and female Australian life expectancies at birth with those of Canada, England and Wales, France, Japan, and the United States. The upward trends confirm the experience of Epidemiologic Transition. Deaths of Australian military personnel during World War II were excluded from national mortality statistics (Taylor et al. 1998), accounting for the absence of a downward spike in male life expectancy observed for some other countries.

In 1921–24, life expectancy in Australia was the highest among the six selected countries. Figure 1 shows that for both males and females, Australian life expectancy exceeded that of the second-highest of this group by as much as four years. Over the next two to three decades, this advantage diminished, and in the 1950s and 1960s Australia fell behind other countries. In the 1960s, for males, only US life expectancy was less than Australian life expectancy, while for females Australian life expectancy was as low as any other at this time. Australian life expectancy has since recovered, ranking first among the selected group for males, and third for females, in the most recent period.

It may be observed in Figure 1 that the life expectancies of the selected countries largely converged in the 1960s. Convergence among the five Western countries persisted for about two decades, and coincided with the period when Japan overtook the Western countries. In recent decades, all six countries have tended to diverge, with differences of as much as five years occurring in the most recent decade. This pattern of convergence and divergence is consistent with wider trends (Meslé and Vallin 2011). Cardiovascular diseases, which are of key importance in the transition from the Age of Degenerative and Man-Made Diseases to the Age of Delayed Degenerative Diseases, played a dominant role in both the convergence and divergence of countries over the entire period (Meslé and Vallin 2011).

Japanese life expectancy increased rapidly in the post–World War II years, in keeping with its characterization as undergoing Accelerated Epidemiologic Transition (Omran 1971; Zhao et al. 2014). Japan has been a leader in life expectancy since the 1970s, particularly for females. In 2011, Japanese females had a 1.6 year advantage over Australian females, though Japanese males were at a slight disadvantage compared with Australian males (HMD 2015). In contrast, the United States has generally ranked last—since the mid-1960s for males, and since the early 1990s for females (Figure 1); this has been attributed to higher prevalences of smoking, obesity, and violence, as well as restricted access to health care (Caselli et al. 2014: 231).

5. 1921 was omitted owing to a large increase in that year.

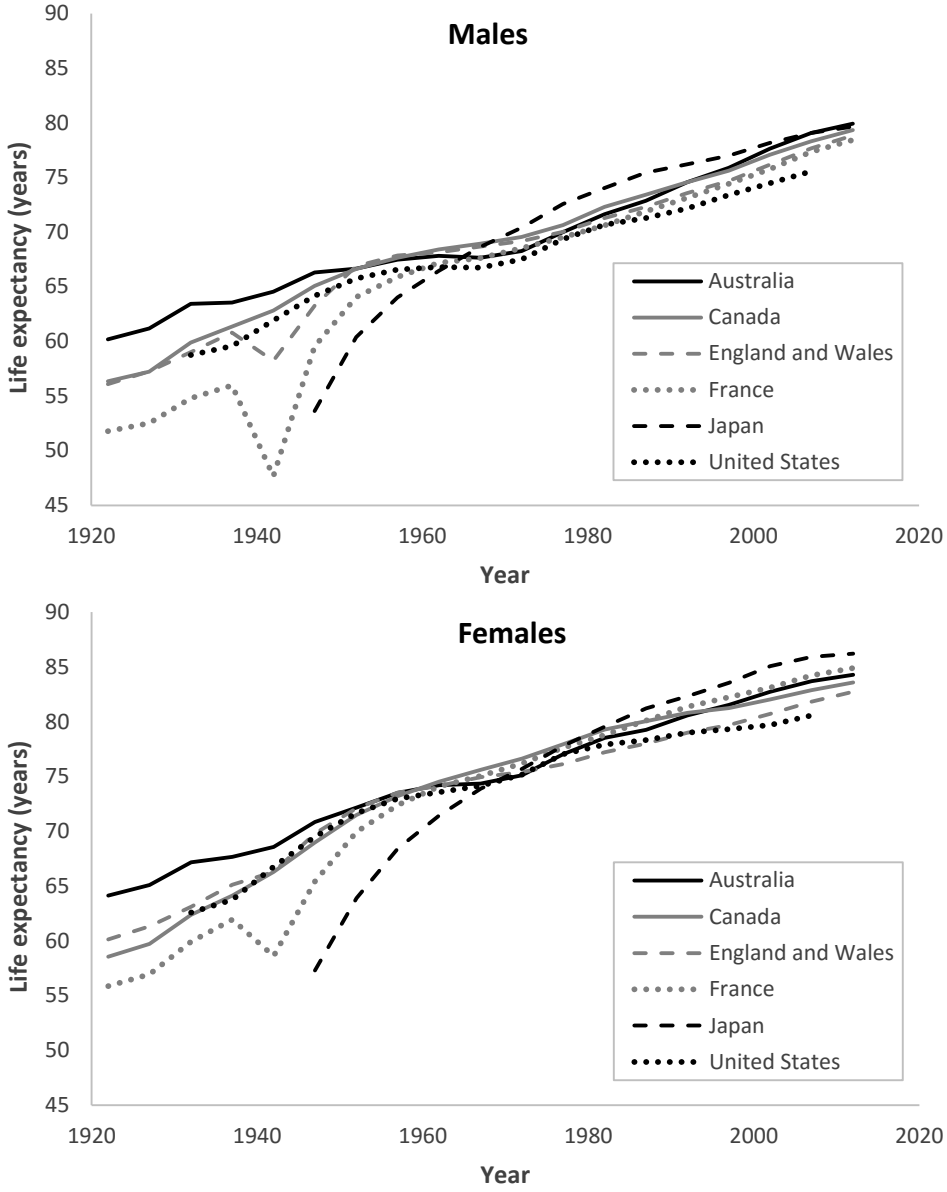


Figure 1. Life expectancy at birth for males and females, selected countries, 1920–24 to present.

Source: Human Mortality Database (HMD 2015) Life tables, five-year.

The sex difference in life expectancy at birth for the selected countries is shown in Figure 2. Ignoring war-related deviations, all countries experienced a general increase in the sex difference, followed by a downturn, as male improvements began to exceed female improvements. The turning point differs among countries, occurring first for England and Wales followed by the United States, Canada, and Australia, France, and finally (only around a decade ago) Japan. This same pattern has been found for high-income countries more generally, and has been attributed in most countries primarily to sex differences in the age pattern of mortality, rather than declining sex ratios in mortality (Glei and Horiuchi 2007). A decomposition analysis of the G7 countries over the three decades to 2000 found that the main causes of death contributing to narrowing of the sex difference were circulatory diseases and accidents, violence, and suicide (Trovato and Heyen 2006).

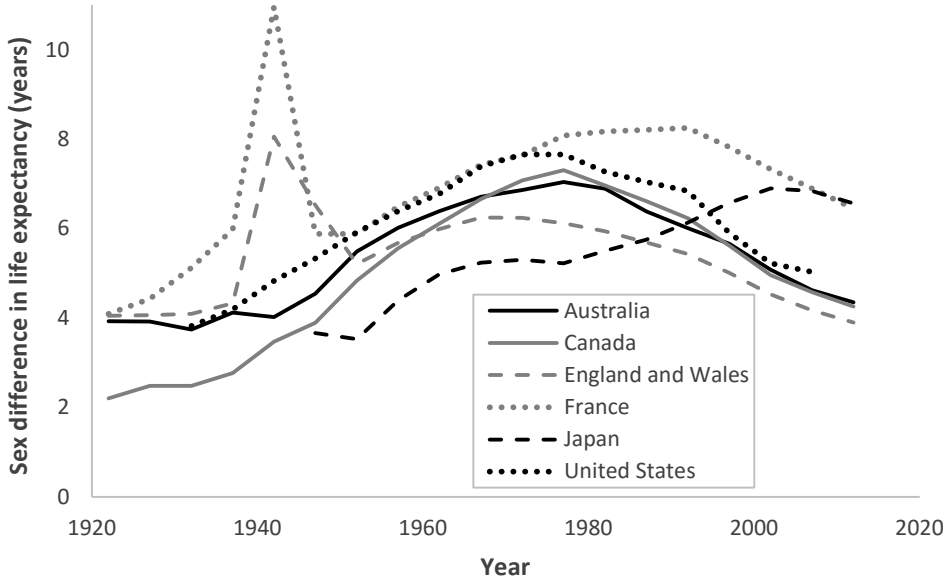


Figure 2. Sex difference in life expectancy at birth in years, selected countries, 1920–24 to present.
Source: Human Mortality Database (HMD 2015) Life tables, five-year.

Australia currently has a sex difference in life expectancy of 4.3 years; this is broadly similar to Canada, the United States, and England and Wales, and lower than France and Japan, where the turning points occurred later. In Australia, the sex difference increased from 3.9 years in 1921–24 to a maximum of 7.0 years in 1975–79, and has since declined linearly. More detailed decomposition analyses appear in Pollard (1996), Trovato and Lalu (1997), Booth (2003), and Tickle (2016).

The Australian experience

Over the period from 1921–24 to 2010–11, life expectancy at birth in Australia increased from 60.2 to 79.9 for males, an average of 2.2 years per decade, and from 64.1 to 84.3 for females, an average of 2.3 years per decade. However, as already indicated, improvements in life expectancy were not uniform over this period. After increases from 1921 to 1960 averaging 1.9 years per decade for males and 2.5 years per decade for females, mortality levels stagnated during the 1960s. The earlier, more rapid increases in life expectancy are characteristic of the second Age of Receding Pandemics, while the slow increases are characteristic of the third Age of Degenerative and Man-Made Diseases as described by Omran (1971). Mortality decline resumed in the early 1970s, with subsequent average improvement rates per decade of 3.0 years for males and 2.3 years for females. This post-1970 experience accords with the fourth Age of Delayed Degenerative Diseases, as described by Olshansky and Ault (1986).

Life expectancies for Australian males and females at ages 0, 50, 65, and 85 from 1921 to 2011 are shown in Figure 3 and Table 1. It is evident that virtually all of the improvement in male life expectancy at birth between 1921 and 1970 was due to mortality decline at ages less than 50: life expectancy at age 50 remained roughly constant over this period and actually declined during the 1930s and 1960s. In contrast, female life expectancy at age 50 improved before 1970, although the 1930s and 1960s were periods of stagnation. Since 1970, gains at the older ages have been rapid, particularly for males. This pattern is consistent with the Epidemiologic Transition, in that it describes mortality improvement as first occurring among children and young women, followed later by reductions in chronic and non-communicable diseases among older people. The age and cause-of-death groups

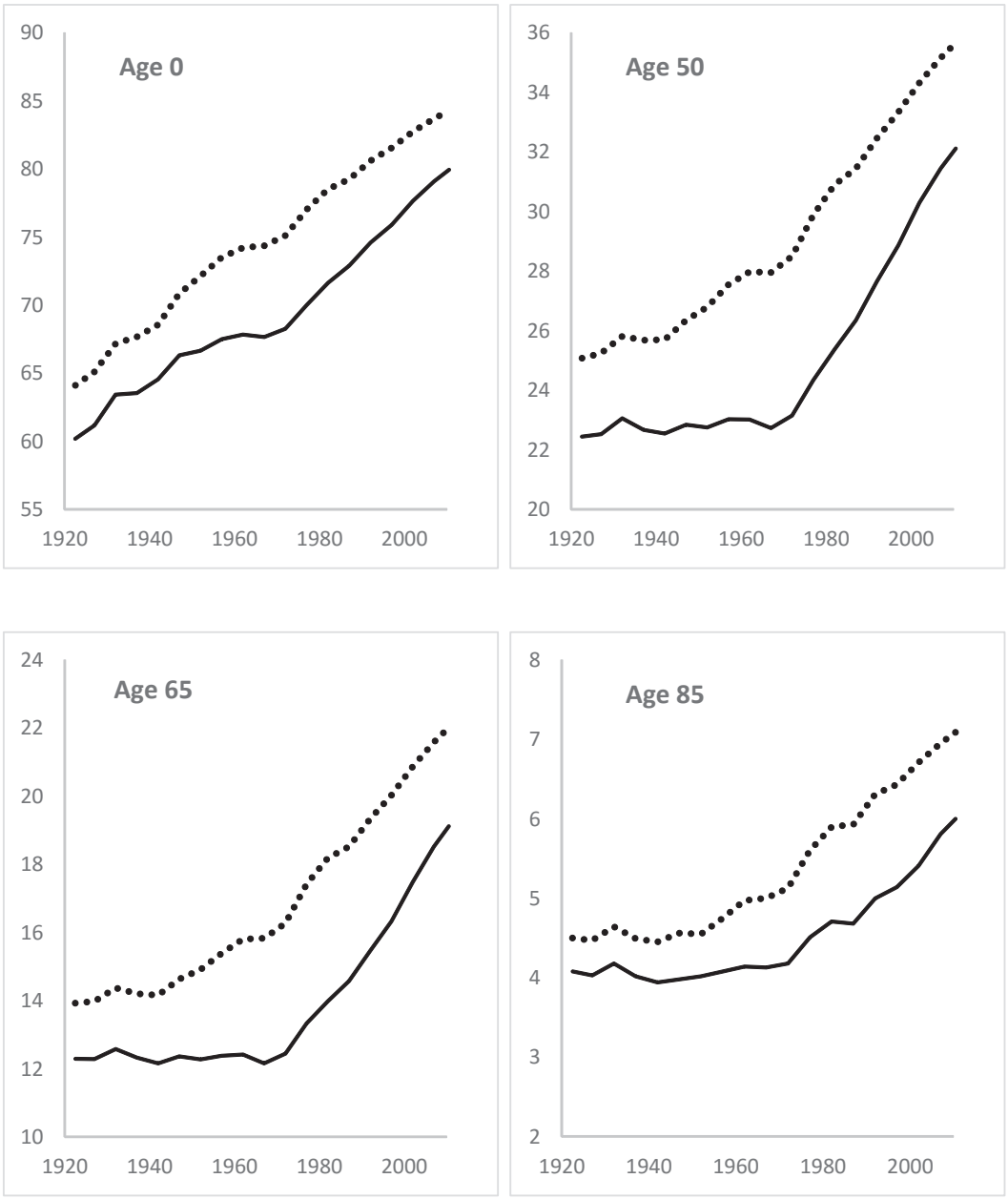


Figure 3. Life expectancy at ages 0, 50, 65 and 85 for males (solid line) and females (dotted line), Australia, 1921 to 2011.
Source: Human Mortality Database (HMD 2015) Life tables, five-year.

contributing to changing life expectancy in Australia are discussed in Section 5; for a more detailed analysis for the period since 1979, see Tickle (2016).

The widening and then narrowing pattern in the sex difference in Australian life expectancy at birth generally also applies at the older ages, as Figure 3 and Table 1 show. The sex differences in life expectancy at ages 0, 50, and 65 all increased to maxima—7.1, 5.7, and 4.2 years, respectively—at around 1980. In contrast, at the oldest ages increases in female advantage persisted longer; the sex difference in life expectancy at age 85 widened to a maximum of 1.4 years in the mid-1990s, before narrowing began.

Table 1. Life expectancy at ages 0, 50, 65 and 85 for males and females and the sex difference, Australia, selected years

	Life expectancy at											
	age 0			age 50			age 65			age 85		
Year	Male	Female	Diff.	Male	Female	Diff.	Male	Female	Diff.	Male	Female	Diff.
1922	60.9	65.1	4.2	22.6	25.3	2.7	12.4	14.0	1.6	4.1	4.5	0.4
1946	65.9	70.2	4.3	22.7	26.1	3.4	12.2	14.5	2.3	3.9	4.5	0.6
1970	67.4	74.2	6.8	22.6	27.8	5.2	12.0	15.7	3.7	4.1	5.1	1.0
1994	74.9	80.8	5.9	27.9	32.6	4.7	15.6	19.4	3.8	4.9	6.3	1.4
2011	80.0	84.3	4.3	32.1	35.7	3.6	19.2	22.1	2.9	6.0	7.1	1.1

Source: Human Mortality Database (HMD 2015) Life tables, single years of age.

Causes of death

Long-term changes in major causes of death

Australia experienced substantial changes in cause-specific mortality over the period 1907 to 2012 (AIHW 2006). Figure 4 shows that mortality from infectious diseases decreased substantially during the first half of the twentieth century: in 1907, infectious diseases accounted for 16 per cent of the total standardised mortality rate for males and 23 per cent for females, but by 1946 accounted for less than 6 per cent for both sexes, and decreased to insignificant levels by 1960. The initial decline of infectious diseases as a cause of death is characteristic of the Age of Receding Pandemics, while their ongoing decline and virtual disappearance is a characteristic of the Age of Degenerative and Man-Made Diseases. The decreasing prevalence of tuberculosis contributed significantly to the decline of infectious diseases as a cause of death in Australia.

The most recent epidemic significantly affecting Australia was Spanish Influenza, a respiratory disease. Though it began in Spain in 1918, this epidemic did not reach Australia until 1919. The occurrence of this epidemic would indicate that Australia experienced the Age of Receding Pandemics until at least 1920. Apart from this epidemic, the mortality rate from respiratory diseases generally decreased over the whole period, and in relative terms it declined from 14 per cent of the total standardised mortality rate in 1921 to 10 per cent or less since 1946. Respiratory diseases contributed substantially to excess male over female mortality, especially in the second half of the 20th century, partly as a result of smoking-related diseases such as COPD, which increased in relative terms.

The pattern of change in circulatory disease mortality involved a substantial increase, beginning in about 1920, before decline commenced, as seen in Figure 4. In 1907, circulatory diseases accounted for 19 per cent of male and 20 per cent of female mortality. For males, mortality from circulatory diseases increased to the late 1960s, reaching 54 per cent of the total standardized mortality rate in 1970. The increase for females was much less pronounced, and rates stagnated in the 1950s and 1960s, but circulatory disease still accounted for 58 per cent of the total standardized mortality rate in 1970. This pattern would suggest that the transition to the Age of Degenerative and Man-Made Diseases began in 1920 or soon thereafter. For both sexes, circulatory disease mortality declined rapidly from about 1970, marking the beginning of the transition to the fourth Age of Delayed Degenerative Diseases. Circulatory diseases remain both a leading cause of death and a leading cause of excess male mortality.

The increase in circulatory disease mortality has been attributed to high blood pressure, smoking, elevated blood cholesterol, and dietary factors (particularly the consumption of saturated fat and salt; AIHW 2000). Other risk factors include socio-economic status, obesity and physical inactivity, and the harmful use of alcohol (AIHW 2014). The decrease in circulatory diseases from 1970 has been substantially attributed to medical advances and health service improvement, as there has been little change

in physical activity levels and a significant increase in the prevalence of overweight (AIHW 2000, 2014). Thus, the Australian experience of circulatory disease is consistent with Olshansky and Ault (1986) in that the main agent for delayed non-communicable morbidity and mortality has been advances in medical technology (Weisfeldt and Zieman 2007), health care programs for the older population, and reduction of risk factors in communities. The Australian experience also supports the hubristic hypothesis of Rogers and Hackenberg (1987) in that lifestyle factors serve to limit and delimit mortality decline.

Deaths from neoplasms accounted for 8 per cent of male and 9 per cent of female mortality in 1907.[6] Though rates remained fairly constant during the first half of the century, declines in overall mortality were such that by the 1950s, neoplasms ranked second among leading causes of death. Mortality from neoplasms subsequently increased, especially among males; this has been attributed to changes in smoking behaviour, diet, and environmental factors (AIHW 2000). Despite decreases from about 1990, neoplasms have ranked first among the leading causes of death since 2005. Deaths from neoplasms currently account for around one-third of total age-standardized mortality rates. The causes of cancer are not yet fully understood, but it has been estimated that in high-income countries, smoking, alcohol use, and overweight and obesity were the most important causes at the turn of the century (Danaei et al. 2005). In terms of the Epidemiologic Transition, the Australian experience of neoplasms since 1990 is characteristic of the Age of Delayed Degenerative Diseases.

Mortality rates from external causes were fairly constant over much of the century, although changes occurred for specific external causes such as motor vehicle accidents and suicides. Rates were consistently higher for males than for females, while for both sexes decreases occurred in recent decades. The relative contribution of external causes of death to overall mortality increased slightly, especially for males. Deaths due to external causes are discussed in greater detail below.

The contribution of 'all other' causes of death to overall mortality declined substantially over time, particularly before 1950, due largely to improvements in the classification of specific conditions and an associated reduction in the 'ill-defined' causes (Lancaster 1990). It is clearly the case that if these deaths had been otherwise classified, the early pattern of mortality decline by cause of death could have looked somewhat different. This observation extends to the causes of excess male over female mortality, most of which is attributed to all other causes in the early part of the period (Figure 4).

These trends in 20th-century Australian mortality rates by major cause of death are broadly similar to those in other Western countries (Meslé and Vallin 2011; Zhao et al. 2014; Bourbeau and Ouellette 2016; this volume). The decline in infectious disease mortality and the timing of Spanish Influenza were contemporaneous across countries. As noted, the transition to the Age of Degenerative and Man-Made Diseases began in Australia in 1920 at the earliest. The increase in circulatory disease mortality also began in about 1920, though it is unknown to what degree improved classification influenced the early trend. It is clear that mortality levels stagnated during the 1960s, due to the combined effect of declining infectious disease mortality and, until around 1970, increasing circulatory disease mortality (Taylor et al. 1998). This pattern of counterbalancing causes of death is characteristic of the third Age of Degenerative and Man-Made Diseases, as described by Omran (1971). The ensuing rapid decline in circulatory disease mortality, combined with declines in respiratory disease mortality from the 1970s, and with declines in deaths from neoplasms from the 1990s, marked the transition to the Age of Delayed Degenerative Diseases, when life expectancy resumed its increase. This decline in circulatory disease mortality was more pronounced in Australia than in other Western countries, including Canada and the US (Barbieri and Ouellette 2012) and England and Wales (Griffiths and Brock 2003).

6. These are probably underestimates as in 1907 the diagnosis and certifying of cause of death for cancer was problematic.

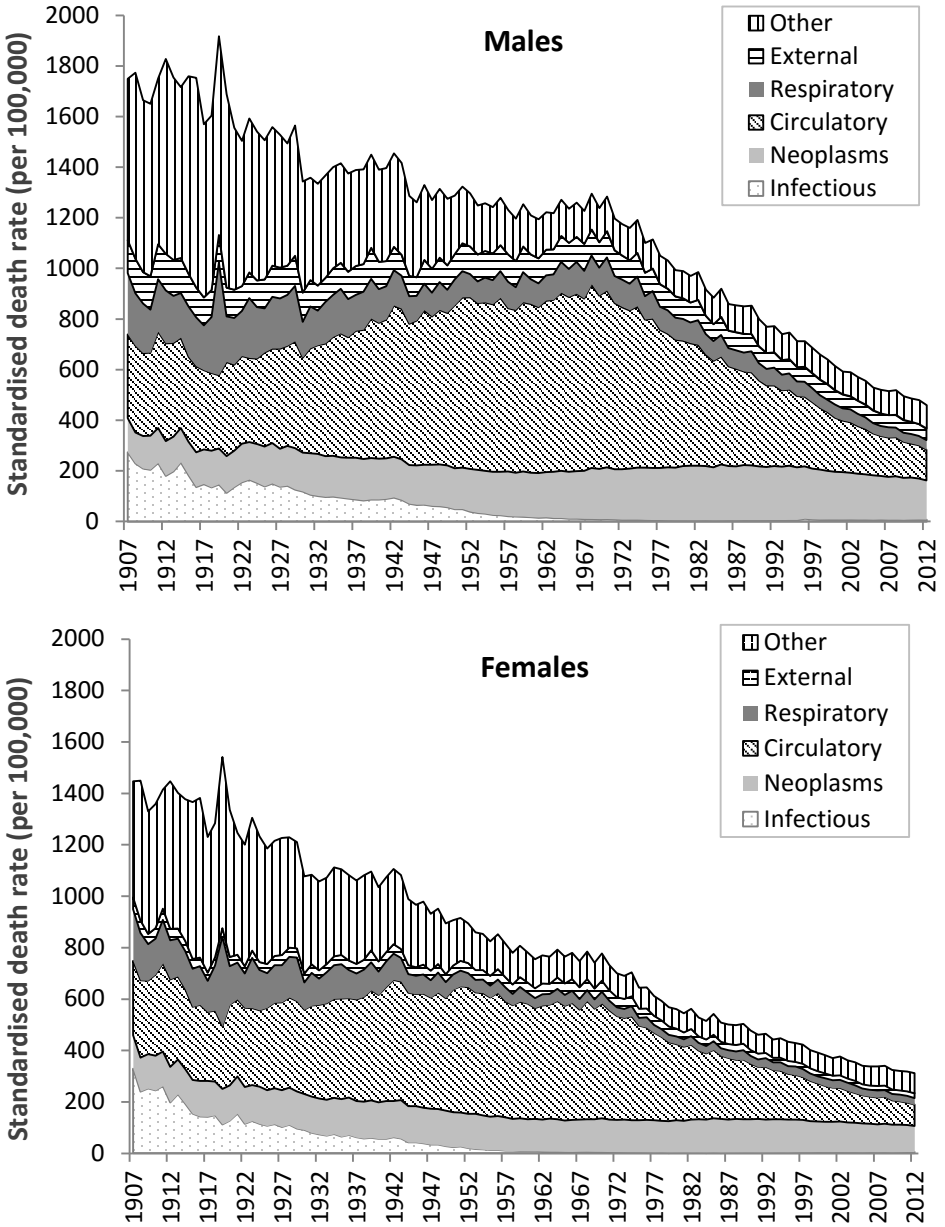


Figure 4. Standardized mortality rate (per 100,000) for males and females by major cause of death, Australia, 1907 to 2012.

Source: Authors' calculations based on data from AIHW (2015a).

Contribution of changes in age-cause-specific mortality to changes in life expectancy at birth

To further identify the roles of the six major causes of death by age group during the Epidemiologic Transition, decomposition analyses of changes in life expectancy were conducted for the four selected periods (see the section on 'Data and methods'). Life expectancies for relevant years are shown in Table 1. The decompositions by age and cause of death are shown in Figure 5 for males and Figure 6 for females.

From 1922 to 1946, life expectancy increased by 5.0 years for both sexes. Mortality reductions at ages 0 to 4 were responsible for a life expectancy gain of 2.6 years for males and 1.9 years for females, half of which was attributable to infectious diseases. Reductions in infectious and respiratory disease mortality at ages 5 and older also contributed to the life expectancy gains, but at older adult ages were counterbalanced by increases in circulatory disease mortality (see Figures 5 and 6). Thus, ages 65 and older for males and 85 and older for females contributed negatively to the life expectancy gains.

In terms of the contribution of deaths from different causes to the increases in life expectancy, infectious diseases contributed 2.3 years for males and 2.1 years for females, while respiratory diseases contributed 1.1 years for males and 0.9 years for females. In contrast, rising circulatory disease mortality at ages 45 and older produced negative contributions of 1.5 years for males and 1.0 year for females. It is noted that reduced deaths from all other causes (which were partly due to better classification) made substantial positive contributions in this period, particularly for females; this may account for some of the negative contribution of circulatory disease mortality (Lancaster 1990). In terms of the Epidemiologic Transition, this analysis would indicate that 1922–46 was the period of transition from the Age of Receding Pandemics to the Age of Degenerative and Man-Made Diseases. The substantial increase in life expectancy over this period would, however, indicate that the transition occurred rather late in the period.

The changes in life expectancy from 1946 to 1970 are smaller than those occurring in the previous period, and differ substantially by sex: life expectancy for females increased by 4.0 years, while that for males increased by only 1.6 years (Table 1). Again, the mortality decline at ages 0 to 4 contributed significantly to the overall increase in life expectancy—by 1.2 years for both sexes. The large sex difference in the net gain in life expectancy is accounted for by a much larger decrease in female than male mortality at ages 15 and older. For males, an increase in circulatory disease mortality (occurring at ages 35 and older) resulted in an overall 0.6-year loss of life expectancy, while an increase in deaths from neoplasms accounted for a 0.4-year loss. In contrast, for females, reduced deaths from circulatory diseases (except at ages 75 and older) and neoplasms contributed to overall gains of 0.3 and 0.2 years, respectively. Further, the life expectancy gains due to respiratory disease mortality were larger for females than for males. Deaths from external causes contributed negatively to the change in life expectancy for both sexes, particularly among males and those aged 15 to 29, attributable to the emergence of the accident hump. Again, reduced deaths from all other causes contributed substantially and positively to life expectancy. During this period, Australia exhibited characteristics of the Age of Degenerative and Man-Made Diseases, especially among males for whom circulatory, respiratory, and external causes—associated with lifestyle and man-made factors such as smoking and motor vehicles—were key. While female mortality was less affected by such factors and continued to decline, albeit at a slower pace than previously, male mortality stabilized and at some ages increased. For both sexes, as shown in Figure 4, non-communicable diseases became dominant, with circulatory diseases becoming the primary killer.

The period 1970–94 was one of renewed acceleration in mortality decline, with life expectancy increasing by 7.5 years for males and 6.6 years for females. The decline in mortality at ages 0 to 4 contributed 1.3 years for males and 1.0 year for females, but these were no longer dominant. Declines at ages 45 to 84 made much larger positive contributions to life expectancy, primarily due to reduced circulatory disease mortality, but also due to reductions in respiratory disease mortality. Mortality from external causes also declined, notably among males aged 15 to 24, contributing to higher life expectancy. In contrast, mortality from neoplasms at ages 65 and older made a small negative contribution to life expectancy, 0.1 years for both sexes. This pattern of change is consistent with the

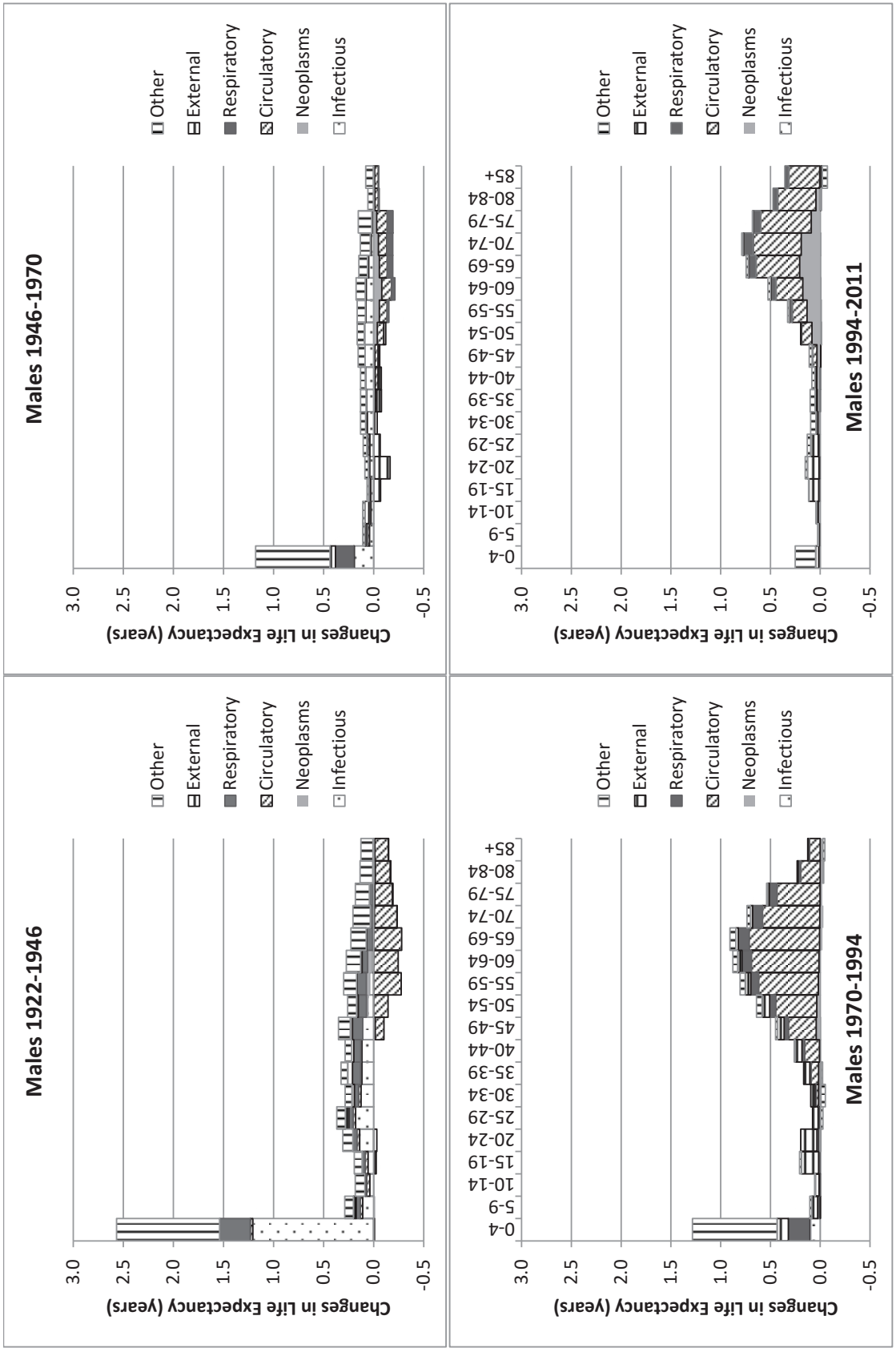


Figure 5. Decomposition of change in life expectancy by period, age and cause of death, males, Australia, 1922 to 2011
Source: Authors' calculations based on data from AIHW (2015a).

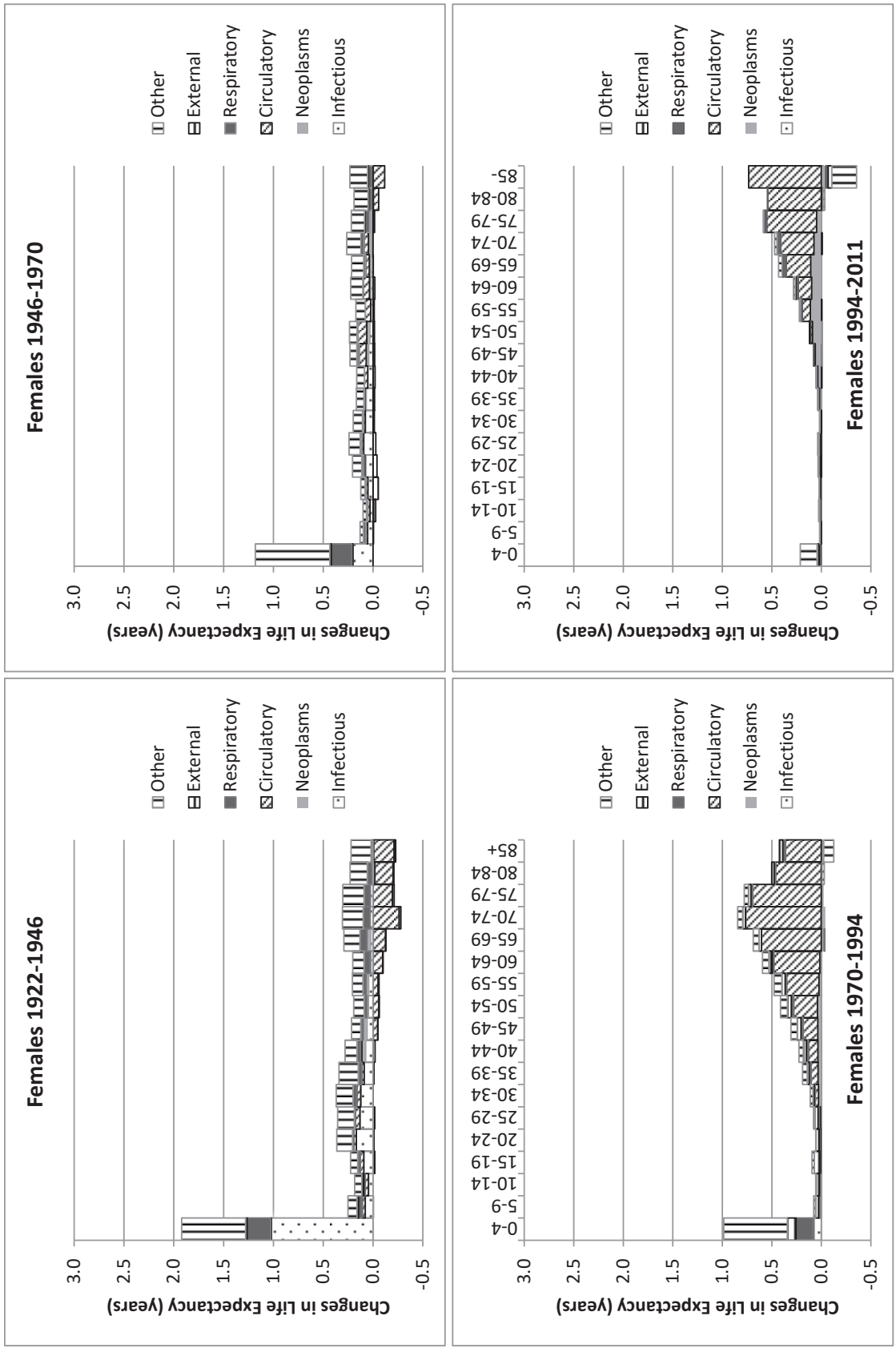


Figure 6. Decomposition of change in life expectancy by period, age and cause of death, females, Australia, 1922 to 2011.
Source: Authors' calculations based on data from AIHW (2015a).

Age of Delayed Degenerative Diseases, which is characterised by a significant decline in circulatory disease mortality (Olshansky and Ault 1986). In Australia, fully 4.3 years of the net gain in both male and female life expectancy was due to reduced deaths from circulatory diseases.

During the final period considered, 1994–2011, life expectancy increased by 5.1 years for males and 3.5 years for females. These increases were mainly attributable to declines in mortality at advanced ages. Indeed, life expectancy at age 65 increased by 3.0 years for males and 2.4 years for females. In terms of causes of death, circulatory diseases were still the primary contributor, accounting for 2.7 years for males and 2.6 years for females. In contrast to the previous period, reduced mortality from neoplasms—mainly at ages 50 to 79 years for males and 45 to 74 for females—contributed positively to changes in life expectancy, though rates continued to increase at older ages. This pattern is consistent with the notion of delayed non-communicable diseases. For males, reduced mortality from respiratory diseases, mainly at older ages and from external causes at young ages, each produced a gain of 0.4 years in life expectancy, while for females, smaller gains of 0.2 and less than 0.1 years, respectively, were produced. The emergence of a loss in life expectancy due to 'all other' causes at age 85 and older, particularly for females, is due to the increased incidence and better reporting of neurological diseases such as dementia.[7] Generally, over this period, the patterns of change in the major causes of death are characteristic of the Age of Delayed Degenerative Diseases, in that the rapid decline in death rates is concentrated mostly at advanced ages (Olshansky and Ault 1986).

Comparison of the four decompositions throws further light on the evolution of the Epidemiologic Transition in Australia. Being chosen on the basis of internal consistency of age-by-cause patterns, these time periods help to identify the processes taking place in the transition. Comparing 1922–46 and 1946–70, it is clear that circulatory disease mortality was more important in the earlier period in limiting life expectancy gains. During this period, gains due to infectious disease mortality, which was concentrated at ages 0 to 4, were counterbalanced by losses due to circulatory disease mortality at older ages. Thus the transition moved into the Age of Degenerative and Man-Made Diseases during this period. For male mortality, the decomposition for 1946–70 shows not only a continuation of this pattern but also life expectancy losses due to increased mortality from external cause (see below subsection on the adolescent and young adult mortality hump), and from neoplasms and respiratory diseases, both of which are associated with smoking. The near-absence of these losses in female life expectancy during this period is largely attributable to the later and more-restricted uptake of smoking among females (AIHW 2000).

It is clear from comparison of the decompositions for 1946–70 and 1970–94 that 1970 marked a turning-point in cause-of-death patterns in Australia. Pre-1970 life expectancy losses, due principally to circulatory disease mortality, became large positive post-1970 gains. Thus, 1970 can be regarded as a watershed between the Age of Degenerative and Man-Made Diseases and the Age of Delayed Degenerative Diseases. Comparison of the decompositions for 1970–94 and 1994–2011 demonstrates how gains in life expectancy due to circulatory disease mortality have moved to older ages, which is a characteristic of the Age of Delayed Degenerative Diseases. Comparison of males with females in 1970–94 and 1994–2011 shows that female gains occur at older ages than male; given higher female life expectancy, this is consistent with the Age of Delayed Degenerative Diseases, in which deaths are progressively delayed. In general terms, it can be said that the Epidemiologic Transition is more advanced for females than for males.

7. Alzheimer's disease was introduced into the ICD in 1979.

Age patterns of change

The broad theoretical approach of the Epidemiologic Transition is complemented in this section using two approaches. First, age patterns of mortality change are examined over time. Second, we focus on three ages that are important in determining the shape of the mortality schedule and the evolution of life expectancy: these are *infancy, adolescence and young adulthood*, and *older age* (or *senescence*).

The age patterns of mortality change themselves change over time. This is seen in Figure 7 which shows the average annual percentage decline in age-specific mortality rates for the four selected time periods. These curves are similar to the overall patterns shown in Figures 5 and 6, but enable direct comparison by age and period in the speed of decline.

In 1922–46, mortality decline was most rapid at childhood (but not infant) ages and at about age 30. In contrast, there was very little change at older adult ages, where in fact some increases occurred, especially for males. This echoes the counterbalancing trends in infectious and circulatory diseases, and provides supporting evidence that the transition to the Age of Degenerative and Man-Made Diseases occurred during this period.

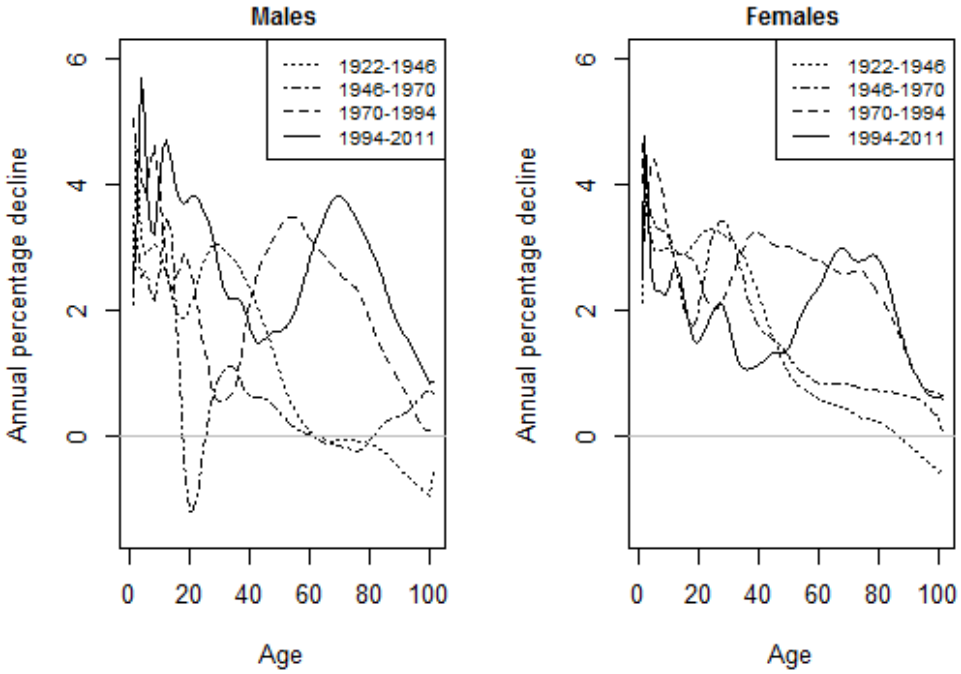


Figure 7. Average annual percentage decline in age-specific mortality rates by sex by period, Australia, 1922 to 2011.

Source: Authors' calculations based on data from HMD (2015).

The second period, 1946–70, is notable for the substantial sex difference in the patterns of mortality decline at adult ages. Though for both sexes the rate of decline was relatively low at age 20, for males the rate was negative around this age, indicating increased mortality that, in combination with modest increases at older ages, resulted in the mortality stagnation of the last decade or so of this period. At older ages, negative rates of decline for males reflect the increasing mortality from circulatory and respiratory diseases and neoplasms that characterizes the Age of Degenerative and Man-Made Diseases. Infant and early childhood mortality declined relatively slowly during this period, again consistent with the Age of Degenerative and Man-Made Diseases.

In 1970–94, infant and childhood mortality resumed a more rapid decline. At post-childhood ages, the most rapid declines occurred at ages 40 to 80 among females and at 50 to 60 among males. This was the period when circulatory disease mortality declined rapidly and life expectancy increases resumed, indicative of transition to the Age of Delayed Degenerative Diseases, as described by Olshansky and Ault (1986). The fact that little change occurred at ages 20–30, especially among males, supports the hubristic hypothesis of Rogers and Hackenberg (1987).

Finally, in 1994–2011, the most rapid declines in adult mortality were at ages 50 to 90 years. The rapid shift of the modal age of mortality decline is a characteristic of the Age of Delayed Degenerative Diseases. While high rates of decline still occurred in infancy and early childhood, they apply to very low rates, reducing their overall impact.

Infant mortality

In common with high-income countries generally, over the last century rapidly declining infant mortality accounted for a very significant component of the increase in Australian life expectancy at birth. This was particularly so during the earlier part of this period, when Australia experienced a rapid decline in infectious disease mortality. de Looper (2015, Chapter 7) noted that deaths in infancy occurred at a rate of about 1 in 10 in 1900, and that they declined sharply after 1903, thanks largely to social and environmental factors.

Figure 8 shows the infant mortality rate, defined as annual deaths of infants under one year of age per 1,000 live births in the same year, over the period 1921–2011. While the decline has been fairly continuous, more rapid declines occurred in the early 1940s—following the introduction of sulfa drugs in the 1930s to combat infection, notably in childbirth—and again in the mid-to-late 1970s—coincident with both the introduction of the Medibank (now Medicare) universal health insurance scheme (Taylor and Lewis 1998) and the operation of new neonatal intensive care units (Taylor and Lewis 1998). By the mid-1970s, infant mortality rates had declined to one-quarter of 1921 levels, and by 2011 to only 6 per cent of 1921 levels. Infant mortality rates in Australia are now such that over 99.5 per cent of infants survive to their first birthday. Although further dramatic reductions are therefore not possible, scope for significant gains is indicated by even lower rates in numerous countries—including Singapore and Hong Kong, where current infant mortality rates are less than half of those in Australia (UNPD 2015). It is noted, however, that many among these countries do not have remote or inaccessible areas such as those in Australia, and are therefore in a better position to deliver universal health services and risk factor reduction programs.

Adolescent and young adult mortality hump

A notable feature of changing Australian mortality over the last century was the appearance and subsequent diminution of the so-called *accident hump* at late teenage and early adult ages. Figure 9 illustrates this phenomenon, showing the emergence of a pronounced hump for males in the 1960s and 1970s[8] and its transformation into a plateau or 'shoulder' by the early 1990s, and the later emergence of a much smaller accident hump for females (Pollard 1996). Since the early 1990s, mortality rates have declined further at all ages, and the plateau shape has been retained. It is questionable whether this feature will persist or eventually disappear. It is noted that historic mortality patterns do not display this feature, and that for Swedish females it has all but disappeared (Booth and Tickle 2008).

8. The main increase (for males) or stagnation (for females) in the probability of death occurred in the 1960s.

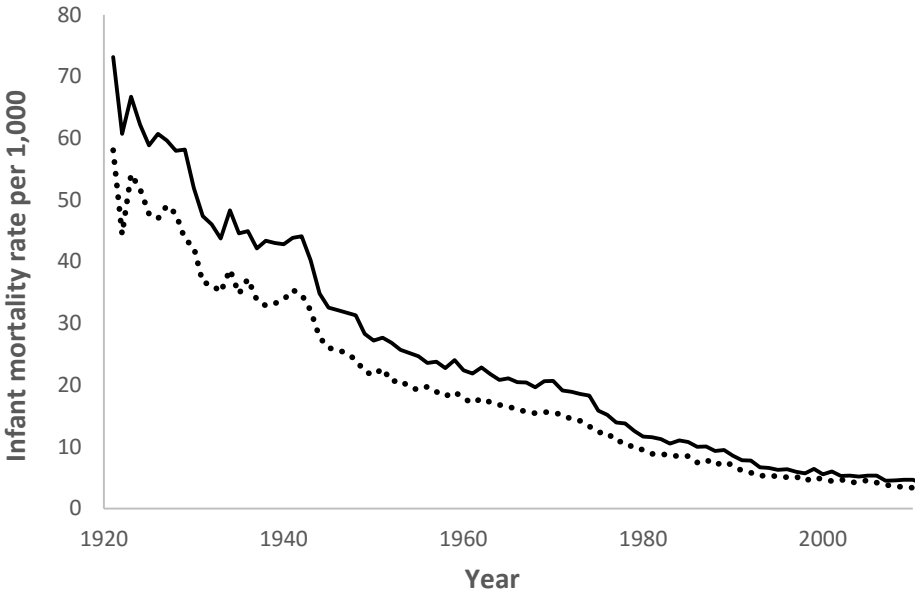


Figure 8. Infant mortality rate per 1,000 live births for males (solid line) and females (dotted line), Australia, 1921 to 2011.
Source: Human Mortality Database (HMD 2015), Births and Deaths, single year.

Pollard (1996) found that the factors behind the change in the Australian male accident hump included a decline in motor vehicle accident mortality in late teenage and early twenties, due to public health measures—including seat belt and random breath testing legislation—as well as improvements in road systems and in vehicle design. Thus, the accident hump is a feature of the Age of Degenerative and Man-Made Diseases, and its diminution may be viewed as characteristic of the Age of Delayed Degenerative Diseases.

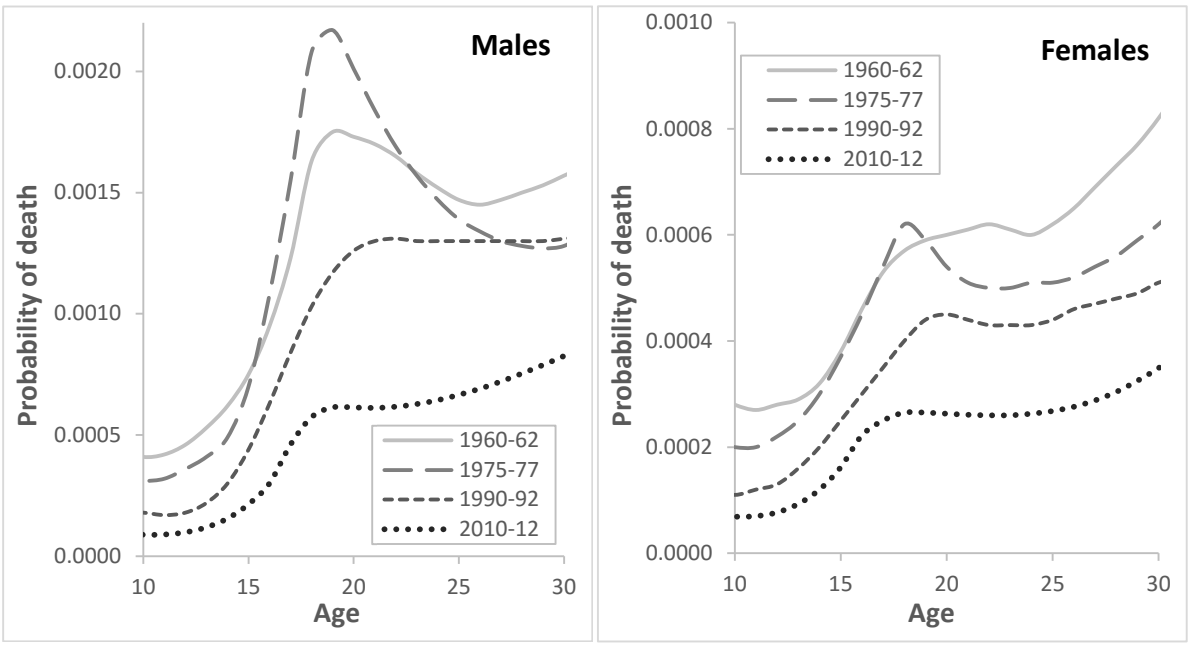


Figure 9. Probability of death at ages 10 to 30 for selected periods for males and females, Australia.
Source: Australian Government Actuary Australian Life Tables (various dates).

Mortality at advanced ages

One of the remarkable features of the Australian mortality transition is the speed at which mortality at advanced ages has declined in recent decades. It has already been demonstrated in Figure 7 that the most rapid rates of decline moved to older ages over time, and that rates of decline at older ages increased substantially. This transition was underway in 1970–94, and by 1994–2011, mortality at ages 50 to 90 was declining rapidly. Such a pattern of change is characteristic of the Age of Delayed Degenerative Diseases (Olshansky and Ault 1986). Figure 7 also shows that in the two most recent periods, the speed of decline at advanced ages (80 years and older) is very similar for males and females, which is also characteristic of this Age. Additionally, Figures 5 and 6 have demonstrated that deaths due to non-communicable diseases—circulatory diseases and neoplasms—have shifted to progressively older ages, which is also characteristic. This is further evidence that the Australian mortality experience from about 1970 is consistent with the Age of Delayed Degenerative Diseases.

Differentials in mortality

Though the Epidemiologic Transition is concerned with broad developments, usually addressed at the national level, the Age of Degenerative and Man-Made Diseases and the Age of Delayed Degenerative Diseases may be experienced at different speeds or times by different subpopulations within a nation. As noted by Caselli, Meslé, and Vallin (2002), the later stages of the transition depend progressively on personal responsibility for one's own health. Many public health messages, initiatives, and services are effective only to the degree of personal compliance. Education, income, occupation, residential environment, and cultural factors all play important roles in health and health behaviour, influencing diet, physical activity, smoking, alcohol consumption, and risky behaviour (AIHW 2014). Government also plays a role through legislation, taxation, and the creation of equitable health-promoting environments. In Australia, substantial differentials in mortality can be found by geographic area and by socio-economic characterization of area, but the largest differential is by indigeneity. This section examines three sources of heterogeneity in mortality based on life expectancy at birth: states and territories, indigeneity, and socio-economic factors.

Mortality for states and territories

Australia consists of six states—New South Wales (NSW), Victoria, Queensland, Western Australia, South Australia, and the island state of Tasmania—and two territories, the Northern Territory and the Australian Capital Territory (ACT).[9] Life expectancy at birth by state and territory since 1971 is shown in Figure 10.

For males, ACT residents clearly have the highest life expectancy at birth, with a consistent advantage over the next-ranked state or territory, averaging just less than one year since the early 1980s. NSW, Victoria, Queensland, South Australia, and Western Australia are ranked next and have similar levels of male life expectancy, differing by at most one year since the early 1990s. Tasmania currently lags behind the lowest of this group by about one year, and there is then a gap of four years to the Northern Territory. For females, similar patterns apply, but the ACT has a smaller lead, Tasmania has a larger lag, and the Northern Territory is currently three years below Tasmania. These patterns of mortality decline indicate that the Epidemiologic Transition in Australia is led by the ACT, with the Northern Territory being a significant laggard.

9. The ACT is a small territory enclaved within NSW and containing the capital city, Canberra.

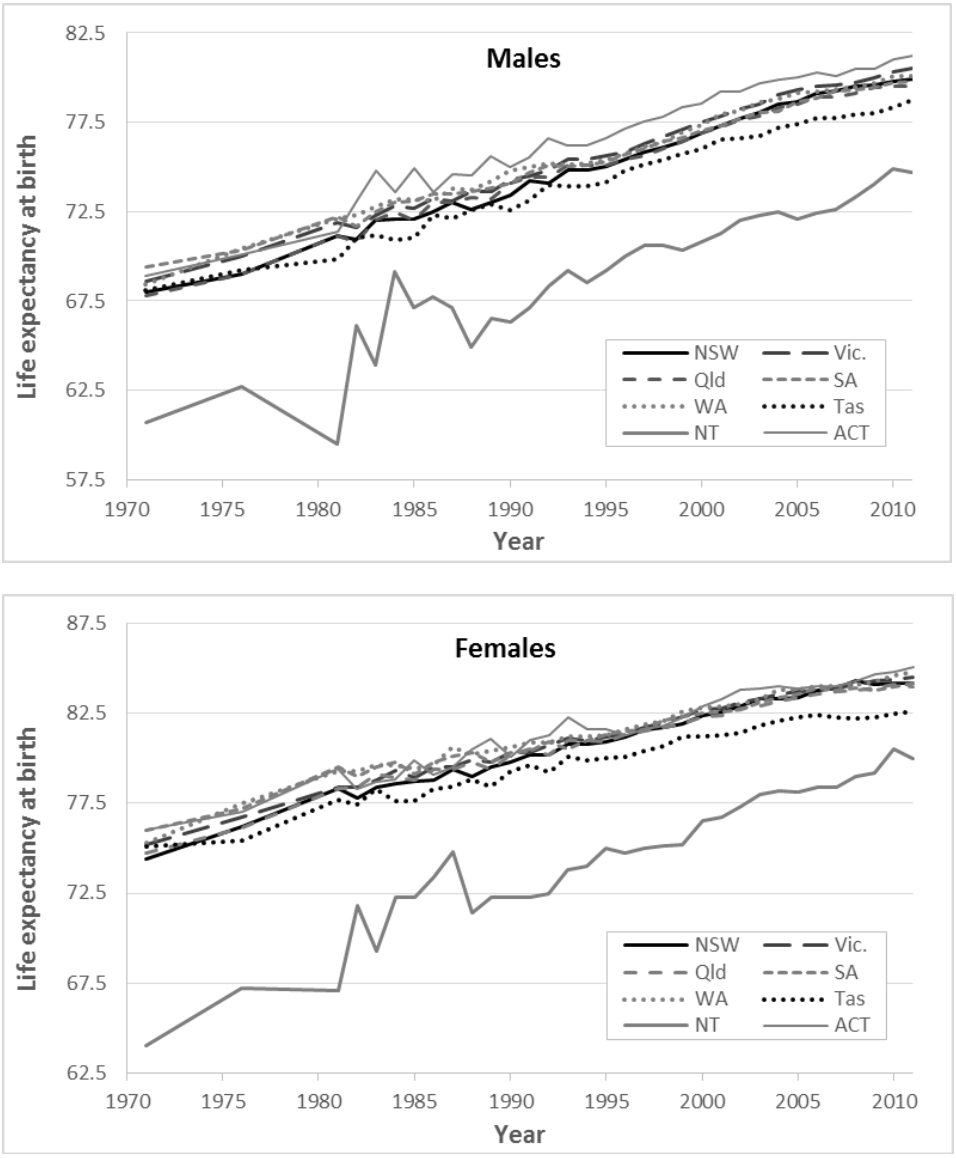


Figure 10. Life expectancy at birth (years) for males and females by state/territory, Australia, 1971 to 2012

Source: Australian Bureau of Statistics (2014b). Figures for 1971 to 1993 are for single years; figures for 1994–2012 are three-year averages.

It is also seen in Figure 10 that the gap in life expectancy between the Northern Territory and other states and territories has narrowed considerably for females. Compared with the Australian average, Northern Territory life expectancy for females was about 10 years lower in the 1970s and is currently about four years lower. For males, there is much less narrowing in evidence, and the gap between the Northern Territory and the Australian average has remained at roughly six years since the 1990s. For both sexes, Northern Territory mortality in 2011was equivalent to that experienced in 1990–95 in other parts of Australia.

A number of factors account for the state and territory differences. Low life expectancy in the Northern Territory reflects at least in part a relatively high proportion of Indigenous (Aboriginal and Torres Strait Islander) peoples, and a significant proportion of the Australian population living in

remote areas. Indigenous mortality is higher than non-Indigenous mortality (see subsection on 'Indigenous mortality'), while mortality in remote areas generally exceeds that in regional areas, which in turn generally exceeds that in major cities (AIHW 2003). Indigenous mortality is a major contributor to higher mortality in remote areas; and people living in regional and remote areas tend to have lower levels of access to health services (AIHW 2007a). Socio-economic factors are also relevant to state and territory differences: for example, that average weekly adult full-time earnings are highest in the ACT and lowest in Tasmania (ABS 2015) accords with observed mortality differentials.

Indigenous mortality

There is a very large gap between Indigenous and non-Indigenous life expectancy. Indeed, in 2009, the Council of Australian Governments (COAG) adopted, among a number of targets to address Indigenous disadvantage, the intention 'to close the life expectancy gap within a generation' (COAG 2009).

Assessment of the gap in life expectancy between Indigenous and non-Indigenous peoples is problematic because of unreliable estimates of Indigenous life expectancy. Both deaths and population data suffer from problems in the reporting of indigeneity: Indigenous deaths may not be identified as Indigenous by the family, health worker, or funeral director, while Indigenous population counts vary according to changes in the propensity to identify as Indigenous (AIHW 2015b). The Australian Bureau of Statistics makes allowances for this, based on an Indigenous deaths and census records linkage study (ABS 2014c); others have linked death records and hospital and other data to obtain different estimates (Neville et al. 2011; AIHW 2015b; Madden et al. 2012). The Australian Institute of Health and Welfare recently estimated the indigeneity gap as 10.6 years for males and 9.5 years for females (AIHW 2015b).

This ten-year difference between Indigenous and non-Indigenous life expectancy places the Indigenous population at mortality levels experienced by the non-Indigenous population some 30 to 40 years ago (see Figure 3, noting that the Indigenous population comprises less than 3 per cent of the total population of Australia). In other words, Indigenous life expectancy is equivalent to that experienced by the non-Indigenous population in the 1970s. Two-thirds of the gap in life expectancy is estimated to be due to deaths from circulatory diseases, endocrine, metabolic and nutritional disorders (including diabetes), cancer, and respiratory diseases (AIHW 2015b). This suggests that the Indigenous population may still be experiencing the third stage of the Epidemiologic Transition—the Age of Degenerative and Man-Made Diseases—and may be best described as undergoing Delayed Epidemiologic Transition (Omran 1971).

Socio-economic and geographic differentials

The collection of data on the characteristics of deceased persons at time of registration of death is not comprehensive in Australia, limiting the availability of data on socio-economic and other differentials in mortality. The method adopted by official agencies for measuring socio-economic differentials relies on area-based socio-economic indices (SEIFA) constructed from census data (ABS 2013). These indices are used to classify geographic areas (generally postcodes) into the quintiles of the socio-economic distribution. As both deaths and population estimates are available by geographic area, the SEIFA scores enable the estimation of mortality differentials. This method involves inaccuracies, in that the SEIFA score is an average for the area and cannot reflect the range of personal socio-economic characteristics in the area.

Table 2. Life expectancy by sex by socio-economic quintile and remoteness, Australia, 2003

	Males	Females	Persons	Sex difference
Socio-economic quintile				
High	80.9	84.5	82.7	3.6
Moderately high	79.0	83.5	81.2	4.5
Average	77.7	82.7	80.2	5.0
Moderately low	77.4	82.8	80.0	5.4
Low	76.9	82.3	79.6	5.4
Remoteness				
Major cities	78.8	83.5	81.2	4.7
Regional	77.5	82.7	80.0	5.2
Remote	75.4	81.5	78.1	6.1
Australia	78.3	83.2	80.7	4.9

Source: AIHW (2007b) Chapter 5.

Table 2 shows life expectancy by socio-economic quintile for 2003[10] (AIHW 2007b). The gradient in mortality by socio-economic quintile demonstrates that the Epidemiologic Transition is led by higher socio-economic areas. The difference in life expectancy between the low and high socio-economic quintiles is greater for males (4.0 years) than for females (2.2 years). Further, the sex difference in life expectancy at the low socio-economic level (5.4 years) is greater than at the high socio-economic level (3.6 years). The Epidemiologic Transition is least advanced among low socio-economic males.

Table 2 also shows life expectancy differences by geographic area: major cities, regional areas, and remote areas. The major city–remote area differences are 3.4 years for males and 2.0 years for females; these are smaller than the socio-economic differences. Sex differences in remote and regional areas are larger than in major cities. These differences demonstrate that the Epidemiologic Transition is led by major cities, and that males in remote areas lag considerably.

Discussion

This analysis has found that the Australian mortality experience over the last hundred years is broadly consistent with the second and third Ages of the Classical or Western model of the Epidemiologic Transition defined by Omran (1971, 1983) and with the fourth Age of Delayed Degenerative Diseases, as described by Olshansky and Ault (1986) and Rogers and Hackenberg (1987). However, the relatively high life expectancy in the early decades of the twentieth century is somewhat anomalous in the Epidemiologic Transition framework.

As noted, the first Age of the Epidemiologic Transition was essentially absent in Australia. From first settlement in 1788, health and mortality conditions were best described as characteristic of the second Age of Receding Pandemics. After a slow decline between the mid-1850s and mid-1880s, mortality declined more rapidly. Based on cause of death analysis, de Looper (2015) concluded that there was no evidence of epidemiologic transition before 1906.

By the early 1920s, Australia enjoyed a life expectancy close to the highest in the world. In 1921–24, life expectancy exceeded the threshold for transition to the Age of Degenerative and Man-Made Diseases by as much as ten years, suggesting a more advanced transition than in other Western populations, where the Age of Receding Pandemics is generally viewed as continuing until mid-century

10. These area-based analyses of mortality are not routinely available.

(e.g., Robine 2001; Lussier et al. 2008). Further, what was to be Australia's last epidemic—Spanish Influenza in 1919—could be seen as having been precipitated by the particular circumstances of the First World War and its aftermath, and the widespread movement of people in 1918–19 (Oxford et al. 2005), such that the Age of Receding Pandemics was exceptionally prolonged.[11]

The analyses in this paper provide partial support for the proposition of a relatively advanced Epidemiologic Transition in Australia, but not to the extent implied by life expectancy levels. During 1922–46, significant decreases in infectious and respiratory disease mortality occurred, as well as substantial increases in circulatory disease mortality. While Figure 4 shows increasing circulatory disease mortality from about 1920, it is possible that this trend is influenced by the improved classification of cause of death (Lancaster 1990), such that the increase is exaggerated. However, the disappearance of ill-defined causes (Lancaster 1990) would imply that by 1946, circulatory disease mortality was much more reliably reported, such that some increase can be confirmed. It can therefore be concluded that Australian mortality was transitioning to the third Age of Degenerative and Man-Made Diseases during this period, but it is not possible to be more precise about timing. Thus, the Australian Epidemiologic Transition may indeed have been slightly advanced in comparison with other industrialized countries at this time.

Whenever its beginnings, the Age of Degenerative and Man-Made Diseases can be said to have endured until about 1970, in keeping with other industrialized countries. From about 1950, increasing circulatory disease mortality began to slow among males, and rates declined among females, a result of prior changes in risk factor behaviours. Over the period 1946–70, circulatory disease mortality made a small positive contribution to the change in female life expectancy, but a sizeable negative contribution in male life expectancy. Thus, for males especially, overall mortality stagnated in the 1960s. This pattern of slow decline and the predominance of circulatory disease mortality is characteristic of the Age of Degenerative and Man-Made Diseases. Life expectancy in 1970 was about 71 years, close to the limit of 70–75 years that was accepted wisdom at the time (Olshansky and Ault 1986).

The beginnings of the Age of Delayed Degenerative Diseases seem clear. Life expectancy increased with renewed vigour from about 1970, driven largely by rapid declines in circulatory disease mortality, in line with the 'cardiovascular revolution' (Meslé and Vallin 2011). Ongoing declines occurred in mortality from circulatory and respiratory diseases from the 1970s and in neoplasms from the 1980s, such that mortality decline is greatest at increasingly older ages, roughly equally for the sexes. This fourth stage continues in the 21st century.

Acknowledgment

We thank Michael de Looper and two anonymous referees for useful comments.

References

Arriaga, E.E. 1984. Measuring and explaining the change in life expectancies. *Demography* 21(1):83–96.

ABS (Australian Bureau of Statistics). 2013. *Socio-economic Indexes for Areas*. Canberra: ABS.

———. 2014a. *Deaths, Australia, 2013*. ABS Cat. No. 3302.0. Canberra: ABS.

———. 2014b. *Australian Historical Population Statistics, 2014*. ABS Cat. No. 3105.0. Canberra: ABS.

11. While Spanish Influenza affected many populations, their lower life expectancies were more in keeping with the Age of Receding Pandemics.

———. 2014c. *Census Data Enhancement project: An update, 2011*. ABS Cat. No. 2062.0. Canberra: ABS.

———. 2015. *Average Weekly Earnings, Australia, Nov 2014*. ABS Cat. No. 6302.0. Canberra: ABS.

AIHW (Australian Institute of Health and Welfare). 2000. *Australia's Health 2000: Seventh Biennial Health Report of the Australian Institute of Health and Welfare*. AIHW Cat. No. AUS 19. Canberra: AIHW.

———. 2006. *Mortality over the Twentieth Century in Australia: Trends and Patterns in Major Causes of Death*. Mortality Surveillance Series 4. AIHW Cat. No. PHE 73. Canberra: AIHW.

———. 2007a. *Rural, Regional and Remote Health: A Study on Mortality*. 2nd edn. AIHW Cat. No. PHE 95. Canberra: AIHW.

———. 2007b. *The Burden of Disease and Injury in Australia 2003*. AIHW Cat. No. PHE 82. Canberra: AIHW.

———. 2014. *Australia's Health 2014*. Australia's Health Series 14. AIHW Cat. No. AUS 178. Canberra: AIHW.

———. 2015a. *GRIM (General Record of Incidence of Mortality) Books*. Canberra: AIHW. Accessed at http://www.aihw.gov.au/deaths/grim-books/.

———. 2015b. *Mortality and Life Expectancy of Indigenous Australians, 2008 to 2012*. AIHW Cat. No. IHW 140. Canberra: AIHW.

Australian Government Actuary. n.d. *Australian Life Tables 1960–62 and Monetary Tables*. Canberra: Commonwealth Government Printer.

———. n.d. *Australian Life Tables 1975–77*. Canberra: Australian Government Publishing Service.

———. 1995. *Australian Life Tables 1990–92*. Canberra: Australian Government Publishing Service.

———. 2009. *Australian Life Tables 2005–07*. Canberra: Australian Government Publishing Service.

Barbieri, M., and N. Ouellette. 2012. The demography of Canada and the United States from the 1980s to the 2000s: A summary of changes and a statistical assessment. *Population-E*, 67(2):177–280.

Booth, H. 2003. The changing dimensions of mortality, in *The Transformation of Australia's Population: 1970–2030*, edited by S-A. Khoo, P. McDonald, and S-E. Khoo. Sydney: UNSW Press.

Booth, H., and L. Tickle. 2008. Mortality modelling and forecasting: A review of methods. *Annals of Actuarial Science* 3(I/II):3–48.

Bourbeau, R., and N. Ouellette. 2016. Trends, patterns, and differentials in Canadian mortality over nearly a century (1921–2011). *Canadian Studies in Population* 43(1–2):48–77.

Caselli, G., S. Drefahl, M. Luy, and C. Wegner-Siegmundt. 2014. Future mortality in low mortality countries, in *World Population and Human Capital in the 21st Century*, edited by W. Lutz, W.P. Butz, and S. KC. Oxford: Oxford University Press.

Caselli, G., F. Meslé, and J. Vallin. 2002. Epidemiologic Transition Theory exceptions. *Genus* 58(1):9–52.

COAG (Council of Australian Governments). 2009. *National Indigenous Reform Agreement: Close the Gap*. Canberra: Commonwealth of Australia.

Danaei, G., S. Vander Hoorn, A.D. Lopez, C.J.L. Murray, and M. Ezzati. 2005. Causes of cancer in the world: Comparative risk assessment of nine behavioural and environmental risk factors. *The Lancet* 366(9499):1784–93.

de Looper, M.W. 2015. Death registration and mortality trends in Australia: 1856–1906. PhD diss. Australian National University.

Gaylin, D.S., and J. Kates. 1997. Refocusing the lens: Epidemiologic Transition theory, mortality differentials, and the AIDS pandemic. *Social Science and Medicine*, 44(5):609–21.

Glei, D.A., and S. Horiuchi. 2007. The narrowing sex differential in life expectancy in high–income populations: Effects of differences in the age pattern of mortality. *Population Studies* 61(2):141–59.

Griffiths, C., and A. Brock. 2003. Twentieth century mortality trends in England and Wales. *Health Statistics Quarterly* 18:5–17.

Human Mortality Database. 2015. University of California, Berkeley (USA) and Max Planck Institute for Demographic Research (Germany), Life tables by single year of age for one and five-year calendar periods, deaths and births by single years of age. Accessed at http://www.mortality.org on 6 August 2015.

Lancaster, H.O. 1990. *Expectations of Life: A Study in the Demography, Statistics, and History of World Mortality*. New York: Springer-Verlag.

Lussier, M-H., R. Bourbeau, and R. Choinière. 2008. Does the recent evolution of Canadian mortality agree with the Epidemiologic Transition theory? *Demographic Research* 18(19):531–68.

Madden, R., L. Tickle, L. Jackson Pulver, and I. Ring. 2012. Estimating indigenous life expectancy: Pitfalls with consequences. *Journal of Population Research* 29(3):269–81.

Meslé, F., and J. Vallin. 2006. The health transition: Trends and prospects, in *Demography – Analysis and Synthesis: A Treatise in Population Studies*, vol. 2, pt. 4, edited by G. Caselli, J. Vallin, and G. Wunsch. Amsterdam: Elsevier. p. 247–60.

———. 2011. Historical trends in mortality, in *International Handbook of Adult Mortality*, edited by R.G. Rogers and E.M. Crimmins. Dordrecht (Netherlands): Springer, p. 9–47.

Neville, S.E., L.K. Taylor, H. Moore, R.C. Madden, I. Ring, L. Jackson Pulver, and L. Tickle. 2011. Enhancement of reporting of deaths among Aboriginal and Torres Strait Islander peoples in ABS mortality data through linkage with hospital data. *Australian and New Zealand Journal of Public Health* 35:543–48.

Olshansky, S.J., and A.B. Ault. 1986. The fourth stage of the Epidemiologic Transition: The age of delayed degenerative diseases. *The Milbank Quarterly* 64(3):355–91.

Omran, A.R. 1971. The Epidemiologic Transition: A theory of the epidemiology of population change. *The Milbank Memorial Fund Quarterly*, 49(4-I):509–38. Reprinted in *The Milbank Quarterly* 83(4):731–57; quotes refer to reprint page numbers.

———. 1983. The Epidemiologic Transition theory: A preliminary update. *Journal of Tropical Pediatrics* 29:305–16.

Oxford, J.S., R. Lambkin, A. Sefton, R. Daniels, A. Elliot, R. Brown, and D. Gill D. 2005. A hypothesis: The conjunction of soldiers, gas, pigs, ducks, geese and horses in Northern France during the Great War provided the conditions for the emergence of the "Spanish" influenza pandemic of 1918–1919. *Vaccine* 23(7):940–45.

Pollard, J.H. 1996. On the changing shape of the Australian mortality curve. *Health Transition Review* 6:283–300.

Robine, J-M. 2001. Redefining the stages of the Epidemiological Transition by a study of the dispersion of life spans: The case of France. *Population* 13(1):173–93.

Rogers, R.G., and R. Hackenberg. 1987. Extending Epidemiologic Transition theory: A new stage. *Social Biology* 34(3–4):234–43.

Taylor, R., and M. Lewis. 1998. The Australian mortality decline: All-cause mortality 1788–1990. *Australian and New Zealand Journal of Public Health* 22(1):27–36.

Taylor, R., M. Lewis, and J. Powles. 1998. The Australian mortality decline: Cause-specific mortality 1907–1990. *Australian and New Zealand Journal of Public Health* 22(1):37–44.

Tickle, L. 2016. Understanding the age and cause drivers of recent longevity trends in Australia. *Journal of Population Research*. Accessed at http://link.springer.com/journal/12546/onlineFirst/page/1#page-1 on 14 January 2016.

Trovato, F., and N.B. Heyen. 2006. A varied pattern of change of the sex differential in survival in the G7 countries. *Journal of Biosocial Science* 38(3):391–401.

Trovato, F., and N.M. Lalu. 1997. Changing sex differences in life expectancy in Australia between 1970 and 1990. *Journal of the Australian Population Association* 14(2):187–200.

UNPD (United Nations Population Division). 2015. *World Population Prospects: The 2015 Revision*, DVD Edition. Accessed at http://esa.un.org/unpd/wpp/DVD/ on 6 August 2015.

Weisfeldt, M.L., and S.J. Zieman. 2007. Advances in the prevention and treatment of cardiovascular disease. *Health Affairs* 26(1):25–37.

WHO (World Health Organisation). 1992. *International Statistical Classification of Diseases and Related Health Problems: Tenth Revision*. Geneva: World Health Organisation.

Zhao, Z., E.J-C. Tu, and J. Zhao. 2014. Long-term mortality changes in East Asia: Levels, age patterns, and causes of death, in *Mortality in an International Perspective*. New York: Springer International. p. 337–55.

Canadian Studies in Population 43, no. 1–2 (2016): 48–77.

Trends, patterns, and differentials in Canadian mortality over nearly a century (1921–2011)

Robert Bourbeau[1]
Nadine Ouellette

Abstract

In the past 90 years, remarkable progress has been made in substantially improving survival and longevity in Canada, establishing it among today's group of very low mortality countries. We use several demographic indicators of all-cause and cause-specific mortality to illustrate the nature of these major advances throughout the lifespan. Reviewing the literature on trends in Canadian mortality, we also uncover various challenges for the decades to come. Reducing or even eliminating important disparities in mortality that persist with regards to geography and several socioeconomic factors is one of the greatest challenges ahead.

Keywords: mortality, longevity, health, trends, Canada.

Résumé

Au cours des 90 dernières années, le Canada a connu des progrès remarquables en matière de survie et de longévité, ce qui le situe parmi le groupe de pays à très faible mortalité. Plusieurs indicateurs démographiques de mortalité générale et par cause sont utilisés pour montrer la nature de ces avancées à tous les âges de la vie. La revue des connaissances sur la mortalité canadienne a aussi permis de mettre en relief les défis des prochaines décennies. Réduire, voire supprimer les différences importantes de mortalité qui persistent selon la région et selon plusieurs caractéristiques socioéconomiques représente un de ces principaux défis.

Mots-clés : mortalité, longévité, santé, tendances, Canada.

Introduction

Canada ranks among the wealthiest and most developed nations in the world according to various socioeconomic indicators such as the Gross Domestic Product and the Human Development Index. It is also known to be a very egalitarian society in terms of resource redistribution and access to public services. Canadians benefit from universal income protection programs at age 65 years, for instance, and a universal healthcare system throughout their lives, administered by the country's ten provinces and three territories. The healthcare system is publicly funded and the governments contribute about 70 per cent of total healthcare costs (OECD 2014).

1. Co-lead authors: Robert Bourbeau (corresponding author), Département de démographie, Université de Montréal, Pavillon Lionel-Groulx, 3150 rue Jean-Brillant, Montréal QC H3T 1N8, e-mail: robert.bourbeau@umontreal.ca; and Nadine Ouellette, Institut national d'études démographiques (INED), Paris.

The majority of developed nations have experienced several profound demographic changes over the last century—notably, an important decline in fertility rates paired with a substantial reduction of mortality, due in part to the changing nature of leading causes of death. In Canada, the total fertility rate was 3.5 children per woman in 1921 and fell to 1.61 in 2011 (Wadhera and Strachan 1993a; Statistics Canada 2013a). Life expectancy at birth for both sexes combined rose, from 57.0 years in 1921 to 81.7 in 2011 (Canadian Human Mortality Database 2014). Migration has also become an increasingly important contributor to population growth over this time period. Whereas less than 25 per cent of the Canadian population growth was due to migratory increase (i.e., surplus of in-migrants over out-migrants) during 1951–56, this share climbed to almost 70 per cent for 2006–11. Immigrants thus make up a significant portion of the Canadian population and the latest figures reveal that 20.6 per cent of current residents are foreign-born (Statistics Canada 2013a). The large immigrant population likely bolsters Canada's health indicators, partly because immigrants are admitted to Canada upon a medical examination. They are also often selected on characteristics that are associated with better health (e.g., higher education and income), and they sometimes have firmly established advantageous cultural behaviours (e.g., healthy diets and lifestyles). This is typically referred to as the "healthy immigrant effect" (Trovato 1985; Bourbeau 2002a; Omariba et al. 2014).

In the present article, we are mainly interested in the tremendous transformation that Canada—like many other developed countries—underwent with regards to its population's health and longevity over nearly a century. There is a fairly large body of literature discussing and documenting various aspects of these changes. Of particular interest here are studies that:

1. examined trends over varying lengths of time (Bourbeau and Légaré 1982; Nagnur 1986; Adams 1990; Nagnur and Nagrodski 1990; Baxter and Ramlo 1998; Manuel and Hockin 2000; Bourbeau 2002b; Beaujot and Kerr 2003; Henripin 2003; Martel and Bourbeau 2003; Prud'homme 2007; Barbieri and Ouellette 2012; Decady and Greenberg 2014);
2. carried out differential or comparative analyses by sex, province, immigrant status, income level, or educational attainment (Wilkins 1980; Trovato 1985, 1993, 2007; Trovato and Lalu 1995, 2001; Nault 1997; Andreev 2000; Bourbeau 2002a; Prud'homme 2007; Wilkins et al. 2008; Zanfongnon 2008; Pampalon 2009a, 2009b, 2009c; Omariba et al. 2014);
3. focused on the epidemiology of population change through cause-of-death analyses (Bah and Rajulton 1991; Bourbeau 2002b; Lussier et al. 2008; Bergeron-Boucher 2012);
4. investigated changes in healthy life expectancy (for an overview see Bourbeau et al. 2011; Mandich and Margolis 2014).

These studies show that the health and longevity evolution in the past 90 years is characterized notably by large declines in infant mortality, a substantial increase in life expectancy, important variations of sex differences in average length of life, improved survival at old and very old ages, rectangularization of the survival curve, changing causes of death, and a reduction of geographic disparities in mortality between Canadian provinces.

The present article is principally intended as a historical overview of trends and patterns of mortality in Canada, and shows the country's spectacular progress in the control of mortality and efforts to improve health. We achieve this objective by bringing together present-day knowledge and research findings to better define future challenges. The health and longevity advances are described using basic or more sophisticated demographic indicators, which will be introduced along the way. The paper begins with an overview of our data sources. We then examine declines in mortality over time that led to a remarkable increase in survival, followed by a section focussing on the changing age distribution of deaths and its consequences. Addressed next are some new challenges in dealing

with survival progress: changes in leading causes of death, emergence of centenarians, healthy life expectancy, obesity, geographic disparities in mortality, and socioeconomic inequalities in health. We conclude by discussing the future of mortality in Canada as compared to other developed countries.

Data sources

Canada's long tradition of registering births, marriages, and deaths is largely attributable to the religious denomination of a significant share of its population. Demographic events pertaining to French-Canadians—which formed a homogeneously Catholic society—were systematically registered by the religious authorities upon their arrival to Canada during the first half of the 17th century. Nearly all baptisms, marriages, and burials of Catholics were thus meticulously registered, making it possible to study demographic trends from a long-term perspective. The major task of reconstituting these trajectories was undertaken in the 1960s by the *Programme de recherche en démographie historique* at the Université de Montréal (Charbonneau et al. 1972). Another share of Canada's population at the time consisted of British-born individuals, most of which were Protestant. While Protestant societies also registered demographic events, the registration was not as systematic as for the French-Canadians. For this reason, the data used in the present article begin only much later (early 1920s). Our study relies on several sources of data: Canada's vital statistics system, the Census, and health surveys.

For Canada as a whole, reliable data on all-cause mortality are available from 1921, when the government established vital statistics registration. While each of the ten provincial and three territorial administrations are in charge of collecting these data, Statistics Canada is responsible for assembling them at the national level. Statistics Canada also produces annual population estimates by age and sex for Canada, provinces, and territories.[2] The recently revised methodology for these estimates gives more accurate population counts, which serve as denominators for the rates calculated in this article (Statistics Canada 2014a). It should be noted that all these data are also available in the Canadian Human Mortality Database (www.bdlc.umontreal.ca), established by demographers at the Université de Montréal in collaboration with the Human Mortality Database (www.mortality.org) project team.

Cause-specific mortality data are based on information listed on death certificates by qualified physicians—in the province or territory where the event took place—and according to WHO's International classification of diseases (ICD); the classification is subject to revision, occurring roughly once every ten years since 1900. In the present paper, our analyses of cause-specific mortality trends start in 1950 and end in 2011, covering five revisions of the ICD.[3] The transition from one ICD revision to the next is likely to create major discontinuities in cause-specific mortality trends over time, especially for highly specific causes of death, while the use of broad disease categories is less problematic. We focus here on cause-of-death groupings that had considerable impact on survival in Canada over the past 60 years: heart diseases, cerebrovascular diseases, smoking-related malignant neoplasms,[4] all other types of malignant neoplasms, infectious and parasitic diseases, respiratory diseases, and external causes of death. The concordance table used for bridging the five revisions of the ICD is provided in the appendix.

2. For 1921–70, see Catalogue no. 91-512, and after 1970, see CANSIM database, Table 051-0001.
3. Although data on causes of death are available since 1921 in Canada, the quality of these data for the 1921–49 period is not sufficient to get a precise picture of trends in mortality by cause. Moreover, the construction of coherent series of deaths by cause is challenging over very long periods of time, because a greater number of successive revisions of the ICD need to be bridged. For these reasons, we have focused our analysis on cause-of-death data from 1950 forward.
4. Our category of smoking-related malignant neoplasms includes most cancers of the respiratory and upper digestive tracts, namely cancers of the lip, oral cavity, pharynx, oesophagus, larynx, trachea, bronchus, and lung, as proposed by Ouellette et al. (2014).

Canadian data are known to be of very good quality, and it is widely accepted that they can be used to portray mortality changes accurately. As for the state of health of the Canadian population, the data presented here are taken from two surveys on the prevalence of diseases, disabilities, and other health-related conditions, namely the National Population Health Survey and the Canadian Community Health Survey. The surveys began at the end of the 1970s, and the data have been collected at irregular intervals ever since.

Changes in mortality over time: A remarkable progress in survival

Death rate trends by age and sex

The evolution of mortality in Canada, both in terms of level and age-pattern, is reflected by a set of mortality rates by age, sex, and calendar year. Using data on death counts and population estimates, we computed death rates by single years of age and sex for each calendar year from 1921 to 2011. These sex-specific death rates by age and time are presented on *shaded contour maps*, also known as *Lexis surface maps* in demography and specifically referred to as *mortality surfaces* in the context of mortality (see Figure 1). The surfaces summarize a considerable volume of data on a single graph and are very useful for looking at long-range mortality trends. They also provide an excellent exploratory tool for detecting age, period, and cohort effects (Caselli et al. 1985). The scale on the right-hand side of Figure 1 indicates how death rates were partitioned into nine groups, each with its own colour. On the surface, death rates belonging to a given group are assigned the same colour.

Surfaces in Figure 1 reveal noticeable changes in colour composition as time unfolds—there are fewer red and orange zones and progressively more green and blue zones—which shows the general decline in death rates since 1921. The pace of the decline, however, varies by age and sex.

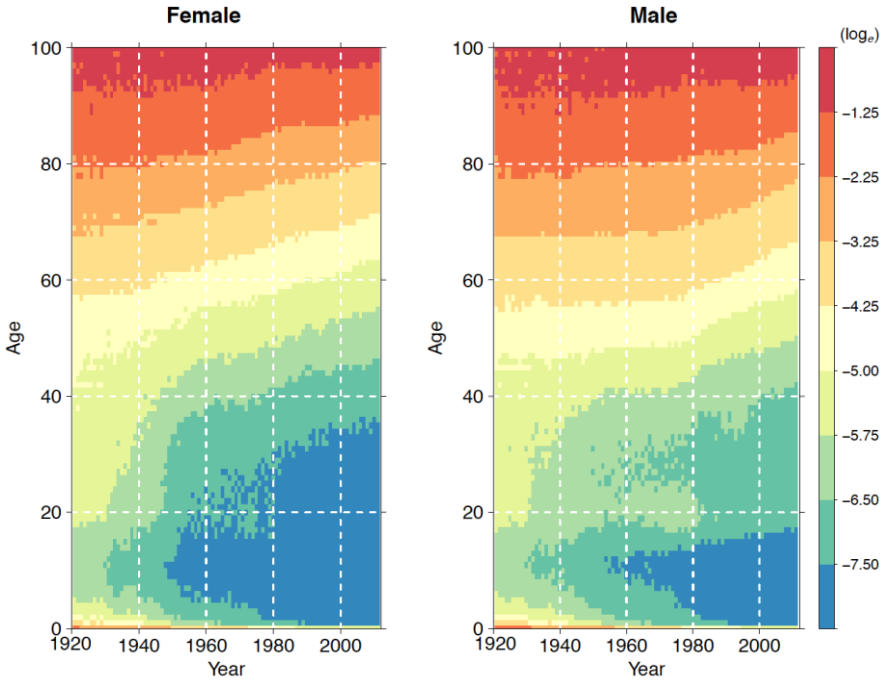


Figure 1. Lexis surface maps of observed death rates (logarithmic scale) for females and males in Canada, ages 0 to 100, 1921–2011.
Source: Canadian Human Mortality Database, 2014.

We first notice a clear fall in infant and juvenile mortality, as evident at the bottom of female and male surfaces. Death rates at these early ages reached very low levels in Canada (less than 10 per thousand) from the mid-1980s onwards. Mortality among young adult females is driven by changes in maternal mortality, which gradually disappears, giving way to deaths due to external causes (e.g., accidents), but at levels well below that of males—shown in the dominance of blue rather than turquoise zones at ages 15–49 after the 1960s on the female surface. The mortality of young adult males is indeed characterized by a significant share of deaths due to accidents and suicides, still perceptible up to 2011, although substantial declines have occurred since the end of the 1970s. Among older adults and at very old ages, the onset of mortality decrease was recorded earlier for females than for males—around the 1940s and 1950s, where yellow and orange diagonal stripes (rather than horizontal) start appearing on the female surface. A similar decline begins only in the 1970s among the males.

Annual rates of mortality change by age and sex

To better identify the specificities of changes in mortality in Canada since 1921, we computed rates of mortality change by age and time, and then graphed these on a Lexis surface map. Using data for single years of age and single calendar years, we calculated annual rates of change of mortality $\rho(x,t) = -\log_e\left(\frac{m(x,t+1)}{m(x,t)}\right)$, where $m(x,t)$ is the death rate for the age interval $[x, x+1[$ during calendar year t. Values of ρ greater/smaller than zero indicate that death rates declined/increased between year t and $t+1$ at age x. The indicator was first proposed by Kannisto (1994) and recently taken up by Rau and colleagues (2013) to detect predominant mortality dynamics, with a particular interest in uncovering age, period, and cohort effects.

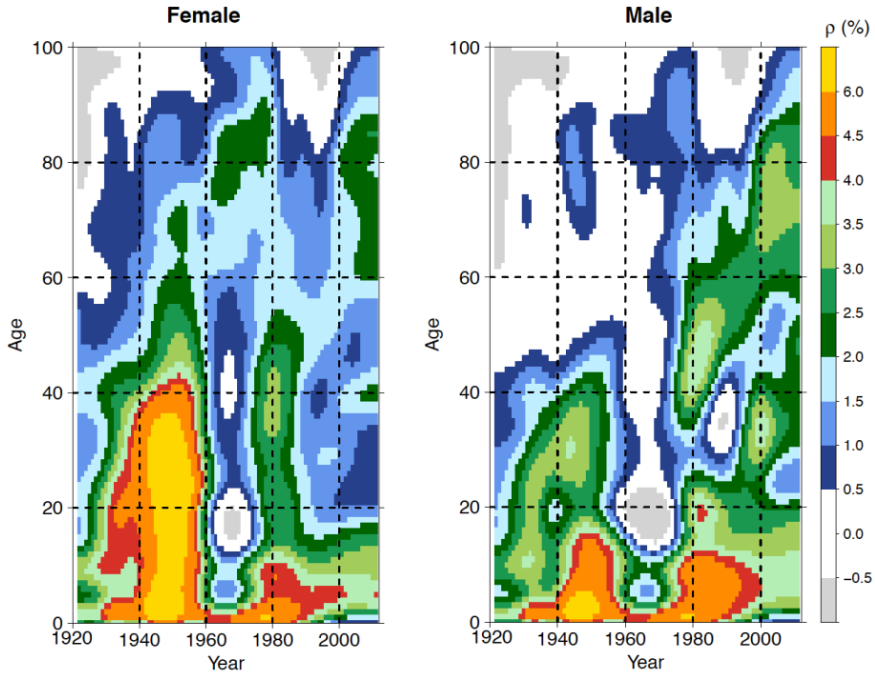


Figure 2. Lexis surface maps of annual rates of mortality change for females and males in Canada, ages 0 to 100, 1921–2011.

Note: Prior to computing ρ, we smoothed death rates over ages and calendar years simultaneously with a P-spline approach based on penalised Poisson likelihood (Eilers and Marx 1996), using the R package "MortalitySmooth" (Camarda 2012).

Source: Author's calculations based on the Canadian Human Mortality Database, 2014.

Figure 2 presents annual rates of mortality change for Canadian females and males separately. The scale on the right-hand side indicates that minor changes ($\rho \in]-0.5\%, 0.5\%]$) are shown in white on the surfaces, slight mortality improvements ($\rho \in]0.5\%, 2.0\%]$) in shades of blue, moderate improvements ($\rho \in]2.0\%, 4.0\%]$) in shades of green, and strong improvements ($\rho > 4.0\%$) in red to yellow shades. Gray is used for worsening mortality conditions ($\rho \leq -0.5\%$).

A first observation is that values of ρ can vary substantially from year to year and from age to age, thus confirming that mortality decline is not uniform across time and over the life course. Annual rates of mortality decline can be greater than 6 per cent but a few episodes of slight mortality increase have also been recorded. For instance, the mortality of young male adults aged 15–24 increased during the 1960s—see the gray round-shaped zone—because of a rise in death rates, notably due to vehicle and traffic injuries. The greatest mortality improvements—red to yellow shaded zones—concerned infants, children, adolescents, and females of childbearing ages.

Moreover, the surfaces show more convincingly than above (Figure 1) that female mortality progress among older adults and at very old ages preceded that of males. For the latter, slight mortality improvements remained scarce, whereas moderate improvements were inexistent at these ages prior to the onset of the cardiovascular revolution around 1970.[5] It is worth noting that during the 1960s, mortality decline stalled among males in Canada, as in many other low-mortality countries. Figure 2 suggests that period effects were the main forces underlying this trend, because it affected many age groups (ages 30–80) simultaneously. In recent years, progress was mostly recorded above age 60, where the vast majority of deaths occur. This is particularly true for males, where rates of mortality improvements range from 2 to 3.5 per cent.

Sex-specific life expectancies at age 0, 65, 75, and 85

The age-specific death rates illustrated on Figure 1 can be summarized by a measure of central tendency, such as life expectancy at birth (e_0). Over nearly a century in Canada, e_0 increased by 25.5 years for females, growing from 58.2 in 1921 to 83.7 years in 2011, and by 23.5 years for males, growing from 56.0 to 79.5 years (Figure 3A). These correspond to gains of about 2.8 and 2.6 years per decade on average, respectively (roughly 3 months per year). Still, the pace of increase in e_0 varied greatly by sex and by period. Among females, the pace slowed down gradually with time. For males, the progress was slowest during 1955–70, but the rapid pace of increase resumed afterward, to meet and even exceed that of females from 1980 onwards. The trend is likely to continue over the next two decades, partly because of diverging smoking-related cancer patterns between the sexes (Pampel 2002; Preston et al. 2014).

As survival to higher ages increases, measures of life expectancies at older ages (e.g., e_{65}, e_{75}, and e_{85}) are of undeniable interest. Figure 3B shows that in Canada, e_{65} started to rise meaningfully during the 1940s among females, e_{75} during the 1950s, and e_{85} during the 1970s. For males, these old-age life expectancies stagnated during many years, showing little to no progress before the 1970s, but eventually increased rapidly.

According to data for the year 2011, Canadian women aged 65 could expect to live to age 86.8 and their male counterparts to age 83.9. These ages at death correspond to lowest possible estimates because they do not include any expected improvement to future old-age mortality.

5. The revolution refers to a broad range of innovations that resulted in widespread and rapid reductions in cardiovascular disease morbidity and mortality. It includes innovative therapeutic and surgical procedures, improvements in healthcare systems (emergency ambulance services, notably), as well as changes in individual behaviour (physical exercise, diet, and tobacco consumption, in particular) (Caselli et al. 2002).

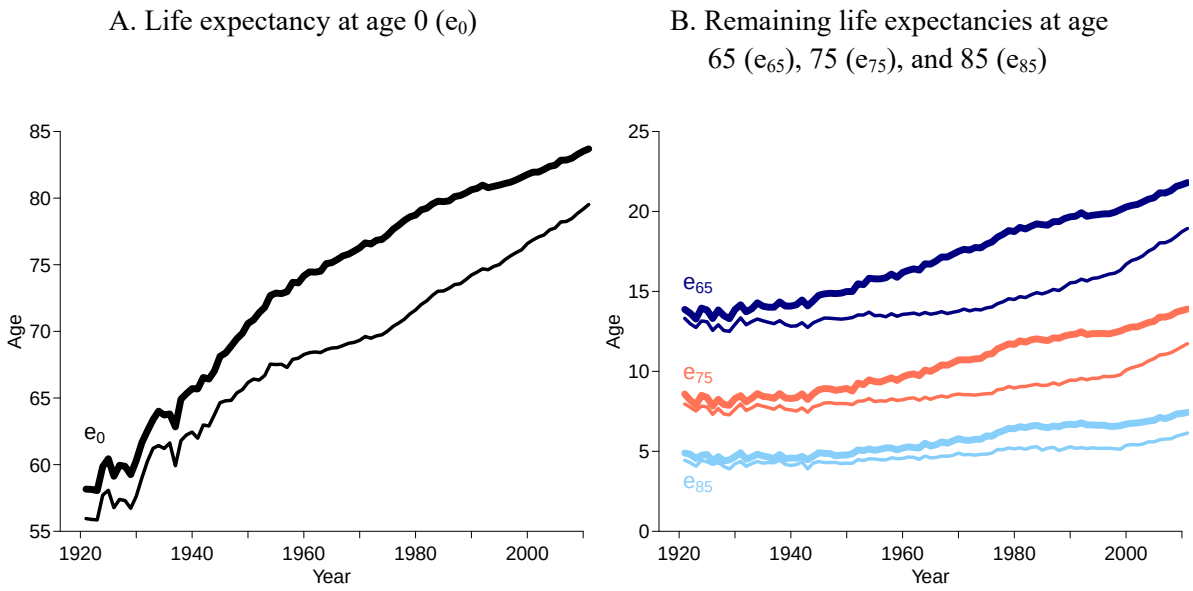


Figure 3. Life expectancy at birth and remaining life expectancies at age 65, 75, and 85 for females (thick lines) and males (thin lines) in Canada, 1921–2011.
Source: Canadian Human Mortality Database, 2014.

Narrowing sex differentials in mortality

In the last nine decades, the sex gap in e_0 (female minus male) in Canada followed a trend comparable to that of most current low-mortality countries. Up until the late 1970s, the gap grew substantially, rising from 2.2 years in 1921 to 7.4 in 1978 (Figure 4), as female e_0 increased more rapidly than that of men (Figure 3A). Afterwards, however, e_0 rose faster for men, and the sex gap in e_0 narrowed unabated to 4.2 years in 2011.

The accelerated widening of the sex gap in e_0 in Canada between the mid-1940s and the late 1970s was in large part due to less favourable trends in male mortality from cardiovascular diseases (heart diseases, in particular) and malignant neoplasms (mainly lung and other types of cancers closely related to smoking) (Waldron 1993; Meslé 2004). The surge in male tobacco consumption contributed significantly to these trends, both from a period (Peto et al. 2005; Preston et al. 2011) and a cohort perspective (Preston and Wang 2006). The narrowing of the gap since the 1978 downturn is due mostly to the reduction of sex differences in cardiovascular mortality, a trend often associated to females progressively adopting social behaviours more similar to those of males (notably in terms of employment, smoking, and alcohol consumption) (Waldron 1993; Trovato and Lalu 1995; Pampel 2002; Meslé 2004; Trovato and Heyen 2006; Trovato 2007). Males have also become increasingly aware of the importance of managing their health (e.g., more frequent doctor visits, routine health check-ups from an earlier age), something that females had understood much earlier (Meslé 2013). While both sexes made substantial progress in cardiovascular mortality since the downturn, males have enjoyed greater gains as they started at a considerable disadvantage (see Figure 10 in the "Causes of death" section below for more details). Sex differences in smoking-related cancer mortality have also narrowed in the past 30 years, with a continuous increase for females (but slowing markedly since the early 1990s) and a rapid decrease among males, due to very distinct patterns in tobacco consumption history.

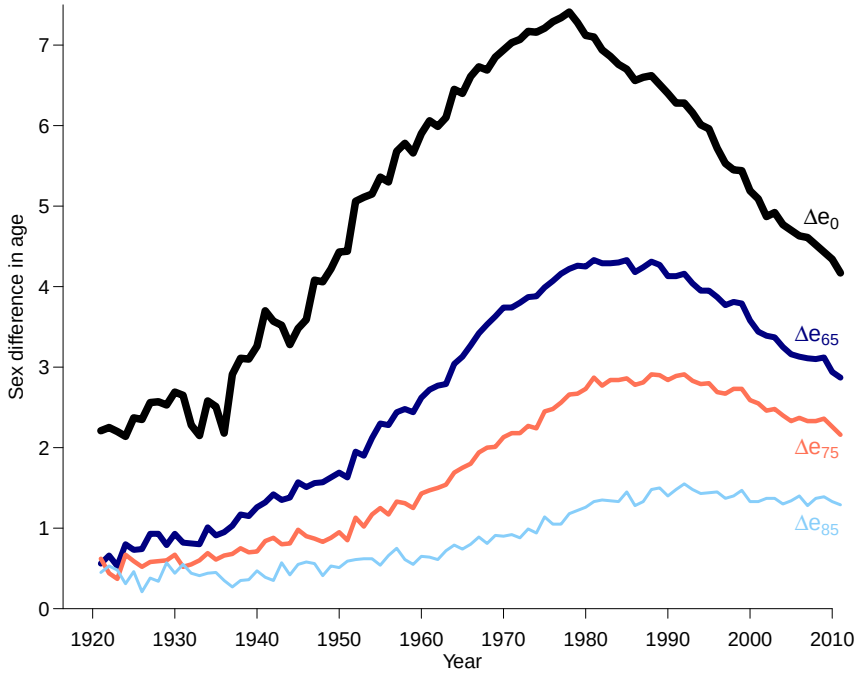


Figure 4. Sex difference (female minus male) in life expectancy at birth (Δe_0), at age 65 (Δe_{65}), at age 75 (Δe_{75}), and at age 85 (Δe_{85}) in Canada, 1921–2011.

Source: Author's calculations based on the Canadian Human Mortality Database, 2014.

Sex differences (female minus male) in life expectancy at older ages such as 65, 75, and 85 are also illustrated in Figure 4. The smaller differences in these life expectancies than in e_0 were expected because sex differentials in e_0 reflect mortality at all ages, whereas sex differences in e_{65}, e_{75}, and e_{85} depend on old-age mortality only. Figure 4 also shows that the four measures of differences between females and males differ not only in levels (i.e., in years) but also in trends. Downturns can be seen for the sex gaps in e_{65}, e_{75}, and e_{85}, but occurred later and were less pronounced than for e_0. In particular, the downturn for e_{85} was fairly recent (around 1990) and very modest. Further investigation is needed to determine the specific causes of death responsible for these differences, and to speculate on future trends.

Excess male mortality by age

Figure 5 shows in greater detail the change over time in excess male mortality, using male-to-female ratios of age-specific death rates. From 1921 until the early 1940s, maternal mortality gave rise to an episode of excess female mortality in Canada at childbearing ages, depicted by a dark blue zone on the mortality ratio surface. Afterwards, male mortality increased slightly for some periods, as seen earlier in Figure 2, but essentially male mortality has decreased less rapidly than for females. Figure 5 shows that excess male mortality has been particularly high for young adults, because of accidents and violent deaths at ages 20–40, as well as at ages 55–70, where the death toll from cardiovascular diseases was substantial.

Excess male mortality remains an important aspect of Canadian mortality studies. But nowadays, the excess remains most prevalent at ages where the level of mortality is relatively low—notably between the ages of 18 and 30 years—and thus weighs less heavily on the overall sex gap in mortality.

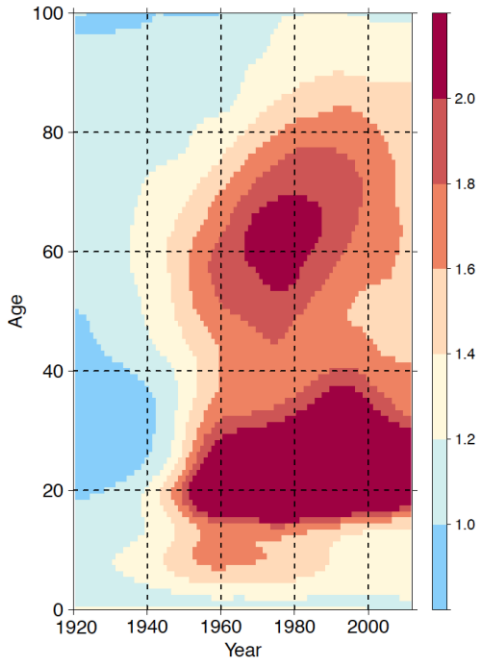


Figure 5. Lexis surface map of male-to-female sex ratio of age-specific death rates in Canada, ages 0 to 100, 1921–2011.

Source: Author's calculations based on the Canadian Human Mortality Database, 2014.

Note: Prior to computing the male-to-female sex ratio of age-specific death rates, we smoothed the death rates over ages and calendar years simultaneously for each sex with a P-spline approach based on penalised Poisson likelihood (Eilers and Marx 1996), using the R package "MortalitySmooth" (Camarda 2012).

Infant mortality: The growing importance of the first 7 days after birth

The infant mortality rate has long been regarded as an important and sensitive indicator of a community's sanitary conditions, as well as its socioeconomic status. To this end, the spectacular decline in infant mortality over the past 85 years is one of the most significant achievements of Canadian society. Mortality during the first year of life was reduced more than 20-fold since 1926 in Canada, falling from 100 infant deaths per 1,000 to less than 5 per 1,000 in 2011 (Figure 6).

Progress is slower since the early 1990s because it is increasingly difficult to reduce mortality, due primarily to so-called *endogeneous* causes (e.g., congenital anomalies or birth defects and perinatal conditions). Generally speaking, as the level of infant mortality declines over time, deaths tend to be progressively concentrated near birth, thus reflecting a shift from predominantly infectious and parasitic diseases to causes predominantly linked to the vicissitudes of nature, genetics, or pregnancy-related traumas. Deaths occurring during the neonatal period—the first 4 weeks after birth—accounted for nearly half (47 per cent) of all infant deaths in Canada in 1926; the proportion grew to 75 per cent in 2011. The increase is even more pronounced for deaths in the early neonatal period—the first 7 days following birth—as the share rose from 33 per cent to 62 per cent over the same timespan.

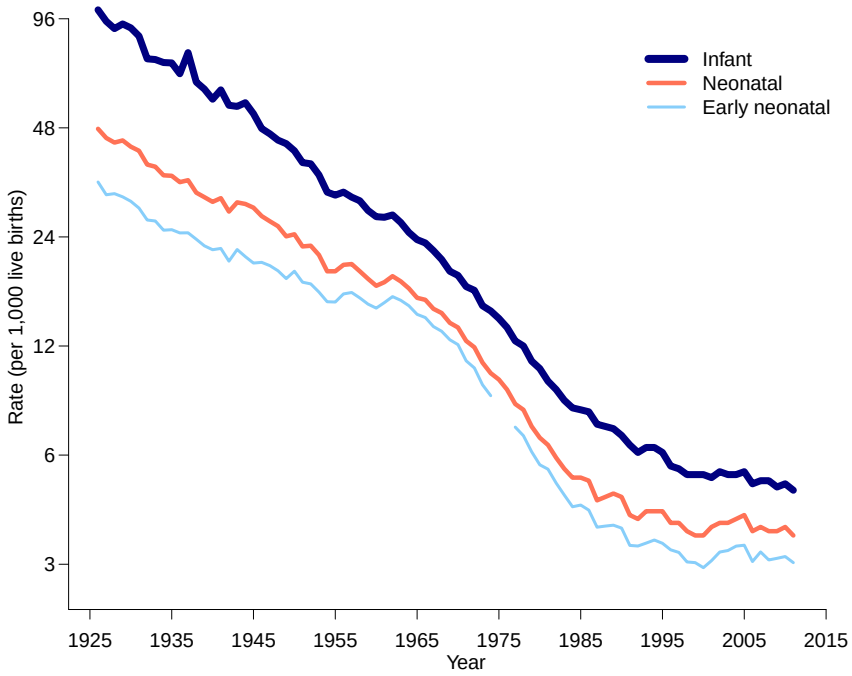


Figure 6. Infant, neonatal, and early neonatal mortality rates (log scale) for both sexes combined, Canada, 1926–2011.

Sources: For infant and neonatal mortality, 1926–90: Wadhera and Strachan (1993b, Tables 2b and 6), 1991–2009: Statistics Canada, CANSIM database (Table 102-0507); for early neonatal mortality, 1926–90: authors' calculations based on Wadhera and Strachan (1993b, Table 6) and the Canadian Human Mortality Database (2014), 1991–2011: authors' calculations based on Statistics Canada, CANSIM database (Tables 102-0508 and 102-4501).

Note: The early neonatal mortality rates for calendar years 1975 and 1976 are missing because the number of early neonatal deaths is not available.

Medical advances, paired with economic growth and a well-targeted perinatal public policy (Canadian Perinatal Surveillance System, or CPSS, of the Public Health Agency of Canada) have played an important role in the great decline in infant mortality since 1926. Current levels of infant mortality in Canada, however, continue to be above those of several European countries, as well as Japan, in some instances by as much as 50 per cent.

The changing age distribution of deaths

Compression of mortality and the rectangularization of survival curves

The above sections of this paper have highlighted the great mortality decline that occurred in Canada during the 20th century. As in most high-income countries, death rates in Canada have fallen more sharply (in relative terms) at younger rather than at older ages. The age distribution of deaths has thus shifted towards more advanced ages and become less dispersed, a phenomenon commonly referred to as *compression of mortality*. Moreover, the shape of the survival curve has become more rectangular, known as the *rectangularization of the survival curve*. These two intuitive concepts, dating back seemingly to the 1920s (Pearl 1923) and which were later given more formal definitions, can be casually inspected from graphical illustrations of the distribution of deaths and the survival curve for a few selected periods.

There is evidence of mortality compression whenever, over time, a rising proportion of deaths occur within a progressively restricted age interval. For instance, Figure 7A shows that as the periods between 1921–24 and 2005–09 unfolded, the distribution of deaths of Canadian females became increasingly concentrated into a narrow range of ages while it shifted to the right. The picture for Canadian males (not shown here) is similar, although the compression of mortality and the shift towards older ages are not as significant.

The corresponding set of changes in terms of survival curves is shown in Figure 7B, which illustrates how Canadian females underwent their rectangularization process. We see that for the 1921–24 period, the proportion of survivors falls sharply during the first years of life because of the high infant and child mortality. Afterwards, the survival curve first levels off somewhat, then declines slowly until about age 60, before dropping off rapidly into advanced old age. Compared to the shape of the 1921–24 survival curve, the one for 1950–54 is more rectangular. Indeed, by 1950–54 we already observe progress in reducing mortality among young children. The survival curve then drops gradually until about age 65, after which the proportion of survivors falls rapidly. The evolution of the survival curves through to 2005–09 is more of the same, except that the curves become slightly closer to a true rectangle.

To move beyond visual inspection and therefore allow for more detailed comparisons over time and space, scholars have proposed a number of measures for either the variability of the age distribution of deaths or the rectangularity of the survival curve (for an overview and critique of the measures, see Wilmoth and Horiuchi 1999; Cheung et al. 2005; van Raalte and Caswell 2013). Nagnur (1986) was the first to look closely at the phenomenon of rectangularization in Canada. Using the *life table entropy*—a measure of rectangularity proposed by Keyfitz—he confirmed that the rectangularization process had in fact been ongoing for both Canadian males and females since the early 1920s. For the province of Quebec more specifically, Martel and Bourbeau (2003) used various measures to show that rectangularization of the survival curve and mortality compression were underway during the period 1921–2000, although occurring at a slower pace after 1960.

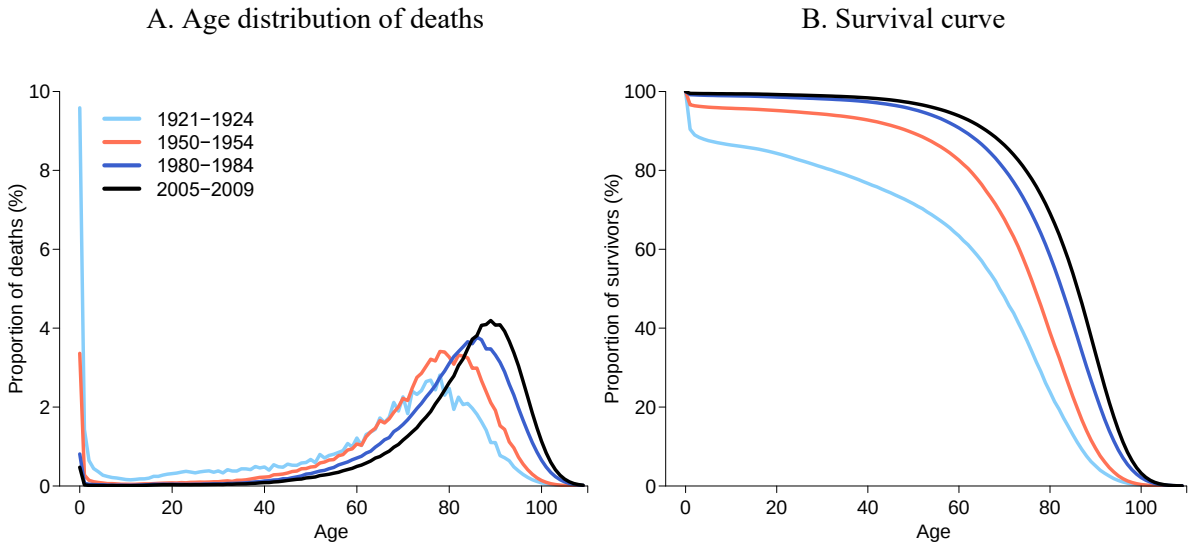


Figure 7. Changes in two life table functions: the age distribution of deaths and the survival curve for Canadian females, selected periods between 1921–24 and 2005–09.
Source: Canadian Human Mortality Database, 2014.

Life expectancy at birth and the modal age at death: Two central tendency measures portraying different stories

While measures of variability or rectangularity are now widely used and acknowledged by population scientists, many disregarded them just a couple of decades ago. Measures of central tendency, in particular the life expectancy at birth (e_0), gathered the most interest at the time. As shown earlier in this paper, an effective summarization of statistical data on human longevity can indeed be obtained with the life expectancy at birth. In low-mortality countries, however, where deaths occur in a restricted age range, e_0 may not be the proper indicator. In fact, increasing attention is lately being given to the adult modal age at death (i.e., the "typical" or most frequent age at death among adults).

Typically, the age distribution of deaths in human life tables is bimodal, with the first local mode at the left end (age 0) and the second local mode at an old age (denoted by M; Figure 8). The number of deaths recorded at the younger mode is greater than that at the older mode in high mortality regimes—as in Canada in 1921—but deaths at the older mode are greater in low-mortality regimes—as in Canada in 2011. In the early 1920s, e_0 for the female Canadian population was about 58 years and M was at 78 years, yielding a difference of 20 years because, unlike e_0—which is affected by mortality at all ages (young, middle, and old)—M is solely determined by old-age mortality (Horiuchi et al. 2013). Nowadays, the gap between the two measures may be comparatively small, about 7 years (90 minus 83, according to 2011 data), but the mode is still more suitable as a longevity measure, given that lifespan extension is mainly due to the reduction in old-age mortality (e.g., Meslé and Vallin 2000; Wilmoth et al. 2000).

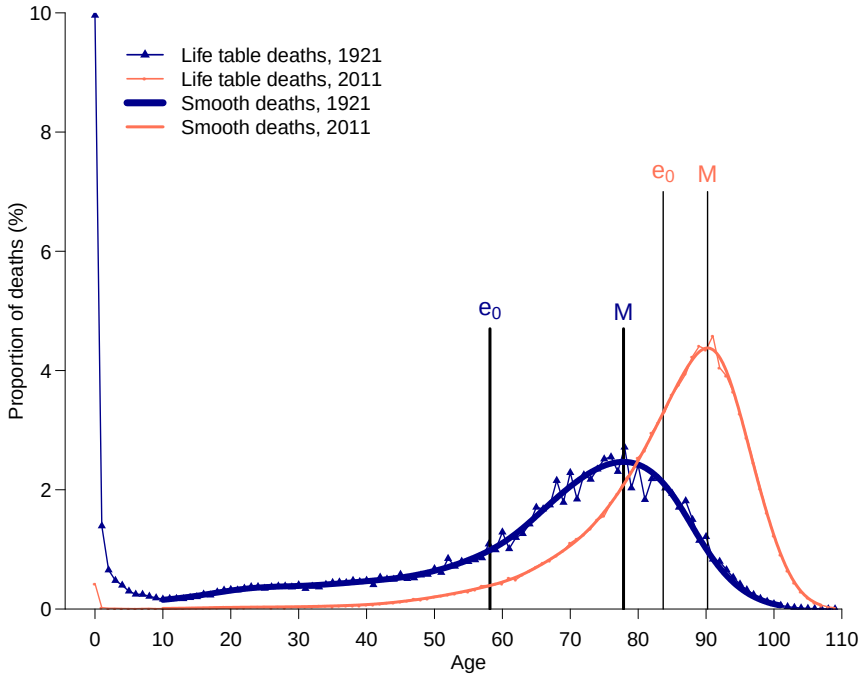


Figure 8. Modal age at death (M) and life expectancy at birth (e_0) for the age-at-death distribution for Canadian females in 1921 and 2011.

Source: Author's calculations based on the Canadian Human Mortality Database, 2014.
Note: The smoothed age-at-death distribution curves for period life tables were directly derived from the P-spline-smoothed mortality curves based on penalised Poisson likelihood (one-dimensional smoothing over ages) (Ouellette and Bourbeau 2011).

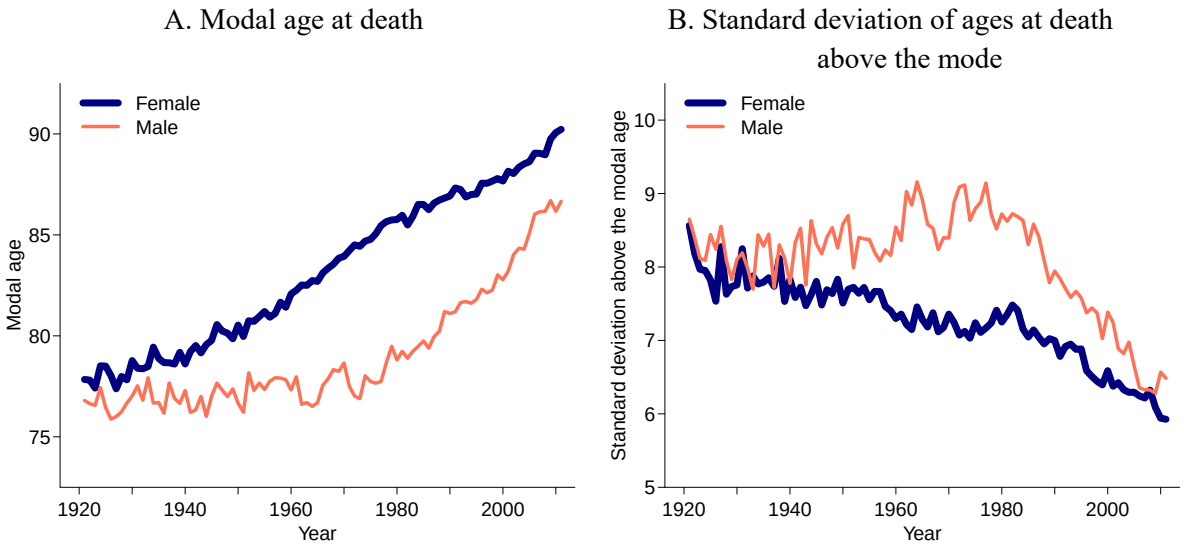


Figure 9. Adult modal age at death (M) and standard deviation of ages at death above the mode (SD(M+)) for females and males in Canada, 1921–2011.

Source: Author's calculations based on the Canadian Human Mortality Database, 2014.

Note: Annual values of M and SD(M+) were computed from smoothed age-at-death distribution curves, which were directly derived from the P-spline-smoothed mortality curves based on penalised Poisson likelihood (one-dimensional smoothing over ages) (Ouellette and Bourbeau 2011).

Other widely used measures of old-age survival mentioned earlier in this paper are life expectancies at some selected old ages such as 65, 75, or 85 (e_{65}, e_{75}, or e_{85}). The life expectancy conditional on survival to the selected old age is obviously independent of mortality at young ages. However, as shown by Horiuchi et al. (2013), changes in these conditional life expectancies tend to underestimate the age shifts of old-age mortality. They also tend to be highly age-dependant; the underestimation intensifies as the starting age selected for the conditional life expectancy increases. M, on the other hand, captures mortality shifts more accurately, and is not subject to such dependency on the selected age range.

Monitoring the compression of mortality at older ages

As in most economically developed countries, the second half of the twentieth century was characterized by an unprecedented decline in old-age mortality in Canada. In this context of longevity extension, it has become more important to distinguish between old-age mortality compression and overall mortality compression (i.e., for the full age range). Up until the 1950s, death rates in childhood and young adult ages diminished markedly, and this was the major driving force of the overall compression of mortality. Afterwards, however, overall mortality compression was slower—see Martel and Bourbeau (2003) as well as Figure 7 for Canada—or halted in some populations (Wilmoth and Horiuchi 1999; Yashin et al. 2001).

In order to analyse changes in the age distribution of deaths at older ages, Kannisto (2001) proposed the following combination of summary measures: adult modal age at death M—to indicate the location of the death heap in old age—and standard deviation of individual life durations above M, denoted by SD(M+)—to size the variability of deaths among older people. A decline in SD(M+) over time indicates that deaths above M are becoming increasingly compressed into a shorter age interval, hence the expression *old-age mortality compression*.

Figure 9 shows estimated time-trends in M and SD(M+) in Canada for each sex since 1921. Among females, M increased steadily and substantially throughout the period. In the early 1920s, M was about 78 years, and by 2011, it had increased by more than 10 years, reaching 90.2 years. Among males, the trajectory of M was almost flat until the late 1960s or even early 1970s. Values wiggled in the high 70s because mortality reductions at ages above M, essential for its increase (Canudas-Romo 2010), were limited during that time period. Afterwards however, M started to increase at a rapid pace, ending at 86.7 years in 2011, and the upward trend will likely continue in the future.

Regarding SD(M+), Figure 9 reveals for both males and females that lower values were recorded at the end of the period studied than at the beginning. In other words, between 1921 and 2011 old-age mortality compression occurred. But it should be noted that the sex-specific trends in SD(M+) did not decline steadily over time. For example, the 1960s and 1970s were periods of relative stagnation in SD(M+) among Canadian females. These episodes demonstrate that a rise in M is not necessarily paralleled with a decrease in SD(M+), as the general scenario of compression of mortality suggests. Other scenarios—such as the shifting mortality scenario, where the age distribution of death at older ages is assumed to move to the right without changing its shape (i.e., increasing trend in M accompanied by a flat trend in SD(M+))—may provide better description in some cases. In fact, many low-mortality populations have clearly been involved in the shifting mortality for several years now (Bongaarts 2005; Cheung and Robine 2007; Canudas-Romo 2008; Cheung et al. 2008; Ouellette and Bourbeau 2011; Ouellette et al. 2012). In recent years, while some clues in support of the shifting mortality scenario were apparent among Canadian females (Ouellette and Bourbeau 2011), the latest data suggest that old-age mortality compression has continued for both sexes (Figure 9).

New challenges

Causes of death

Building on Omran's theory of epidemiologic transition (Omran 1971) and its revision by Olshansky and Ault (1986), Frenk and colleagues (1991) proposed the broader concept of *health transition* to account for both the extraordinary advances in health conditions of societies since the 18th century and the evolution of organized social response to these changing health conditions. The present section examines fundamental developments in cause-specific mortality over successive stages of health transition in Canada since 1950.

We computed age-standardized death rates by sex and broad groups of causes of death (see Table A-1 for a full listing) for single calendar years from 1950 to 2011 and for three selected periods (1950–54, 1979–83, and 2007–11), using the total Canadian population (both sexes) by five-year age groups in 1981 as the standard.

Cardiovascular diseases and malignant neoplasms have remained the leading causes of death in Canada from 1950 to 2011. Taken together, these two broad groups of diseases have accounted for no less than 59 per cent (and slightly above 70 per cent at most) of the all-cause age-standardized death rate since 1950 (Table 1). Up until very recently, cardiovascular disorders formed the largest group of the two. Indeed, in the early 1950s, the share of cardiovascular diseases in total mortality was more than 50 per cent for each sex, but the share dropped to about 25 per cent in 2011 because of the remarkable decline in cardiovascular mortality over time (−75 per cent for males and −80 per cent for females). The first two panels of Figures 10A and 10B provide a more detailed illustration, displaying the death rate trends since 1950 for the two main subcategories of cardiovascular disorders: heart diseases and cerebrovascular diseases. Despite differences in levels (the proportion of

deaths attributable to heart diseases is considerably larger than that from cerebrovascular diseases in every calendar year, especially among males), the trends are similar. For females, the declining mortality trend was fairly steady for both groups of cardiovascular diseases until around 1990, and then commenced a period of slower decline. For males, the onset of the decline was delayed (around 1968 for heart diseases and slightly earlier for cerebrovascular diseases) and took place after a period of levelling-off in the mortality trend. It should be noted that males in many other high-income countries also experienced noticeable turning points in cardiovascular mortality trends in the late 1960s or early 1970s, at the beginning of the cardiovascular revolution (Ouellette et al. 2014).

From the malignant neoplasms cause-of-death category, we distinguished two groups: smoking-related cancers and all other types of cancers, which currently account for respectively about one third and two thirds of the malignant neoplasms age-standardized death rate (Table 1). Figure 10A shows that mortality trends have been clearly diverging for these two groups among females: whereas

Table 1. Age-standardized death rate (per 10,000) and mortality proportion (%) for broad cause-of-death categories by sex in Canada in 1950–54, 1979–83, and 2007–11[a]

Cause-of-death category	1950–54		1979–83		2007–11	
	per 10,000	%	per 10,000	%	per 10,000	%
Males						
Malignant neoplasms	16.4	14.1	21.2	23.2	16.7	30.8
Smoking-related malignant neoplasms[b]	3.2	2.8	8.0	8.8	5.8	10.7
Other malignant neoplasms	13.2	11.3	13.2	14.4	10.9	20.1
Cardiovascular diseases	60.5	52.1	42.6	46.7	15.1	27.9
Heart diseases	44.9	38.6	32.9	36.0	11.7	21.7
Cerebrovascular diseases	12.0	10.4	6.6	7.3	2.5	4.6
Other cardiovascular diseases	3.6	3.1	3.2	3.5	0.9	1.6
Infectious and parasitic diseases	3.4	2.9	0.4	0.5	1.1	2.1
Respiratory diseases	6.7	5.7	7.3	8.1	4.7	8.7
Other diseases	18.7	16.1	10.5	11.6	11.2	20.7
Deaths from external causes	10.5	9.1	9.1	10.0	5.3	9.9
All causes	116.1	100.0	91.3	100.0	54.1	100.0
Females						
Malignant neoplasms	14.5	16.8	13.3	25.6	12.0	33.5
Smoking-related malignant neoplasms[b]	0.8	0.9	2.0	3.9	3.5	9.6
Other malignant neoplasms	13.8	15.9	11.3	21.7	8.6	23.9
Cardiovascular diseases	45.8	52.9	24.6	47.3	9.1	25.3
Heart diseases	30.4	35.1	17.2	33.1	6.5	18.0
Cerebrovascular diseases	12.7	14.7	5.5	10.6	2.1	6.0
Other cardiovascular diseases	2.7	3.2	1.8	3.6	0.5	1.4
Infectious and parasitic diseases	2.3	2.7	0.3	0.5	0.8	2.2
Respiratory diseases	4.9	5.6	3.0	5.7	2.9	8.2
Other diseases	15.1	17.4	7.4	14.3	8.8	24.5
Deaths from external causes	3.9	4.5	3.4	6.6	2.2	6.2
All causes	86.5	100.0	51.9	100.0	35.9	100.0

Source: Author's calculations based on data from Statistics Canada (1950–99: special tabulations; 2000–11: CANSIM database, Table 102-0521) and from the Canadian Human Mortality Database, 2014.

Note: Deaths from ill-defined causes were distributed proportionally across the broad groups of well-defined causes. They represent less than 1.5% of total deaths (between 0.6% and 2.8% for each sex and year over the 1950–2011 period).

[a]The standard population corresponds to the total Canadian population (both sexes) in 1981. The content of each group of causes of death is described in Table A-1.

[b]Includes all deaths from malignant neoplasms of lip, oral cavity, pharynx, oesophagus, larynx, trachea, bronchus, and lung as the underlying cause.

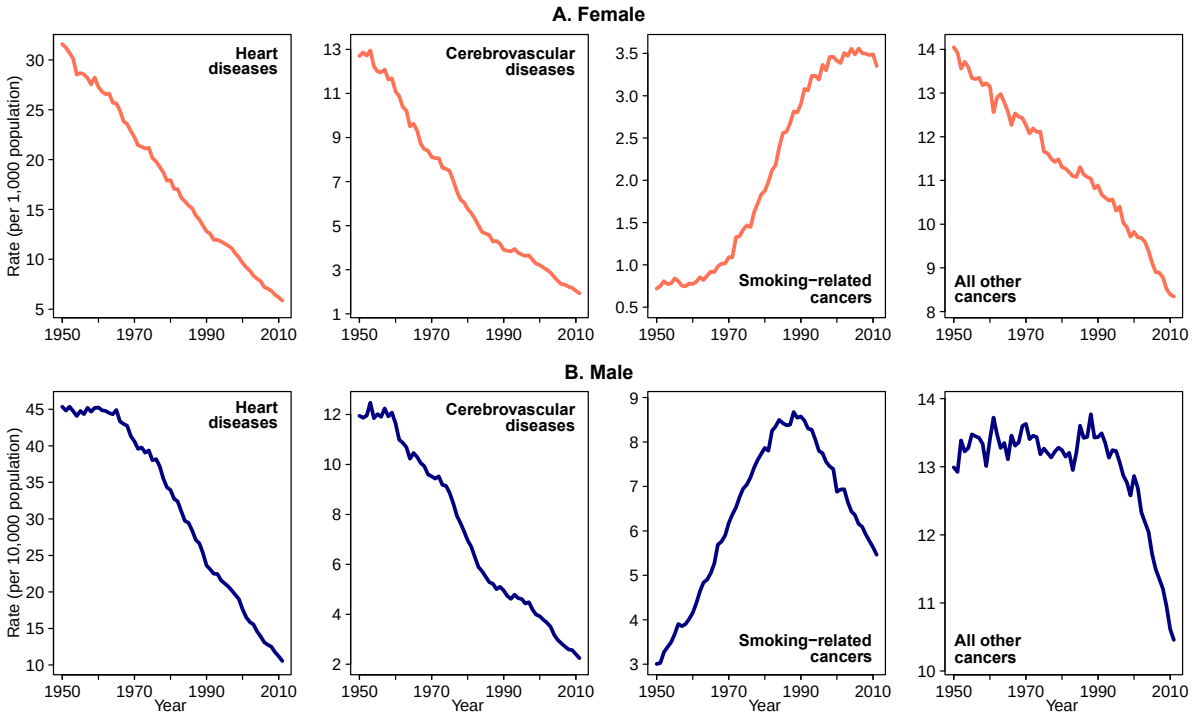


Figure 10. Age-standardized death rates for selected causes of death for females and males in Canada, 1950–2011.

Source: See Table 1.

Notes: The standard population corresponds to the total Canadian population (both sexes) in 1981. The smoking-related cancer death rate includes all deaths from malignant neoplasms of lip, oral cavity, pharynx, oesophagus, larynx, trachea, bronchus, and lung as the underlying cause.

death rates from smoking-related cancers increased throughout most of the period studied (death rates recently reached a plateau at a level 5 times higher than 50 years earlier), mortality from other forms of cancers has declined continuously since 1950. Among males, trends for the two groups also differ, but less strikingly: whereas mortality from smoking-related cancers started to decline steeply at the end of the 1980s after a long period of sustained increase, death rates for all other cancers began to fall around 1990, following an extended period of levelling-off. The substantial differences by sex for cancers closely related to smoking in Canada (and in many other high-income countries as well) reflect the very distinct trends in tobacco consumption between males and females over the past 60 years. The recent stagnating mortality trend among females could mark the start of a new era.

The "other diseases" cause-of-death category is the third-largest group of causes in Canada since 1950. It currently accounts for as much as 21 per cent and 25 per cent of the male and female all-cause age-standardized death rates, respectively (Table 1). This disease category combines a large spectrum of conditions, each with its own set of etiological factors, which makes the overall patterns rather difficult to interpret. However, the very rapid decline in death rates recorded between 1950–54 and 1979–83 (−44 per cent for males and −51 per cent for females) was in large part driven by reductions in infant mortality due to congenital malformations or birth trauma.

Since the 1970s, mortality from external causes of death has declined considerably, especially among Canadian males, where the death rate is now about half of what it used to be (Table 1). Deaths from external causes mostly involve male teenagers and young adults aged 15–44 in Canada, and improvements in mortality due to vehicle and traffic injuries greatly contributed to the progress observed in the last 30–40 years.

After a sustained increase in male and female death rates for respiratory diseases during the 1980s and 1990s, due mostly to a rise in deaths from chronic obstructive pulmonary disease attributable to tobacco consumption, mortality declined continuously afterwards. However, the share of respiratory diseases in total mortality has increased over time (Table 1) as these diseases are more common among the elderly—especially the very old, who have become one of the fastest growing segments of the Canadian population (Statistics Canada 2012a). With this aging phenomenon, it is essential to fill the current gaps in knowledge about the health of the elderly population. A better understanding of morbidity and mortality due to respiratory disease is a particularly important part of this effort.

Emergence of centenarians

The unanticipated decline in mortality above age 80, and especially the magnitude of this decline after 1970, was a pleasant surprise. Works by Kannisto (1994) and by Thatcher and colleagues (1998) in the 1990s were the first to report these as-yet-unknown mortality improvements at older ages. Exploiting data for a large set of high-income countries, these authors showed that age-standardized death rates for ages 80-99 fell significantly over time, although the rate of mortality decline varied by country.

Great improvements in survival at older ages have also been recorded in Canada (Bourbeau and Lebel 2000) and caused what was described as an "explosion" of the number of centenarians. The size of the total centenarian population (both sexes) grew 25-fold over six decades, from slightly above 200 in 1951 to nearly 5,300 in 2011 (Figure 11). Between 2006 and 2011, this was one of the most rapidly growing age groups of all, with an increase of more than 20 per cent (Statistics Canada

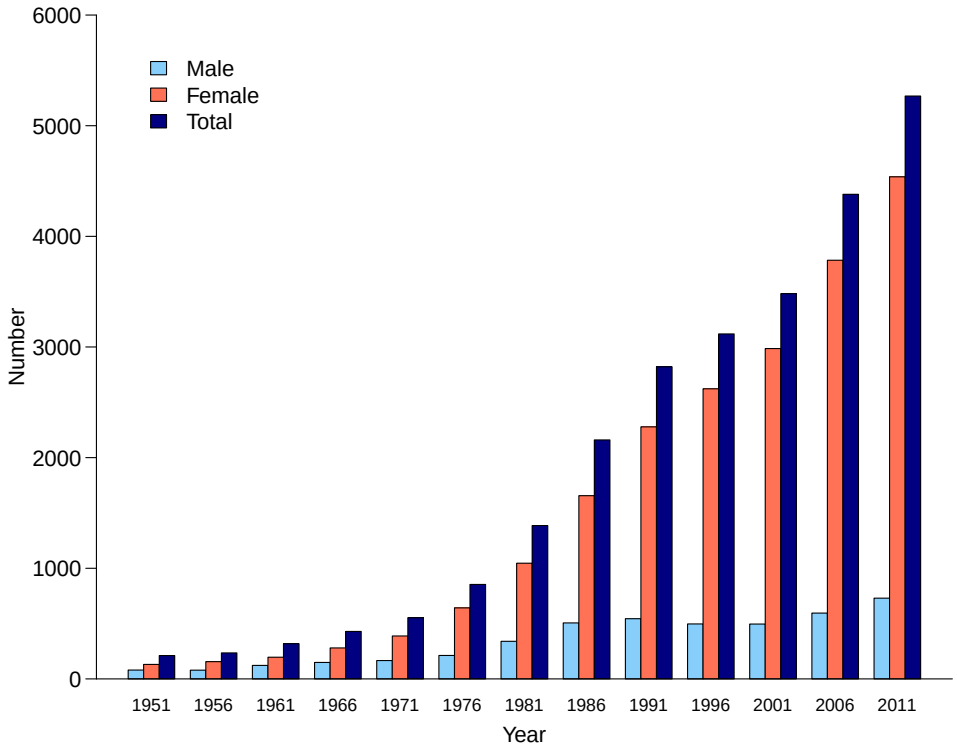


Figure 11. Number of centenarians for females and males in Canada, 1951–2011.
Sources: 1951–96: Canadian Human Mortality Database, 2014; 2001–11: Statistics Canada, CANSIM database (Table 051-0001).
Note: Estimated numbers of individuals aged 100 and above at 1st July in each year.

2012a). Moreover, the total number of centenarians in Canada could more than triple by 2031 and exceed 17,000 (Statistics Canada 2012b).

Given that females experience lower risks of death at every age compared to males, they are much more likely to reach the age of 100 than their male counterparts. In 2011, 85 per cent of Canadian centenarians were females. It is noteworthy that at the time of writing, the fourth-oldest verified person ever is Canadian: Marie-Louise Meilleur was born in 1880 and died in 1998 at age 117.6 (Desjardins 1999). She became the oldest verified living person in 1997 after Jeanne Calment's death[6] and held the title for close to nine months afterwards.

The number of centenarians is rising very rapidly in several other high-income countries, too. In Japan for instance, the population of centenarians was estimated at nearly 55,000 for 2013, yielding the world's highest rate, at more than 37.0 per 100,000 inhabitants. Canada counted about 17.4 centenarians per 100,000 in 2011, a share that is just below the average value for all G8 countries (Statistics Canada 2012b).

Healthy life expectancy

Declines in old-age mortality over time and the unprecedented numbers of people surviving to old and very old ages raise important questions about the quality of life. To determine whether extra years of life gained through increased longevity are mostly lived in good health (*compression of morbidity* scenario) or whether a greater share of these years are lived with disability, dependence, and/or handicap (*expansion of morbidity* scenario), one needs to assess the health status of the population. This implies developing new concepts—including that of disability, loss of autonomy, and social participation—and proposing indicators to monitor the health status of individuals and populations.

In Canada, interest in measuring health status goes back to 1950–51, when the first nationwide survey on health was conducted (Statistics Canada 1987). But the first estimated values of healthy life expectancy emerged only in the 1970s (Statistics Canada 1981, with linked data from the 1978–79 Canada Health Survey to the 1976 Canadian census), based on the Sullivan method (1971). Most cross-sectional surveys provide point estimates of the magnitude of the incapacity, disability, or poor health outcomes of individuals. These estimates then allow to disentangle the total number of years lived from those lived in good and poor health, and finally to compute values of life expectancy (LE)—at birth or at any other age—according to the selected health criteria (disability-free LE, handicap-free LE, health-adjusted LE, etc.).

Changes in healthy life expectancies could thus be monitored over time to determine whether a given population experiences compression or expansion of morbidity. The task is, however, quite challenging, because the data are often not comparable from one survey to the next—owing to the varying definition of health concepts, notably—or because periodic surveys are lacking. In fact, in Canada, the data available do not allow the study of long-term trends (Bourbeau et al. 2011). Studies over short-time periods prior to the mid-1990s reveal that gains in life expectancy have been roughly equally distributed between years lived with and without disability or dependence (Wilkins and Adams 1992; Roberge et al. 1999; Carrière and Légaré 2000; Martel and Bélanger 2006).

A recent Canadian study by Mandich and Margolis (2014) has enriched our knowledge by examining changes in disability-free life expectancy by sex between 1994 and 2007. Using data from two nationally representative surveys—the 1994–95 National Population Health Survey and the 2007–08 Canadian Community Health Survey—they define disability in two ways, reporting in terms of needing help with

6. Jeanne Calment was born in France in 1875 and died in 1997 at age 122.4 (Robine and Allard 1999). She is currently known as the oldest verified person who has ever lived.

at least one of the five everyday tasks[7] *and* needing help with at least two of these tasks. The results of the study differ by sex. For males, the findings do not clearly support either the compression or expansion of morbidity, because there were increases in both disability-free life expectancy and disabled years between 1994 and 2007. By contrast, female gains in life expectancy over the period consisted mostly of disabled instead of healthy years, thus supporting the expansion of morbidity scenario. For instance, Canadian females aged 70 can expect to live 17.2 more years in 2007 compared to 15.9 in 1994, but out of the 1.3 years of life gained, 1.2 years (92 per cent) are spent with disability. In sum, these findings indicate that the number of Canadians—females in particular—who require assistance with their daily activities is increasing. Public health policy adjustments to this reality are imperative.

The challenge of combating obesity

The growing presence of risk factors such as obesity, unhealthy diet, and physical inactivity among human populations supports arguments by some scholars— mainly social biologists—foreseeing a levelling-off or even a decline in life expectancy at birth and at older ages in the 21st century (Olshansky et al. 2005). The findings concern the United States, in particular, where obesity rates recorded in the early 2000s were especially high: "28 percent of men, 34 percent of women, and nearly 50 percent of non-Hispanic black women are currently obese [body mass index (BMI) between 30 and 35 kg/m^2]" (Olshansky et al. 2005: 1139). However, a recent study by Preston and colleagues (2014) sheds a different light on the topic by analyzing the effects of changes in obesity and smoking on future trends in life expectancy at age 40 (e_{40}) in the United States. Because gains in e_{40} from reduced smoking will exceed losses from increased obesity, e_{40} should continue to increase over the next 30 years in the United States, with projected net gains of 0.83 years for males but only 0.09 years for females.[8]

Nonetheless, obesity remains a matter of concern in Canada, both in terms of the burden of the disease and its financial consequences: obesity increases the risk of developing chronic diseases (e.g., cardiovascular diseases, diabetes, some types of cancers), and it has been estimated that in 2008 obesity cost the Canadian economy roughly $4.6 billion, up $735 million since 2000 (PHAC-CIHI 2011).

The overall national prevalence of *self-reported* obesity more than doubled between 1985 and 1998 in Canada, rising from 6 per cent to 15 per cent (Katzmarzyk 2002). According to the latest estimations, obesity rates *corrected for self-report bias* reached nearly 23 per cent in 2003 and 25 per cent in 2011, thus confirming a continued increase in the prevalence of obesity across the country over the past decade (Gotay et. al 2013). There is possibly a flattening since 2009 but it remains to be seen whether this trend will endure. In general, estimated obesity rates vary little by sex in Canada, but regional differences exist, with Atlantic provinces and the territories (except Yukon) having the highest values (current rates exceed 30 per cent) and British Columbia and Quebec the lowest ones (current rates below 25 per cent).

As to what are the *direct* effects of obesity on mortality, they are not well understood because it remains difficult to disentangle obesity's own effect on mortality from that of other risk factors, comorbidities, and confounding variables. A Canadian study has estimated that 9.3 per cent of all deaths recorded at ages 20–64 in 2000 could be attributed to overweight and obesity (Katzmarzyk and Ardern 2004). There is no doubt that obesity will continue to be a serious public health challenge in Canada, by increasing the number of years spent in poor health rather than reducing the total years lived.

7. The comparable tasks in both surveys have to do with preparing meals, personal care, moving about inside the house, doing housework, and leaving the house to attend somewhere or to pick up items.
8. These results differ from those of Stewart et al. (2009), who forecast negative net gains for both sexes combined over the period 2005–20.

Geographic disparities in mortality

In terms of regional mortality conditions, all Canadian provinces have recorded substantial mortality progress over the period 1921–2011 (Figure 12). Previous studies have shown that these mortality improvements tended to reduce any disparities that prevailed among them (Field 1980; Wilkins 1980; Adams 1990; Nault 1997). Such a finding is in line with the proposal that Canadian regions are becoming increasingly homogeneous in terms of their economic and socio-demographic characteristics over time (Matthews and Davis 1986; Goyder 1993). In spite of that, regional mortality differentials persist in Canada. For instance, long-standing geographical disparities continue to exist in favour of provinces in the Western part of the country compared to those in the East. More recent findings even suggest that since the late 1980s, the traditional east-west gradient might have clarified further into a well defined east-central-prairies-west gradient (Manuel and Hockin 2000; Prud'homme 2007), thereby confirming that regional mortality disparities are still worth documenting in Canada.

Studies reporting the prevalence of several major well-established risk behaviours and health conditions for cardiovascular disease by province help elucidate these provincial mortality disparities (Health Canada 1995; PHAC 2009). The life expectancy advantage of the westernmost Canadian provinces—British Columbia in particular—with respect to the other provinces is clearly reflected in their lower prevalence of smoking, physical inactivity, high blood pressure, and obesity. Nativity composition of the population in each province also proves helpful for understanding regional mortality differentials in Canada. Since immigrants account for a much larger share of the total population in western provinces, especially British Columbia, rather than Atlantic provinces, western provinces are likely to be advantaged in terms of overall mortality conditions (*healthy immigrant effect*). Moreover, immigrants established in western provinces may even experience lower mortality than those living in Atlantic provinces, because a greater part of them originate from non-European countries, namely Asia (Chen et al. 1996; Bourbeau 2002a).

A recent study focusing on mortality at adult and older ages reveals another aspect of geographical disparities in Canada (Ouellette et al. 2012). Using the adult modal age at death (M) and standard deviation of individual life durations above M (SD(M+)) to summarize the age distribution of deaths (see the section "Monitoring the compression of mortality at older ages"), the authors show that provincial disparities in old-age mortality have hardly decreased between 1930 and 2007, with western and central provinces currently displaying a clear survival advantage. Furthermore, some evidence of the shifting mortality regime was observed among females for a few western and central provinces, whereas all other populations were still undergoing an old-age mortality compression regime.

The Northwest Territories, Nunavut, and Yukon were excluded from Figure 12 mainly because of their relatively small population size, leading to substantial fluctuations, and also in that their data series are relatively shorter. Moreover, the territories are not directly comparable to other Canadian regions, due to their distinctive ethnic composition, consisting mostly of Aboriginal populations (First Nations, Métis, and Inuit). Life expectancy at birth values for the territories are relatively low, especially for males and females in Nunavut, who currently live on average 10 years less than all Canadians (Statistics Canada 2013b). Corresponding differences are smaller for the Northwest Territories and Yukon, about 3–4 years, but worrying nonetheless. Higher levels of infant, juvenile, and young adult mortality play major roles in explaining these disparities.

Socioeconomic inequalities in health

Socioeconomic inequalities in health persist. According to a deprivation index based on information collected at the micro-geographic level (Pampalon et al. 2009a), the life expectancy at age 25 of Canadian males living in advantaged neighborhoods in 1991–2001 was 4.4 years greater than that of

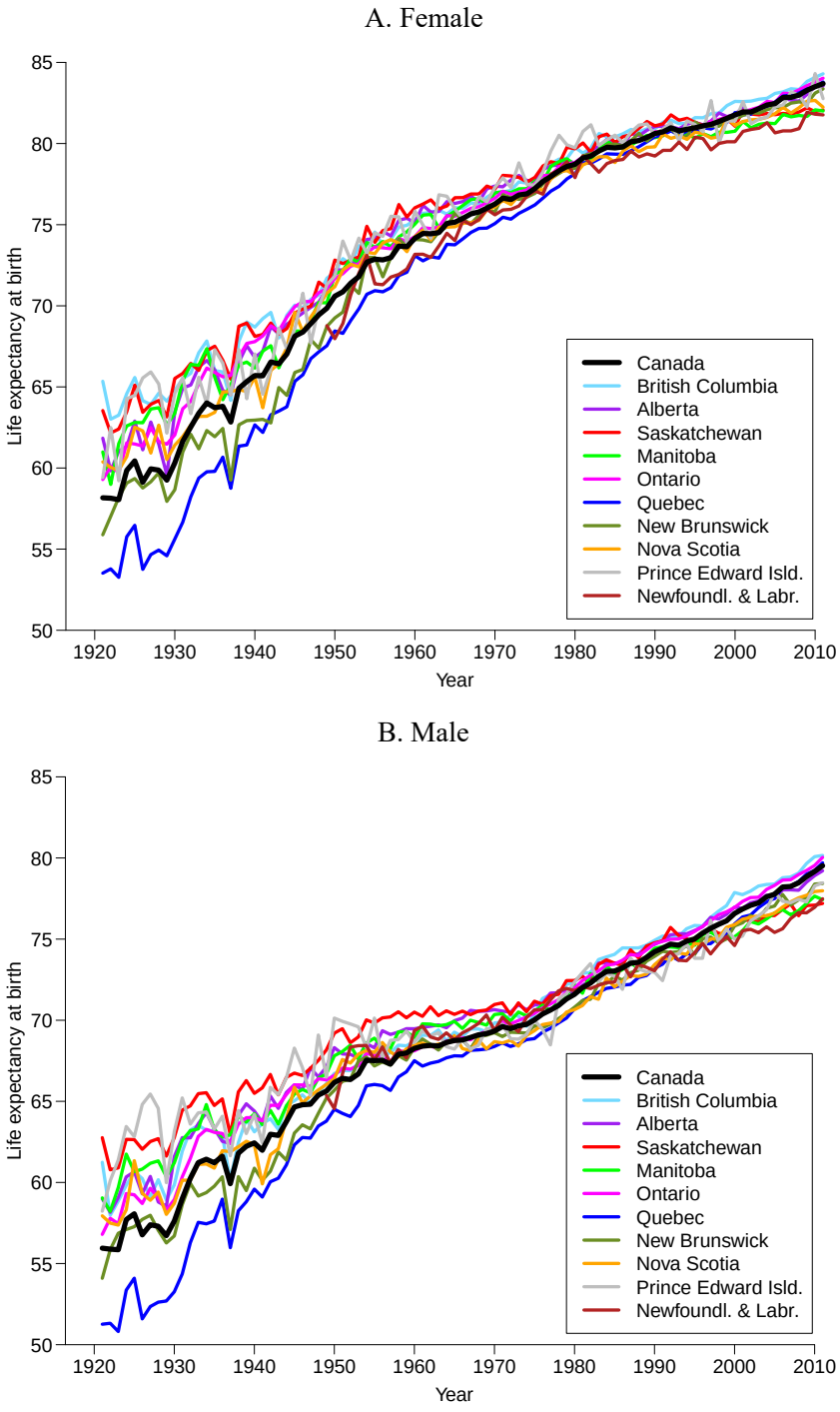


Figure 12. Life expectancy at birth for females and males, Canadian provinces, 1921–2011.

Source: Canadian Human Mortality Database, 2014.

males living in disadvantaged neighborhoods (Pampalon et al. 2009b); for women, the gap was 2.9 years. Moreover, social and material inequalities in health have likely worsened in Canada: the ratio of age-standardized mortality rates between the extreme quintiles of material and social disadvantage rose from 2.0 in 1989–93 to 2.6 in 1999–2003, for males and females aged under 75 (Pampalon et al. 2009c).

As opposed to several European countries, the United States, and New Zealand, Canada has long lacked nationally representative population-based cohort studies allowing researchers to fully examine the effect of socioeconomic status (SES) on mortality. This gap was filled partly in recent years by the Canadian census mortality follow-up study, an initiative of Statistics Canada to link mortality data from the Canadian Vital Statistics Death Database for the period 1991–2006 to the 1991 Canadian census data (Wilkins et al. 2008).

With these linked-data, it is possible to analyze all-cause mortality differences according to several socioeconomic factors (Wilkins et al. 2008; Mustard et al. 2013), in particular, place of birth (Omariba et al. 2014; Omariba 2015) and ethnic origin or Aboriginal identity (Tjepkema et al. 2009, 2010, 2012a), as well as cause-specific mortality differences by occupation and skill level (Mustard et al. 2010; Tjepkema et al. 2013b), by educational attainment (Tjepkema et al. 2012b), and by income level (Tjepkema et al. 2013a). In most cases, the studies find a gradient in mortality favouring persons of higher SES (with skilled jobs, higher levels of education, higher incomes, etc.), with the greatest differences recorded for causes of death that are closely related to tobacco and alcohol consumption. The gradient is also usually steeper at the lower rather than the higher end of the socioeconomic hierarchy, meaning that in the perspective of reduction or even elimination of health disparities, future declines in mortality would then be more pronounced for disadvantaged rather than advantaged groups.

Conclusion

Mortality projections for Canada and comparison with other low-mortality countries

To conclude, we shall look into the future and examine the various mortality projection scenarios that are currently available. In Canada, official statistics agencies often prepare projections as part of the development of population perspectives. At the federal level, Statistics Canada carries out periodic projections, with the latest results dating from 2014 (Statistics Canada 2014b). The Office of the Chief Actuary of Canada also conducts mortality projections for the *Actuarial Report on the Canada Pension Plan* (Office of the Chief Actuary 2012).

According to Statistics Canada, life expectancy at birth (e_0) could reach 87.6 years among males and 89.2 years among females in 2063 under a so-called *medium-growth* or central scenario. There are of course uncertainties about the future, which are reflected by a less favourable (*low-growth*) scenario, where e_0 would reach 86 and 87.3 years, respectively, for males and females; a more optimistic scenario (*high-growth*), on the other hand, suggests that e_0 would increase to 89.9 and 91.9 years for each sex, respectively, in 2063 (Statistics Canada, 2014b). The Office of the Chief Actuary's 2012 mortality projections are, on average, more conservative: male e_0 would attain 85.7 years, and female e_0 88.6 years, in 2075.

Table 2 allows comparisons between projections for Canada and for a set of 9 selected countries, made by their respective statistical offices. It should be noted, however, that these comparisons must be made carefully, keeping in mind that the expectations of life projected are likely produced using different assumptions about the pace and extent of mortality change in each of the countries over the projection period. The projection methodologies may also differ by country. From a general point of view, Table 2 shows that all offices foresee a continued growth of e_0 over the next 50 years. According to central scenarios presented in the table, Canada would remain among the countries with the lowest levels of mortality—in particular for males, where Canadian projections of e_0 rank them

first, just above those for the United Kingdom. Among females, the French are projected to overtake the Japanese in the next five decades, with a value of e_0 exceeding 91 years in 2060. In the United Kingdom, the Office for National Statistics forecasts that with a 90-year life expectancy at birth in 2062, about 60 per cent of UK females would survive to age 90 and 20 per cent to age 100, making 95 years the modal age at death (ONS 2013). These figures certainly render even more relevant the longstanding debate about whether humans possess an immutable lifespan limit.

Table 2. Period life expectancy at birth (in years) in 2012 and projected[a] to around 2060 for Canada and other selected countries

	2010/2012[b]		2060/2061/2062[c]	
Country	Males	Females	Males	Females
Canada	79.6	83.8	87.6	89.2
Australia	79.7	84.2	85.2	88.3
France	78.5	84.8	86.0	91.1
Japan	79.9	86.4	84.2	90.9
Netherlands	79.1	82.8	84.5	87.4
Norway	79.4	83.4	86.2	89.3
Sweden	79.5	83.4	84.9	87.0
Switzerland	80.5	84.7	86.1	90.2
United Kingdom	79.0	82.7	87.3	90.3
United States	75.7	80.8	82.8	86.8

Sources: For Canada, Statistics Canada (2014b); for France, INSEE (2010); for all other countries, Office for National Statistics (2013).

[a]Central scenarios.

[b]2010 for the United States and 2012 for all other countries.

[c]2060 for the Netherlands, the United States, and France, 2061 for Australia, and 2062 for all other countries.

Despite the greater presence of factors such as obesity, climate change, and air pollution that may adversely affect future human longevity increases (Finch et al. 2013), projections are heading in the same direction: over the next 50–60 years, e_0 will continue to rise not only in Canada but also in most low-mortality countries. This entails a wide range of challenges for societies, especially in regards to providing care to increasingly larger numbers of old and very old people, as well as persistent socio-economic inequalities.

References

Adams, O. 1990. Life expectancy in Canada: An overview. *Health Reports* 2(4):361–76.

Andreev, K. 2000. Sex differentials in survival in the Canadian population, 1921–1997: A descriptive analysis with focus on age-specific structure. *Demographic Research* 3(12):19p.

Bah, S.M., and F. Rajulton. 1991. Has Canadian mortality entered the fourth stage of the epidemiologic transition. *Canadian Studies in Population* 18(2):18–41.

Barbieri, M., and N. Ouellette. 2012. The demography of Canada and the United States from the 1980s to the 2000s: A summary of changes and a statistical assessment. *Population-E* 67(2):177–280.

Baxter, D., and A. Ramlo. 1998. *What Can You Expect: Life Expectancy in Canada, 1921 to 2021*. Vancouver: Urban Futures Institute.

Beaujot, R.P., and D. Kerr. 2003. *Population Change in Canada*. Toronto: Oxford University Press.

Bergeron, M-P. 2012. Changements épidémiologiques au Canada : un regard sur les causes de décès des personnes âgées de 65 ans et plus, 1979–2007. Master's thesis, Université de Montréal, Département de démographie.

Bongaarts, J. 2005. Long range trends in adult mortality: Models and projection methods. *Demography* 42(1):23–49.

Bourbeau, R. 2002a. L'effet de la "sélection d'immigrants en bonne santé" sur la mortalité canadienne aux grands âges. *Cahiers québécois de démographie* 31(2):249–74.

———. 2002b. Canadian mortality in perspective: A comparison with the United States and other developed countries. *Canadian Studies in Population* 29(2):313–369.

Bourbeau, R., and J. Légaré. 1982. *Évolution de la mortalité au Canada et au Québec 1831–1931: Essai de mesure par génération*. Démographie canadienne 6. Montréal: Presses de l'Université de Montréal.

Bourbeau, R., and A. Lebel. 2000. Mortality statistics for the oldest-old: An evaluation of Canadian data. *Demographic Research* 2:36p.

Bourbeau, R., J. Légaré, and N. Ouellette. 2011. Revue de la littérature sur l'évolution future de l'espérance de vie et de l'espérance de vie en santé. *Social and Economic Dimensions of an Aging Population* 289:101p.

Camarda, C.G. 2012. MortalitySmooth: An R package for smoothing Poisson counts with P-splines. *Journal of Statistical Software* 50(1):1–24.

Canadian Human Mortality Database. 2014. Université de Montréal (Canada), University of California, Berkley (USA), and Max Planck Institute for Demographic Research (Germany). Accessed via http://www. bdlc.umontreal.ca (data downloaded on [25/07/2014]).

Canudas-Romo, V. 2008. The modal age at death and the shifting mortality hypothesis. *Demographic Research* 19:1179–1204.

———. 2010. Time trends and record values for longevity. *Demography* 47(2):299–312.

Carrière, Y., and J. Légaré 2000. Unmet need for assistance with ADLs and IADLs: A measure of healthy life expectancy. *Social Indicators Research* 51(1):107–23.

Caselli, G., J.W. Vaupel, and A.I. Yashin. 1985. Mortality in Italy: Contours of a century of evolution. *Genus* 41(1–2):39–55.

Caselli, G., F. Meslé, and J. Vallin. 2002. Epidemiologic transition theory exceptions. *Genus* 58(1):9–51.

Charbonneau, H., Y. Lavoie, and J. Légaré. 1972. Étude des caractéristiques nominatives dans l'état civil et les recensements canadiens du XVIIe siècle : prélude à l'utilisation des ordinateurs pour le jumelage des données. *Annales de démographie historique* 72:269–95.

Chen, J., R. Wilkins, and E. Ng. 1996. Health expectancy by immigrant status, 1986 and 1991. *Health Reports* 8(3):29–38.

Cheung, S.L.K., and J-M. Robine. 2007. Increase in common longevity and the compression of mortality: The case of Japan. *Population Studies* 61(1):85–97.

Cheung, S.L.K., J-M. Robine, E.J-C. Tu, and G. Caselli. 2005. Three dimensions of the survival curve: Horizontalization, verticalization, and longevity extension. *Demography* 42(2):243–58.

Cheung, S.L.K., J-M. Robine, and G. Caselli. 2008. The use of cohort and period data to explore changes in adult longevity in low mortality countries. *Genus* LXIV(1–2):101–29.

Decady, Y., and L. Greenberg. 2014. *Ninety Years of Changes in Life Expectancy: Health at a Glance*. Catalogue no. 82-624-X. Ottawa: Statistics Canada.

Desjardins, B. 1999. Did Marie Louise Meilleur become the oldest person in the world? In *Validation of Exceptional Longevity*, edited by B. Jeune and J.W. Vaupel. Odense: Odense University Press, pp. 189–94.

Eilers, P.H.C., and B.D. Marx. 1996. Flexible smoothing with B-splines and penalties (with discussion). *Statistical Science* 11(2):89–121.

Field, N.C. 1980. Temporal trends and spatial patterns of mortality in Canada, in *Canadian Studies in Medical Geography*, edited by F.A. Barrett. Toronto: Department of Geography, Atkinson College, York University, pp. 32–58.

Finch, C.E., H. Beltrán-Sánchez, and E.M. Crimmins. 2013. Uneven futures of human lifespans: Reckonings from Gompertz mortality rates, climate change, and air pollution. *Gerontology* 60(2):183–88.

Frenk, J., J.L. Bobadilla, C. Stern, T. Frejka, and R. Lozano. 1991. Elements for a theory of the health transition. *Health Transition Review* 1(1):21–38.

Gotay, C.C., P.T. Katzmarzyk, I. Janssen, M.Y. Dawson, K. Aminoltejari, and N.L. Bartley. 2013. Updating the Canadian obesity maps: An epidemic in progress. *Canadian Journal of Public Health* 104(1):e64–e68.

Goyder, J. 1993. The Canadian syndrome of polarities: An obituary. *Canadian Review of Sociology and Anthropology* 30(1):1–12.

Health Canada. 1995. *Canadians and Heart Health, Reducing the Risk*. Catalogue no. H39-328/1995E. Ottawa: Minister of Supply and Services Canada.

Henripin, J. 2003. Les victoires contre la mort. In *La métamorphose de la population canadienne*, edited by J. Henripin, Montréal : Édition Varia, pp. 107–292.

Horiuchi S., N. Ouellette, S.L.K. Cheung, and J-M. Robine. 2013. Modal age at death: Lifespan indicator in the era of longevity extension. *Vienna Yearbook of Population Research* 11:37–69.

INSEE. 2010. *Estimations de population et statistiques de l'état civil jusqu'en 2007 et projection de population 2007–2060*. From N. Blanpain and O. Chardon. Projections de population à l'horizon 2060. INSEE Première (no. 1320, October).

Kannisto, V. 1994. *Development of Oldest-Old Mortality, 1950–1990: Evidence from 28 Developed Countries*. Odense: Odense University Press.

Kannisto, V. 2001. Mode and dispersion of the length of life. *Population: An English Selection* 13(1):159–71.

Katzmarzyk, P.T. 2002. The Canadian obesity epidemic, 1985–1998. *Canadian Medical Association Journal* 166(8):1039–40.

Katzmarzyk, P.T., and C.I. Ardern. 2004. Overweight and obesity mortality trends in Canada, 1985–2000. *Canadian Journal of Public Health* 95(1):16–20.

Lussier, M-H., R. Bourbeau, and R. Choinière. 2008. Does the recent evolution of Canadian mortality agree with the epidemiological transition theory? *Demographic Research* 18:531–68.

Mandich, S., and R. Margolis. 2014. Changes in disability-free life expectancy in Canada between 1994 and 2007. *Canadian Studies in Population* 41(1–2):192–208.

Manuel, D.G., and J. Hockin. 2000. Recent trends in provincial life expectancy. *Canadian Journal of Public Health* 91(2):118–19.

Martel, L., and A. Bélanger. 2006. An analysis of the change in dependence-free life expectancy in Canada between 1986 and 1996. *Report on the Demographic Situation in Canada, 1998–1999*. Catalogue no. 91-209-XPE. Ottawa: Statistics Canada.

Martel, S., and R. Bourbeau. 2003. Compression de la mortalité et rectangularisation de la courbe de survie au Québec au cours du XXe siècle. *Cahiers québécois de démographie* 32(1):43–75.

Matthews, R., and J.C. Davis. 1986. The comparative influence of regions, status, class, and ethnicity on Canadian attitudes and values, in *Regionalism in Canada*, edited by R.J. Brym. Toronto: Irwin, pp. 89–122.

Meslé, F. 2004. Écart d'espérance de vie entre les sexes : les raisons du recul de l'avantage féminin. *Revue d'épidémiologie et de santé publique* 52(4):333–52.

———. 2013. Will the gender gap in mortality continue to narrow? Paper presented at the Annual Meeting of the Population Association of America, New Orleans (April 11–13).

Meslé, F., and J. Vallin. 2000. Transition sanitaire : tendances et perspectives. *Médecine-Science* 16(11):1161–71.

Mustard, C.A., A. Bielecky, J. Etches, R. Wilkins, M. Tjepkema, B.C. Amick, P.M. Smith, W.H. Gnam, and K.J. Aronson. 2010. Suicide mortality by occupation in Canada, 1991–2001. *Canadian Journal of Psychiatry* 55(6):369–76.

Mustard, C.A., A. Bielecky, J. Etches, R. Wilkins, M. Tjepkema, B.C. Amick, P.M. Smith, and K.J. Aronson. 2013. Mortality following unemployment in Canada, 1991–2001. *BMC Public Health* 13:441–51.

Nagnur, D. 1986. Rectangularization of the survival curve and entropy: The Canadian experience, 1921–1981. *Canadian Studies in Population* 13:83–102.

Nagnur, D., and M. Nagrodski. 1990. Epidemiologic transition in the context of demographic change: The evolution of Canadian mortality pattern. *Canadian Studies in Population* 17(1):1–24.

Nault, F. 1997. Narrowing mortality gaps, 1978 to 1995. *Health Reports* 9(1):35–41.

Organisation for Economic Co-operation and Development (OECD) 2014. *OECD Health Statistics 2014*. Website: Public expenditure on health, % total expenditure on health, TEH. http://stats.oecd.org/Index.aspx?DataSetCode=SHA

Office for National Statistics. 2013. Historic and projected mortality data from the period and cohort life tables, 2012-based, UK, 1981–2062. *Statistical Bulletin* (Dec).

Office of the Chief Actuary. 2012. *26th Actuarial Report on the Canada Pension Plan, as at 31 December 2012*. Catalogue no. IN3-16/1-2012E-PDF. Ottawa.

Olshansky, J.S., and B.A. Ault. 1986. The fourth stage of the epidemiologic transition: The age of delayed degenerative diseases. *The Milbank Quarterly* 64(3):355–91.

Olshansky, S.J., D.J. Passaro, R.C. Hershow, J. Layden, B.A. Carnes, J. Brody, L. Hayflick, R.N. Butler, D.B. Allison, and D.S. Ludwig. 2005. A potential decline in life expectancy in the United States in the 21st century. *The New England Journal of Medicine* 352(11):1138–42.

Omariba, W.R. 2015. Immigration, ethnicity, and avoidable mortality in Canada, 1991–2006. *Ethnicity & Health* 20(4):409–36.

Omariba, D.W.R., E. Ng, and B. Vissandjée. 2014. Differences between immigrants at various durations of residence and host population in all-cause mortality, Canada 1991–2006. *Population Studies* 68(3):339–57.

Omran, A. 1971. The epidemiologic transition: A theory of the epidemiology of population change. *The Milbank Memorial Fund Quarterly* 49(4):509–38.

Ouellette, N., M. Barbieri, and J.R. Wilmoth. 2014. Period-based mortality change: Turning points in trends since 1950. *Population and Development Review* 40(1):77–106.

Ouellette, N., and R. Bourbeau. 2011. Changes in the age at death distribution in four low mortality countries: A nonparametric approach. *Demographic Research* 25:595–628.

Ouellette, N., R. Bourbeau, and C.G. Camarda. 2012. Regional disparities in Canadian adult and old-age mortality: A comparative study based on smoothed mortality ratio surfaces and age-at-death distributions. *Canadian Studies in Population* 39(3–4):79–106.

Pampalon, R., D. Hamel, P. Gamache, and G. Raymond. 2009a. A deprivation index for health planning in Canada. *Chronic Diseases in Canada* 29(4):178–91.

Pampalon, R., D. Hamel, and P. Gamache. 2009b. A comparison of individual and area-based socio-economic data for monitoring social inequalities in health. *Health Reports* 20(4):85–94.

Pampalon, R., D. Hamel, and P. Gamache. 2009c. Un indice de défavorisation pour la planification de la santé au Canada. Paper presented at the joint CIHI-INSPQ Workshop, Montreal (September 23).

Pampel, F.C. 2002. Cigarette use and the narrowing sex differential in mortality. *Population and Development Review* 28(1):77–104.

Pearl, R. 1923. *Introduction to Medical Biometry and Statistics*. Philadelphia: W.B. Saunders Co.

Peto, R., A.D. Lopez, J. Boreham, and M. Thun. 2005. *Mortality from Smoking in Developed Countries 1950–2000*. 2nd edn. Oxford: Oxford University Press.

PHAC (Public Health Agency of Canada). 2009. Tracking Heart Disease and Stroke in Canada (Cat. No. HP32- 3/2009E). Accessed via http://www.phac-aspc.gc.ca/publicat/2009/cvd-avc/pdf/cvd-avs-2009-eng.pdf.

Preston, S.H., and H. Wang. 2006. Sex mortality differences in the United States: The role of cohort smoking patterns. *Demography* 43(4):631–46.

Preston, S.H., D.A. Glei, and J.R. Wilmoth. 2011. Contribution of smoking to international differences in life expectancy. In *International Differences in Mortality at Older Ages: Dimensions and Sources*, edited by E.M. Crimmins, S.H. Preston, and B. Cohen. Washington D.C.: National Academies Press, pp. 105–31.

Preston, S.H., A. Stokes, N.K. Mehta, and C. Bochen. 2014. Projecting the effect of changes in smoking and obesity on future life expectancy in the United States. *Demography* 51:27–49.

Prud'homme, P. 2007. Évolution de la mortalité différentielle selon la province au Canada. Master's Thesis. Université de Montréal, Département de démographie.

Public Health Agency of Canada, and Canadian Institute for Health Information (PHAC-CIHI). 2011. *Obesity in Canada*. Ottawa.

Rau, R., C. Bohk, M.M. Muszynska, and J.W. Vaupel. 2013. Rates of mortality improvement on the Lexis surface: Visualizing age-, period-, and cohort-effects. Paper presented at the Annual Meeting of the Population Association of America, New Orleans (April 11–13).

Robine, J-M., and M. Allard. 1999. Jeanne Calment: Validation of the duration of her life, in *Validation of Exceptional Longevity*, edited by B. Jeune and J.W. Vaupel. Odense: Odense University Press, pp. 145–72.

Roberge, R., J-M. Berthelot, and K. Cranswick. 1999. Adjusting life expectancy to account for disability in a population: A comparison of three techniques. *Social Indicators Research* 48:217–243.

Statistics Canada. 1981. *The Health of Canadians: Report of the Canada Health Survey*. Catalogue no. 82-538. Ottawa: Health and Welfare Canada/Statistics Canada.

———. 1987. *A review of National Health Surveys in Canada, 1878–1987*. Report by the Working Group on Health Indicators. Ottawa: Health Division.

———. 2012a. *The Canadian Population in 2011: Age and Sex*. Catalogue no. 98-311-X. Ottawa: Demography Division.

———. 2012b. *Centenarians in Canada: Age and sex, 2011 Census*. Catalogue no. 98-311-X2011003. Ottawa.

———. 2013a. *Report on the Demographic Situation in Canada. Fertility: Overview, 2009 to 2011*. Catalogue no. 91-209-X. Ottawa: Demography Division.

———. 2013b. *Life Tables, Canada, Provinces and Territories, 2009 to 2011*. Catalogue no. 84-537-X – No. 005. Ottawa: Demography Division.

———. 2014a. *Annual Demographic Estimates: Canada, Provinces and Territories*. Catalogue no. 91-215-X. Ottawa: Demography Division.

———. 2014b. *Population Projections for Canada (2013 to 2063), Provinces and Territories (2013 to 2038)*. Catalogue no. 91-520-X. Ottawa: Demography Division.

Stewart, S.T., D.M. Cutler, and A.B. Rosen. 2009. Forecasting the effects of obesity and smoking on U.S. life expectancy. *The New England Journal of Medicine* 361:2252–60.

Sullivan, D. 1971. A single index of mortality and morbidity. *HSMHA Health Reports* 86:347–54.

Thatcher, A.R., V. Kannisto, and J.W. Vaupel. 1998. *The Force of Mortality at Ages 80 to 120*. Odense: Odense University Press.

Tjepkema, M., R. Wilkins, N. Goedhuis, and J. Pennock. 2012a. Cardiovascular disease mortality among First Nations people in Canada, 1991–2001. *Chronic Diseases in Canada* 32(4):200–07.

Tjepkema M., R. Wilkins, and L. Long. 2012b. Cause-specific mortality by education in Canada: A 16-year follow-up study. *Health Reports* 23(3):3–11.

———. 2013a. Cause-specific mortality by income adequacy in Canada: A 16-year follow-up study. *Health Reports* 24(7):14–22.

———. 2013b. Cause-specific mortality by occupational skill level in Canada: a 16-years follow-up study. *Chronic Diseases and Injuries in Canada* 33(4):219–30.

Tjepkema M., R. Wilkins, S. Senécal, É. Guimond, and C. Penney. 2009. Mortality of Métis and registered Indian adults in Canada: An 11-year follow-up study. *Health Reports* 20:31–51.

———. 2010. Mortality of urban Aboriginal adults in Canada, 1991–2001. *Chronic Diseases in Canada* 31(1):5–25.

Trovato, F. 1985. Mortality differences among Canada's indigenous and foreign-born populations, 1951–1971. *Canadian Studies in Population* 12(1):49–80.

———. 1993. Mortality differences by nativity during 1985–87. *Canadian Studies in Population* 20(2):207–23.

———. 2007. Narrowing sex differential in life expectancy in Canada. In *The changing Face of Canada. Essential Readings in Population*, edited by R. Beaujot and D. Kerr. Toronto: CSPI, pp. 127–40.

Trovato, F., and N.M. Lalu. 1995. The narrowing sex differential in mortality in Canada since 1971. *Canadian Studies in Population* 22(2):145–67.

———. 2001. Narrowing sex differences in life expectancy: Regional variations, 1971–1991. *Canadian Studies in Population* 28(1):89–110.

Trovato, F., and N.B. Heyen. 2006. A varied pattern of change of the sex differential in survival in the G7 countries. *Journal of Biosocial Science* 38(3):391–401.

van Raalte, A.A., and H. Caswell. 2013. Perturbation analysis of indices of lifespan variability. *Demography* 50:1616–40.

Wadhera, S., and J. Strachan. 1993a. *Selected Birth and Fertility Statistics, Canada, 1921–1990*. Catalogue no. 82-553. Ottawa: Statistics Canada.

———. 1993b. *Selected Infant Mortality and Related Statistics, Canada, 1921–1990*. Catalogue no. 82-549. Ottawa: Statistics Canada.

Waldron, I. 1993. Recent trends in sex mortality ratios for adults in developed countries. *Social Science & Medicine* 36(4):451–62.

Wilkins, R. 1980. *L'état de santé au Canada, 1926–1976*. Montréal: Institut de recherches politiques.

Wilkins, R., and O. Adams. 1992. Les tendances de l'espérance de vie en santé au Canada, 1951–1986. In *Espérances de santé*, edited by J-M. Robine, M. Blanchet, and J.E. Dowd. Paris: INSERM.

Wilkins, R., M. Tjepkema, C. Mustard, and R. Choinière. 2008. The Canadian census mortality follow-up study, 1991 through 2001. *Health Reports* 19(3):27–48.

Wilmoth, J.R., L.J. Deegan, H. Lundström, and S. Horiuchi. 2000. Increase of maximum life-span in Sweden, 1861–1999. *Science* 289(5488):2366–68.

Wilmoth, J.R., and S. Horiuchi. 1999. Rectangularization revisited: Variability of age at death within human populations. *Demography* 36(4):475–95.

Yashin, A.I., A.S. Begun, S.I. Boiko, S.V. Ukrainseva, and J. Oeppen. 2001. The new trends in survival improvement require a revision of traditional gerontological concepts. *Experimental Gerontology* 37(1):157–67.

Zanfongnon, R. 2008. Évolution de la mortalité différentielle selon le sexe au Canada, 1921–2004 : variations régionales. Master's Thesis, Université de Montréal, Département de démographie.

Table A-1. Concordance table used for bridging five revisions of the International Classification of Diseases for broad cause-of-death categories

Cause of death	ICD categories				
	ICD-6	ICD-7	ICD-8	ICD-9	ICD-10
Malignant neoplasms	140–205	140–207	140–209	140–208	C00–C97
Smoking-related malignant neoplasms[a]	140–148, 150, 161–163	140–148, 150, 161–163	140–150, 161–162	140–150, 161–162	C00–C15, C32–C34
Other malignant neoplasms	151–160, 164–205	151–160, 164–207	151–160, 163–209	151–160, 163–208	C16–C31, C37–C97
Cardiovascular diseases	330–334, 400–468	330–334, 400–468	390–458	390–459	I00–I99
Heart diseases	400–447, 465	400–447, 465	390–429, 450	390–429	I00–I52
Cerebrovascular diseases	330–334	330–334	430–438	430–438	I60–I69, G45
Other cardiovascular diseases	450–464, 466–468	450–464, 466–468	440–448, 451–458	440–459	I70–I99
Infectious and parasitic diseases	001–138	001–138	000–136	001–139	A00–B99
Respiratory diseases	241, 470–527	241, 470–527	460–519	460–519	J00–J99
Other diseases	240, 210–326, 340–398, 530–776	240, 210–326, 340–398, 530–776	210–389, 520–779	210–389, 520–779	D00–D89, E00–H95 (excl. G45), K00–Q99
Deaths from external causes	E800–999	E800–999	E800–999	E800–999	V01–Y98
Ill-defined causes of death	780–795	780–795	780–796	780–799	R00–R99

Source: Created by the authors from various sources.
Note: Items of ICD-6 are for years 1950-1957, ICD-7 for 1958-1968, ICD-8 for 1969-1978, ICD-9 for 1979-1999, and ICD-10 from 2000.
[a]Includes malignant neoplasms of lip, oral cavity, pharynx, oesophagus, larynx, trachea, bronchus, and lung.

Canadian Studies in Population 43, no. 1–2 (2016): 78–116.

Canada's immigration trends and patterns

Barry Edmonston[1]

Abstract

Canada was settled by immigrants, including Aboriginal peoples who arrived thousands of years ago, French and British settlers who first began arriving in the 1600s, and people from many other nations who have migrated in the past four centuries. Now, almost 150 years since the Confederation of Canada in 1867, immigrants numbered 6.8 million and comprised 20 per cent of the total population in 2011. Canada's population has completed the demographic transition from high mortality and fertility to relatively low vital rates, accompanied by continued, fluctuating international migration. Canada's population reflects this fertility and mortality history, as well as the effects of international migration. Immigration has increased in significance in recent decades as one of the key factors influencing population change. This paper examines Canada's trends and patterns in international migration.

Keywords: Immigration history, Canada, population change, emigration.

Résumé

Le Canada fut colonisé par des immigrants, y compris les Autochtones qui arrivèrent il y a des milliers d'années, les colons français et britanniques dès les années 1600 et les peuples de beaucoup d'autres nations qui migrèrent au cours des quatre derniers siècles. De nos jours, presque 150 ans après la fédération canadienne de 1867, le pays accueillit 6,8 millions d'immigrants qui représentèrent 20 pour cent de la population totale en 2011. La population canadienne compléta la transition démographique, allant d'une mortalité et fertilité élevée à des indices vitaux relativement bas, mais toujours accompagnés d'une migration internationale continue et fluctuante. La population canadienne reflète cet historique de fertilité et mortalité ainsi que l'effet de la migration internationale. L'immigration a pris plus d'importance au cours des dernières décennies en tant qu'un des facteurs clés influençant les fluctuations démographiques. Cet article examine les tendances et les pratiques en matière de migration internationale.

Mots-clés : historique de l'immigration, Canada, fluctuations démographiques, émigration.

Introduction

Canada is a nation primarily composed of immigrants and the descendants of immigrants. The nation has a long and complex immigration history. An understanding of this history is indispensable in order to appreciate the present ethnic background and the contribution of immigration to Canada's population change. Moreover, immigrant origin and ethnic origin remain an important factor in the social, political, and economic lives of many people. The fact that a large and increasing fraction of Canadian residents is foreign-born means that ethnic heterogeneity remains high. The number of

1. Research Professor, Department of Sociology and Population Research Group, University of Victoria, PO Box 3050 STN CSC, Victoria BC V8W 3P5. E-mail: be@uvic.ca.

foreign-born persons is currently large, and the number of children and grandchildren of foreign-born persons is much larger, and will continue to increase.

This paper provides a survey of Canada's immigration trends and patterns. It is not intended to be an exhaustive review of the state of knowledge of immigration to Canada. Rather, this paper limits attention to an historical overview of demographic trends in international migration since the mid-1800s, a summary of data on the composition and characteristics of the recently arrived and total foreign-born population, a short discussion of two key factors affecting immigrant integration, and the demographic effects of Canada's immigration. The paper ends with a discussion of future prospects for Canadian immigration, including national population projections, public opinion on Canada's immigration, and concluding remarks.

International migration trends

Since 1851, immigration flows to Canada have averaged around 120,000 arrivals per year, with considerable variation from the peaks during the 1900s, 1910s, and 1950s to the valleys of the 1890s, late 1910s, 1930s, and early 1940s. Figures 1 and 2 trace the history of immigration to Canada since the inception of population censuses for Canada in 1851.[2] Figure 1 shows annual immigrant arrivals for 1851 to 2014. Figure 2 presents five-year annual averages for immigration, emigration, and net immigration, in order to highlight the main trends that may be obscured in volatile annual data. These figures show the immigration boom that occurred during the period of 1900 to 1914. Immigration from Europe was especially numerous during this period, which was a time of population settlement of the Prairie provinces and rapid urbanization and industrialization throughout Canada. The peak year for admission of immigrants to Canada was 1913, when almost 350,000 immigrants entered and added about 5 per cent to the Canadian population in one year alone. From 1880 to 1930 there was prolonged large-scale immigration from Europe to Canada; during this fifty-year period, immigration exceeded 10 immigrants per 1,000 population, with comparatively much higher rates in the late 1880s and from 1900 to 1914. However, during this period, high levels of emigration, especially of Canadian-born residents, offset immigration levels, with net out-migration for most of the 1870 to 1900 period.

The five-year period of 1909 to 1913 witnessed the largest volume of Canadian immigration, in both absolute and relative terms, with the arrival of 1.3 million immigrants, or more than 250,000 annually. By 1913, more than one-sixth of the Canadian population had arrived in the preceding five years. Limiting attention to the foreign-born population in 1913, about one-half had arrived in Canada in the prior five years.

Immigration levels declined during World War I and increased in the early 1920s. As economic conditions worsened in Europe in the 1920s, migration to Canada increased after 1918, averaging about 100,000 immigrants annually in the early 1920s and almost 150,000 immigrants in the late 1920s. In contrast, few immigrants came during the 1890s, World War I, and the 1930 to 1945 period of the Great Depression and World War II. There were only about 15,000 immigrants arriving per year on average in the 1930s, and the numbers decreased even further during World War II, to a low of 7,500 immigrants in 1942. At the same time, there was substantial emigration from Canada during the 1930s, resulting in net outmigration during the Depression years.

2. Immigration and emigration tables and figures are based on published Statistics Canada data and are discussed in the Appendix. See Edmonston and Michalowski (2003) for a discussion of international migration data and definitions. See Simmons (2010), Boyd (2011), and Beaujot and Raza (2013) for additional descriptions of Canadian immigration trends.

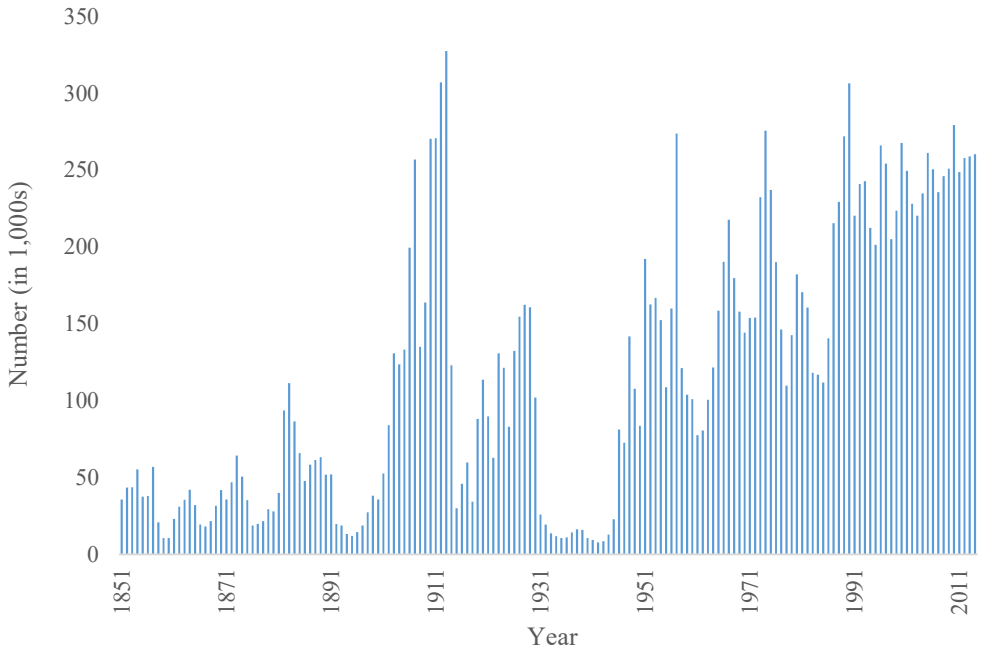


Figure 1. Annual number of immigrant arrivals (in 1,000s) for Canada, 1851–2014.
Sources: Citizenship and Immigration Canada, 1999 and 2014; annual figures adjusted for 1851 to 1861 from Keyfitz, 1950; for 1861 to 1931 from McInnis, 2000a and 2000b; and for 1931 to 2014 from Statistics Canada, www.statcan.gc.ca/tables-tableaux/sum-som/l01/cst01/demo03-eng-htm and CANSIM Table 051.004..

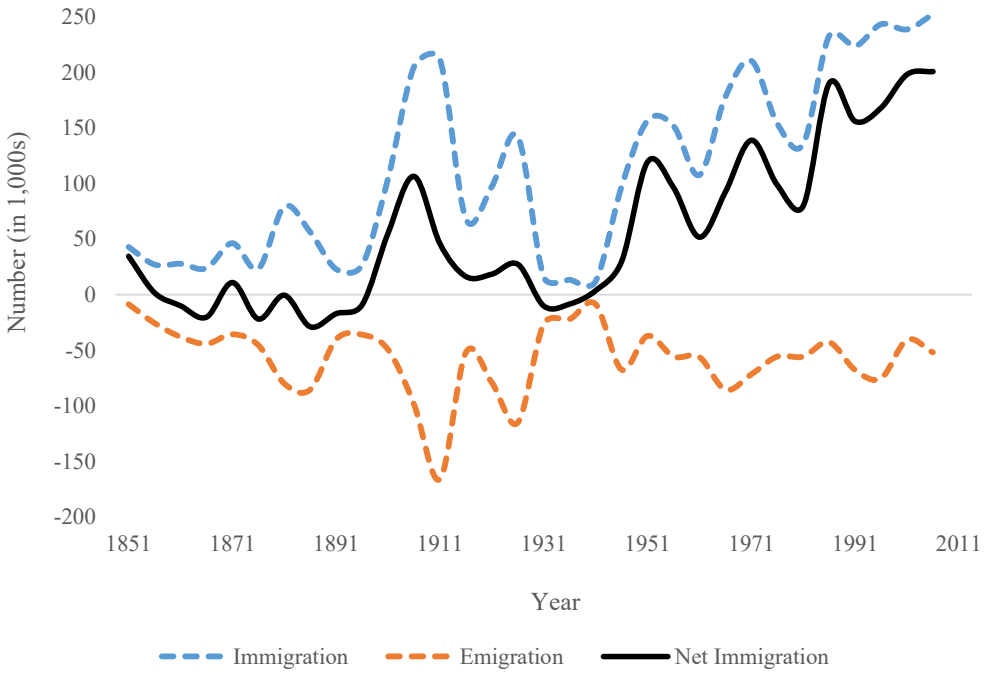


Figure 2. Five-year annual average international migration numbers (in 1,000s) for Canada, 1851–2011.
Source: Appendix Table 2, annual averages based on the beginning of each 5-year period..

Immigration increased steadily in the decades after World War II because Canada enjoyed a high degree of political freedom and economic prosperity, compared with Europe and many other parts of the world. Available employment in the expanding manufacturing, resource, and construction sectors of the Canadian economy gave ample opportunities for a new wave of immigrants. The 1967 changes in immigration law, including the elimination of national preference policies that had favoured immigration from European countries, prompted further increases as Canada began to receive new immigrants from Asia and Latin America. After 1967, equal preference was given to applications from any country, evaluated based on a point system for individual characteristics (higher points were given to younger adults, persons who spoke English or French, and those having higher education or occupation skills needed in Canada).

Because Canada's population has grown considerably since 1851, it is important to consider the volume of immigration compared to population size in assessing the total impact of net immigration (see Figure 3, which shows international migration rates per 1,000 population at the beginning of each 5-year period). Since 1851, when Canada's population numbered 2.6 million, the population has increased thirteen-fold, to 34.5 million in 2011. Has immigration increased at a comparable rate? The answer is clearly no. As shown in Figure 3, immigration relative to population size is now about one-third of the peak levels in the first decade of the twentieth century. Immigration during the 1901–11 decade, for example, amounted to 27.6 per cent of the 1901 population. The comparable figure for 2001–11 is 8.3 per cent, or about one-third the 1901–11 rate. Relative net immigration levels are also lower than earlier in the 20th century. Net immigration during 2001–11 is 5.9 per cent of the population at the beginning of the decade, compared with 15.5 per cent during the 1901–11 decade. The relative differences are slightly larger for net immigration than for gross immigration alone, because of the higher levels of emigration (both in relative and absolute terms) early in the twentieth century.

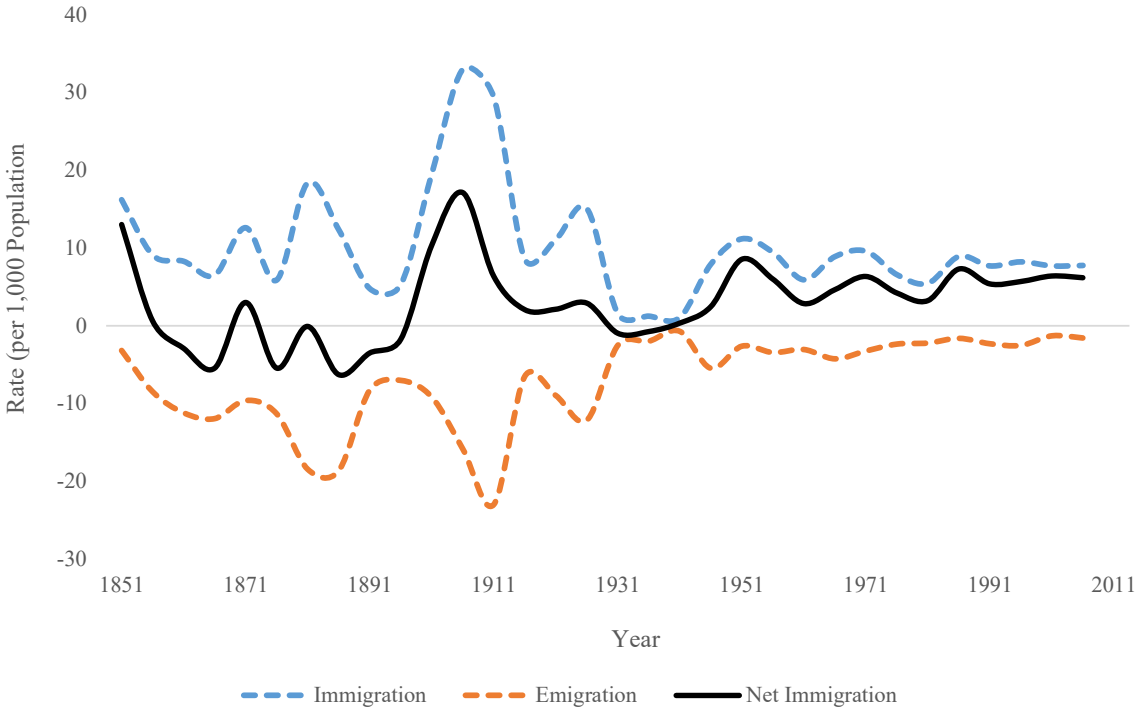


Figure 3. Five-year annual average international migration rates for Canada, 1851–2011 (rates are per 1,000 population at the beginning of the year).
Source: Appendix Table 2, annual average rates based on the beginning of each 5-year period.

Foreign-born population

The 2011 census counted 6.8 million foreign-born residents in Canada. By comparison, the 1901 census enumerated less than one million foreign-born. The foreign-born population increased to 1.6 million in 1911, almost 2 million in 1921 and 2.3 million in 1931. The foreign-born population diminished during the Great Depression and World War II years, dropping to 2.1 million in 1951. Since then, the foreign-born population has grown steadily.

The lowest proportion of foreign-born was in 1901, when 13 per cent of Canada's population was foreign-born (see Figure 4). This proportion almost doubled, to 22 per cent, in 1931. With low immigration until after World War II, the foreign-born population decreased to less than 15 per cent in 1951. The proportion foreign-born has increased since 1951, to 16 per cent in 1961, 18 per cent in 2001 and 21 per cent in 2011.

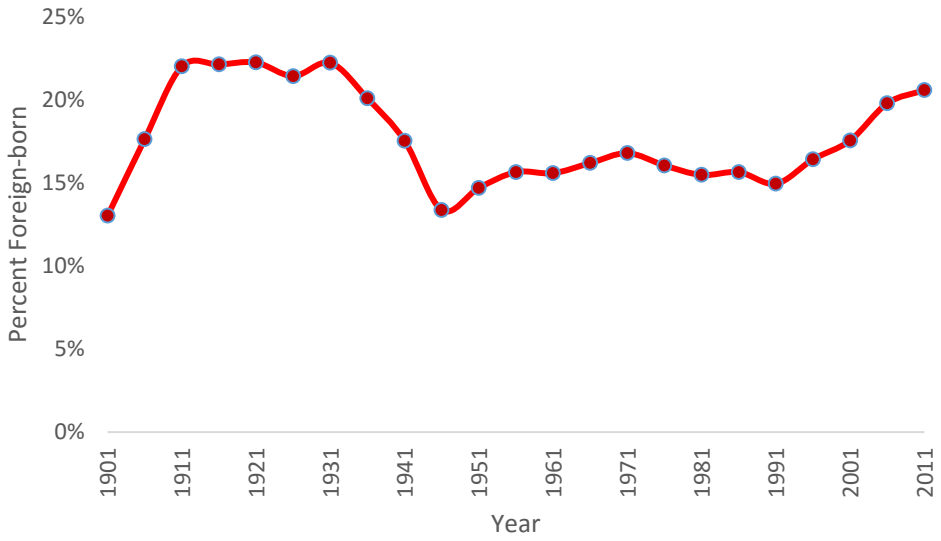


Figure 4. Per cent foreign-born for Canada, 1901–2011.
Sources: Statistics Canada, Number and share of the foreign-born population in Canada, 1901 to 2006, downloaded from http://www12.statcan.ca/census-recensement/2006/as-sa/97-557/figures/c1-eng.cfm; Statistics Canada, 2011 National Household Survey microdata sample.

Emigration trends

Immigration has had a considerable impact on population growth in Canada during the past 160 years. To fully appreciate the overall influence of immigration, however, it is necessary to take into account the effect of emigration as well as immigration. Emigration offsets the population gains stemming from immigration. Moreover, the number of emigrants has changed substantially since 1851.

As shown in Figures 2 and 3, emigration reached a peak of 150,000 per year around 1911, and another peak of 100,000 per year in the late 1920s. As discussed below, the first period of high emigration from 1901 to 1931 was characterized by large flows of Canadian-born residents, while the second period from 1931 to 1941 witnessed both returning emigration of European-origin immigrants as well as some emigration of Canadian-born residents to the United States. Current levels of emigration are now lower, both in numerical and percentage terms. There were about 460,000 emigrants during the 2001–11 decade. As a result, the gains from net immigration today are almost twice

as large as in the first decade of the 20th century. In the decade ending in 1911, there were 1,550,000 immigrants and 740,000 emigrants, producing a net immigration of 810,000. For the decade ending in 2011, there were almost 2,457,000 immigrants and 462,000 emigrants, yielding a net immigration gain of 1,995,000, more than twice as high as the net immigration for 1901–11. Thus, compared with early in the 20th century, immigration levels are moderately higher, emigration is considerably lower, and net immigration is twice as large.

Past discussion of Canada's emigration trends has largely focussed on overall emigration. It is of some interest to also examine the distinctive trends in emigration separately for the foreign- and Canadian-born.[3] Both the foreign-born and Canadian-born might depart Canada because of better prospects in other countries. The two groups, however, have different backgrounds and are likely to emigrate for different reasons. Some immigrants to Canada learn that they prefer living in their home country after experiencing Canadian residence. Other immigrants do not find suitable employment and learn after arrival that their prospects are better in their home country. This type of emigration is most common among recently arrived immigrants. Canadian-born people may decide to visit or study in other countries, particularly in the United States, and establish social networks there that lead to employment opportunities. Canadian-born residents may also emigrate because of marriage to someone in another country.

The number of emigrants by nativity reveals striking difference in the periods before and after 1931 (as shown in Figure 5). Prior to about 1931, the largest number of emigrants were

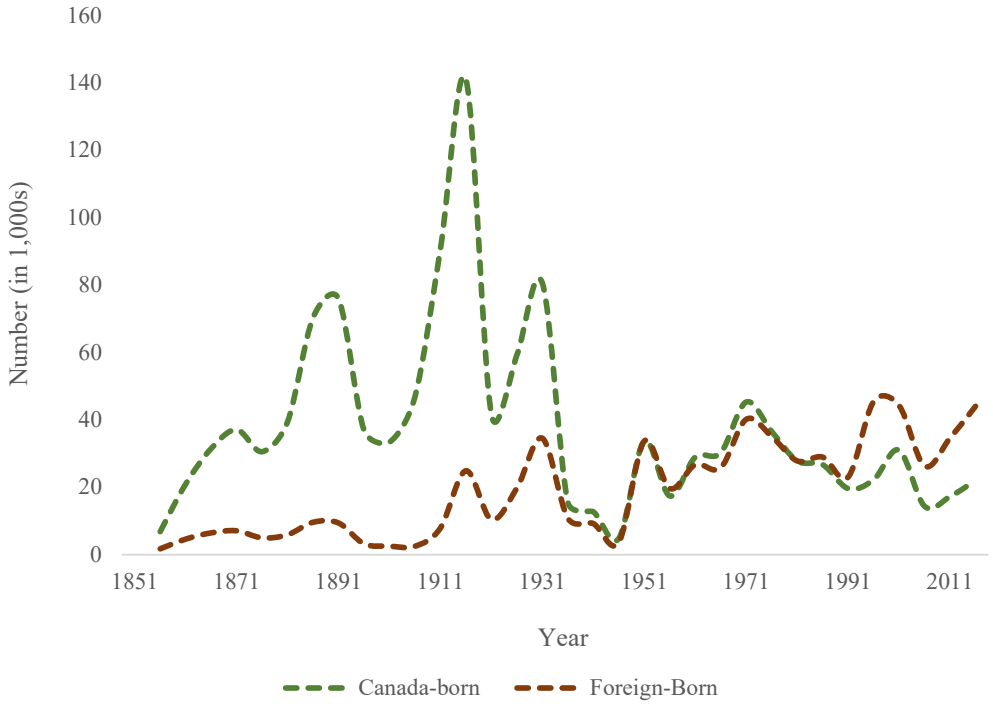


Figure 5. Five-year annual average emigration numbers (in 1,000s) by nativity for Canada, 1851–2011.

Source: Appendix Table 2, annual averages based on the beginning of each 5-year period.

3. As explained in the Appendix, this paper presents historical estimates of emigration for the foreign-born and Canadian-born for 1851 to 2011. Previous emigration estimates are limited to the total population.

Canadian-born, with a heavy flow of emigrants to the United States in the late 1800s and early 1900s, when there was rapid industrialization in the northeast and midwest regions of the United States. The emigration of Canadians to United States was particularly large during 1881 to 1914, reaching a peak of 140,000 annually in the first decade of the 1900s (Lavoie 1972). Emigration of the foreign-born was at a much lower level than the Canadian-born prior to 1931, with annual emigration levels usually less than 20,000 per year. Unlike Canadian-born emigrants, the foreign-born often returned to their home country, although some, like the Canadian-born, also moved to the United States.

Annual emigration numbers for Canadian- and foreign-born were similar between 1931 and 1981, with 20,000 to 40,000 annual emigrants for each of the two nativity groups. Since 1981, emigration has become larger for the foreign-born than the Canadian-born. In recent years, about 20,000 Canadian-born and 40,000 foreign-born emigrate annually.

In addition, because the relative sizes of the Canadian-born and foreign-born population vary over time, it is useful to further examine *emigration rates* for each group. Figure 6 presents data on trends in emigration rates, per 1,000 population, over time by nativity. Although emigration rates were somewhat higher for the Canadian-born than the foreign-born prior to about 1911, the differences in emigration rates differ much less than the number of emigrants. Because the foreign-born population was relatively small in the 1800s, even if emigration rates were similar to those for the Canadian-born, it would produce a comparatively small number of emigrants. Since about 1941, the emigration rate for the Canadian-born has remained relatively low, ranging between 0.5 and 2.0 per 1,000 population. The emigration rate for the foreign-born has fluctuated considerably during the past fifty years. In recent years, the emigration rate for the foreign-born has been about 6 per 1,000, much higher than the emigration rate for Canadian-born residents.

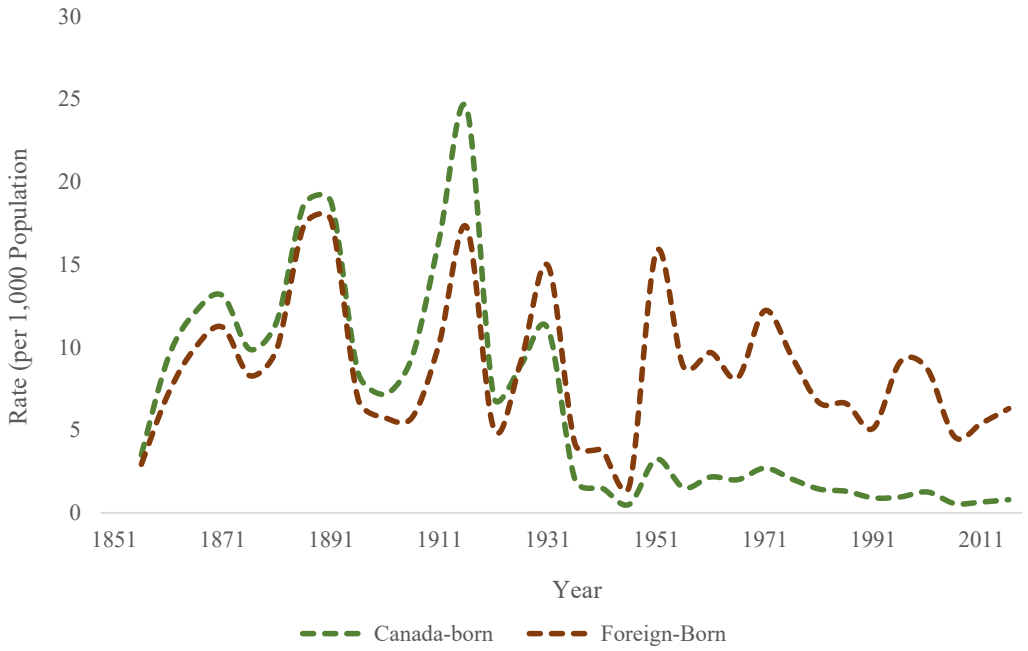


Figure 6. Five-Year annual average emigration rates for Canada by nativity, 1851–2011 (rates are per 1,000 population at the beginning of the year).
Source: Appendix Table 2, annual average rates based on the beginning of each 5-year period.

Current foreign-born population

Immigration has injected large numbers of the foreign-born into the population of Canada. These immigrants come from many different nations. Some of these national groups are quite large, and become influential socially and politically in their settlement communities, while others are relatively small and are less noticeable.

Of the countries with one million or more foreign-born residents in 2013 (UNPD 2013; Tables 1 and 3), Australia has the highest proportion foreign-born (27.7 per cent), followed by New Zealand (25.1 per cent), Canada (20.7 per cent), Sweden (15.9 per cent), and Austria (15.7 per cent).[4] Although the United States ranks sixth, with 14.3 per cent foreign-born, its foreign-born population numbered 45.8 million in 2013, and is more than the combined total foreign-born population (43.8 million) in the other top ten immigrant destinations.

This section examines the characteristics of Canada's foreign-born population, looking first at recently arrived immigrants (defined as immigrants who arrived within five years prior to the census), followed by data on the overall foreign-born population. Data on recently arrived immigrants illustrate trends in the *flow* of immigrants as they arrive in Canada. Data on the total foreign-born population document the characteristics of the *stock* of all immigrants.

Recently arrived immigrants

Table 1 displays demographic characteristics of non-immigrants and recently arrived immigrants in 1991, 2001, and 2011.[5] Recently arrived immigrants are defined as foreign-born residents who arrived during the five years prior to the census date. With annual arrivals of about 250,000 immigrants and taking emigration into account, there were more than one million recently arrived immigrants enumerated in the 2011 population census.

Age, Sex, and Marital Status. The average age of recently arrived immigrants is about 30 years, indicating that the average age of arrival of immigrants is around 27 to 28 years, because recently arrived immigrants would have moved to Canada about two and a half years prior to the census, on average. Recently arrived immigrants are younger than non-immigrant Canadians. Canada's immigration system selects mainly immigrants in the early adult years, along with their children (if any). As a result, nearly one-half of recently arrived immigrants are aged 25 to 44 years. Another one-third of recently arrived immigrants are children and youth. Relatively few recently arrived immigrants are older than 65 years.

Most recently arrived immigrants are married or cohabiting, which was especially true in 2001 and 2011, when three-fourths of recently arrived immigrants are married, compared to slightly over 60 per cent of non-immigrants. Most recently arrived immigrant families report themselves as married or cohabiting couples, with relatively few living alone. Although not common, more recently arrived immigrants than non-immigrants are multiple families. Average family size is slightly larger for recently arrived immigrants than non-immigrants.

Housing. Recently arrived immigrants overwhelmingly reside in rental housing. Only about one-third of recently arrived immigrants own their house, compared to more than two-thirds of non-immigrants. Research on homeownership trends (Edmonston and Lee 2013) suggests, however, that homeownership trajectories increase sharply for immigrants, and immigrant arrival cohorts achieve homeownership levels similar to non-immigrants after about 20 years of residence in Canada.

4. This listing excludes some smaller countries such as Switzerland and United Arab Emirates that have a high proportion of foreign-born residents, but have less than one million immigrants.
5. The most recent public-use census microdata are from the 2011 National Household Survey, which replaced the traditional long-form census questionnaire. Data for earlier years are from the census long-form questionnaire.

Table 1. Demographic characteristics of non-immigrants and recent immigrants, 1991, 2001, and 2011

Characteristics	1991		2001		2011	
	Non-immigrant	Recent immigrant	Non-immigrant	Recent immigrant	Non-immigrant	Recent immigrant
Number (1,000s)	22,419	818	23,997	962	25,420	1,055
Average age	32.5	29.8	34.8	29.9	37.0	30.3
Age groups (%)	100	100	100	100	100	100
0–14	24	21	23	21	20	21
15–24	15	17	14	15	14	14
25–44	33	47	30	47	25	47
45–64	18	12	23	13	28	14
65–84	9	4	10	3	11	3
85+	1	0	1	0	1	0
Marital status[a] (%)	100	100	100	100	100	100
Never married	20	23	22	17	24	19
Married[b]	67	68	64	75	62	74
Other	13	9	14	8	14	7
Family type[c] (%)	100	100	100	100	100	100
Married[b]	62	65	59	68	59	71
Single parent	9	10	10	8	11	7
Multiple families	1	4	1	5	1	3
Living alone	23	14	26	13	25	14
Other	5	7	4	6	4	5
Average family size[c]	2.6	3.3	2.5	3.2	2.6	3.2
Housing tenure[c] (%)	100	100	100	100	100	100
Own	63	30	66	31	72	36
Rent	37	70	34	69	29	64
Family income[c,d]						
Average	$71,200	$46,000	$76,900	$45,500	$75,200	$48,700
% $100,000+	19	8	28	9	24	10
% Low-income[e]	15	43	16	45	15	41

Note: "Recent immigrants" are defined as foreign-born who arrived in Canada within five years prior to the census.

[a]Population aged 20 years and older.

[b]Married includes couples who are legally married or living in a common-law union.

[c]For the household maintainer, the person designated as the primary contributor to household expenses, who is aged 25 to 64 years.

[d]Family income is in constant 2006 dollars.

[e]Statistics Canada calculates a low-income cutoff based on family size and composition.

Family Income. Family income of recently arrived immigrants is considerably lower than that of non-immigrants. In the 1991 to 2011 censuses, recently arrived immigrants report family incomes (in constant 2006 dollars) that are about two-thirds or less of non-immigrants' family incomes. Fewer recently arrived immigrants report family incomes of $100,000 or more, compared to non-immigrants and more recently arrived immigrants report family incomes that are below Statistics Canada's low-income cut-off, again compared to non-immigrants.

Place of Settlement. Further information on social characteristics of non-immigrants and recently arrived immigrants is shown in Table 2. The initial place of settlement of immigrants in Canada is selective, with most immigrants choosing to reside in metropolitan areas in Ontario, Quebec, and British Columbia. Relative to the provincial population distribution of non-immigrants, a rela-

tively high proportion of recently arrived immigrants decide to live in Ontario and British Columbia. Whereas, for example, 35 per cent of non-immigrants lived in Ontario in 2011, 43 per cent of recently arrived immigrants lived in Ontario. Several areas of Canada, especially the Atlantic provinces, receive relatively few immigrants.

Table 2. Social characteristics of non-immigrants and recent immigrants, 1991, 2001, and 2011

Characteristics	1991		2001		2011	
	Non-immigrant	Recent immigrant	Non-immigrant	Recent immigrant	Non-immigrant	Recent immigrant
Province (%)	100	100	100	100	100	100
Atlantic	10	2	9	1	9	1
Quebec	28	16	27	14	26	20
Ontario	33	55	34	56	35	43
Prairies	18	11	18	9	19	20
British Columbia	11	15	12	20	12	17
Northern Canada	0	0	0	0	0	0
Metropolitan Area (%)	100	100	100	100	100	100
Montreal	11	14	11	12	11	17
Toronto	10	41	11	43	11	36
Vancouver	5	13	5	18	5	15
Other Metropolitan	28	24	29	20	34	26
Non-Metropolitan	46	8	44	7	38	6
Birthplace (%)		100		100		100
Europe/USA	–	27	–	22	–	16
Middle East	–	10	–	10	–	10
South Asia	–	9	–	18	–	17
East Asia	–	30	–	32	–	31
Latin American/Caribbean	–	16	–	9	–	12
Other	–	8	–	9	–	15
Religion[a] (%)	100	100	100	100	100	100
Catholic	48	34	46	20	44	24
Protestant	37	18	31	10	30	17
Muslim	0	9	1	18	0	18
Jewish	1	2	1	1	1	1
Buddhist	0	5	0	4	0	3
Hindu	0	5	0	6	0	7
Sikh	0	4	0	5	0	6
Otherb	14	23	21	36	25	26
Home Language[a] (%)	100	100	100	100	100	100
English	70	30	71	25	72	24
French	27	4	26	5	27	8
Other European	1	16	1	5	1	13
Arabic	0	5	0	4	0	6
South Asian	0	9	0	16	0	17
East Asian	0	20	0	20	0	25
Other	1	16	1	24	0	7

Note: "Recent immigrants" are defined as foreign-born who arrived in Canada within five years prior to the census.

[a]Population aged 20 years and older.

[b]The "other" category includes the reporting of other religions as well as "no religion." A large proportion of recent immigrants from eastern Europe report that they are Orthodox Christians, which is included as "other." A high proportion of East Asian immigrants report "no religion," perhaps because they have no single religious affiliation. For example, 65 per cent of Chinese immigrants report "no religion."

Recently arrived immigrants not only choose to settle in larger cities, a pattern similar to the United States and other large immigration destination countries, but are highly concentrated in Canada's three largest metropolitan areas: Toronto, Montreal, and Vancouver. These three metropolitan areas receive about three-fourths of all immigrants, and metropolitan Toronto alone received approximately 40 per cent of all newly arrived immigrants in recent decades. Comparatively few immigrants settle in smaller towns and rural areas. The concentration of Canadian immigrants in the three largest metropolitan areas differs from the United States, where immigrants are dispersed in many metropolitan areas and cities.

Place of birth. The birthplace of newly arrived immigrants has shifted in recent decades. The proportion of immigrants from Europe and the United States decreased, from 27 per cent in 1991 to 16 per cent in 2011. Immigrants born in the United Kingdom comprise about one-fourth of recent immigrants from Europe and the United States. The proportion of recently arrived immigrants from South Asia has steadily increased, growing from 9 per cent in 1991 to 17 per cent in 2011. Immigrants from East Asia make up the largest share of recently arrived immigrants, with Chinese immigrants comprising about one-half of East Asian immigrants. Immigrants from the Philippines are the second largest group of East Asian immigrants to Canada. Overall, East Asian immigrants comprised 31 per cent of all recently arrived immigrants in 2011. Smaller proportions of immigrants arrive from the Middle East, Latin America and the Caribbean, and other countries.

Religion. Every ten years, Canadian censuses include a question that asks residents about their religious affiliation.[6] Compared to 1991, there were decreases in 2001 in the proportion of recently arrived immigrants who identified themselves as Catholic or Protestant, followed by modest increases in 2011. While 74 per cent of non-immigrants in 2011 were Christian (Catholic or Protestant), only 41 per cent of recently arrived immigrants were Christian.[7] Relatively few non-immigrants in Canada identify themselves as Muslim, although the proportion of Muslim immigrants has increased from 9 per cent in 1991 to 18 per cent in 2011. Comparatively few non-immigrants and recently arrived immigrants identify themselves with other religious affiliations, such as Jewish, Buddhist, Hindu, or Sikh. A higher proportion of recently arrived immigrants identify themselves as "other" religion.[8] Detailed inspection of data on religious affiliation reveals that a large proportion of recently arrived East Asian immigrants indicates "other" or "no religion." A high proportion of recently arrived immigrants from China selects "no religion," which may reflect that they have no specific religious preference or that they are reluctant to report their religious preference on a census questionnaire.

Language. More than 90 per cent of recently arrived immigrants to Canada report knowledge of English, French, or both. But a large proportion speaks languages other than English or French at home. Although 99 per cent of non-immigrants spoke English or French at home in 2011, only 32 per cent of recently arrived immigrants use either of the two official languages at home. Recently arrived immigrants in 2011 reported home languages that are other European languages (13 per cent, with Spanish, Italian, Portuguese, and Polish being most common), Arabic (6 per cent), South Asian languages (17 per cent, with Punjabi being most common), East Asian (25 per cent, with Chinese being most common), or some other languages (7 per cent).

6. The 2011 NHS questionnaire asked, "What is this person's religion?" and requested the respondent to state a specific denomination or religion, even if they were not currently an active member of that group.
7. Orthodox Christians are included in the "other" category. So, the overall percentage of respondents who are Christian is actually higher than only the sum of Catholics and Protestants.
8. For comparability over censuses, the "other" category includes respondents who reported either "no religion" or a religious affiliation that is not listed.

A profile of all immigrants

The previous section limited out attention to recently arrived immigrants, those who arrived in Canada within five years of the census date. This section provides a profile of the overall foreign-born population, including education, income, language, place of residence, immigrant children and youth, and elderly immigrants. The tables in this section list 8 ethnic origin groups, including an "other" category for single-origins that are not included in the main 7 single-origin groups, as well as all respondents who reported multiple-origins. Notes on Table 3 provide more information about the ethnic origin categories presented in this section.

Table 3. Per cent with Bachelor's degree or higher for non-immigrants and immigrants, aged 25 to 64 years, by ethnic origin and sex, 1991, 1996, 2001, 2006, and 2011

	Men			Women		
Nativity and ethnic origin	1991	2001	2011	1991	2001	2011
Non-immigrant European	18	15	17	16	15	21
Immigrant						
All immigrants	28	30	38	22	24	34
European	21	22	28	16	17	28
Arab	45	22	45	29	30	40
South Asian	36	42	41	27	27	36
Chinese	38	35	48	25	29	39
Other East Asian	42	41	38	39	33	39
Latin American	27	38	26	23	16	27
Black/Caribbean	22	22	35	14	11	24
Other	38	20	40	31	30	38
Ratio (Immigrant/Non-immigrant European) times 100						
All immigrants	155	195	225	134	158	166
European	117	141	168	98	115	133
Arab	248	141	271	182	199	192
South Asian	201	277	243	166	183	173
Chinese	208	228	288	153	193	188
Other East Asian	230	268	226	239	218	186
Latin American	147	249	155	142	108	131
Black/Caribbean	122	143	207	89	74	116
Other	209	134	241	194	201	186

Note: In order to have comparable ethnic-origin categories for the 1991, 2001, and 2011 censuses, using publicly available microdata samples, ethnic-origin is coded in the eight categories shown in this and following tables. Except for the "other" category, the ethnic-origin groups are for respondents who report themselves as single origin. For example, respondents who report themselves as Italian would be included in the European category. The "other" category includes persons reporting themselves as Aboriginal as well as the large number reporting multiple origins, such as English/Italian or Chinese/Canadian/Irish. Some multiple origin adults report that all their origins are European. The "other" group includes the following sub-categories: Aboriginal (4.4 per cent), British and other (52.9 per cent), French and other (13.5 per cent), British, French, and other (8.3 per cent), and other multiple origins (20.9 per cent).

Education. Table 3 presents information on the percentage of immigrants and non-immigrants who have completed a university bachelor's degree. Non-immigrants of European origins are selected as the reference group in Table 3, shown in the top row. In 2011, 17 per cent of non-immigrant males aged 25 to 64 years had completed a bachelor's degree, compared to 38 per cent

Table 4. Mean family income of non-immigrants and immigrants by ethnic origin: 1991, 2001, and 2011

Nativity and ethnic origin	1991	2001	2011
Non-immigrant European	$70,000	$75,100	$73,100
Immigrant			
All immigrants	$74,400	$73,200	$71,300
European	$79,200	$82,700	$80,600
Arab	$57,400	$55,700	$59,400
South Asian	$69,400	$67,200	$72,600
Chinese	$70,100	$66,000	$70,000
Other East Asian	$64,000	$62,100	$63,700
Latin American	$44,300	$54,200	$54,800
Black/Caribbean	$55,700	$56,400	$53,600
Other	$77,400	$81,500	$78,100
Ratio (Immigrant/Non-immigrant European) × 100			
All immigrants	106	97	98
European	113	110	110
Arab	82	74	81
South Asian	99	89	99
Chinese	100	88	96
Other East Asian	91	83	87
Latin American	63	72	75
Black/Caribbean	80	75	73
Other	111	109	107

Note: Family income is in 2006 constant dollars for families with a maintainer aged 25 to 64 years.

of immigrants.[9] Overall, in 2011 immigrant males were more than twice as likely (2.25), compared to non-immigrant males, to have a bachelor's degree. For females in 2011, the ratio of immigrants to non-immigrants with a bachelor's degree was 1.66.

The proportion with university degrees increased steadily from 1991 to 2011 for both male and female immigrants, reflecting Canada's immigration policy to select immigrants with advanced education. The proportion of immigrants with a bachelor's degree is higher for males, however, than females. There are variations by ethnic origin in the proportion of immigrants with bachelor's degrees. In general, Chinese, Arab, South Asian, other East Asian, and immigrants of "Other" ethnic origin are more likely to have completed university degrees. In 2011, 48 per cent of Chinese males and 45 per cent or more of Arab males, for example, had bachelor's degrees. European, Latin American, and Black/Caribbean immigrants are less likely to have bachelor's degrees than other immigrants. But all immigrant groups—both males and females, except for Black/Caribbean females in 1991 and 2001—are more likely to have bachelor's degrees than European-origin non-immigrants.

Income. Data presented in the previous section note that recently arrived immigrants have lower family incomes than non-immigrants. Table 4 presents information on average family income for all

9. Canada ranks relatively high among developed countries in the proportion of adults aged 25–64 years that have a university education (27 per cent in the 2011 census, which is similar to the figure of 28 per cent cited for Canada in OECD 2014). By nativity, 23 per cent of Canadian-born and 36 per cent of foreign-born adults have a university education. Among the Canadian-born, European-origin adults have lower rates (20 per cent) of university education than other ethnic origin groups, such as South Asians with 54 per cent and Chinese with 59 per cent. The lower university education levels of European-origin Canadian-born adults, who comprise about one-third of adults aged 25–64, reduces the overall levels of university education for Canada.

Table 5. Per cent distribution of home language and knowledge of official languages for immigrants aged 25 to 64 years, by ethnic origin and sex, 1991, 2001, and 2011

	Men			Women		
Characteristic and ethnic origin	1991	2001	2011	1991	2001	2011
Home language is English or French (%)						
All immigrants	61	54	49	59	54	48
European	69	69	67	66	65	64
Arab	40	36	34	28	28	28
South Asian	42	36	33	41	38	32
Chinese	19	17	19	18	18	20
Other East Asian	24	26	28	34	36	36
Latin American	26	34	37	31	31	38
Black/Caribbean	88	80	72	91	80	74
Other	81	74	69	84	77	70
Knowledge of official languages (knows English, French, or both (%)						
All immigrants	96	96	96	94	94	94
European	97	98	98	95	97	98
Arab	96	97	97	91	94	94
South Asian	97	97	96	91	91	92
Chinese	88	88	85	79	84	83
Other East Asian	95	96	96	93	94	95
Latin American	87	95	96	86	92	95
Black/Caribbean	100	100	100	99	99	99
Other	99	99	99	99	98	98

immigrant families, by ethnic origin, for 1991 to 2011. In constant 2006 dollars, average family income increased for non-immigrants between 1991 and 2001, and then declined modestly between 2001 and 2011. For immigrants, however, average family income decreased in constant dollars throughout the 1991 to 2011 period.

Relative to non-immigrant families, immigrant families had slightly higher average family incomes in 1991. Immigrant family incomes relative to non-immigrant families dropped between 1991 and 2001 and rose slightly between 2001 and 2011, with 2001 and 2011 averages remaining below non-immigrant levels. This may be partially due to an increasing proportion of recently arrived immigrant families that, as shown in Table 1, have relatively low family incomes. Immigrant families that are European or "Other" ethnic origin have slightly higher average family incomes than non-immigrant European-origin families. Arab, Latin American, and Black/Caribbean immigrant families are noticeable for having average family incomes that are relatively low (again, these figures may also be influenced by recently arrived immigrants with relatively low family incomes).

Language. Most immigrants to Canada know English, French, or both upon arrival in Canada—mainly because their admission is based, in part, on knowledge of either of these, Canada's official languages. For the majority of immigrants, however, English or French is not their mother tongue, and many immigrants speak a language other than English or French at home. Table 5 presents information on home language and knowledge of official languages for immigrants by sex for 1991 to 2011.

Overall, there has been a sizeable decrease from 1991 to 2011 in the percentage of immigrants that report English or French as their home language. By 2011, about one-half of male or female immigrants reported that they speak English or French as their normal home language, compared to higher levels in preceding years. Some immigrant groups—including European, Black/Caribbean, and "Other" ethnic origins—are more likely to speak English or French at home, because a high

proportion of European immigrants are from the United Kingdom and many Caribbean immigrants are from English-speaking countries. Most immigrant groups, however, are likely to speak languages other than English or French at home. A relatively high proportion of Chinese immigrants, more than 80 per cent, does not speak English or French at home. Likewise, most Arab, South Asian, other East Asian, and Latin American immigrants speak a language other than English or French at home.

A high proportion of immigrants reports that that they know English, French, or both. In 2011, 96 per cent of male immigrants and 94 per cent of female immigrants reported knowledge of official languages, which is about the same as reported in previous censuses. Knowledge of official languages exceeds 90 per cent for all ethnic origin groups, except for Chinese immigrants, who reported levels of 85 to 83 per cent for males and females, respectively, in 2011.

A higher proportion of males generally report knowledge of official languages. This is particularly apparent for three ethnic origin groups in which more males than females report knowing official languages: Arab males are 4 percentage points higher, South Asian males are 6 per cent points higher, and Chinese males are 5 percentage points higher than females, on average, for the 1991 to 2011 period.

Table 6. Provincial distribution of non-immigrant and immigrant families by ethnic origin, 2011

Nativity and ethnic origin	Region or province of residence					
	Atlantic	Quebec	Ontario	Prairies	British Columbia	Northern Canada
Non-immigrant	9	29	32	18	12	0
Immigrant						
All immigrants	1	16	53	13	17	0
European	1	16	57	11	15	0
Arab	2	27	50	9	12	0
South Asian	0	5	64	13	18	0
Chinese	1	6	48	11	34	0
Other East Asian	0	10	45	21	24	0
Latin American	0	35	46	12	7	0
Black/Caribbean	0	37	52	9	2	0
Other	3	15	49	14	19	0
Ratio (Immigrant/Non-immigrant) times 100						
All immigrants	11	55	166	72	144	0
European	14	55	178	61	127	33
Arab	22	93	156	50	102	0
South Asian	3	17	200	72	153	0
Chinese	11	21	150	61	288	33
Other East Asian	0	34	141	117	203	33
Latin American	0	121	144	67	60	0
Black/Caribbean	0	128	163	50	19	0
Other	33	52	153	78	161	33

Place of Residence. Canada's population is not spread evenly across its vast territory. The population primarily lives in the southern area, within 200 kilometers of the border with the United States. Population density is low in the Atlantic provinces, the rocky Laurentian Plateau north of the Great Lakes, and the western mountains. Even fewer people live in the northern boreal forests and the far north. As shown in Table 6, more than one-half of non-immigrant families lives in either Quebec (29 per cent) or Ontario (32 per cent), with 9 per cent in the four Atlantic provinces, 18 per cent in the three Prairie provinces, and 12 per cent in British Columbia.

Immigrants are even more selective in their spatial residence, with a greater proportion living in Ontario and British Columbia compared to non-immigrants. Immigrant families are 44 per cent more likely to live in British Columbia and 66 per cent more likely to settle in Ontario than non-immigrants. Relatively fewer immigrants live in Quebec or the Prairie provinces. And comparatively few immigrants, compared to non-immigrants, live in the Atlantic provinces.

Immigrants of different ethnic origins vary in their provincial residence. Immigrants of European and "Other" ethnic origins are more likely to live in Ontario and British Columbia. Those of Arab and Latin American origins are more likely to reside in Quebec and Ontario. Immigrants of South Asian origin are more likely to live in Ontario, followed by British Columbia. Immigrants of Chinese and other East Asian origins are more likely to live in British Columbia, followed by Ontario. Other immigrants, for example, those of Black/Caribbean origins, are more likely to reside in Ontario.

As noted earlier, immigrants to Canada settle primarily in the larger metropolitan areas. Table 7 provides more detailed information on the metropolitan area distribution of immigrant families in 2011 compared to non-immigrant families. Most non-immigrants lived in either Montreal (12 per cent), Toronto (8 per cent), Vancouver (5 per cent), or other larger metropolitan areas (35 per cent), while 40 per cent of non-immigrant families were in smaller metropolitan areas, small towns, or rural areas.

Table 7. Metropolitan area distribution of non-immigrant and immigrant families by ethnic origin: 2011

Nativity and ethnic origin	Metropolitan area of residence				
	Montreal	Toronto	Vancouver	Other major metro	Smaller metro and non-metro
Non-immigrant	12	8	5	35	40
Immigrant					
All immigrants	14	36	13	27	10
European	14	31	8	31	16
Arab	25	35	12	26	2
South Asian	5	56	14	22	3
Chinese	6	41	32	19	2
Other East Asian	10	36	22	28	4
Latin American	31	34	6	24	5
Black/Caribbean	34	42	2	20	2
Other	12	29	11	33	15
Ratio (Immigrant/Non-immigrant) times 100					
All immigrants	116	439	277	77	25
European	116	378	168	89	40
Arab	207	427	255	74	5
South Asian	41	683	298	63	7
Chinese	52	501	683	54	4
Other East Asian	79	439	468	80	10
Latin American	256	415	132	69	11
Black/Caribbean	281	512	45	57	5
Other	99	354	234	94	38

Immigrant families have a different metropolitan distribution than non-immigrants. Although about the same proportion of immigrants settles in Montreal, immigrants are more than 4 times more likely to live in Toronto and almost 3 times more likely to live in Vancouver than non-immigrants. Immigrants are less likely than non-immigrants to live in other metropolitan areas or non-metropolitan areas. Arab, Latin American, and Black/Caribbean immigrant families are more likely

to live in Montreal. This occurs to a large extent because these groups include immigrants from French-speaking areas of the Middle East and North Africa, East Africa, and Haiti and other Caribbean islands. Toronto attracts immigrant families of many ethnic origins, although there is striking preference for Toronto among South Asian, Chinese, and Black/Caribbean immigrants. Immigrants of South Asian, Chinese, and other East Asian origins have a marked preference for Vancouver, which is also attractive for other ethnic origin groups except for Black/Caribbean families.

Table 8. Social characteristics of immigrant and non-immigrant children and youth, aged 0 to 19, 2011

Characteristics	1991			2001			2011		
	All children and youth	Immigrant	Non-immigrant	All children and youth	Immigrant	Non-immigrant	All children and youth	Immigrant	Non-immigrant
Number (1,000s)	7,575	437	7,138	7,770	582	7,188	7,638	667	6,971
Per cent immigrant or non-immigrant	100	6	94	100	7	93	100	9	91
Age distribution									
0–4	100	2	98	100	3	97	100	3	97
5–9	100	5	95	100	6	94	100	8	92
10–14	100	7	93	100	9	91	100	11	89
15–19	100	9	91	100	12	88	100	12	88
Ethnic origin (%)	100	100	100	100	100	100	100	100	100
European	51	30	52	39	19	41	30	13	32
Arab	0	8	0	2	10	1	2	8	1
South Asian	1	9	1	3	13	2	5	15	4
Chinese	2	16	1	3	17	2	3	13	2
Other East Asian	2	11	1	2	11	1	3	14	2
Latin American	0	4	0	0	4	0	1	4	1
Black/Caribbean	1	7	1	3	9	2	3	12	2
Other	42	15	44	48	17	51	53	21	56
Per cent in low-income families									
All immigrants	17	37	16	19	41	17	17	34	15
European	17	30	17	18	31	17	14	24	14
Arab	54	62	34	49	57	42	42	51	35
South Asian	21	33	15	29	44	21	24	34	21
Chinese	27	39	15	31	46	21	28	38	22
Other East Asian	27	36	21	33	43	25	25	33	20
Latin American	47	50	42	38	40	35	31	41	27
Black/Caribbean	42	46	40	47	53	45	39	46	35
Other	14	32	14	15	30	15	14	25	14

Immigrant children and youth. An increasing proportion of children and youth, aged 0 to 19, are immigrants.[10] In 2011, 9 per cent of children and youth were foreign-born, as shown in Table 8. The number of immigrant children and youth grew from 437,000 in 1991 to 667,000 in 2011.

Relatively few immigrant families arrive in Canada with very young children. As shown in Table 8, there are relatively few children aged 0 to 4 years who are foreign-born. By the teen-age years, however, the proportion foreign-born increases to more than 10 per cent.

10. A high proportion of Canadian children and youth are sons and daughters, born in Canada, of immigrants. Although the characteristics and achievements of the 2nd immigrant generation are an important topic for study, we limit attention in this paper to foreign-born children and youth.

Table 9. Demographic and social characteristics of immigrant and non-immigrant elderly, aged 65 years and older for females and males, 1991, 2001, and 2011

Characteristics	1991			2001			2011		
	All elderly adults	Non-immigrant	Immigrant	All elderly adults	Non-immigrant	Immigrant	All elderly adults	Non-immigrant	Immigrant
Number, both sexes (1,000s)	2,974	2,181	793	3,629	2,591	1,038	4,593	3,221	1,372
					Females				
Number (1,000s)	1,699	1,254	445	2,035	1,470	565	2,490	1,758	732
Age distribution (%)	100	100	100	100	100	100	100	100	100
65–74	61	62	58	55	55	55	56	57	54
75–84	32	32	31	36	36	36	33	33	34
85+	7	6	11	9	9	9	11	10	12
Marital status (%)	100	100	100	100	100	100	100	100	100
Never-married	7	8	4	5	6	4	6	6	5
Married[a]	44	44	44	45	44	47	50	50	49
Divored/Separated	5	5	5	7	8	6	11	11	10
Widowed	44	43	47	42	42	43	34	33	36
Family type (%)	100	100	100	100	100	100	100	100	100
Married[a]	48	47	49	49	48	51	50	50	51
Single parent	6	6	7	8	7	9	8	7	10
Multiple families	2	1	5	3	1	7	4	2	9
Living alone	38	39	34	37	39	31	35	38	28
Other	6	7	5	4	5	2	3	3	2
Ethnic origin (%)	100	100	100	100	100	100	100	100	100
European	80	80	79	66	66	65	56	57	52
Arab	0	0	1	1	0	2	1	0	3
South Asian	1	0	2	1	0	4	2	0	7
Chinese	1	0	5	2	0	9	3	0	10
Other East Asian	1	0	3	1	0	3	1	0	5
Latin American	0	0	0	0	0	1	0	0	1
Black/Caribbean	0	0	1	1	0	3	1	0	4
Other	17	20	9	28	34	13	36	43	18
% in low-income families[b]	23	22	26	22	22	23	16	15	18

Note: a Married includes couples who are legally married or living in a common-law union.
b Statistics Canada calculates a low-income cutoff based on family size and composition. Shown here is the per cent of families below the low-income cutoff.

The ethnic origin of children and youth is quite different for immigrants and non-immigrants. Among non-immigrants, children and youth are primarily European or "Other" ethnic origins (usually multiple European origins). On the other hand, most immigrant youth are not European or "Other" ethnicities. As shown in Table 8, for 2011, the main ethnic groups among immigrant youth were South Asian (15 per cent), other East Asian (14 per cent), Chinese (13 per cent), Black/Caribbean (12 per cent), Arab (8 per cent), and Latin American (4 per cent).

An examination of data on the proportion of children and youth in low-income families reveals that immigrant as well as non-immigrant Arab, Black/Caribbean, and Latin American children are more likely to be in low-income families, although the proportion in low-income families is higher for immigrants than non-immigrants. For other ethnic origin groups, immigrant children and youth are more likely than comparable non-immigrants to be in low-income families.

Elderly immigrants. The arrival of immigrants from new origins in recent decades is beginning to affect the elderly population, as shown in Table 9, which presents information on the population

aged 65 years and older for females and males for 1991 to 2011. The first panel of Table 9 shows information for immigrant females, and the second panel shows immigrant males. The immigrant elderly population grew from 793,000 in 1991 to 1,372,000 in 2011, increasing from 27 to 30 per cent of the overall elderly population. In 2011, the ratio was 114 elderly immigrant females (732,000) to 100 elderly immigrant males (640,000).

In 1991, immigrant females were noticeably older than non-immigrants, reflecting the large number of immigrants who arrived in Canada in the early 1900s. By 2011, the age distribution of elderly females was similar for both immigrants and non-immigrants.

There are no significant differences in marital status for older immigrant and non-immigrant females. There are differences, however, in their living arrangements. Immigrant elderly females are more likely to live in multiple family arrangements (mainly living with other relatives), and less likely to live alone.

The ethnic origin of elderly females illustrates changing levels over time. Although immigrant elderly females had predominantly European backgrounds in 1991, this has been steadily decreasing. By 2011, more immigrant elderly females reported themselves to be Chinese, South Asian, other East Asian, Black/Caribbean, Arab, and Latin American than previously. Changes in the proportion of the elderly population that are foreign-born, coupled with shifts in the ethnic origin of immigrants, is altering the ethnic composition of the overall elderly population.

Table 9 (cont'd).

Characteristics	1991			2001			2011		
	All elderly adults	Non-immigrant	Immigrant	All elderly adults	Non-immigrant	Immigrant	All elderly adults	Non-immigrant	Immigrant
					Males				
Number (1,000s)	1,699	1,254	445	2,035	1,470	565	2,490	1,758	732
Age distribution (%)	100	100	100	100	100	100	100	100	100
65–74	61	62	58	55	55	55	56	57	54
75–84	32	32	31	36	36	36	33	33	34
85+	7	6	11	9	9	9	11	10	12
Marital status (%)	100	100	100	100	100	100	100	100	100
Never-married	7	8	4	5	6	4	6	6	5
Married[a]	44	44	44	45	44	47	50	50	49
Divored/Separated	5	5	5	7	8	6	11	11	10
Widowed	44	43	47	42	42	43	34	33	36
Family type (%)	100	100	100	100	100	100	100	100	100
Married[a]	48	47	49	49	48	51	50	50	51
Single parent	6	6	7	8	7	9	8	7	10
Multiple families	2	1	5	3	1	7	4	2	9
Living alone	38	39	34	37	39	31	35	38	28
Other	6	7	5	4	5	2	3	3	2
Ethnic origin (%)	100	100	100	100	100	100	100	100	100
European	80	80	79	66	66	65	56	57	52
Arab	0	0	1	1	0	2	1	0	3
South Asian	1	0	2	1	0	4	2	0	7
Chinese	1	0	5	2	0	9	3	0	10
Other East Asian	1	0	3	1	0	3	1	0	5
Latin American	0	0	0	0	0	1	0	0	1
Black/Caribbean	0	0	1	1	0	3	1	0	4
Other	17	20	9	28	34	13	36	43	18
% in low-income families[b]	23	22	26	22	22	23	16	15	18

The second panel of Table 9 presents information for elderly males. Many of the patterns described for elderly females are similar for elderly males. The age distribution of elderly males is similar for immigrants and non-immigrants. Immigrant elderly males are more likely to live in multiple families and less likely to live alone, as is the case for immigrant elderly females. Immigrant elderly males, however, are more likely to be married than non-immigrant males. The ethnic origin of immigrant elderly males is changing over time, with a greater proportion of males reporting themselves as non-European ethnic origins.

Changes in the proportion of the elderly population that is foreign-born, coupled with shifts in the ethnic origin of immigrants, are altering the ethnic composition of the overall elderly population, both females and males. Only 3 per cent of elderly adults reported themselves as not European or "other" in 1991; this percentage increased to 8 per cent for elderly females and 10 for elderly males in 2011, and will continue to increase in the next decades as large number of immigrants reach 65 years of age and contribute an increasing share of the elderly population.

Immigrant integration

In countries with large immigrant populations, researchers, policymakers, and the general public are understandably interested in the integration of newcomers. While many factors influence immigrant adjustment and integration (it is beyond the scope of this paper to discuss all these factors and the many dimensions of immigrant integration), two migration-related characteristics have notable effects that, while distinctive, can be overlapping: *age at arrival* and *duration of residence*. This section briefly highlights their role in Canadian immigrant integration.

Age at arrival

Immigrants to Canada arrive at different ages. The 2011 National Household Survey reported that of the 6.2 million immigrants, 35 per cent arrived as children or youths aged 18 years or younger.

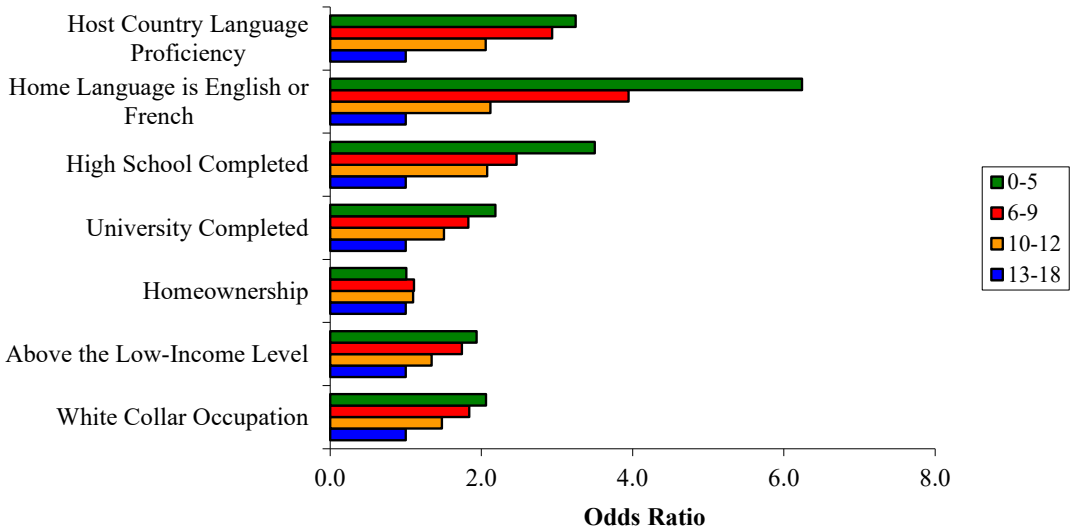


Figure 7. Odds ratios for status attainment relative to age at immigration of 13–18 years, for Asian immigrants aged 25 to 50 years in Canada, 2006.
Source: Lee and Edmonston 2011, Figure V.

Age-at-arrival is considered a key factor in immigrant integration, given the central role of age in defining life-cycle stages, such as school attendance, entry into the labor force, and marriage and family formation. Cognitive capacities for mastering certain skills are also age-linked and hierarchical, meaning that learning progresses through successive stages. The early development of skills therefore influences the ability to master related and other skills later in life. For immigrants, age-at-arrival is also related to duration of residence and years of experience in the host country, which has been shown in previous research to be important for outcomes such as employment, earnings, host country language proficiency, intermarriage, and homeownership (see Lee and Edmonston 2011 for a review of the research literature).

In a recent paper focusing on Asian immigrants in Canada, Lee and Edmonston (2011) calculate odds ratios for seven different outcomes for four age-at-arrival categories: 0 to 5 years, 6 to 9 years, 10 to 12 years, and 13 to 18 years, with the last category being the reference category. In all cases, the outcome variable is for adult immigrants aged 25 to 60 years in 2006, who arrived in Canada before their nineteenth birthday. The results are shown in Figure 7.

The most striking findings shown in Figure 7 are the differences between the reference category (Asian immigrants who arrived as teenagers between the ages of 13 and 18, which is shown with an odds ratio of 1.0 for each outcome variable) and Asian immigrants who arrived in Canada at ages younger than 6 (that is, who arrived between ages 0 and 5). The latter are much more likely to have English or French as their home language, to be proficient in at least one of Canada's official languages, to have completed high school or university, and to be in white-collar occupations. They are also more likely to be above the low-income cutoff. The only outcome where differences are small is homeownership.

While Asian immigrants who arrived at ages 6 to 12 years are more likely than those who arrived as teenagers to have odds ratios indicating better outcomes on these indicators, as shown in Figure 5, the differences are not as large and striking as those between the reference category and immigrants who arrived at ages younger than 6. The differences are particularly large for three outcomes: host country language proficiency, home language, and high school completion. In summary, there is a strong effect of age-at-arrival—for immigrants arriving in Canada as children or youth—on many important measures of immigrant integration.

Duration of residence

Duration of residence is another key factor in immigrant adaptation. Analysis of duration of residence requires making a distinction between cross-sectional and longitudinal inferences. Shifts in age group differences over time reflect both aging and intercohort differences. Shifts in immigrant cohorts over time reflect both adaptation and intercohort differences. Based on a single survey or census, differences in immigrants based on duration of residence might be due to aging, adaptation, or intercohort effects.

In order to correctly disentangle processes of aging and immigrant adaptation, it is necessary to analyze data from two or more surveys or censuses using an appropriate statistical model. For this type of analysis, a double-cohort model is particularly useful. With immigrant cohorts nested within birth cohorts, this model includes three main variables—birth cohort, immigrant cohort, and period—as well as interaction terms between each of the three main variables. This model provides estimates for changes over time for a series of immigrant cohorts within birth cohorts, compared to similar birth cohorts of native-born residents. We illustrate the effects of duration of residence with results from a study on homeownership trends for Canadian immigrants (Edmonston and Lee 2013).

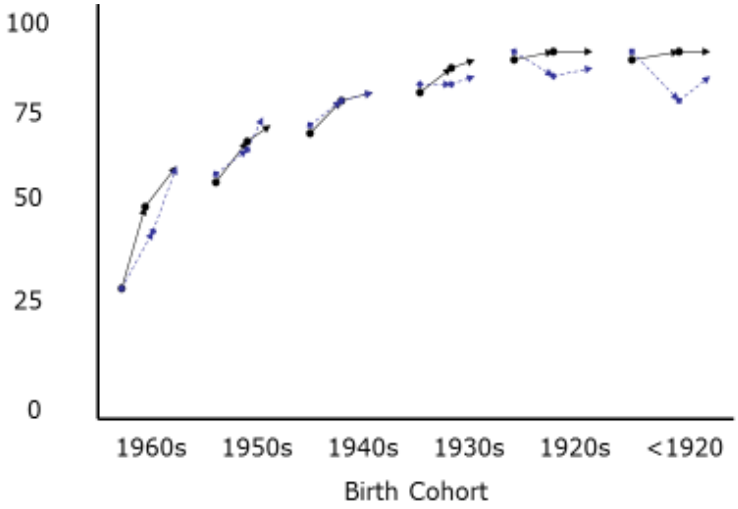


Figure 8. Homeownership trajectory plot for Canada-born residents and the 1970s immigrant cohort by birth cohort, 1991–96 and 1996–2001.
Source: Edmonston and Lee 2013, Figure 3.
Note: Per cent homeownership is shown on the vertical axis. Each birth cohort is shown for changes in per cent homeownership, with a solid circle and arrow, for change between 1991 and 1996, and between 1996 and 2001. Canada-born residents are show with solid lines, with trajectories that begin with solid circles. Immigrants are shown with dashed lines, with trajectories that begin with solid squares.

The effects of immigrant adaptation indicate the changes in homeownership for immigrant cohorts, within birth cohorts, over time. These effects can best be illustrated in a set of homeownership trajectory graphs that show changes in homeownership for immigrant cohorts, relative to Canada-born residents, for similar birth cohorts.

We derive these trajectories by calculating the homeownership rates from logistic regression equations that include temporal, household, ethnic group, and place effects, evaluated at the mean category for the non-temporal variables.

Figure 8 shows the predicted per cent homeownership, holding all other factors constant, on the vertical axis. The horizontal axis shows the set of birth cohorts, with separate arrows in the figure displaying the change in homeownership for 1996 to 1996 and 1996 to 2001. Figure 8 shows homeownership trajectories for Canada-born households and the 1970s immigrant cohort (that is, all immigrants that arrived in Canada during 1971 to 1980). Canadian-born households present a picture of changes typically associated with life cycle changes: homeownership rates are low and quickly rising for younger householders, homeownership levels peak and stay steady for householders aged 50 to 70, and homeownership rates decrease slightly for older householders. The 1970s immigrant cohort resembles that for Canada-born householders, except for a notable decrease in homeownership rates for older householders—those born in the 1930s and earlier. Apparently, immigrants who arrived in Canada in the 1970s at age 40 and older (these would have been birth cohorts from the 1930s, 1920s, and 1920 and earlier) had stable or declining rates of homeownership during 1991–2001.

Overall, immigrant households display rapid gains in homeownership with longer residence in Canada. Among immigrant householders who have resided in Canada for 20 years or longer, homeownership rates are comparable with those for Canada-born householders. Edmonston and Lee (2013) report that more recent immigrant householders begin their housing careers with lower levels of homeownership. But even recent immigrants made rapid and remarkable gains in homeownership during the 1991 to 2001 period.

Demographic effects of immigration

The preceding sections discussed trends and patterns of immigration, characteristics of immigrants, and highlighted the role of age at arrival and duration of residence on some aspects of immigrant integration. This section examines the contribution of immigration to Canada's population growth, including how immigration influences population changes (Edmonston 2010, 2014). Immigration affects a population demographically in two ways: directly, through the contribution of new members (immigrants) to the population, and indirectly, through future births to the immigrants and their descendants. To measure the first effect, we need to take into account net immigration (the number of immigrants minus the number of emigrants, as discussed in previous sections). To measure the second effect, we must examine the reproduction of the population after immigration. The effect of immigrants on future reproduction in a population is a function of their age and sex, levels of childbearing, and mortality rates. Determining their effect thus requires a population model that disaggregates the population by age, sex, and immigrant generation and takes into account four components of population change—immigration, emigration, fertility, and mortality.

From 1851 to 2011, the total population of Canada increased from 2.6 million to 34.3 million, or at an average annual rate of 1.6 per cent. Figure 9 displays the effect of immigration on the size of Canada's population for the period from 1851 to 2011. This graph shows the contribution of immigration to the population for five key immigrant cohorts: immigrants arriving in 1851–1901, 1901–31, 1931–51, 1951–71, and 1971–2011. The overall graph represents the growth of the total population from 1851 to 2011. The bottom portion of the graph shows the hypothetical population size under conditions of no immigration since 1851. The different components in the upper portions of the graph show the population growth attributable to different waves of immigrants and their descendants.

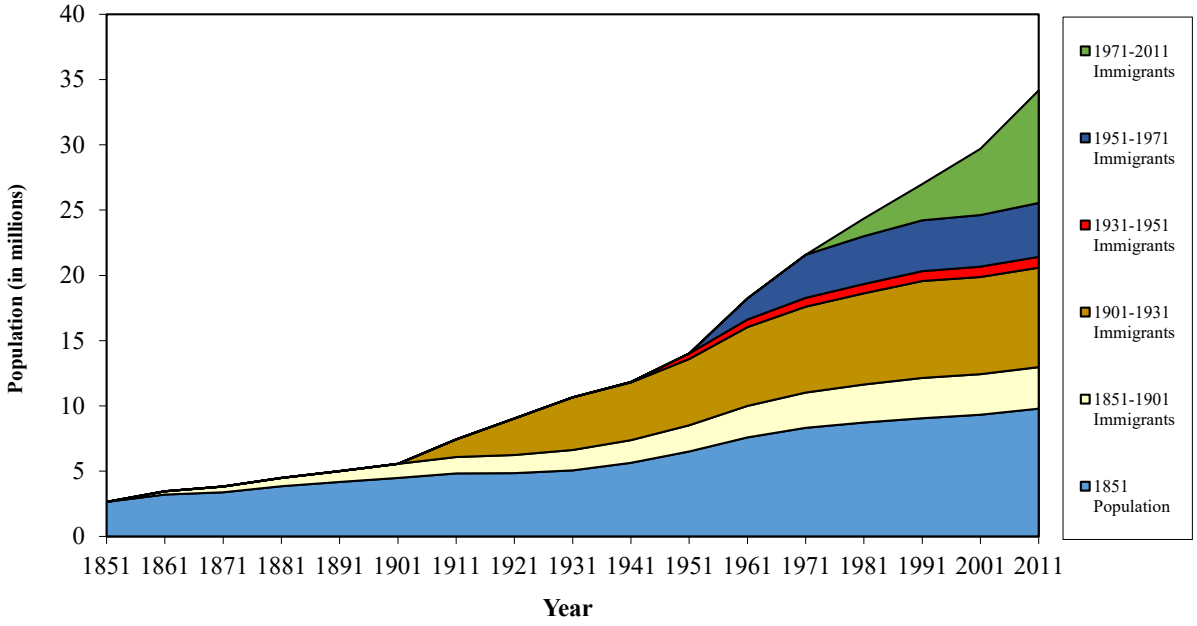


Figure 9. Demographic contribution of the 1851 population and selected immigrant entry cohorts to total population, Canada, 1851–2011.
Source: A historical reconstruction of Canada's population, as described in the Appendix.

For this contrafactual population projection, the 1851 population is projected under the same fertility, mortality, and emigration conditions as the overall population projection. The population projection is cohort-based and does not explicitly indicate children born to possible unions of Canada-born and immigrant adults. Thus, for example, the contribution of the 1901–31 immigrant cohort is calculated by comparing the inclusion to the omission of immigration for 1901–31—again, with the same fertility, mortality, and emigration conditions as the overall projection. Edmonston and Passel (1992) provide more discussion of the methods for immigrant generation projections, and Edmonston and Passel (1994) offer a comparable analysis of the contribution of immigrant cohorts to US population growth.

These numbers, derived from the historical reconstruction of Canada's population described in the Appendix, represent demographic constructs and are not genealogical derivations. For example, 25.1 per cent of Canada's population of 34.5 million in 2011, or about 8.6 million people, can be attributed to immigrants who entered the country since 1971 and their offspring (shown as the top band in Figure 9). These 8.6 million represents a demographic contrafactual answer to the question "If no immigration to Canada had occurred between 1971 and 2011 but emigration, fertility, and mortality had remained the same, how much smaller would Canada's population be in 2011?"

As shown in Figure 9, the 2011 Canada population would have numbered 9.8 million (or 29.2 per cent of the observed 2011 population) if there had been no immigration since 1851. In other words, Canada's 2.6 million residents in 1851 would have increased more than threefold, to 9.8 million in 2011. Migration in the latter half of the nineteenth century, from 1851 to 1901, was characterized by modest immigration and moderate emigration, and yielded net out-migration from Canada. All together, immigration during 1851–1901 contributed 3.2 million persons to the 2011 Canada population, or 9.3 per cent of the 2011 population. Immigration during the 1901–31 period contributed about 7.6 million people to the 2011 population, or 21.8 per cent of the total population. Immigration during 1931–51 provided a relatively small contribution, only 800,000 or 2.4 per cent of the total 2011 population. Immigration from 1951–71 contributed 4.1 million persons, or 12.4 per cent of the 2011 Canadian population.

Immigration during the last 40 years, from 1971 to 2011, has produced a slightly higher impact on the 2011 population than the first 30 years of this century. As of 2011, the post-1971 immigrant cohorts have had a larger overall effect—which will increase in future years—on Canada's population than selected earlier immigrant cohorts.

Future prospects

In this final section, we discuss the role of immigration for Canada's future population by looking at population projections and public attitudes toward immigration. We conclude with some summary comments on how immigration has and will continue to affect Canada's population.

Population Projections

Similarly to other national statistical agencies, Statistics Canada issues population projections that are revised every few years. These projections offer invaluable demographic information for the study of future population trends. Statistics Canada's (2010b) population projections are based on the 2009 population, with projections for Canada and its provinces to 2036. For the sake of concentrating on the effect of immigration, we assume a stable fertility level (a total fertility rate of

1.7) and a slow gradual increase in life expectancy at birth. Statistics Canada's projections include three different immigration assumptions: a low rate of 6.0 annual immigrants per 1,000 population (implying 245,000 immigrants in 2036), a medium rate of 7.5 annual immigrants per 1,000 population (implying 334,000 immigrants in 2036), and a high rate of 9.0 annual immigrants per 1,000 population (implying 435,000 immigrants in 2036). Because Canada's immigration rate from 1991 has been, on average, close to 7.5 per 1,000, we focus on the assumption of a medium immigration rate for this paper.

Future immigration levels will have a major effect on Canada's future population growth. Canada's population size will grow from 33.7 million in 2009 to 43.8 million in 2036, a 30 per cent increase of 10.1 million. Annual population growth rates, however, will slacken from 1.2 per cent in 2009 to 0.8 per cent in 2036. Canada's future population growth will depend primarily on net immigration. Between 2008 and 2009, the population increased by 353,000, with 147,000 due to natural increase (the excess of births minus deaths) and 206,000 due to net immigration. Between 2035 and 2036, the population is projected to increase by 342,000, with natural increase accounting for 61,000 and net immigration accounting for 281,000. Stated differently, 82 per cent of annual growth will be due to net immigration in 2036, compared to 58 per cent of annual growth in 2009.

Immigration will have modest effects on Canada's future age distribution. Although there will be important shifts in Canada's future age distribution, as noted below, there is only a one year difference in the 2036 median age distribution between the low and high immigration assumptions (Statistics Canada 2010b: 73). Overall, variations in immigration levels have a limited influence on the age distribution, compared to the larger relative effects of assumed fertility variations.

The population's median age increased from 30 years in 1981 to 40 years in 2009. With the advancing age of baby-boomers, the median age will continue to increase, to 44 years in 2036. Changes in the population's median age reflect changes in three major age groups: children and youth aged 0 to 14 years, older teenagers and adults aged 15 to 64 years, and older adults aged 65 years and older. The number of children and youth will continue to increase, growing from 5.9 million in 2009 to 6.9 million in 2036, but their percentage of the total population will decline, from 17.5 per cent to 15.8 per cent. The number of older teenagers and adults will increase from 22.7 million in 2009 to 26.8 million in 2036, while decreasing as a per cent of the total population from 67.4 per cent to 61.2 per cent. Only the elderly population will increase absolutely and relatively between 2009 and 2036, almost doubling from 5.1 million to 10.1 million, and increasing from 15.1 per cent of the 2009 population to 23.1 per cent of the 2036 population. The relative decrease of the population in the working-age group, 15 to 64 years, will alter Canada's dependency ratio, calculated as the number of children and youth plus number of elderly per 100 persons aged 15 to 64 years. In 2006, there were 24 children and youth plus 20 elderly per 100 persons in the working years, or a dependency ratio of 44 per 100. By 2036, this ratio will increase to 26 children and youth plus 39 elderly per 100 persons in the working years, or a dependency ratio of 65 per 100. The demographic fact that there will be a 47 per cent increase in Canada's dependency ratio, with most of the increase occurring for the elderly population, underlies much of the concern about the country's future public finance policies, especially regarding public pensions and health care.

As discussed previously, most immigrants settle in Ontario and British Columbia, and interprovincial migration further reallocates Canada's population. Statistic Canada's (2010b) projections indicate that all provinces except Newfoundland and Labrador will increase their population between 2009 and 2036. The fastest population growth will occur in Ontario and British Columbia, which will increase their share of the national population.

Changes in immigration will affect Canada ethnic and religious composition in future decades. Statistics Canada (2010c) has used innovative microsimulation methods to understand changes in the diversity of the population, projecting the 2006 base population forward to 2031. Staff relied on Statistics Canada's Demosim microsimulation model to project forward a 20 per cent sample of individuals in the 2006 population. Individuals in this type of demographic simulation experience fertility, mortality, and migration—using assumptions similar to those in Statistics Canada's standard cohort-component projections—as well as other transitions, such as change of education level, marital status, labour market participation and occupation, religion, and income.

The demographic microsimulation demonstrates three effects of immigration on Canada's population composition. First, there will be changes in the composition of the foreign-born population. In 1981, as shown in Figure 10, about two-thirds of the foreign-born population was from Europe. European-origin immigrants decreased to less than one-third of the foreign-born in 2011, and will decline further to one-in-five in 2031. Immigrants from Asia increased from 14 per cent in 1981 to 45 per cent in 2011, and will become more than one-half (55 per cent) of the foreign-born population in 2031. Immigrants from Africa will triple between 1981 and 2031, growing from 3 per cent to 9 per cent.

Secondly, changes in the composition of the foreign-born will be amplified by the addition of their children to the future population. Canada's visible minority population numbered 5.3 million, or 16 per cent of the total population. As a result of immigration and future births, the visible minority population will more than double by 2031, increasing to 12.9 million, or 31 per cent of the total population. The largest three visible minority groups currently are South Asian, Chinese, and Arabs, and these groups will continue to increase in absolute and relative size. South Asians will increase from 1.3 million in 2006 to 3.6 million in 2031; Chinese will grow from 1.3 million in 2006 to 2.7 million in 2031, and Arabs will increase from 300,000 in 2006 to 900,000 in 2031.

Finally, Statistics Canada's microsimulation work indicates immigration will increase religious diversity. Most Canadians reported themselves as Christian in 2006. But the proportion of Christians

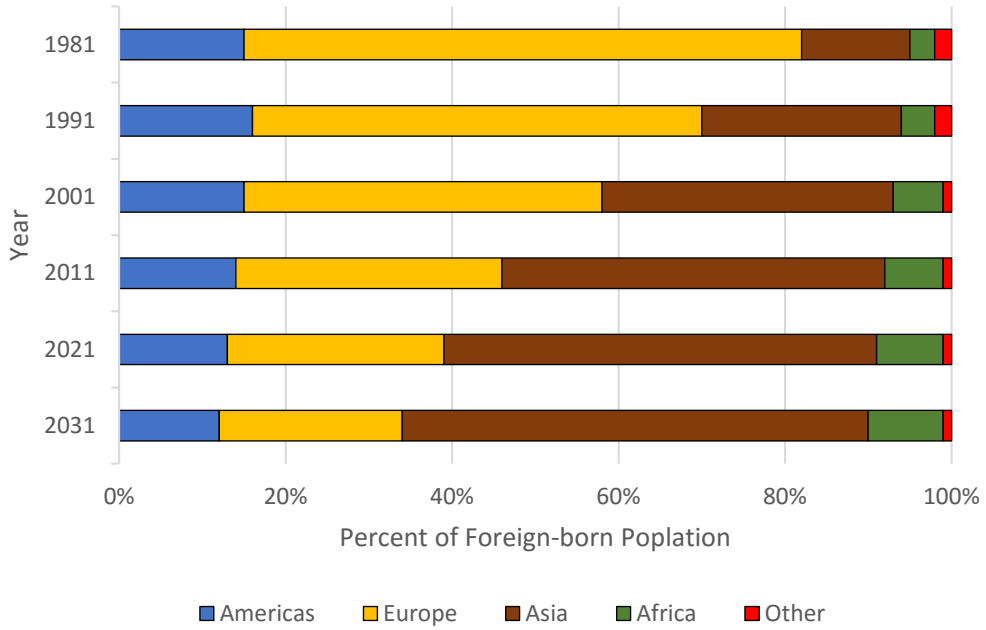


Figure 10. Composition of the foreign-born population by continent of birth, Canada, 1981 to 2031.

Source: Statistics Canada 2010c, Figure 2.

is likely to decrease, from 75 per cent in 2006 to 65 per cent in 2031, as the non-Christian and non-religious population increases. There were 2.5 million non-Christians in 2006, comprising 8 per cent of the population; this population will increase to 6.0 million in 2031, or 14 per cent of the population. In 2031, about one-half of non-Christians in Canada are expected to be Muslim.

Public Opinion

Canada is fortunate to have a long record of survey research on attitudes towards immigration. Environics, a public opinion survey company, has asked Canadians about their attitudes towards immigration in their Focus Canada Survey since 1977. One statement that has been regularly queried is, "Overall, there is too much immigration to Canada," with response choices being "strongly agree," "agree," "neither," "disagree," and "strongly disagree."[11] An overall measure of public concern with Canada's immigration levels can be calculated by combining the responses for "strongly agree" and "agree" on this survey question. By this measure, 38 per cent of adult Canadians agreed or strongly agreed that there is too much immigration to Canada in the 2015 survey. Figure 11 shows public attitudes about the country's immigration levels for the period 1977 to 2015. About 60 per cent or more of Canadians thought that immigration levels were too high from 1977 to the mid-1990s. After about 1995, public worries about too much immigration steadily decreased, to about one-third in 2005. During recent years, there have been slight increases in the percentage who are concerned about too much immigration, with the percentage agreeing or strongly agreeing with the survey question ran-

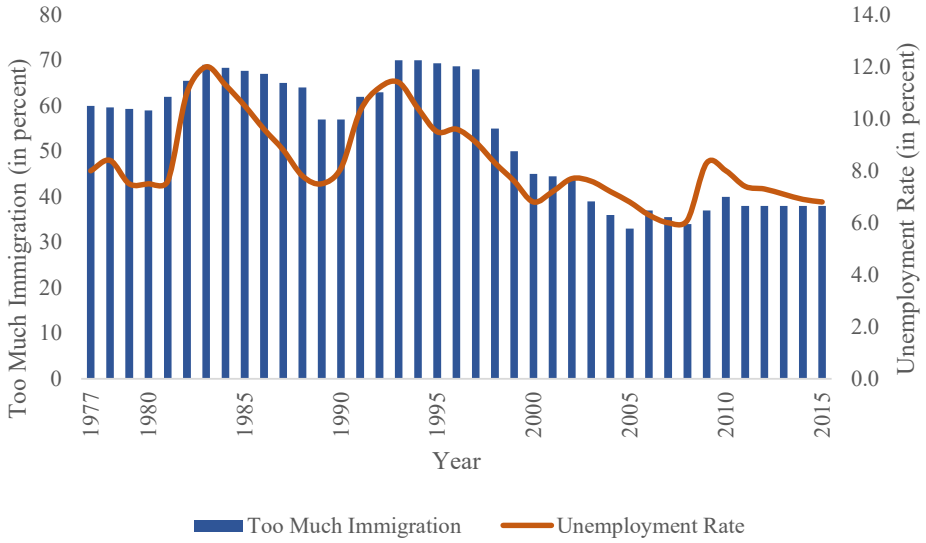


Figure 11. Relationship between Canada's unemployment rate and percentage agreeing or strongly agreeing with the statement "Overall, there is too much immigration to Canada," 1977–2012.

Sources: (1) Unemployment rates are from Statistics Canada, annual Labour Force Survey, downloaded from www.stats.gov.nl.ca/statistics/Labour/PDF/UnempRate.pdf, March 26, 2014; (2) Public attitudes on immigration are from Environics, Focus Canada Surveys, downloaded from www.queensu.ca/cora, March 26, 2014; see text for discussion of these data.

11. Environics first asked the survey question in 1977. The question has been included in annual Focus Canada Surveys, except for 1978, 1979, 1981, 1982, 1984, 1985, 1995, 1996, 1999, 2001, 2004, 2007, 2009, 2013, and 2014. In order to show trends over time, the responses for years with missing data are interpolated from the known data.

ging between 34 to 40 per cent. However, these respondents remain a minority. Overall, Canadians offer broad support for immigration, generally believe that immigrant levels are at about the right level, and think that immigration has positive effects on the economy and society. This suggests that while immigration policies are dynamic, there is no strong public support for dramatic reductions in immigration to Canada.

Public attitudes about immigration levels are strongly affected by economic conditions. Figure 9 also displays the relationship between public attitudes about immigration and Canada's annual unemployment rates. When economic conditions deteriorate—and the unemployment rate increases—public attitudes change, with a greater percentage expressing concerns that immigration levels are too high. Indeed, a simple regression equation for these data suggests that a one percentage point increase in the unemployment rate predicts a 6.6 percentage point increase in the proportion agreeing or strongly agreeing that there is too much immigration.[12] It is likely that public support for immigration will remain generally positive, as long as Canada's economy is fairly strong.

Concluding remarks

Current immigration to Canada of about 250,000 new arrivals per year is similar to the peak levels of 1909–13, but also exceptional because they have continued for much of the past 25 years. The relative immigrant rate—about 9 immigrants per 1,000 resident population—is a considerably lower, however, than the 30 to 32 per 1,000 in earlier Canadian history, during 1909 to 1913. Absorbing large numbers of newcomers has costs as well as benefits. The costs are immediately apparent, but some of the benefits take longer to appear. Schools, hospitals, and social service agencies may have to arrange for language services and other special programmes for immigrants; however, most of the costs of these adjustments are paid by immigrants and their families. Immigrants have given up the familiarity of home in their quest for more rewarding careers and greater opportunities for their children. Immigrants must also contend with a receiving society that is ambivalent, and sometimes hostile, to their presence. The benefits of immigration are less apparent and more diffuse—lower costs and more diverse goods and services—and appear over longer periods, as the children of immigrants complete their education, enter the labour force, and start to pay taxes.

Contemporary immigrants adapt and integrate to Canadian society—probably as fast as earlier waves of immigrants. Integration is not instantaneous, however, and the process is never complete, at least for adult immigrants. But for their Canadian-born children, and for those who arrive in Canada as young children, integration is a natural process that reflects immersion in Canadian schools and culture.

Immigrants and their children, however, are not the same as Canadian-born residents. In addition to many obvious characteristics such as language, religion, and cuisine, they generally differ on social and educational characteristics. Immigrants are also not representative of the society from which they come. Because of Canada's selective immigration policies, immigrants are not drawn from the least successful ranks of their home societies, but are generally well above average in terms of their education and other skills.

Perhaps the most important contribution of immigrants is their children. Many immigrants have made enormous sacrifices for their children's welfare, including the decision to settle in Canada.

12. This regression analysis is based on 39 data points for 1977 to 2015. Readers should note as a caution: 15 data points for public attitudes are interpolated from known data. Nevertheless, the simple regression without imputed data points is similar, and is statistically significant at the 0.05 level. The R-squared value for the linear regression is 0.60.

Immigrant parents often have to work in multiple jobs, and sometimes in occupations well below the status they would have received if they had remained at home. These sacrifices have meaning, because immigrant parents believe that their children will have better educational and occupational opportunities in Canada than in their homelands. Immigrant parents push their children to excel by reminding them of their own sacrifices. These high expectations for the children of immigrants generally lead to high motivations for educational and occupational success.

Some cultural conservatives fear that immigrants will change Canadian character and identity. Yet, the definition of a Canadian national identity is elusive. Unlike many other societies, Canada does not have an identity tied to an ancient lineage. A key reason for a broad definition of Canadian identity is that the overwhelming majority of the Canadian population is descended from early English and French settlers as well as large waves of 19th- and 20th-century immigrants from many countries. Demographic estimates suggest that less than one-third of the 2011 Canadian population was descended from the mid-19th-century Canadian population (see Figure 7).

The Canadian experiment in nation-building is, in large part, the story of how immigrants have been absorbed into Canadian society, and how immigrants have enlarged and transformed Canada. Immigrants settled the western and northern frontiers; they participated in constructing canals, roads, and railroads; and they contributed significantly to the armed forces in Canada's wars. Immigrants provided much of the agricultural labour for the settlement of the prairies, and manufacturing labour for the Canadian industrial revolution, as well as a disproportionate share of the contemporary highly skilled scientists and engineers that are central to the modern economy. Most interestingly, immigrants and the children of immigrants have been among the most important creative artists who have shaped the development of the cultural arts, including movies, theatre, dance, and music.

Immigration is perhaps one of the most distinctive feature of Canadian history. Immigration has had a disproportionate effect on the demographic size, ethnic diversity, culture, and character of Canadian society. Immigrants and their children have integrated in Canada, but they have also shaped Canadian institutions in ways that have allowed strangers to participate in a new society.

Several common themes emerge in this paper. First of all, immigration takes many forms. The movement of South Asians to Toronto, Haitians to Montreal, Ukrainians to Manitoba, and Chinese to Vancouver have different causes and consequences. In most cases, the motivation for the immigrants is to improve their situation, usually by finding a better job or to obtain a better quality of life. Immigration to Canada certainly helps the immigrants and their families. Immigrants gain new skills, save money, learn new languages and ideas, and often start new businesses and create jobs in their new homes.

Second, immigration clearly affects Canadian society. Immigrants not only add new residents but also influence Canada's fertility and mortality. Because most immigrants are younger, their effects on fertility are especially important, because they contribute more births to the population than their numbers might suggest. A major demographic effect of immigration is the proportionately large number of children born in Canada, much larger than the number of foreign-born children and youth who arrive with their parents.

Third, discussion of current immigration in Canada requires a historical perspective. An honest appraisal of immigration over the past fifty years needs to acknowledge that immigration has not brought about the ethnic tensions and employment problems that some pessimists have predicted. Rather, the lives of millions of immigrants have been dramatically improved and immigrants have enriched Canada culturally and economically. To be sure, immigrants with low skills have competed with low-skilled domestic workers, and this has depressed wages for some. But low-skilled workers

were already at risk because of technology improvements and, in some instances, competition from foreign goods. The appropriate public policy is to help low-skilled workers improve their job skills, not to reduce immigration, which might result in negative effects on the whole economy.

Finally, recent migration trends in Canada ensure that the population will continue to be reshaped by both international and internal migration. Long-term internal migration will continue, as people move from small towns and rural areas to larger towns and cities, and from less to more attractive areas, influenced by many factors, including economic opportunities. In addition, international migration will continue to be a powerful demographic force, as thousands of people arrive and alter Canada's population and society. Moreover, future immigration will not merely continue old patterns. For example, future immigration (and emigration) is likely to include a greater proportion of highly skilled workers who move between and within countries on a temporary basis. Immigration is likely to be more diverse in multiple ways, encompassing more categories of migrants and more varied forms of migration flows that will expand transnational migrant communities. Migration, by definition, is dynamic and fluid. We can be sure that future immigration in Canada will reveal new forms and new effects of this powerful demographic process.

Acknowledgments

I thank my colleague Sharon M. Lee and three anonymous reviewers for their helpful comments and constructive suggestions.

References

Beaujot, R., and M. Munib Raza. 2013. Population and immigration policy, in *Canadian Studies in the New Millennium*, edited by M. Kasoff and P. James. Toronto: University of Toronto Press.

Bélanger, A., and S. Gilbert. 2003. Immigrant women and their Canadian-born daughters, in *Report on the Demographic Situation in Canada 2002*, edited by A. Bélanger. Ottawa: Ministry of Industry, p. 127–51.

Bourbeau, R., and J. Légaré. 1982. *Évolution de la mortalité au Canada et au Québec 1831–1931*. Montreal: Les Presses de l'Université de Montréal.

Boyd, M. 2011. Immigrants in Canada: Trends and issues, in *The Changing Canadian Population*, edited by B. Edmonston and E. Fong. Montreal and Kingston: McGill–Queen's University Press.

Charbonneau, H. 1984. Trois siècle de depopulation amérindienne, Page 28-48 in L. Normandeau and V. Piche (editors), *Les populations amérindienne et Inuit du Canada.* Montréal: Les presses de l'Université de Montréal.

CIC (Citizenship and Immigration Canada). 1999. *Citizenship and Immigration Statistics 1996*. Catalogue No. MP22-1/1996. Ottawa: Ministry of Public Works.

———. 2014. *Facts and Figures 2014*. Downloaded 10 December 2015 from www.cic.gc.ca/english/resources/statistics/facts 2014/permanent/01.asp.

Edmonston, B. 2010. Measuring the effect of immigration on population growth, in *Demographic Aspects of Migration*, edited by T. Saltzmann, B. Edmonston, and J. Raymer. Amsterdam: Springer-Verlag.

———. 2014. Two centuries of demographic change in Canada. *Canadian Studies in Population* 41(1–2):1–37.

Edmonston, B., and S.M. Lee. 2013. Immigrants' transition to homeownership, 1991 to 2006. , *Canadian Studies in Population* 40(1-2; Special Issue on Lifecourse Perspectives on Immigration):57–74.

Edmonston, B., and M. Michalowski. 2003. International Migration, in *The Methods and Materials of Demography*, 2nd edn, edited by H. Shryock, J. Siegel, and D. Swanson. New York: Academic Press.

Edmonston, B., and J.S. Passel. 1992. Immigration and immigrant generations in population projections. *International Journal of Forecasting* 8:459–76.

———. 1994. Immigration and race: Recent trends in immigration to the United States, in *Immigration and Ethnicity: the Integration of America's Newest Arrivals*, edited by B. Edmonston and J.S. Passel. Washington: The Urban Institute Press.

Henripin, J. 1972. *Trends and Factors of Fertility in Canada*. A 1961 Census Monograph. Ottawa: Statistics Canada.

Kerr, D., and R. Beaujot. 2010. Aboriginal demography, in *Visions of the Heart: Canadian Aboriginal Issues*, 3rd edn, edited by D. Long and O.P. Dickason. Toronto: Oxford University Press.

Lavoie, Y. 1972. *L'émigration des Canadiens aux Ètats-Unis avant 1930: Mesure du Phénomème*. Montreal: Les Presses de L'Université de Montréal.

Lee, S.M., and B. Edmonston. 2011. Age-at-arrival's effects on Asian immigrants' socioeconomic outcomes in Canada and the United States. *International Migration Review* 45(3): 527–61.

Keyfitz, N. 1950. The growth of Canadian population. *Population Studies* 4:47–63.

McDougall, D.M. 1961. Immigration into Canada, 1851–1920. *Canadian Journal of Economics and Political Science* 27(May):162–75.

McInnis, M. 1994. Immigration and emigration: Canada in the late nineteenth century, in *Migration and the International Labor Market 1850–1939*, edited by T.J. Hatton and J.G. Williamson. London and New York: Routledge.

———. 2000a. The population of Canada in the nineteenth century, in *A Population History of North America* edited by M.R. Haines and R.H. Steckel. Cambridge (UK): Cambridge University Press, p. 371–432.

———. 2000b. The population of Canada in the twentieth century, in *A Population History of North America*, edited by M.R. Haines and R.H. Steckel. Cambridge (UK): Cambridge University Press, p. 529–99.

OECD (Organization of Economic Cooperation and Development). 2014. *Education at a Glance 2014*. Paris: OECD.

Simmons, A.B. 2010. *Immigration and Canada: Global and Transnational Perspectives*. Toronto: Canadian Scholars' Press.

Statistics Canada. 1965 *Historical Statistics of Canada*. Ottawa: Statistics Canada.

———. 1994. *Canada Year Book 1994*. Ottawa: Ministry of Industry, Science, and Technology.

———. 2010a. *Canada's Demographic Estimates*. Catalogue no. 91-C00-29. Ottawa: Ministry of Industry.

———. 2010b. *Population Projections for Canada, Provinces and Territories: 2009 to 2036*. Catalogue no. 91-520-X. Ottawa: Ministry of Industry.

———. 2010c. *Projections of the Diversity of the Canadian Population: 2006-2031*. Catalogue no. 91-551-X. Ottawa: Ministry of Industry.

———. 2011–14. *Annual Demographic Estimates: Canada, Provinces and Territories.* Catalogue no. 91-215-X. Ottawa: Ministry of Industry.

UNDP (United Nations Population Division). 2013. *International Migration Report 2013*. New York: United Nations.

Appendix

International migration estimates for Canada

This Appendix describes the data and methods for international migration estimates for Canada for the period 1851 to 2011. These estimates are based on previously published historical estimates for immigration and emigration. The historical international migration estimates are used in an immigrant generation population reconstruction model to estimate emigration separately for foreign-born and Canadian-born residents.

This work requires several steps: (1) a reconstruction of the 1851 population by nativity; (2) estimates of the 1851 to 1941 population that includes the population of Newfoundland, which was included in the 1951 and later censuses;[13] (3) new immigration and emigration estimates for 1871 to 1901; and (4) an immigrant generation population model to estimate international migration by nativity. Each step is discussed below, with a concluding section discussing the new international migration estimates.

Reconstructing the 1851 population by nativity

The first census for the national Census of Canada was conducted in 1851. It did not include an enumeration of Aboriginal peoples and did not distinguish between foreign-born and Canadian-born residents. The reconstruction of the 1851 Canadian population by nativity, excluding Aboriginal peoples, uses population counts from 1670 to 1851 from colonial censuses of England and France, as well as assumptions about fertility and mortality levels. Population counts for New France (Quebec) are available for 1670 and earlier years. English population censuses for the colonies of Nova Scotia and Newfoundland become available by 1680, New Brunswick by 1710, Prince Edward Island by 1740, Upper Canada (Ontario) by 1780, and Manitoba by 1800. English censuses of Nova Scotia provide separate counts for Acadians starting in 1700. Canada's population is reconstructed from 1670 to 1851, assuming that the total fertility rate declined from 7.0 to 5.6, life expectancy for females improved from 39.0 to 43.4, life expectancy at birth for males increased from 38.5 to 42.4, and there were 1,000 annual emigrants during the period. These assumptions are based on available estimates of fertility, mortality, and emigration from research on Canada's colonial population. They imply annual net immigration levels of less than 1,000 for 1670 to 1781, higher net immigration of 3,000 to 4,000 annually during 1781 to 1801 (including net immigration of about 40,000 Loyalists during and

13. Newfoundland became the tenth province of Canada, changing its official name to Newfoundland and Labrador, on 31 March 1949. In common conversation, Newfoundland refers to the island and Labrador refers to the portion of the province that is on the Canadian mainland.

following the U.S. War of Independence; McInnis 2000a: 375), and annual net immigration increasing to about 27,000 in the 1840s. These net immigration estimates are similar to those commonly cited in historical population studies.

Census populations for 1851 to 1951

Two adjustments are made to the census population figures, to derive an estimated total population of Canada for the period from 1851 to 1951.

First, an estimate for the population of Newfoundland is added to the census counts for Canada for the 1851 to 1941 period, prior to Newfoundland joining Canada in 1949 and its inclusion in the 1951 census. This adjustment is made so that there is a consistent population over the 1851 to 2011 period for the population reconstruction. The population of Newfoundland is small relative to the Canadian total (about 2 to 4 per cent of the total during 1851 to 1941). English censuses of Newfoundland show population growth from 109,000 in 1851 to 361,416 in 1951. Any errors in the estimates for Newfoundland's population would have a comparatively minor impact on international migration estimates for the Canadian population.

Second, Dominion Bureau of Statistics research for the 1931 census of Canada (cited by Keyfitz 1950: 47) suggests that there may have been an undercount of about 100,000 native individuals in the 1851 and 1861 censuses. Allowing for this undercount, 100,000 is added to the census counts for 1851 and 1861. Keyfitz (1950: 47) estimates that 100,000 native persons were omitted in the 1851 and 1861 censuses, presumably in addition to some who were counted. Charbornneau (1984) suggests that the Aboriginal population numbered about 300,000 prior to European contact. But Kerr and Beaujot (2010) estimate that by the late 1800s, the Aboriginal population had declined to just 100,000.

If these two adjustments were not made to the census counts, the calculated Canadian population would be 8 per cent smaller for 1851 and 2 per cent smaller for 1941. The effect of not making these adjustments would be a modest reduction of emigration numbers for the population reconstruction.

International migration estimates for 1871 to 1901

Keyfitz (1950) prepared the first consistent set of international migration estimates for Canada. His work offers a careful review of available life tables and alternative mortality assumptions, surviving census populations by age and sex forward ten years, and estimating *net* international migration. Taking immigration estimates from official records, he derived emigration as a residual. His work is also useful for its analysis of the Canadian-born population in US censuses, and for providing the first Canadian emigration estimates. His work, conducted while at the Dominion Bureau of Statistics, was a forerunner of later estimates prepared by Statistics Canada. Statistics Canada (1965) revised and updated Keyfitz's pioneering estimates. Statistics Canada (1994, 2010, 2011–2014) provide international migration estimates for the period since 1965; these data are usually cited as Canada's "official" historical immigration estimates.

There is a serious problem of international transients to Canada being counted as immigrants in the immigration statistics for the late nineteenth century. Warnings about the overstatement of immigration numbers for the 1870 to 1900 period have been sounded by McDougall (1961) and McInnis (1994), as well as the *Historical Statistics of Canada* (Statistics Canada 1965: 11), where historian Kenneth Buckley notes that the immigration statistics are "grossly exaggerated from 1873 to 1891."

McDougall's (1961) work incorporated two important revisions. First, he argued that life tables derived from the US mortality experience are preferable for the study of Canadian mortality, rather

than the English life tables used by Keyfitz.[14] Second, he presented alternative immigration statistics, derived from information on emigration from Europe and the United States. A major limitation to official Canadian immigration data for the late nineteenth century is that the data do not distinguish between long-term immigrants and international transients. A substantial proportion of "immigrants" into Canada during the 1851 to 1901 period are persons who were in transit to the United States, or who resided in Canada for only a short period before moving to the US. Canadian immigration data for the late nineteenth century might more aptly be called *arrival data*.

McInnis's research addresses additional problems in the immigration and emigration data of the late nineteenth century, and provides new estimates. To emphasize the problems with "official" Canadian immigration data, McInnis writes:

> In the decade 1871–80, the Canadian emigration rate of 109.3 (per 1,000 population; implied by official immigration numbers) is almost double that shown for Ireland, the European country with the highest rate. In the following decade the Canadian rate soared to 243.1, far higher than experienced by any European country. If we are to believe the conventionally used figures, the emigration from Canada in that decade [the 1880s] would have been equal to one-quarter of the whole population, at a time when about half of the population was under fifteen years of age. That is little short of astonishing, and compels one seriously to question the validity of the [immigration] data" (1994: 141).

McInnis's reassessment of immigration statistics includes a careful analysis of published records of Canadian immigration agents. He points out that counts of immigrant arrivals include several sources of misstatement: (a) along with transient passengers (arrivals in Canada who were destined for the United States), there were also persons ticketed for a Canadian destination who then travelled on to a final destination in the United States; (b) the reported immigration numbers for western inland ports probably missed many immigrants from the United States but also mistakenly included Canadians from Ontario who travelled west by a US route; (c) arrivals at the Niagara suspension bridge included many Canadians living in the United States who were making a visit home; and (d) arrivals at Pacific ports were reported after 1880, but included many arrivals who were probably not immigrants. After considering available information, McInnis suggests that it may be preferable to use available Canadian data on intercontinental arrivals for immigration analysis. Data on intercontinental arrivals count only arrivals at ocean ports (consisting of all European and Asian immigrants to Canada); such data do not count immigrants from the United States, but would include arrivals that were using Canada as a route to the United States. Even so, McInnis's opinion (1994: 148) is that data on intercontinental arrivals are probably an overstatement of Canadian immigration. Appendix Table 1 shows McInnis's revised figures on immigration for 1871 to 1901 as a starting basis for these new estimates, as well as this paper's estimates, which are discussed below.

Immigrant generation population projection

Immigrant generation population projections were proposed by Edmonston and Passel (1992) as a method for preparing national population projections by age, sex, and three immigrant generations: foreign-born (the 1st generation), sons and daughters of immigrants (the 2nd generation), and grandsons and granddaughters of immigrants as well as subsequent descendants (the 3rd and higher generation). The terminology for immigrant generations is commonly used in immigration research. It should be noted, however, that the individual description focuses on an ancestor who most recently

14. Some of the US life tables cited by McDougall (1961) were constructed in the 1950s and were not available to Keyfitz when he published his international migration estimates.

Table A1. Estimates of international migration, Canada, 1871–1901 (numbers in 1000s)

Decade	CIC	Keyfitz	McDougall	McInnis (2000a)
		Immigration		
1871–1881	343	353	253	350
1881–1891	886	903	448	680
1891–1901	339	326	249	250
		Emigration		
1871–1881	–[a]	438	293	404
1881–1891	–[a]	1,108	602	826
1891–1901	–[a]	507	364	380
		Net immigration		
1871–1881	–[a]	−85	−40	−54
1881–1891	–[a]	−205	−154	−146
1891–1901	–[a]	−181	−115	−130

Sources: CIC 1999; Keyfitz 1950: Table 11; McDougall 1961: Table 3; McInnis 2000a: Table 9.3.
[a]not available.

arrived as an immigrant, rather than possible ancestors who arrived less recently. Also, Canada's Aboriginal population and many other Canadians, especially the French, have particularly long-standing residence in Canada. Given these qualifications, the immigrant generation model is most appropriately interpreted for immigrants, their children, and their grandchildren. The primary purpose of the model in this paper is a population reconstruction model that illuminates international migration and its demographic effects since 1851.

The data requirements for immigrant generation population projections are more demanding than standard national population projections, because data are required on fertility, mortality, and migration for each generation. Requiring such data for each generation has some advantages, however. For example, most standard national populations assume that immigrants acquire the fertility and mortality schedules of the resident population the instant they arrive, which is often unrealistic. Immigrant generation population projections have several advantages. Most importantly, they present estimates for the population by immigrant generations, showing the number and characteristics of the foreign-born and their descendants.

The immigrant generation population projection model is used for the historical reconstruction of Canada's population from 1851 to 2011. The population estimates and estimated components of change are derived using a modified cohort-component methodology to develop population estimates by age, sex, and immigrant generation. The model keeps track of three generations: the first generation, the second generation, and the third and higher generation. The data follow the designations used in Canadian censuses: an individual's generation is defined by the most recent immigrant ancestor. Thus, an individual with one immigrant parent and one Canadian-born parent is a member of the second immigrant generation.

The demographic model combines data on (a) fertility, mortality, immigration, and emigration for the total population from the consistent census correction estimates described above; and (b) data separate by immigration generation to produce population estimates for the total population of Canada, by immigrant generation. The basic strategy for the estimates involves fitting data on each of the four components (fertility, mortality, immigration, and emigration) to the series of population counts from the censuses of 1851 to 2011. The fitting involved an iterative process of progressively fitting the component series to the population targets. Because our interest is pri-

marily in international migration, the targets for each date were the foreign-born population, the second-generation population (i.e., in census parlance, the Canadian-born population of foreign or mixed parentage), and the third-and-higher generation population (i.e., the Canadian-born of Canadian-born parentage).

Data from the following sources are used for the historical population reconstruction:

1) Age-sex population data are from Canadian population censuses from 1851 to 2011.

2) Mortality data are from two sources: (a) 1851 to 1941 survival values are based on comparable US life tables adjusted to fit life table expectancy at birth, by sex, values from Keyfitz (1950) and Bourbeau and Légaré (1982); and (b) 1951 to 2011 survival values are from Dominion Bureau of Statistics and Statistics Canada life tables.

3) Fertility data are primarily are Henripin (1972), with estimates of crude birth rates and age-specific fertility rates for the 1851 to 1951 period. Dominion Bureau of Statistics and Statistics Canada publications provide fertility estimates after 1951. Bélanger and Gilbert (2003) provide information on fertility levels by nativity for the 1961 to 2006 period.

4) Five-year immigration and emigration are from Keyfitz (1950) for 1851 to 1861; McInnis (2000a and 2000b) for 1861 to 1931, Statistics Canada (www.statcan.gc.ca/sum-som/l01/cst01/demo03-eng.htm) for 1931 to 2001; and Statistics Canada's CANSIM table 051.004 for 2001 to 2011. When data for 1851 to 1931 are available only for ten-year periods, five-year data are interpolated, based on the adjusted historical data on annual immigrant arrivals. The age-sex distribution of immigrants and emigrants for 1851 to 1941 are from Keyfitz (1950). Data on the age-sex distribution of international migration for more recent years are from Statistics Canada's (2010a, 2011–2013) Annual Demographic Statistics. These same immigration and emigration figures are also cited and described in Beaujot and Raza (2013).

It is important to note a significant difference between annual data on immigrant arrivals—as reported in Citizenship and Immigration Canada's data on legal permanent arrivals—and immigration data presented in publications of academic researchers or Statistics Canada. Summing Citizenship and Immigration Canada data for ten-year periods produces different numbers than the immigration totals cited in Keyfitz (1950), McInnis (2000a and 2000b), and Statistics Canada. For the 1991 to 2001 period, for example, Citizenship and Immigration Canada (2014) records 2,215,000 immigrant arrivals (rounding to the nearest 1,000) while Statistics Canada (2010a) reports immigration of 2,335,000, or 120,000 more. The difference occurs because immigration numbers reported by Statistics Canada and other national statistical offices include legal permanent immigrant arrivals as well as several other groups of persons who cross Canada's borders. Other than legal permanent immigrants, immigration numbers may also include non-immigrant aliens (such as students, foreign government officials, and temporary workers), returning Canadian government employees and military personnel and their families, arrivals of Canadians returning from foreign residence, and illegal entrants (Edmonston and Michalowski 2014: 462). This leads to a critical caution: *There are sometimes large differences between annual immigrant arrival data recorded by Citizenship and Immigration Canada and the annual, five-year, or ten-year immigration data reported in publications by researchers and Statistics Canada.* The immigration numbers in this paper, as discussed above and in the main text, are based on immigration arrival data reported by researchers and Statistics Canada, and include legal permanent immigrant arrivals as well as other persons who enter Canada for longer periods of residence.

As in a standard cohort-component projection, we begin with a population age x at time t, P_x^t, survival rates for survival from age x to $x+5$ during the period from t to $t+5$, $S_x^{t,t+5}$, and age-specific

fertility rates for women age x at time t, F^t_x. We assume five-year age groups, so a population age x represents the age group x to $x+4$. To include international migration, we expand the basic model by defining immigrants age x during the period t to $t+5$, $I^{t,t+5}_x$, and emigrants age x during the period t to $E^{t,t+5}_x$. Then, net migrants during the period are defined as $N^{t,t+5}_x = I^{t,t+5}_x - E^{t,t+5}_x$. We assume that all demographic data and calculations are separate for males and females.

We add an immigrant generations index to the basic model. Consider a population indexed by k generations, where $k = 1$, 2, and 3: k=1 indicates the first generation, $k = 2$ indicates the second, and $k = 3$ indicates the third and higher generations. The survival of the population alive at the beginning of the projection period, for all age groups but the last, becomes:

$$P^{t+5}_{x+5,k} = P^t_{x,k} S^{t,t+5}_{x,k} + \frac{N^{t,t+5}_{x,k}(1 + S^{t,t+5}_{x,k}) + N^{t,t+5}_{x+5,k}(1 + S^{t,t+5}_{x+5,k})}{4}$$

For the open-ended age category, the survival rates are adjusted to define the survival from the open-ended age category in one period to the open-ended age category in the next period.

In general, the number of immigrants by generation is non-zero for the first generation and zero for the second and higher generations; immigrants are rarely Canadian-born persons. On the other hand, the model makes apparent that emigrants by generation may have non-zero values for all generations. Hence, observed values of net migration by generation are usually positive for the first generation (representing net immigration of the foreign-born) and typically negative for the second and higher generations (indicating emigration of the Canadian-born).

In a female-dominant model, a mother in the kth generation would produce an offspring in the $k+1$st generation. We use the term *female-dominant* to mean that the model derives the generational characteristics of children from the mother. In other words, the generational membership of the father has no relevance for the offspring in the female dominant perspective. Since it is logically impossible for a mother to give birth to a foreign-born child while resident in Canada, the population aged 0 to 4 for the first generation derives solely from immigration.

The female-dominant model, however, needs to be modified to correspond to the most recent ancestor definition usually used in Canada censuses. It might be thought that a first-generation mother would give birth to a second-generation offspring, a second-generation mother would give birth to a third-generation offspring, and a third-plus mother would always give birth to a third-plus offspring. In actuality, a woman may have a partner who is not of the same immigrant generation. If a woman has a partner who has more recent immigrant ancestry, the offspring's immigrant generation will depend on the partner's immigrant generation, rather than on the mother. For example, if a third-plus generation woman has a child with an immigrant father, then the child (according to census definitions) will be reported as second-generation. This immigration generation effects can be including in a population projection model by incorporating a transition matrix that determines the immigrant generation of births from the joint immigrant generations of both mother and father.

Consider a matrix $G_{k,m}$, which indicates the proportion of births in the mth generation ($m = 1,2,3$) born to women in the kth generation. In the female-dominant model, $G_{1,2} = G_{2,3} = G_{3,3} = 1$, and all other cells in the G matrix are zero. After modelling the generational membership for recent birth cohorts, the following G matrix best fits the observed Canadian census data: $G_{1,2} = 1.00$, $G_{2,2} = 0.13$, $G_{2,3} = 0.87$, $G_{3,2} = 0.05$, $G_{3,3} = 0.95$.

Incorporating the *G* matrix for the population in the first five years of life is:

$$P_{0,4}^{t+5} = \sum_{k=1}^{3}\left[G_{k,m}(B_k^{t,t+5} \bullet \frac{S_{b,k}^{t,t+5} + S_{b,k+1}^{t,t+5}}{2}) \right] + \frac{N_{0,4}^{t,t+5}(1 + S_{b,4}^{t,t+5})}{4}$$

where $S_{b,k}^{t,t+5}$ represents the survival from birth to age 0–4 for the *k*th generation during the period *t* to $t+5$ and the total births in the *k*th generation are calculated as:

$$B_k^{t,t+5} = 2.5\sum_{x=15}^{45} P_{x,k-1}^{t}(F_{x,k-1}^{t} + S_{x,k-1}^{t,t+5}F_{x,k-1}^{t+5}) + B_{I,k}^{t,t+5}$$

where $B_{I,k}^{t,t+5}$ represents the births to net immigrants during the period.

Starting with the reconstructed 1851 population described above, population data by five-year age groups, sex, and immigrant generation were fitted for every five years from 1851 to 2011, using the fertility, mortality, and international estimates described above. Generational age-sex distributions were fitted to available data: (a) age-sex tabulations for the 1851 and 1861 censuses; (b) population totals for the Canadian-born and foreign-born for the 1871 to 1911 censuses; and (c) age and sex of the Canadian-born and foreign-born for censuses since 1921. In addition, age and sex data are available on the Canadian-born of foreign-born parents (the second generation) for 1921, 1931, 1971, 2001, 2006, and 2011 censuses; subtracting information on the first and second generation from the total Canadian-born population yields estimates for the third-plus generation.

The result of the fitting process is a detailed set of fertility, mortality, and immigration and emigration estimates for 5-year periods from 1851 to 2011, for immigrant generations by age and sex. Because the focus of this paper is on international migration, we present only the immigration and emigration estimates in Appendix Table 2, which also shows emigration estimates by nativity.

Table A2. International migration estimates for Canada, in 1000s, 1851 to 2011

	Total population			Emigrants	
5-year period beginning in	Immigrants	Emigrants	Net immigrants	Foreign-born	Canadian-born
1851	216	43	173	9	34
1856	136	127	9	23	105
1861	140	189	−49	32	157
1866	120	221	−101	35	185
1871	233	178	55	25	153
1876	117	226	−109	29	197
1881	397	399	−2	48	352
1886	283	427	−144	47	380
1891	116	201	−85	16	185
1896	134	179	−45	13	167
1901	524	247	278	12	234
1906	1,026	493	532	39	454
1911	1,058	829	229	124	705
1916	342	260	82	52	208
1921	488	395	93	99	296
1926	712	575	137	173	403
1931	81	132	−50	54	78
1936	68	109	−42	46	63
1941	61	42	19	18	24
1946	487	337	150	168	168
1951	783	185	598	98	87
1956	760	278	482	133	145
1961	539	280	259	129	151
1966	890	427	463	201	226
1971	1,053	358	695	175	183
1976	771	278	493	139	139
1981	678	278	400	145	133
1986	1,164	213	951	115	98
1991	1,118	338	780	227	111
1996	1,217	376	841	221	155
2001	1,194	203	991	131	72
2006	1,263	259	1,004	173	86

Source: historical population reconstruction, described in the Appendix.

Canadian Studies in Population 43, no. 1–2 (2016): 117–145.

Developments in Australian migration

David Smith[1]
Dan Payne
Mathew Horne
Debbie Claridge

Abstract

Against the backdrop of changes in the nature and volume of people movement, migration to Australia has changed substantially in the past decade. Using a diverse range of statistical data and departmental policy information, this paper provides a comprehensive assessment of recent developments, discussing not only changes in the scale and composition of migration to Australia, but also the influence of policy decisions and various departmental programmes on this movement. The paper also examines the dispersal of migrants throughout the country post-arrival and the linkages between temporary and permanent migration, which are a reflection of increased global mobility and changing attitudes to permanent settlement.

Keywords: Australia, migration policy, permanent migration, temporary migration, Australian citizenship.

Résumé

Les changements dans la nature et le volume de mouvements démographiques en toile de fond, la migration vers l'Australie changea considérablement au cours des derniers dix ans. Au moyen de données statistiques variées et de l'information sur les politiques du département, cet article fournit une évaluation complète des derniers développements en examinant les changements dans l'échelle et la composition de la migration en Australie ainsi que l'influence des décisions stratégiques et des divers programmes départementaux sur ce mouvement. L'article examine la dispersion des migrants à travers le pays après leur arrivée ainsi que les liens entre la migration temporaire et permanente reflétant une plus grande mobilité mondiale et de nouvelles attitudes à l'égard de l'établissement permanent.

Mots-clés : Australie, politique de migration, migration permanente, migration temporaire, la citoyenneté australienne.

Introduction

Australia is a country built on migration. At the time of the 2011 Census, more than one-quarter of the population was born overseas—more than double the rate at the end of the Second World War (Figure 1). Another one in five Australians has an overseas-born parent (ABS 2011). Collectively, this means that in the Australia of today, almost half of the population has a direct migrant connection. In addition, there are more than one million people temporarily in Australia at any one time (DIAC 2013b).

1. David Smith, Director, Economic Analysis Unit, Policy Research and Statistics Branch, Strategic Policy and Planning Division, Policy Group, Australian Government Department of Immigration and Border Protection, PO Box 25, Belconnen, ACT 2616, Australia, e-mail: david.smith@border.gov.au; and Dan Payne, Mathew Horne, and Debbie Claridge, all of the Australian Government Department of Immigration and Border Protection.

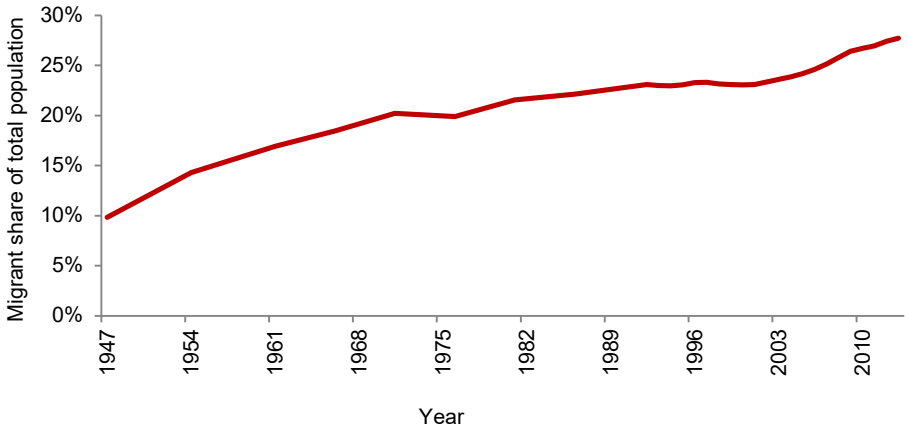


Figure 1. Growth in Australia's migrant population share.

What is even more remarkable is that this impact on Australian society has occurred in less than a lifetime. At the end of the Second World War and on the eve of its first formal migration programme, Australia was an Anglo-Celtic society of just seven million. Since then, Australia has received almost eight million new migrants into the country, including 825,000 former refugees fleeing conflict and persecution (DIBP 2014e). A measurable impact of this transformation is that between 1947 and 1999, the share of the population that identified as Anglo-Celtic fell steadily, from 89.9 per cent to 69.9 per cent (Price 1999).

The importance of migration has not abated over this period. In fact, one could argue that it is more important than ever, as the country grapples with the challenges of an ageing population against a backdrop of below-replacement fertility. This is why we have a permanent migration programme running at record levels, a heavy emphasis on skilled migration and are increasingly open to temporary migration.

Despite these seismic shifts, Australian attitudes towards migration are generally positive. Results from the 2013 Scanlon Survey of Social Cohesion show strong levels of support for multiculturalism with 84 per cent of respondents agreeing with the statement that multiculturalism has been good for Australia, 75 per cent saying it benefits the economic development of Australia and 60 per cent saying that multiculturalism strengthens the Australian way of life (Markus 2013).

If this paper was being written in 1984, we could be far more definitive about this subject. Thirty years ago almost all migrants coming to Australia would arrive with the intention of settling permanently. The handful of students, skilled workers and working holiday makers that were in Australia on a temporary basis would first have to return overseas if they wanted to apply for permanent settlement. Now, in an era of increased international mobility, brought about by improvements in communication, lower airfares and the emergence of a global workforce, the world is getting much smaller and traditional migration paradigms are less applicable.

Compared to earlier decades, the contemporary setting is more likely to involve migrants who first arrive on a temporary visa, and then subsequently make a decision to apply for permanent residence onshore. In today's more mobile world, this decision-making process may take several years, as people progress from one temporary visa to another and venture to different parts of the world along the way. The concept of permanence is shifting as well, with many permanent residents eventually leaving Australia not because they are dissatisfied, but because they want to take advantage of opportunities that are increasingly accessible elsewhere in the world.

In this paper, we look at the changing face of migration in Australia, with a particular focus on recent developments. In doing so, we will be discussing changes in the scale and composition of tempor-

ary and permanent migration into Australia, the linkages between temporary and permanent migration, the dispersal of migrants throughout the country and the effect of policy-decisions on migration.

The two sides of permanent migration to Australia: Immigrants and refugees

When we think of permanent migration, there are two main elements to consider; each of which is important in its own way. In terms of numbers and impacts on wider Australian society, the most substantive of these is Australia's Migration Programme. This incorporates both skilled and family reunion migration, and is the main pathway to permanent residence for around 190,000 migrants each year (DIBP 2014g).

The other side to permanent migration is Australia's Humanitarian Programme. Although only a fraction of the size of the Migration Programme, the policy's complexity and extent of international collaboration and involvement are significant. The issues surrounding both of these programmes are quite different, and as such, it is appropriate that they are discussed separately.

Before doing so, it's worth noting that the free movement of New Zealanders into Australia via the Trans-Tasman Travel Arrangement could also be considered as a form of permanent migration. This is because New Zealand citizens who arrive in Australia are able to live and work in Australia indefinitely, provided that they satisfy health and character requirements. However, the situation differs for those who arrived before and after February 2001, the time that the Australian Government introduced new residence and citizenship rules for New Zealand citizens. These rules work as follows:

1. Those who arrived before February 2001 are automatically eligible for social security payments and Australian citizenship;
2. Those arriving after February 2001 need to apply for a permanent residence visa if they wish to get access to the full range of social security payments and become eligible for Australian citizenship.

Under these arrangements, the reality for most New Zealanders living in Australia is that they are neither in a relationship with an Australian resident (meaning that they are unable to apply for a family reunion visa), nor do they necessarily have the skills and experience needed to apply for a skilled visa. This means that the pathway to citizenship is essentially blocked.

In this light, our focus returns to Australia's Migration Programme and the Humanitarian Programme.

Australia's Migration Programme—the main pathway to settlement

Australia's permanent migration programme supports two important objectives:

1. It contributes to economic and labour force growth through the delivery of skilled migrants;
2. It enables the reunion of Australians with close family members.

These objectives are administered through the two separate streams of immigrants, namely, the *skill stream* and the *family stream*. As the name suggests, the skill stream provides a migration pathway for persons with certain skills to contribute to Australia's economy, whereas the family stream helps Australians reunite with their close family members overseas. A further stream, known as the *special eligibility stream*, is much smaller in terms of the number of places. Its role is to allow for people who previously held permanent residence to re-enter the country permanently, so long as they have maintained close ties with Australia.

The annual Migration Programme is announced by the Government as part of the federal budget in May each year. In developing the programme, options are provided surrounding the size—how many places overall—and the composition—what categories of migrants make up those places. Determining this make-up relies on many factors, including economic and demographic indicators, estimates of demand for skilled labour from a range of sources, and long-term labour force growth estimates.

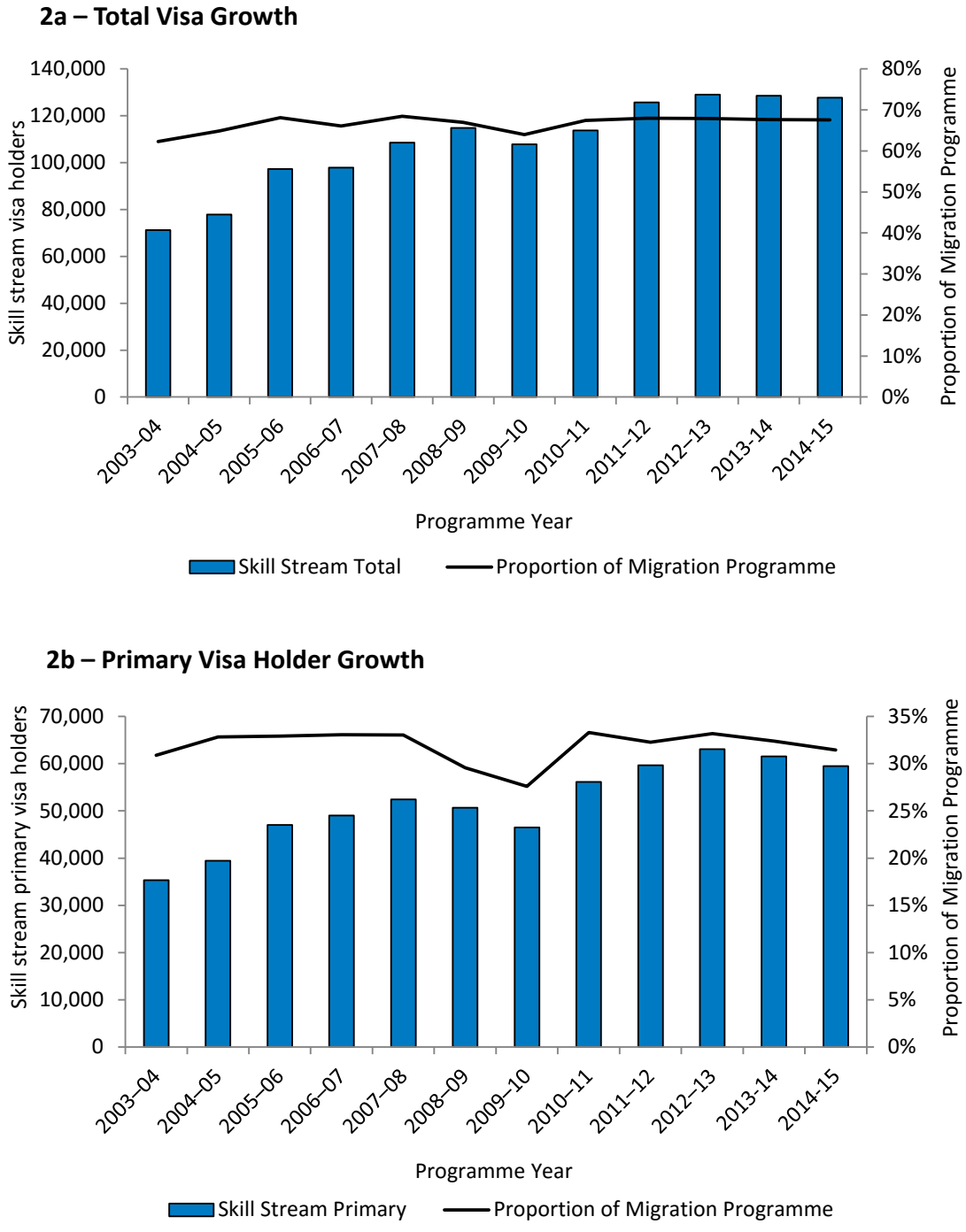


Figure 2a and 2b. Growth of the Skill stream, 2003–04 to 2014–15.
Source: Department of Immigration and Border Protection, Migration Programme Outcome Data.

In addition to this, the Government consults widely with key stakeholders, including government agencies as well as representatives from the community, business, and academia. The product of these deliberations is planning levels for various visa categories within the three streams of the Migration Programme.

Planning levels are ceilings, not targets. The Department carefully manages and reviews these levels throughout the year, to ensure the responsiveness of the programme to Australia's economic and social needs. For example, in March 2009 the skilled component of the programme was reduced by 14 per cent, in response to the weaker labour market conditions that arose from the global financial crisis (DIAC 2009: 29).

The Skill stream

The Skill stream accounts for more than two-thirds of Australia's annual Migration Programme, and has more than tripled in size since the year 2000 (DIBP 2014g). In delivering ever larger skilled programmes, successive governments have made the case that skilled migration enhances workforce participation and results in stronger productivity, along with greater entrepreneurism and connectedness with the rest of the world.

In analysing this growth, it should be understood that official figures include the entire migrating unit—that is, the Primary Applicant as well as their dependents (children included). Therefore, in order to get a more accurate assessment, Figures 2a and 2b present skilled migration growth in two ways: first in terms of all migrants, and then in terms of the Primary Applicant only—that is, the person selected

Figure 3. Components of Australia's Skill stream, visa places in 2014–15

Skill stream—127,774 visa places	
Points-Tested Skilled Migration 72,840 places	Permanent Employer-Sponsored 48,250 places
Applicants are not sponsored by an employer but must: be invited to apply; be under 50 years of age; have competent English; have relevant skills and qualifications for an occupation on a designated list; and have their skills assessed by the relevant assessing authority. They must also pass a points test that awards higher points to prospective migrants with certain skills and characteristics. Visa categories: Independent—43,990 places State/Territory Sponsored—26,050 places Skilled Regional—2,800 places	Applicants must be sponsored by an Australian employer to fill a genuine vacancy in the employer's business. The programme caters to migrants in Australia on a Temporary Work (Skilled) visa (subclass 457), those applying from outside Australia or already in Australia on a temporary visa other than the subclass 457 visa programme, and those sponsored through a tailored and negotiated Labour Agreement. Visa categories: Employer Nomination Scheme (ENS)—35,867 places Regional Sponsored Migration Scheme (RSMS)—12,380 places Labour Agreements—<5 places[a]
Business Innovation and Investment 6,484 places	Distinguished Talent 200 places
Applicants must have a demonstrated history of success in innovation and business and want to own and manage a new or existing business in Australia, or maintain business and investment activity in Australia after making an investment in Australia. Once the initial stage provisional visa requirements are fulfilled, the migrant can apply for a second-stage permanent visa.	Applicants must have special or unique talents of benefit to Australia. This visa is typically granted to individuals internationally recognised for exceptional and outstanding achievement in a profession, the arts, sport, or research and academia.

Source: Migration Reporting, Department of Immigration and Border Protection.

[a]From 1 July 2012, Labour Agreement visas were replaced with new arrangements made available in the ENS and the RSMS.

for skilled migration. As can be seen from these figures, the number of migrants selected on the basis of their skills accounts for about half the total number of skilled visas issued, and over the past decade, skilled migration's share of the total programme has remained about the same. This is a departure from earlier trends: prior to 1996, skilled visas accounted for less than half of the total Migration Programme.

To investigate skilled migration more deeply, it is first important to understand that it is made up of four components, each fulfilling a different objective. As shown in Figure 3, the largest of these components is Points Tested Skilled Migration, which comprised 56 per cent of the Skill stream in 2014–15. This is followed by the Employer Sponsored and the Business Innovation and Investment categories, accounting for 37 per cent and 5 per cent, respectively. Distinguished Talent is the smallest component, representing only 0.2 per cent of the Skill stream in 2014–15.

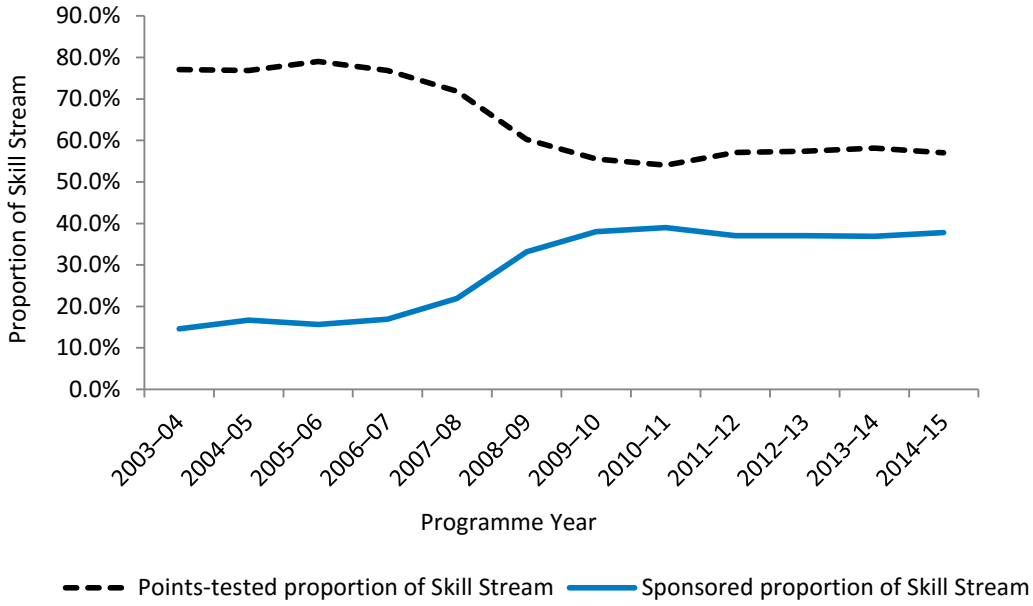


Figure 4. Volume of points-tested and demand-driven visas, 2003–04 to 2014–15.
Source: Department of Immigration and Border Protection, Migration Programme Outcome Data.

While points-tested migration is the largest component of the Skill stream, its share has decreased in recent years (Figure 4). This has happened as governments have favoured demand-driven migration policies that can meet the immediate needs of business, and have instructed that applications for employer sponsorship are to be given the highest processing priority. In contrast, points-tested migration is designed to recognize a migrant's human capital and employment potential, and is therefore more targeted at meeting Australia's longer-term skills needs.

There have also been substantial changes to the way the points test operates over the past decade (Cully 2011). In 2007 there was an increase in the minimum English requirements, and the test itself allocated a greater share of points to English ability. This was in response to concerns about inadequate levels of English among some skilled migrants, and the strong association between English proficiency and labour market performance.

In early 2010, the Migration Occupations in Demand List (MODL), a list of almost one hundred occupations that could contribute up to one-sixth of the points test pass-mark, was revoked. This was because it was not reflecting genuine labour shortages, and many occupations on the list were associated with low-value, easily acquired qualifications. Essentially, the MODL was introducing distortions to the skilled migration caseload; for example, colleges were being established that offered

low-quality (but often high-cost) courses to international students (e.g., hairdressing and cookery) with the sole aim of delivering an easy pathway to skilled migration.

The points test requirements changed again in July 2011 (DIAC 2011a). This time, the changes were more substantive and were intended to remove inequities which had favoured migrants aged under 30, did not award points for qualifications obtained outside of Australia, and undervalued overseas work experience. Collectively, these factors had worked against older, more experienced migrants applying offshore for skilled migration.

Furthermore, with the growing emphasis on demand-driven migration and the consequent decline in the number of points-tested visas that were issued, the test also sought to raise the overall standard of applications. This was done through increased recognition of higher qualifications, attaching greater weight to English ability, and awarding maximum points for those with a superior level of English or above. It was also accompanied by a much shorter Skilled Occupational List (SOL), which went from 400 occupations to under 190. The SOL, which is used to prescribe the range of eligible occupations for skilled migration, had been allowed to grow over the years, and like the MODL, it did not necessarily reflect the skill needs of employers. As well as being shorter and more targeted, the government made the commitment to have the composition of the SOL reviewed annually.

To facilitate a pathway to permanent residence for international students, the government introduced a temporary visa known as the Skilled Graduate visa in September 2007 (DIAC 2009: 12–13). This visa was valid for 18 months, and gave former students who did not meet the criteria for points-tested migration additional time to improve their skilled migration prospects by undertaking further study, seeking employer sponsorship, or improving their level of English. Alternatively, they could use the additional time they had in Australia to gain work experience and then return to their home country.

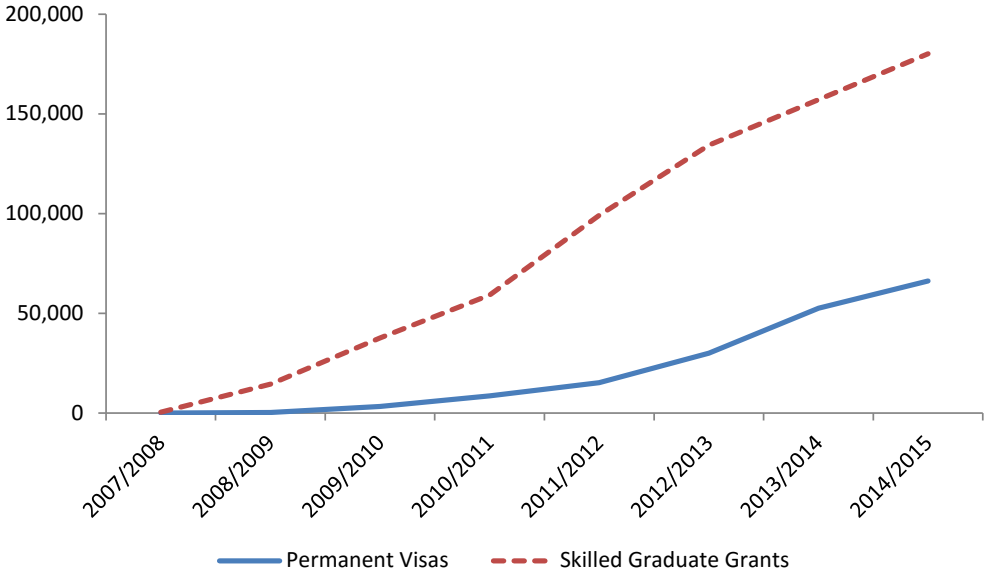


Figure 5. Cumulative totals of Skilled Graduate visas issued and subsequent permanent visa grants, 2007–08 to 2014–15.
Source: Department of Immigration and Border Protection Migration Programme Outcome Data.

Data from the Department indicates that from 2007–08 to 2014–15, just over 180,000 Skilled Graduate visas were granted to former students. Among this cohort, just over 66,000 had gone on to secure permanent residence by the end of 2014–15, 5,600 of whom received a visa through the family reunion programme. Figure 5 shows, by the use of cumulative totals, the time lag between a

Skilled Graduate visa and subsequent grant of a permanent visa.[2]

This particular visa was amended in early 2013, and was renamed the Temporary Graduate visa, which is valid for up to four years but no longer provides a direct application pathway to permanent skilled migration. It is now a temporary visa designed to provide graduates with an opportunity to obtain work experience, helping to make them more employable upon their return to their home country.

The visa has two streams: (1) The *graduate work stream* is for eligible international students who graduate with skills and qualifications that relate to an occupation on the skilled occupations list; and (2) The *post-study work stream* caters to international students who graduate with a higher education degree from an Australian education provider regardless of their field of study.

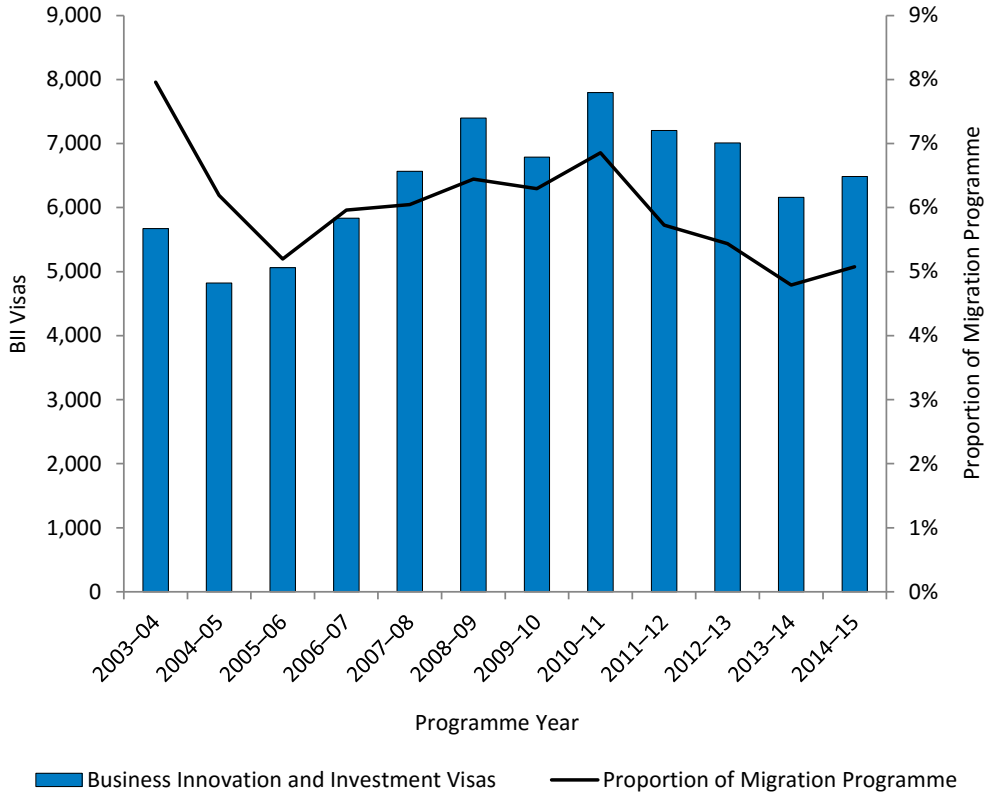


Figure 6. Business visas granted, 2003–04 to 2014–15.
Source: Department of Immigration and Border Protection, Migration Programme Outcome Data.

Over the course of the past decade, the number of business migrants to Australia has varied little, ranging between 5,000 and 8,000 grants (Figure 6). However, on the back of the country's strong economic resilience during the global financial crisis of 2008, Australia was in a position to be more discriminating about the migrants selected through this programme. Following a comprehensive review, the Business Skills Programme was replaced by the Business Innovation and Investment Programme (BIIP) in July 2012. By utilizing a points test, this new programme is designed to encourage a greater level of entrepreneurism and investment among business migrants, and to foster innovation (DIAC 2012).

2. While these data could be used to infer that just over one-third of Skilled Graduates went on to secure permanent residence, it should be remembered that there would be a significant lag between the issuing of a Skilled Graduate visa and the subsequent issuing of a permanent visa. As a result, the proportion of visa holders who were successful in obtaining permanent residence would be somewhat higher.

One important aspect of this new Programme is the Significant Investor visa. This particular visa is targeted at individuals willing to invest at least $5 million into the Australian economy. To encourage this investment, and in acknowledgement of their greater mobility, experience, and access to business networks, this visa offers some concessions, such as a reduced residency period and no upper age limit.

Further changes to the SIV programme were introduced on 1 July 2015, including: (1) greater oversight of 'complying investment' policy to ensure investment settings reflect national priorities; (2) creation of new residency requirements, to encourage the families of high net-worth individuals to settle longer-term in Australia. Additionally, there was the introduction of a Premium Investor visa (PIV) requiring a $15 million complying investment and offering eligibility for permanent residence after 12 months.

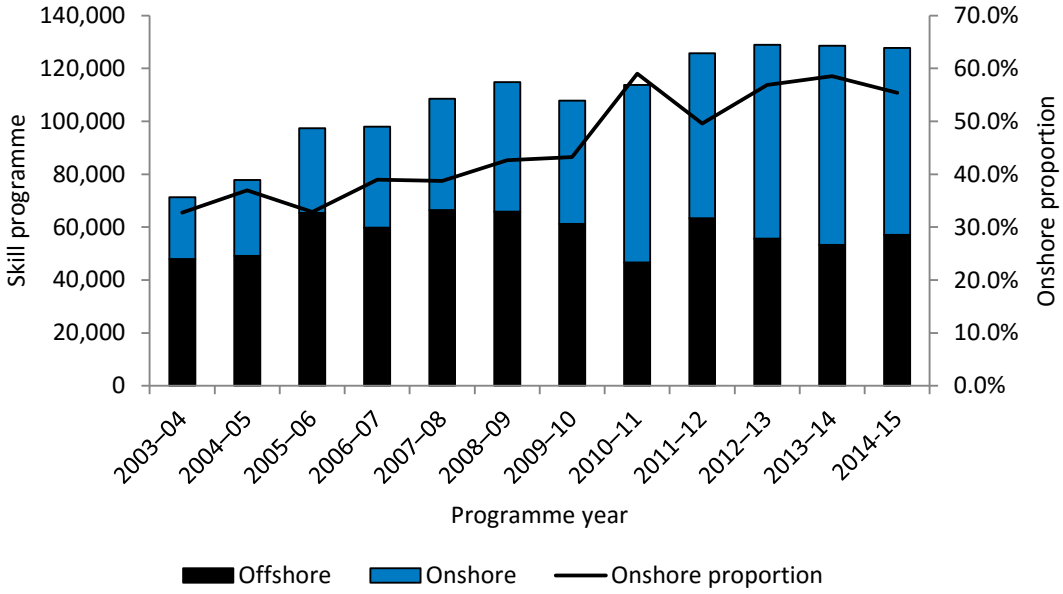


Figure 7. Onshore and offshore Skilled Visa grants 2003–04 to 2014–15.
Source: Department of Immigration and Border Protection, Migration Programme Outcome Data.

Temporary migration issues

Onshore migration

Reflecting the changing nature of migration, an increasing share of the permanent skilled migrant cohort is made up of people who are already in Australia on a temporary visa. The past decade has seen the onshore proportion increase from 32.7 per cent to 55.4 per cent in 2014–15 (Figure 7). Delving a little deeper, in 2014–15 more than 32 per cent of skilled visas issued onshore were to people who were on a student visa or who had moved from a student visa to some form of skilled graduate visa. Another 61 per cent were people on long-term temporary skilled visas.

One positive consequence of growth in the onshore proportion of skilled migrants is that these people have already grown accustomed to life in Australia, and their decision to stay or go is an informed one. A recent departmental report, based on a survey of more than 3,000 subclass 457 visa holders, shows that around three-quarters of them intended to seek permanent residence in Australia, which is reflective of the fact that more than 90 per cent indicated they were settling well

into Australian society (DIBP 2014d).[3] Among those visa holders who wanted to leave Australia, the most common reasons cited were the high cost of living, homesickness, and their partner wanting to return to their home country.

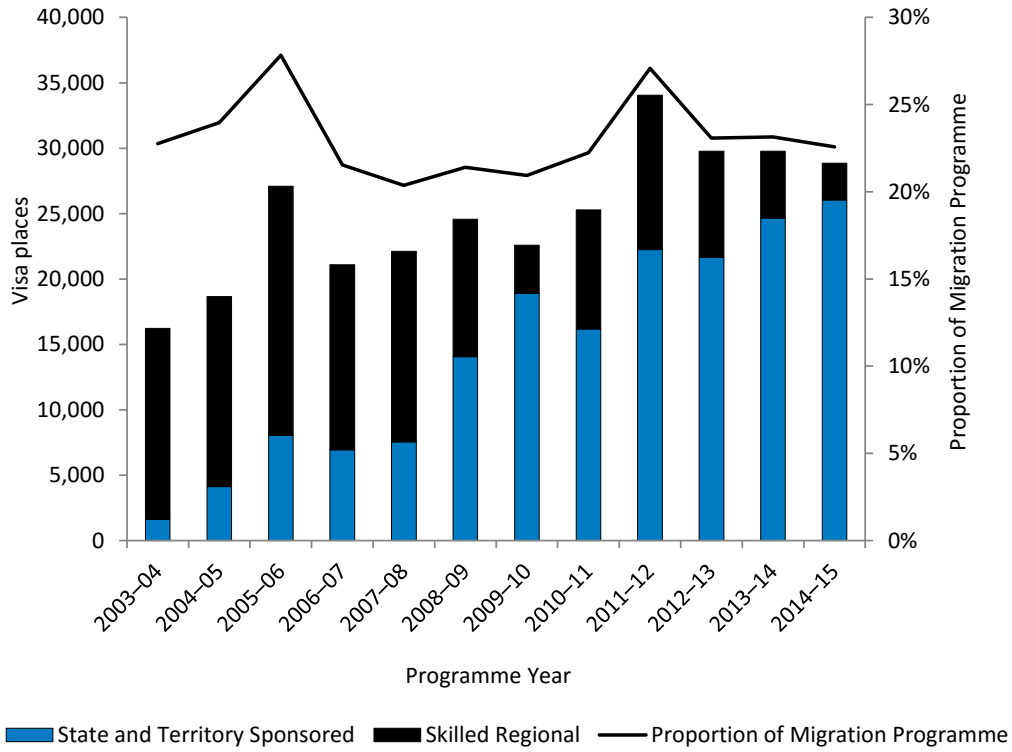


Figure 8. State/Territory Sponsored and Skilled Regional Visa schemes to promote migration to specific state or territory and regional areas in Australia.
Source: Department of Immigration and Border Protection, Migration Programme Outcome Data.

Regional migration

Over the past decade, there has been an absolute growth in schemes that promote migration to specific jurisdictions, or to regional and low population growth areas in Australia (Figure 8).

They also include flexible criteria that recognise the special circumstances of rural and regional areas, and aim to attract young, skilled, English-speaking migrants to areas of Australia where they are most needed. Skilled migration visas that are sponsored by regional employers or nominated by state and territory governments also receive priority processing, enabling them to influence the number and profile of skilled migrants settling in their areas in line with their skill needs and development objectives (DIBP 2014f).

State Nominated and Territory Nominated visas are a points-tested visa introduced in 1999, intended to give governments in each jurisdiction greater flexibility in addressing specific skill shortages and local labour market needs. This is a significant issue for Australia, as the strength of labour markets and the demand for particular occupations varies widely across the country. Compared with more conventional points-tested visas, these visas provide separate occupation lists for each jurisdic-

3. The survey asked people to use a score of zero to ten to indicate how well they were settling in Australia; more than 90 per cent provided a score of seven or higher.

tion, which can reflect local needs. Points are also awarded for state or territory nominations, and applications are processed as a higher priority.

Skilled Regional Sponsored visas are points-tested visas that enable a participating state or territory government to nominate, or an eligible relative to sponsor, a skilled migrant. Like the State and Territory Nominated visas, applicants for these particular visas are awarded points for sponsorship. It is also important to note that these visas are first issued on a provisional basis, and provided they meet the residency requirements, visa holders are eligible to apply for a permanent visa.[4]

Regional Sponsored migration is a form of employer sponsorship designed to address skilled shortages in Australia's regions. Under current arrangements, a sponsoring employer's workplace can be located anywhere in Australia, except for Melbourne, the Brisbane–Gold Coast region, and the Newcastle-Sydney-Wollongong conurbation. Compared with the standard form of employer sponsorship, salary levels are generally lower, given that they need only satisfy minimum wage laws, and the range of eligible occupations is greater.[5] Both forms of employer sponsorship are founded on the principle that the job being filled could not be undertaken by an Australian worker and that the migrant being sponsored is being paid at market rates—a deliberate strategy to ensure that there is no undercutting of wages and conditions or exploitation of migrant workers.

More recently, designated area migration agreements (DAMAs)[6] have been introduced. These allow businesses from anywhere within Australia that are experiencing labour shortages to sponsor skilled and semi-skilled workers from overseas. DAMAs are built on the principle that Australians are recruited as a first priority and that participating employers develop strategies to facilitate the recruitment and retention of Australian workers (DIBP 2015).

SkillSelect

This is the Department's online skilled migration system, introduced in July 2012, and designed to give the Australian Government greater control over the composition and quality of the Skilled Migration programme (DIAC 2013a). Migrants interested in points-tested skilled migration or business migration (DIBP 2014a) are now required to submit an online expression of interest in SkillSelect for most of these visas. Those seeking employer sponsorship may still approach an employer directly, or they can submit an expression of interest through SkillSelect to bring themselves to the attention of potential employers.

Compared with the former approach of people submitting an application and waiting for a decision, the advantage of this approach is that it does away with long processing pipelines. The Department has control over when it invites people to apply and the number of invitations that are issued. This ensures that the skilled migrant cohort is not dominated by a small number of occupations, which could potentially crowd out local workers. In addition, ceilings are applied across all occupations.

4. To qualify for a permanency, visa holders nominated by a State or Territory government need to have lived for a minimum of two years outside of the Sydney-Newcastle-Wollongong conurbation, the Brisbane–Gold Coast conurbation, Melbourne, Perth, and the Australian Capital Territory. If sponsored by a relative, the visa holder is eligible if they have lived anywhere outside of Brisbane and the Sydney-Newcastle-Wollongong conurbation.
5. The range of eligible occupations for an RSMS visa extends to any job that requires a minimum of a certificate level III qualification, accompanied by two years of relevant work experience. For an ENS visa, the range of eligible occupations is limited to jobs on the Department's Consolidated Skilled Occupations list.
6. Designated Areas of Australia, http://www.border.gov.au/Trav/Work/Work/Allocation-dates-for-General-Skilled-Migration-applications/designated-areas.

Figure 9. Components of the Family stream, 2014–15

Family stream—61,085 visa places	
Partner—47,825 visa places	Child—4,135 visa places
Applicants must be married, intending to get married (fiancé) or in a de facto relationship (including those in a same-sex relationship) to an eligible Australian resident. Main visa categories: Prospective marriage—4,745 places Partner (spouse/de facto)—43,080 places	Applicants must be a dependent child of an eligible Australian resident. Main visa categories: Child—3,541 places Adoption—190 places Orphan Relative—404 places
Parent—8,675 visa places	Other Family—450 visa places
Applicant must have a child who is an eligible Australian resident. To help offset the cost to Australia of Parent visas, the Contributory Parent visa costs more, but is generally processed faster. Main visa categories: Parent—1,500 places[a] Contributory Parent—7,175 places	Applicant must be joining their remaining relative (sibling or parent), or an aged relative who depends on an Australian relative for most of their living costs, or a carer needed to look after an Australian relative with a medical condition. Main visa categories: Remaining Relative—76 places Aged Dependent Relative— < 5 places Carer—370 places

Source: Migration Reporting, Department of Immigration and Border Protection.
[a]Closed to new applications on 2 June 2014 and reinstated on 25 September 2014.

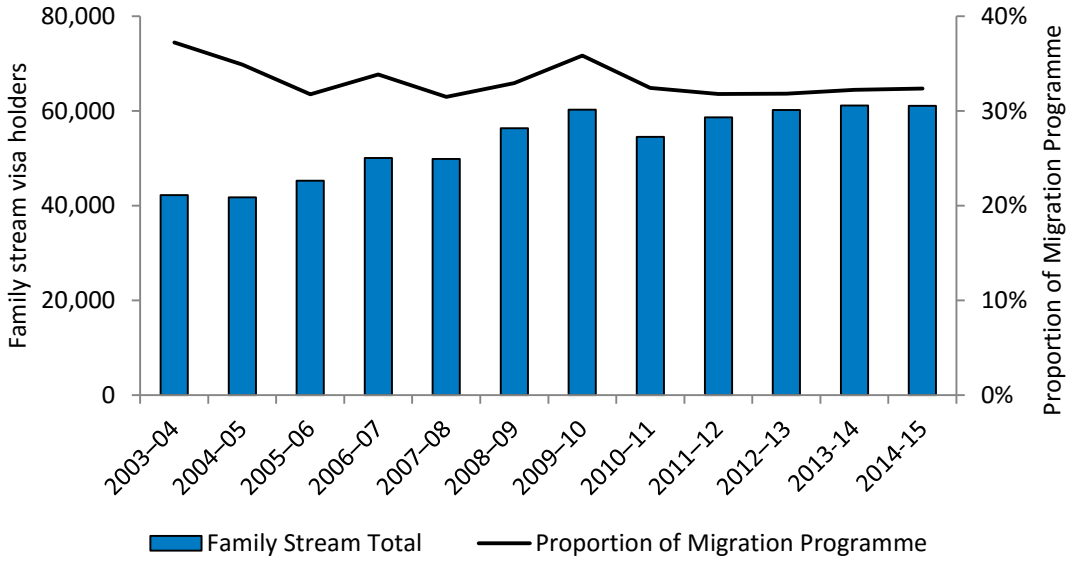


Figure 10. Growth in the Family stream, 2003–04 to 2014–15.
Source: Department of Immigration and Border Protection, Migration Programme Outcome Data.

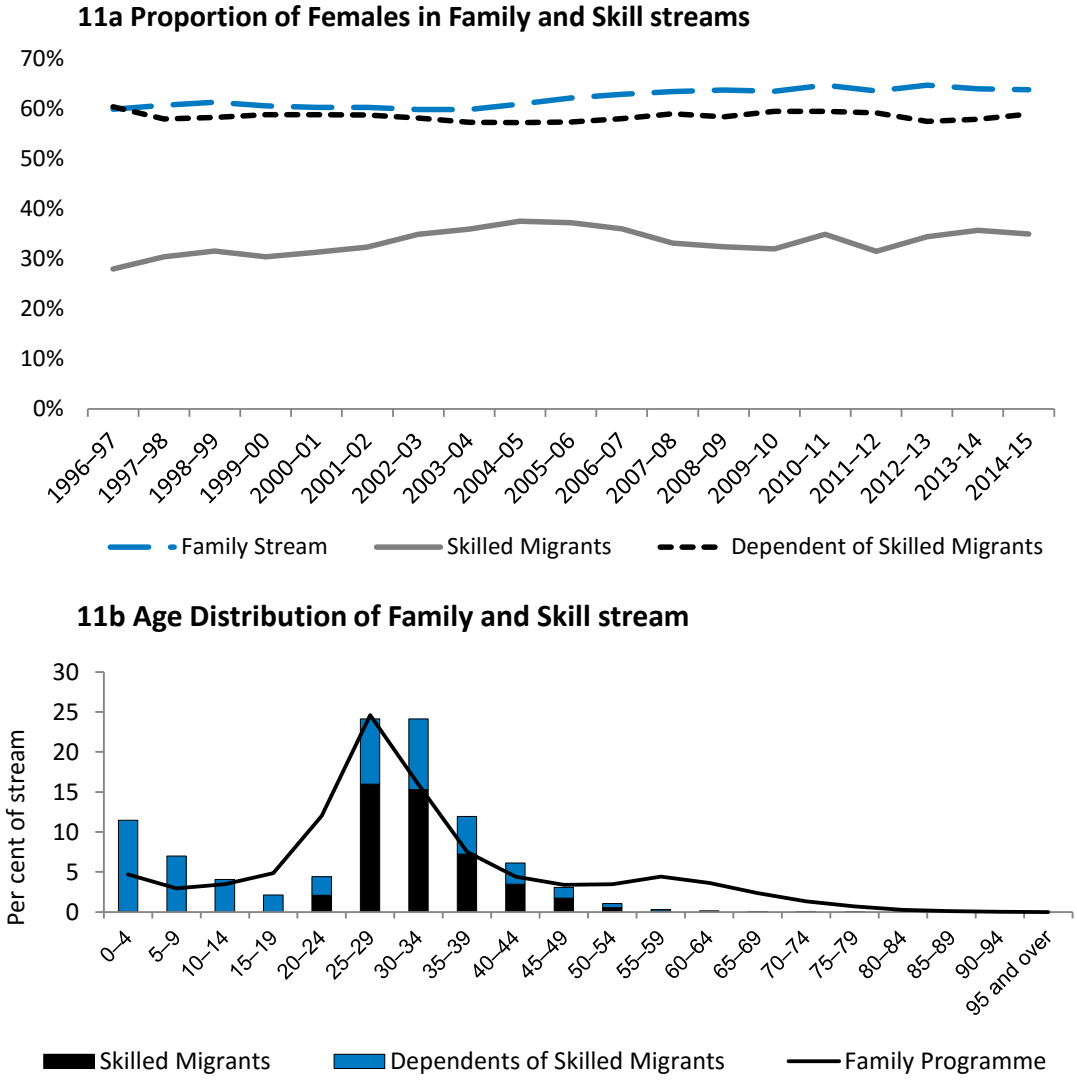
Family stream

The Family stream of the Migration Programme enables the entry of close family members of: Australian citizens, Australian permanent residents, and eligible New Zealand citizens. It focuses on reuniting the affianced, partners, and dependent children, and also provides the opportunity for other family members, such as parents, aged dependent relatives, carers, and last remaining relatives, to join their family in Australia. Australia's Family stream is comprised of four components (Figure 9). The

largest of these is the Partner category which accounted for more than three-quarters of all family migration in 2012–13. This is followed by Parent and Child categories, accounting for 14 per cent and 6 per cent, respectively. The remaining components are even smaller, and in 2014–15 collectively represented only 2.1 per cent of the Family stream.

The Child category was a component of the Family stream of the annual managed migration programme until 2015/2016. In support of the Prime Minister's Inter-country Adoption agenda, from 2015 to 2016 Child category visas were removed from the managed migration programme. This removal was to transition child visas to a demand-driven model.

When examined over the past decade, the size of the Family Programme has increased by around 46 per cent. However, successive governments' increased emphasis on skilled migration has meant that the pace of growth has not kept up with the rest of the Migration Programme. In 2004–05, 35 per cent of all Migration Programme visas were issued through the Family stream (Figure 10);



Figures 11a and 11b. Demographics of the Family and Skill streams.
Source: Department of Immigration and Border Protection, Migration Programme Outcome Data.

ten years later, this figure had fallen to 32 per cent.[7] There are a growing number of international students, working holidaymakers, and migrants on temporary skilled visas who are applying through the Family stream. In 2014–15, more than one-fifth of all family visas went to these temporary migrants.

A consequence of the way the Family Reunion Programme is structured is that it does deliver some important demographic dividends. As shown in Figure 11a, a Migration Programme entirely made up of primary applicant skilled migrants would have males outnumbering females by about two to one. Family migration, which is about two-thirds female, plus the migration of dependents of the skilled migrants (which is around sixty per cent female), helps to offset this gender imbalance.

Figure 11b shows that skilled migrants are concentrated in a narrow age range between 25 and 34 years of age. By comparison, the dependents of skilled migrants are mainly young children. Collectively, the skill and family streams are therefore delivering migrants who are in the prime of their working life, as well as a substantial cohort of younger people who represent the workforce of the future.

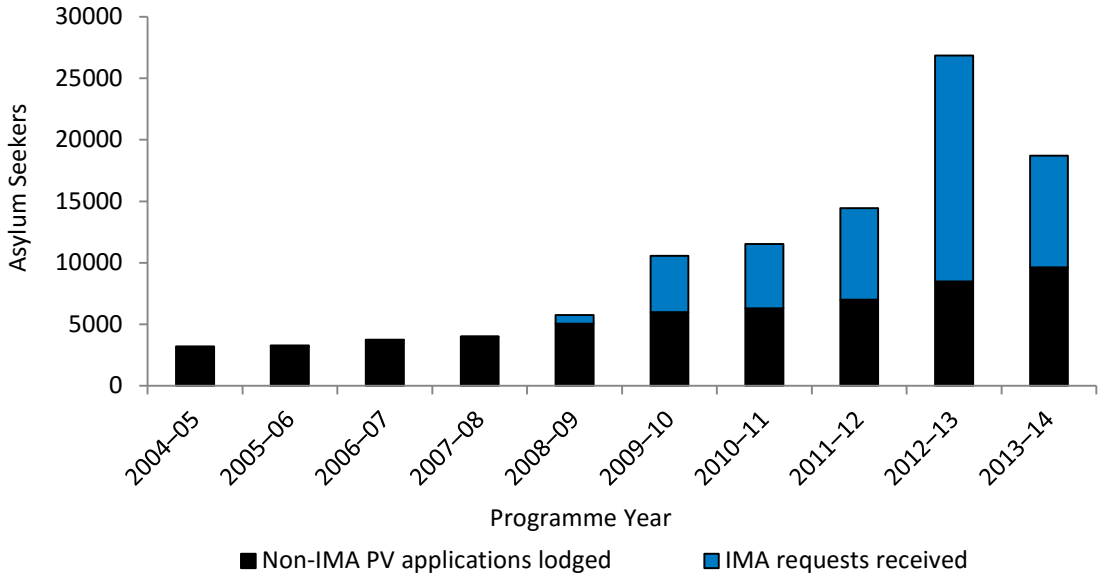


Figure 12. Onshore asylum seekers, 2003–04 to 2013–14.
Source: Department of Immigration and Border Protection systems.
Note: Refugee status determination requests from 2008–09 onwards are counted as people screened into a determination process for IMAs. Figures are as officially revised at the end of 2013–14, and therefore may differ from statistics previously published.

The Humanitarian Programme

Programme Structure

Australia's Humanitarian Programme has an offshore resettlement component and an onshore protection component. Within the offshore component there are two categories. The *Refugee* category is for people who are subject to persecution in their home country, most of whom are identified by the UNHCR as being in need of resettlement and referred to Australia for consideration. Within the Refu-

7. Planning levels for 2013–14 and 2014–15 see the Family stream continuing to account for 32 per cent of the total Migration Programme, which remains at 190,000 places.

gee category is the *Woman at Risk* visa subclass, for women who don't have the protection of a male relative and are in danger of being victimized, harassed, or seriously abused because of their gender.

The *Special Humanitarian* category is for people outside their home country who are subject to substantial discrimination, amounting to gross violation of their human rights. Applicants for Special Humanitarian visas must be proposed for resettlement by an Australian citizen, permanent resident, or organisation that can support them through the settlement process.

The onshore protection component is for people seeking asylum from within Australia. It consists of people who arrive in Australia on a valid visa and subsequently seek asylum, and those who entered Australia illegally by boat (illegal maritime arrivals).

For most of the past decade, the size of Australia's Humanitarian Programme has varied little; aside from a spike of 20,000 places in 2012–13 it has stayed within a narrow range of between 13,000 and 14,000 people per annum. This stability does, however, mask a substantial shift in the balance between offshore resettlement and onshore protection over this period. As seen from Figure 12, the number of people seeking asylum onshore between 2004–05 and 2013–14 has increased from 3,209 to 18,718 per year, with a peak of 26,427 in 2012–13. This was mostly driven by an increase in the number of Illegal Maritime Arrivals (IMAs), from just 21 IMAs in 2007–08 to over 18,000 in 2013–14. With the size of the Humanitarian Programme remaining fairly uniform over this period, this unregulated movement of people had a severe impact on the Department's capacity to provide places for offshore resettlement, and contributed to a sharp decrease in the Special Humanitarian Programme, which fell from almost 9,000 in 2003–04 to 503 in 2012–13. In September 2015, the Australian Government announced that a further 12,000 refugee places would be made available in the 2015–16 programme, as a result of the humanitarian crisis in Syria and Iraq. This increased intake for 2015–16 is on top of the planned increase of 7,500 places over the next three years (Media Release, Dutton 2015).

Associated with the surge in a period of illegal maritime arrivals was a large loss of life at sea. This very difficult policy environment set the scene for a review of the asylum seeker policy by an independent expert panel,[8] commissioned by the former Federal Government between 2010 and 2013. The ensuing Report of the Expert Panel on Asylum Seekers, released in August 2012, incorporated a range of recommendations to better manage the asylum seeker situation, and to actively discourage people from undertaking hazardous sea journeys to Australia (Houston et al. 2012). The recommendations included:

1. Increased co-operation with Malaysian and Indonesian governments to prevent the transit of potential asylum seekers.
2. Expanding regional processing arrangements to Papua New Guinea and Nauru. The full impact of this recommendation occurred over a twelve-month period. Asylum seekers who entered Australia on or after 13 August 2012 were liable for transfer to a regional processing country (PNG or Nauru) to have their asylum claim assessed. From 19 July 2013, these arrangements were modified so that persons assessed to be refugees in a regional processing country would be resettled in that country or another third country, and would not be resettled in Australia.
3. Placing limitations on family reunions, so that asylum seekers granted protection could no longer use the Special Humanitarian Programme to fast-track the sponsorship of other family members.

8. The expert panel that led the review comprised former Chief of Defence Angus Houston, refugee advocate Paris Aristotle, and the former Foreign Affairs Secretary, Michael L'estrange. The then-Prime Minister, Julia Gillard (24 June 2010–27 June 2013), appointed the expert panel in June 2012, to examine asylum seeker policy and prepare a report recommending a solution for the Government's consideration.

4. Increasing the 2012–13 Humanitarian Programme to 20,000 places, which included a minimum of 12,000 places for the Refugee category.
5. Removing economic incentives. IMAs who arrived in Australia before August 2012, and those already living in the Australian community, had the right to work and had access to government benefits. Those arriving between August 2012 and July 2013 no longer had work rights and were provided with a reduced level of government benefits.

Following the election of a new government in September 2013, Operation Sovereign Borders was implemented. This border security operation is designed to deter and disrupt people-smuggling activities, detect and intercept illegal vessels, and detain Illegal Maritime Arrivals at regional processing centres so that their asylum claims can be assessed (Customs 2014).

As a way of deterring IMAs and disrupting the activities of people smugglers, these measures—including other changes to the onshore protection component of Australia's Humanitarian Programme—have been highly effective. Based on the evidence to date, what has been particularly effective is removal of the permanent visa pathways and ongoing activities involved with Operation Sovereign Borders. These measures have led to a dramatic decline in the number of asylum seekers arriving in Australia by boat, with recent monthly data indicating that only a handful of IMAs have arrived in 2014.[9] This is in stark contrast to the thousands of monthly arrivals occurring in early to mid-2013.

Changing composition of the Humanitarian Programme

The Humanitarian Programme is designed to be flexible and responsive to emerging and ongoing global issues. As a result, the main source countries and proportions for each component of the programme have changed over time.

In 2002–03, very few asylum seekers were granted protection in Australia, and the vast majority of visa recipients were processed through the offshore component. Five of the top ten countries of birth were in the Africa region (Sudan, Ethiopia, Liberia, Sierra Leone, and Somalia), while (former) Yugoslavia and Croatia also featured.

In 2007–08, the Humanitarian cohort was more geographically balanced, with around one-third coming from Asia, one-third from Africa, and one-third from the Middle East. In 2013–14, almost half of all Humanitarian visas were granted to people originating from Afghanistan and Iraq (both offshore resettlement and onshore asylum seekers). Other major source countries were Myanmar (predominantly through offshore resettlement) and Pakistan (predominantly onshore asylum seekers) (Figure 13).

Temporary migration—a pathway to permanence

Introduction

There are three main categories of temporary resident visas available in Australia. Working Holiday Maker (WHM) visas are targeted at young adults interested in having an extended holiday in Australia, combined with periods of short-term work and the opportunity to study. The Subclass 457 visa is a skilled work visa that enables Australian businesses to sponsor employees for up to four years.[10] Finally, student visas are for people studying full-time in the university, vocational, or schools sectors.[11]

9. At the time of writing (14 March 2014), only two asylum seekers had arrived by boat in the first three months of 2014, as per information from the Operation Sovereign Borders newsroom website, Department of Immigration and Border Protection.
10. The official name of this visa is Temporary Work (Skilled) visa (subclass 457).
11. In addition to these three major categories is a range of other, less commonly used visas, allowing people

2002-03 Humanitarian Programme 12 522 grants			
Offshore Resettlement - 11656 grants		**Onshore Protection - 866 grants**	
Main Categories			
Offshore Refugee	4380 grants	Onshore Refugee	866 grants
Special Humanitarian Programme	7280 grants		
Main Regions			
Africa	47%	Iraq	14%
Middle East and South West Asia	37%	Iran	9%
Europe	10%	Sri Lanka	8%
2007-08 Humanitarian Programme 13 014 grants			
Offshore Resettlement - 10 799 grants		**Onshore Protection - 2215 grants**	
Main Categories			
Offshore Refugee	6004 grants	Onshore Refugee	1900 grants
Special Humanitarian Programme	4795 grants		
Main Regions			
Myanmar	27%	Sri Lanka	22%
Iraq	21%	PRC	21%
Afghanistan	11%	Iraq	11%
2012-13 Humanitarian Programme 19985 grants			
Offshore Resettlement - 12 477 grants		**Onshore Protection - 7508 grants**	
Main Categories			
Offshore Refugee	11,974 grants	Onshore Refugee	7508 grants
Special Humanitarian Programme	503 grants		
Main Regions			
Iraq	33%	Afghanistan	32%
Afghanistan	19%	Iran	18%
Myanmar	19%	Pakistan	12%
2013-14 Humanitarian Programme 13 768 grants[1]			
Offshore Resettlement – 11 016 grants		**Onshore Protection – 2752 grants**	
Main Categories			
Offshore Refugee	6,501 grants	Onshore Refugee	2752 grants
Special Humanitarian Programme	4,515 grants		
Main Regions			
Afghanistan	25%	Pakistan	17%
Iraq	21%	Egypt	15%
Myanmar	17%	Iran	14%

Figure 13. Composition of the Humanitarian Programme across different years.
Source: Population Flows Immigration Aspects (various edns) and Australia's Migration Trends (various edns).
Note: Figures officially revised at the end of 2013–14, and therefore may differ from statistics previously published.
1. Includes a small number of visas granted through ministerial intervention counted against the Programme.

into Australia for social, cultural, international relations, training and research purposes, or for undertaking highly specialized short-stay work.

While there have been many changes in the regulation and policy framework underpinning these temporary residence categories, these types of visas have been in existence for many years; Australia's Working Holiday Maker Programme commenced in 1975 with an agreement between the UK and Australia; the Subclass 457 Programme commenced in 1996; and the provision of education to international students dates back to the time of the Colombo Plan in the late 1950s.

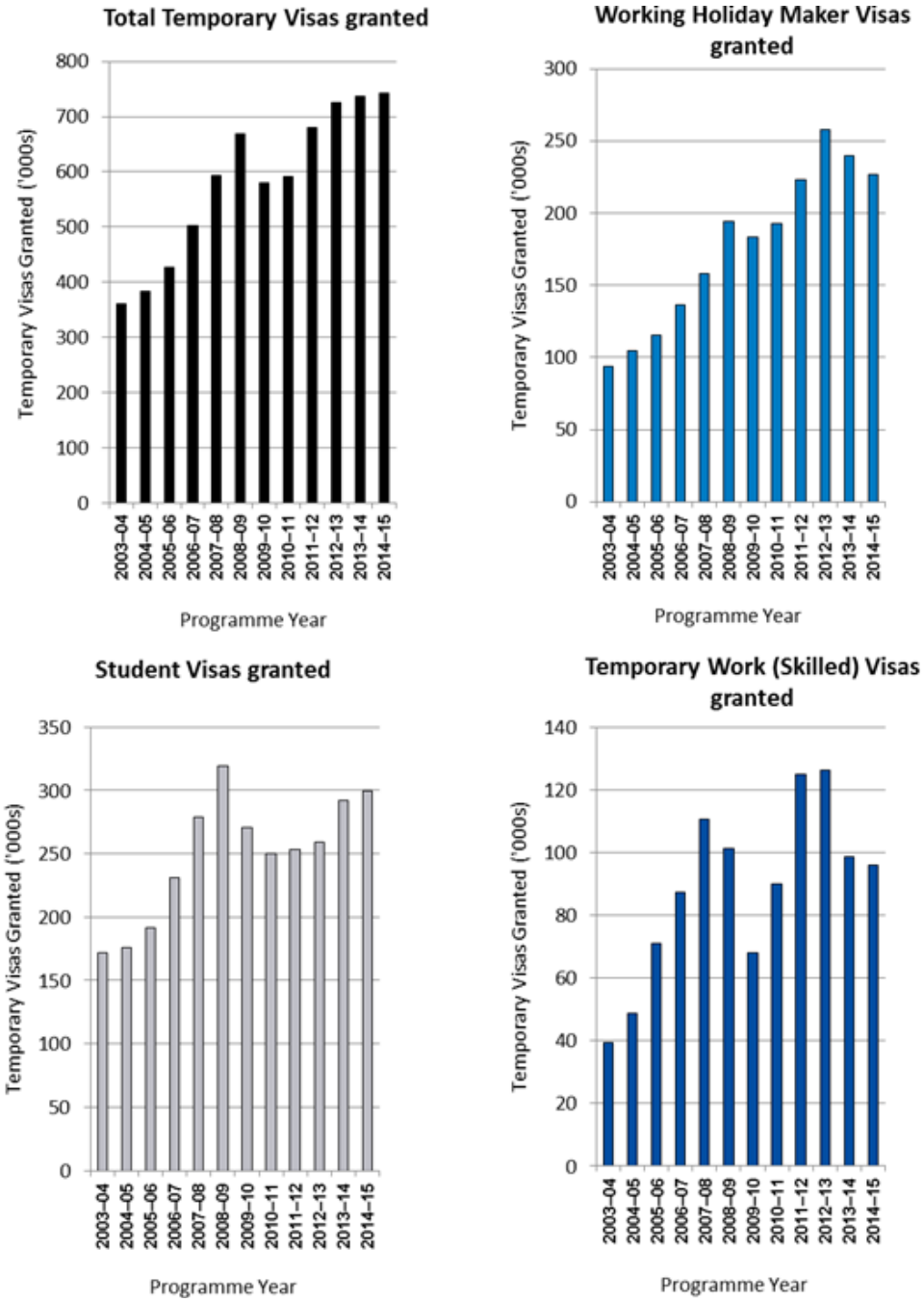


Figure 14. Grants of Temporary visas, 2003–04 to 2014–15.
Source: Department of Immigration and Border Protection, Temporary Entry Statistics.

All three categories of visa are uncapped, meaning that in most circumstances a visa will be issued to any applicant who meets the requirement of the visa and pays the relevant fee.[12] This factor, along with other factors such as greater labour mobility, lower travel costs, growth in international education, and the increased presence of migrant networks in Australia, has contributed to strong growth in these visas over the past decade (Figure 14).

Despite this growth, the 2009–10 programme year saw a significant drop for these visa categories and temporary visas more generally. This drop was almost entirely due to a fall in demand (rather than supply) associated with the global financial crisis; for student visas, additional factors included increased competition from other countries, a stronger Australian dollar, student safety, education provider closures, and integrity concerns. In other words, there was no change in the way these types of visas were approved or granted; the smaller grant numbers were almost entirely a result of the smaller pool of applicants.

Since the end of the global financial crisis, WHM and Temporary Work (Skilled) visa grants have increased past their pre–global financial crisis highs. Student visa demand also recovered, but remained at lower levels for longer. Virtually all temporary residence visas come with work permits, thereby helping to meet Australia's labour needs. In practice, this means that holders of subclass 457 visas are sponsored to work full-time in skilled jobs that are difficult to fill domestically. Working Holiday Makers fill an important niche as seasonal workers on Australian farms and in the hospitality sector, and many international students work part-time to help support themselves during their studies.

Aside from the obvious benefit of funding a study or a working holiday, this arrangement also delivers substantial fiscal benefits, as temporary residents are generally required to pay taxes on income earned in Australia but have very limited access to government services. For example, temporary migrants are ineligible for welfare, and unless reciprocal healthcare agreements are in place, they are also unable to access public health services. While most jurisdictions in Australia allow the children of temporary visa holders to attend government schools free of charge, there are exceptions: New South Wales, which charges annual tuition fees of up to $6,000 per child, the Australian Capital Territory (up to $13,900 per child), and Western Australia ($4,000 per family) (DTWD 2015).

Australia's Student Programme

With around 260,000 places offered each year to international students, Australia is (after the US and UK) the third-largest provider of education services to international students in 2011 (OECD 2014). In fact, with export earnings of $17.6 billion in 2014, international education is Australia's fourth-largest source of export earnings—after iron ore, coal, and natural gas (DFAT 2014).

With such a large and diverse caseload, the risk of people breaching the conditions of their visa is ever-present. To mitigate against this, until March 2014 applicants for student visas were assigned an Assessment Level (AL) of risk between 1 (low) and 5 (high). The level was derived from compliance data that took into account an applicant's country of origin and education credits. In March 2014, the government simplified the AL framework, and now it comprises three levels (AL1 to AL3). Applicants who are part of a cohort that is, based on evidence, deemed to be of greater risk of non-compliance are required to provide a higher level of evidence as part of their migration application.

Following a review of the student visa programme in 2011, the concept of streamlining was introduced in March 2012 at eligible universities, and subsequently extended to eligible non-university

12. A minor exception to this general rule is the annual caps on the number of Work and Holiday (subclass 462) visas issued to applicants from countries such as Chile, Indonesia, Argentina, and Thailand.

higher education and vocational education and training (VET) providers in 2014 (DIAC 2011b). Under this scenario, applicants are assigned either a streamlined or non-streamlined pathway, based on the institution they plan to attend. Those with a confirmed enrolment at an institution with a good record on immigration compliance (based on an analysis of departmental data) are processed through the streamlined pathway, and will be processed more quickly. Those going through the non-streamlined pathway continue to follow the Assessment Level process (DIBP 2014c).

In June 2015, the Australian Government announced the introduction of a new simplified international student visa framework to replace both the streamlined visa processing arrangements and the current Assessment Level framework for all international students. The new framework will support the sustainable growth of the international education sector, by enhancing both competitiveness and integrity, while extending streamlined processing to all education sectors and course types. The key changes are: (1) a reduction in the number of student visa subclasses from eight to two; and (2) the introduction of a simplified single immigration risk framework for all international students.

Between the end of the 1990s and through early 2010, there was a strong association between being an international student and obtaining a permanent Skilled Independent visa. This situation was able to flourish because students had the ability to apply for these visas onshore, and because the general skilled migration points test strongly favoured young people who had studied in Australia.

As mentioned earlier, changes to the migration points test between 2010 and 2011 brought this situation to an end, and made the transition to a skilled visa far more difficult for international students. The most notable consequences of these changes were:

1. The end of more than a decade of continued growth in student numbers, with the number of visas issued falling from a peak of 320,000 in 2008–09 to 270,000 one year later.[13] T decline was especially large among vocational students, as growing concerns around visa compliance and fraudulent activity resulted in increased integrity measures for this caseload.
2. An increase in onshore grants of student visas. This was occurring as some students who were already in Australia changed courses, to extend their stay or get a qualification better aligned to a skilled migration outcome.
3. Former students experiencing a more diverse range of permanent migration outcomes. With Skilled Independent visas becoming more difficult to obtain, there has been an increase in partner visas being issued through the Family Reunion Programme, as well as growth in Employer sponsored and State and Territory sponsored visas.

Australia's 457 Programme—filling the gaps

Businesses can utilise Australia's Subclass 457 Programme in a range of ways. As well as providing a mechanism to bring migrant workers into positions that are difficult to fill, it can be used by overseas businesses seeking to establish a branch in Australia, participate in joint ventures, transfer employees between branches, or fulfil a specific contract.

The subclass 457 visa is designed to meet Australia's short term skill needs, and tends to be sensitive to changes in labour market conditions (Parliament of Australia 2013). This is in contrast to points-tested migration, which takes a longer-term view and takes more account of an applicant's human capital. Underpinning the subclass 457 visa is the Consolidated Sponsored Occupation List (CSOL)—a list of over 700 skilled occupations, or about four times the size of the points-tested Skilled Occupation List (SOL).

13. Visa Reporting, DIBP.

Following its inception, the programme got off to a slow start, with only 25,786 visas issued in 1995–96 and an average of less than 30,000 visas issued for each of the first five programme years. Over time, however, the ability to facilitate the deployment of a temporary labour force into sectors of the economy experiencing labour shortages has made the subclass 457 Programme increasingly popular with employers. In 2012–13, 126,350 visas were issued under the Programme, which is equivalent to one per cent of the total Australian labour force.

There is also a pathway for skilled workers and their dependents holding a subclass 457 visa to apply for permanent residence. Between 2010 and 2013, more than 120,000 permanent visas were issued to subclass 457 migrants and their families. This equates to approximately 32 per cent[14] of the number of Subclass 457 visas issued over the same period. Around 92 per cent[15] of those granted permanent residence received permanent employer-sponsored visas, generally with the same business that had sponsored them temporarily.

With increased growth, there is an increased risk of the scheme being abused and workers being exploited. As a result, the scheme has undergone two rounds of reform since 2009.

The first round of reforms was based on the Deegan Review conducted in 2008; in broad terms, it was designed to ensure that that migrant workers were not being: exploited, used as a substitute for local workers, or used to undercut local wages. Under these new measures, employers were required to match the pay rates of overseas workers with those of Australian workers with the same skills and experience, and to commit to training their own workforces.

The second round of reforms was driven by concerns that the programme was not being used in the way it was intended. Of particular concern was the strong growth in 457 visa activity in industries or parts of Australia that were not experiencing skills shortages. To better align the use of the programme with its original intent, requirements were either strengthened or made clearer. Specific changes included a further increase in the English language requirements, to align it to the standard required for permanent employer sponsorship, requiring the employer to provide greater evidence that the position being filled is genuinely skilled, increasing the range of occupations requiring a skills assessment, requiring regional employers to pay migrant workers at a rate comparable to Australians with similar skills who are working in the same part of Australia, and providing migrant workers more time to find new sponsors if they cease employment.

In addition to these regulatory measures, new legislation was introduced in June 2013 to ensure that employers undertake labour market testing to seek an Australian worker before using the subclass 457 visa programme. The legislation also increased the range of actions the Department could take to sanction sponsors who fail to comply with their obligations, and increased the authority of inspectors to monitor compliance with the programme.

In 2015, legislative change progressed in order to implement the recommendations of the 2014 Independent Review into Integrity in the 457 Programme. This review evaluated programme settings, with a particular focus on bolstering integrity, while maintaining flexibility and responsiveness. In response to this review, the English language requirements have been amended to increase flexibility for 457 visa applicants, and the period during which start-up companies can become approved sponsors has been increased from 12 to 18 months. Further reforms include making it an offence for employers to seek payment for sponsoring an applicant, streamlining of the sponsorship process, and a restructure of the training obligation component of the programme.

14. This figure calculated by summing 457 migrant visa holders and their families who attained permanent residency between 2009–10 and 2012–13, and dividing by total 457 visa holders from 2009–10 to 2012–13.

15. This figure was calculated across programme years 2009–10 to 2014–15.

Australia's Working Holiday Maker Programme

Australia's Working Holiday Maker Programme is an important source of supplementary labour for employers in industries that need short-term or seasonal workers, such as the hospitality, agriculture, mining, and construction industries. In addition to meeting labour market needs, the programme encourages cultural exchange between young people and closer ties between arrangement countries. Participants in the programme can stay in Australia for up to 12 months, and those who have worked in regional Australia in the agriculture, mining, or construction sectors may be eligible for an additional 12-month extension.

Growth in this visa category has been strong. In 2014–15, there were 226,812 Working Holiday Maker visas issued—almost triple the number from a decade earlier (93,898 in 2003–04). Growth in the Programme can be attributed to an increase in the number of participating countries, increased awareness of the programme, and the lower costs of international travel.[16]

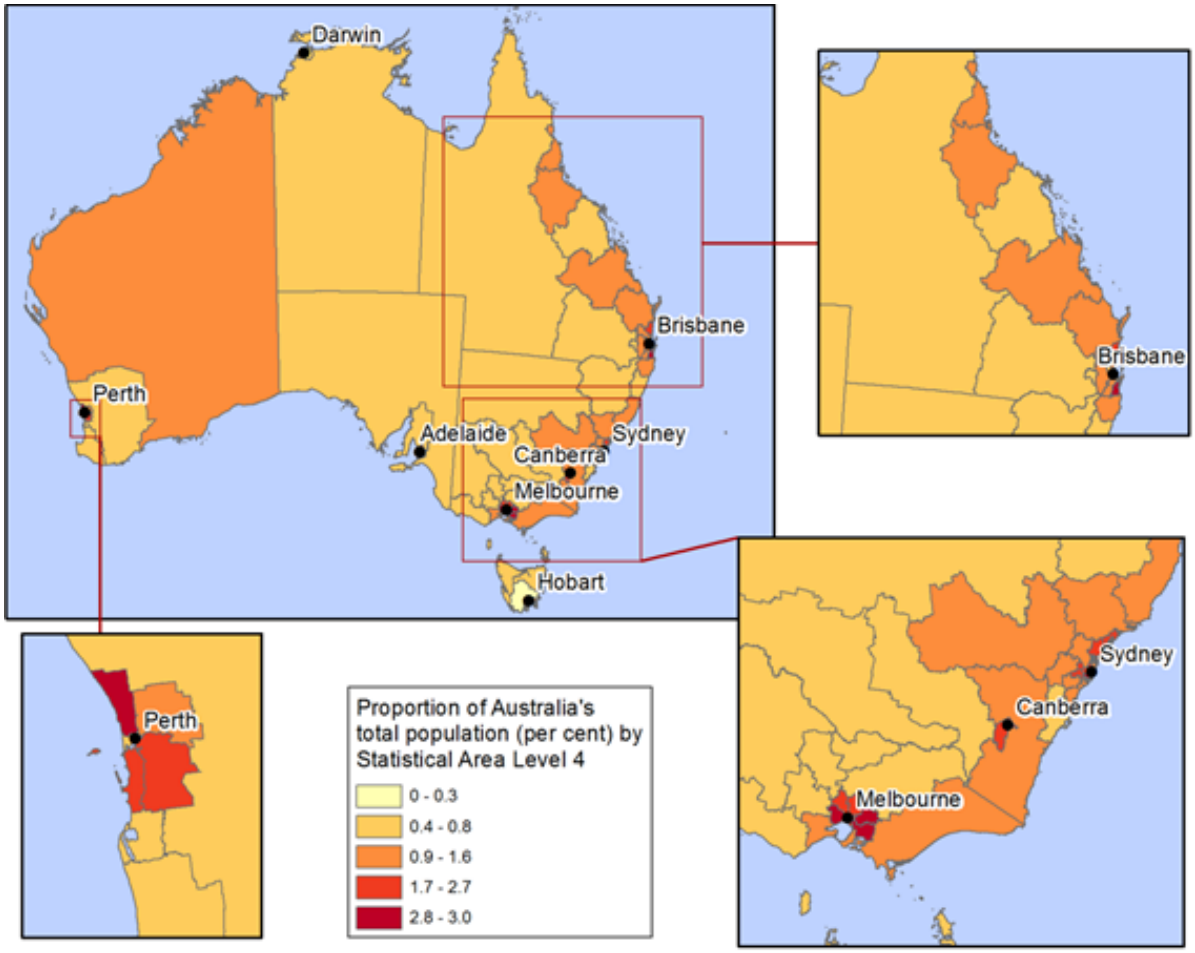


Figure 15. Australia's population distribution by Statistical Area Level 4,[17] Census 2011 data.

16. At November 2015 there were 32 participating countries. These comprise Belgium, Canada, Cyprus, Denmark, Estonia, Finland, France, Germany, Hong Kong, Ireland, Italy, Japan, Korea, Malta, Netherlands, Norway, Sweden, Taiwan, United Kingdom, Argentina, Bangladesh, Chile, China, Indonesia, Malaysia, Poland, Portugal, Spain, Thailand, Turkey, USA and Uruguay.
17. Statistical Areas Level 4 (SA4s) are designed to reflect one or more whole labour markets for the release of Labour Force Survey data. SA4s are required to have large populations of over 100,000 persons, in order to enable accurate labour force survey data to be generated on each. For this reason, in rural areas SA4s

Another factor has been the global financial crisis. For instance, between 2008 and 2012, Ireland, a country of less than five million, emerged as a major provider of Working Holiday makers to Australia. It is likely that the high rates of Irish youth unemployment were behind much of this growth. Since then, demand from Ireland has fallen to around 30 per cent.

While working holidaymakers are an important source of supplementary labour, unlike other work visas, the scheme is not targeted towards any occupation (through the SOL or CSOL) or region of Australia in particular. Therefore, according to a 2008 departmental survey, people issued these visas tend to be employed in lower-skilled jobs in the hospitality and agriculture industries (Tan et al. 2009).

Regional dispersal of migrants

Thus far in this paper, we have looked at the policies and programmes administered by the Department of Immigration and Border Protection that control the flow of people coming into Australia. In this final section, we examine the dispersal of these migrants after they enter Australia, including migrant settlement, labour market integration, social cohesion, provision of services, and housing availability.

Australia is one of the world's most urbanized countries. Some 62 per cent of our population lives in one of the five mainland state capitals (ABS 2011). Beyond these major cities, there are also other significant population centres on Australia's eastern seaboard (Figure 15). By comparison, Australia's overseas-born population is even more highly urbanized, and is concentrated in Melbourne and Sydney (Figure 16); these, Australia's two largest cities, are home to 52 per cent of migrants (ABS 2011), compared to 40 per cent of the overall Australian population.

Such an uneven population distribution, compounded with very large distances, means that access to services, employment opportunities, and lifestyle choices is limited for those migrants who happen to live in regional areas. In order to build and maintain sustainable communities outside the major cities, and to address skill shortages within regional and remote parts of Australia, the Australian Government offers various incentives to certain occupations, in order to entice workers to remain within these regional areas. These can take the form of targeted incentives, such as regional scholarships allocated to teachers and medical professionals through the Australian Government's rural health workforce strategy incentive programmes (Rural Health 2014) and the New South Wales State Government's fast-track teaching development options (NSW Government 2014).

There are also policy interventions, such as Australia's Regional Sponsored Migration Scheme. As already mentioned, this scheme offers a slightly easier skilled migration pathway for employer-sponsored migrants who are willing to settle in regional Australia and work for a regionally based business for at least two years.

To fill seasonal or temporary employment opportunities, the Australian Government has developed temporary migration policies in order to entice overseas workers into regional areas. The ongoing Seasonal Worker Programme, which replaced the Pacific Seasonal Worker Pilot Scheme, is one example. The programme builds on the pilot's economic development objectives for the Pacific and Timor-Leste, while assisting Australian employers who cannot source local labour in selected industries.

generally represent aggregations of multiple small labour markets with socioeconomic connections or similar industry characteristics. Large regional city labour markets (150,000 people) are generally defined by a single SA4. Within major metropolitan labour markets, SA4s represent sub-labour markets (Glossary, Census Geographic Areas, www.abs.gov.au).

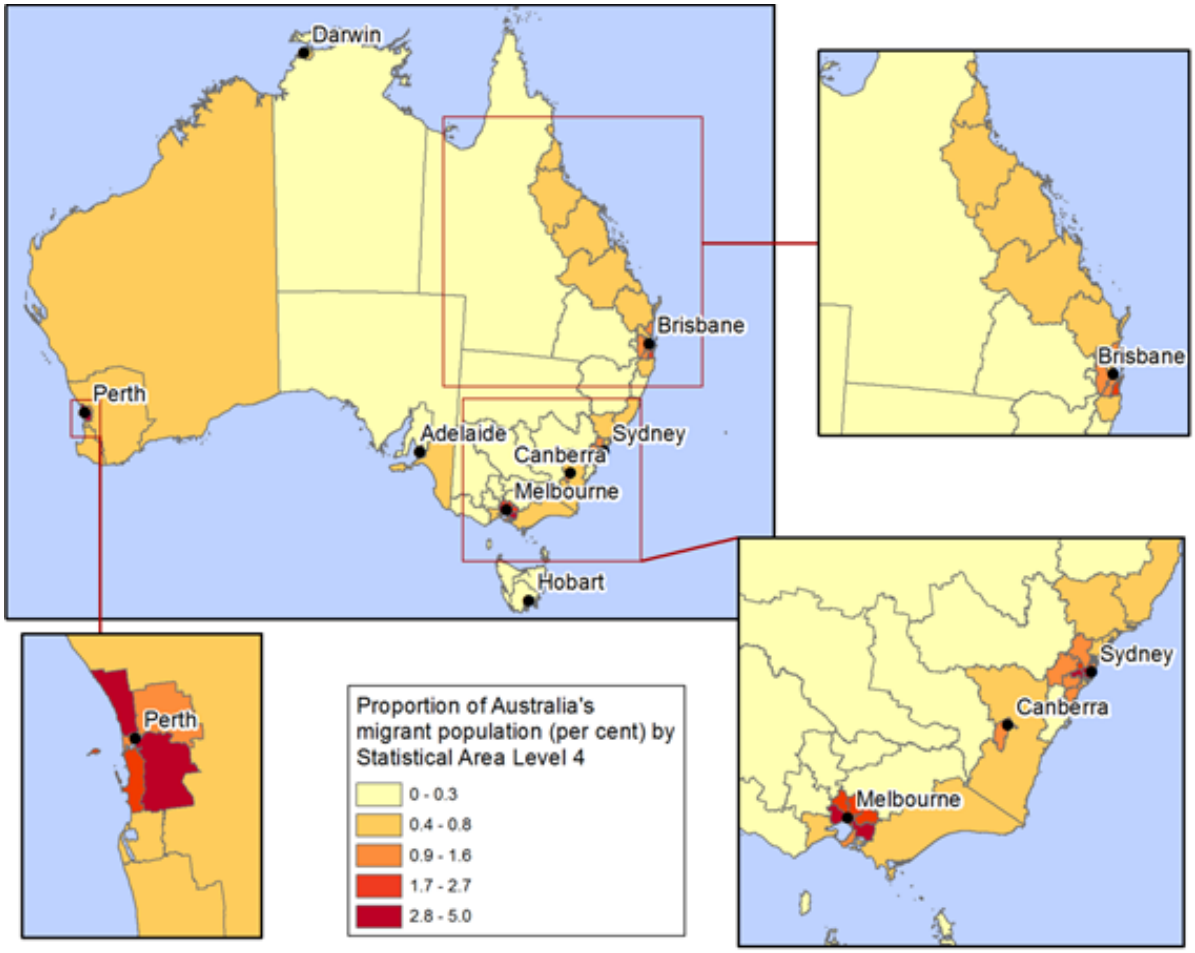


Figure 16. Australia's migrant population distribution by Statistical Area Level 4, Census data 2011.

For example, this programme allows horticultural businesses to recruit seasonal workers from Papua New Guinea as well as Kiribati, Nauru, Samoa, Solomon Islands, Timor-Leste, Tonga, Tuvalu, and Vanuatu. The programme also includes a small-scale three-year trial with the accommodation, aquaculture, cane, and cotton sectors in selected regions. The programme is demand-driven, with the number of visa places capped at 12,000 over four years (2012–16): 10,450 visas open to the horticulture industry nationally over four years, and 1,550 visas for the small-scale trial in selected regions, to end in June 2015. As at 30 June 2013, just under 1,500 grants had been issued under the Pacific Seasonal Worker Programme (DIBP 2014g).

While Australia's Humanitarian Settlement Service aims to locate refugee and humanitarian entrants with family or friends close to metropolitan areas, the possible rural background of many humanitarian entrants provides opportunities to foster regional engagement and development. This approach is supported by local community networks, and enables new humanitarian entrants to feel part of a community and contribute to the Australian economy (DSS 2013). More than 15,500 vulnerable women and their dependents have been resettled in Australia under this service since it was introduced in 1989.

Australia's Working Holiday Maker Programme, which currently issues in excess of one-quarter of a million visas per year, is a significant provider of temporary labour to regional Australia, particularly in the highly seasonal agricultural sector. A 2008 survey of working holidaymakers showed that 41 per cent of jobs held were in regional areas, and that farmhands were the single largest job

classification, accounting for more than one-quarter of all jobs held (Tan et al. 2009). Government initiatives such as the harvest trail website, and informal networks, are an important facilitator in this respect, helping direct this pool of mostly unskilled labour to where the jobs are.

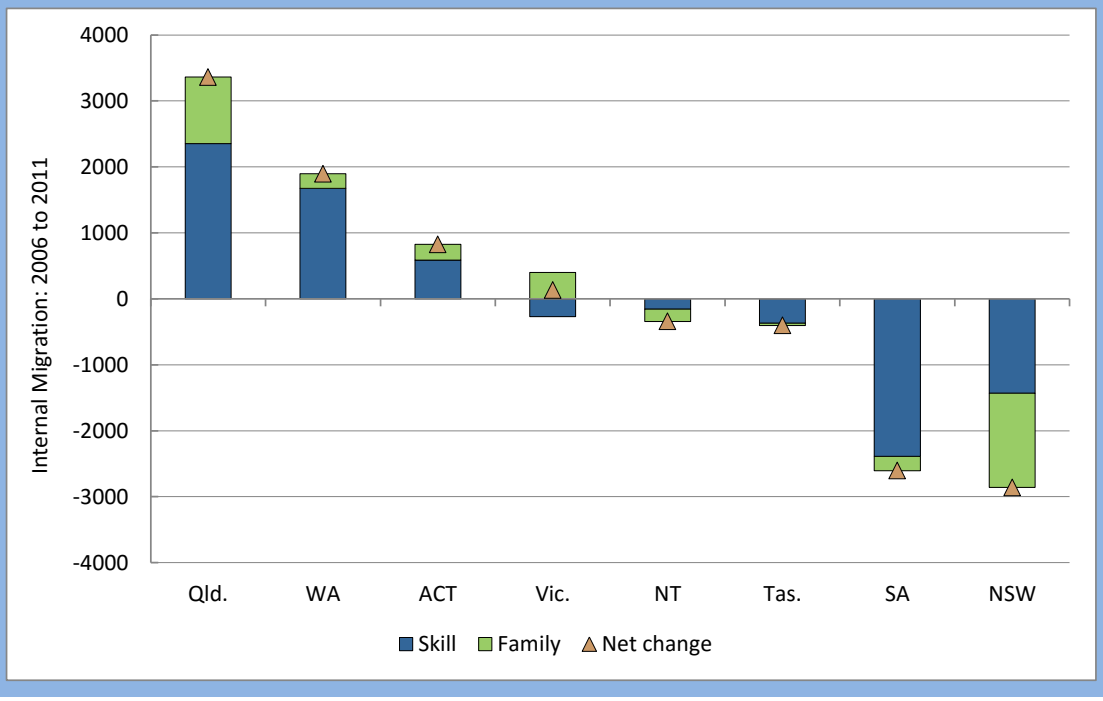
Working against these efforts to bring migrants into different parts of Australia is a high propensity for recently arrived permanent migrants to move considerable distances from where they first settled. These moves are influenced by lifestyle considerations, including access to family and friends, cultural and lifestyle choices, and employment opportunities. Data from the Australian Census and Migrants Integrated Dataset for 2011 (ABS 2014) provide additional insight into this issue.

Box 1 – International and Internal Migration by State and Territory.

Location of overseas migrants arriving 2006 to 2011

	NSW	VIC	QLD	SA	WA	TAS	NT	ACT	TOTAL
Family stream	Share of Family stream (%)								
Capital City	35.9	24.5	8.5	4.2	9.6	0.4	0.6	1.6	85.4
Rest of State/Territory	4.2	2.2	6.0	0.4	1.2	0.4	0.2	0.0	14.6
Skill stream	Share of Skill stream (%)								
Capital City	27.3	24.7	9.8	6.8	15.6	0.4	0.6	1.6	86.9
Rest of State/Territory	2.6	1.6	6.4	0.4	1.6	0.3	0.2	0.0	13.1

Net interstate migration of overseas migrants: 2006 to 2011



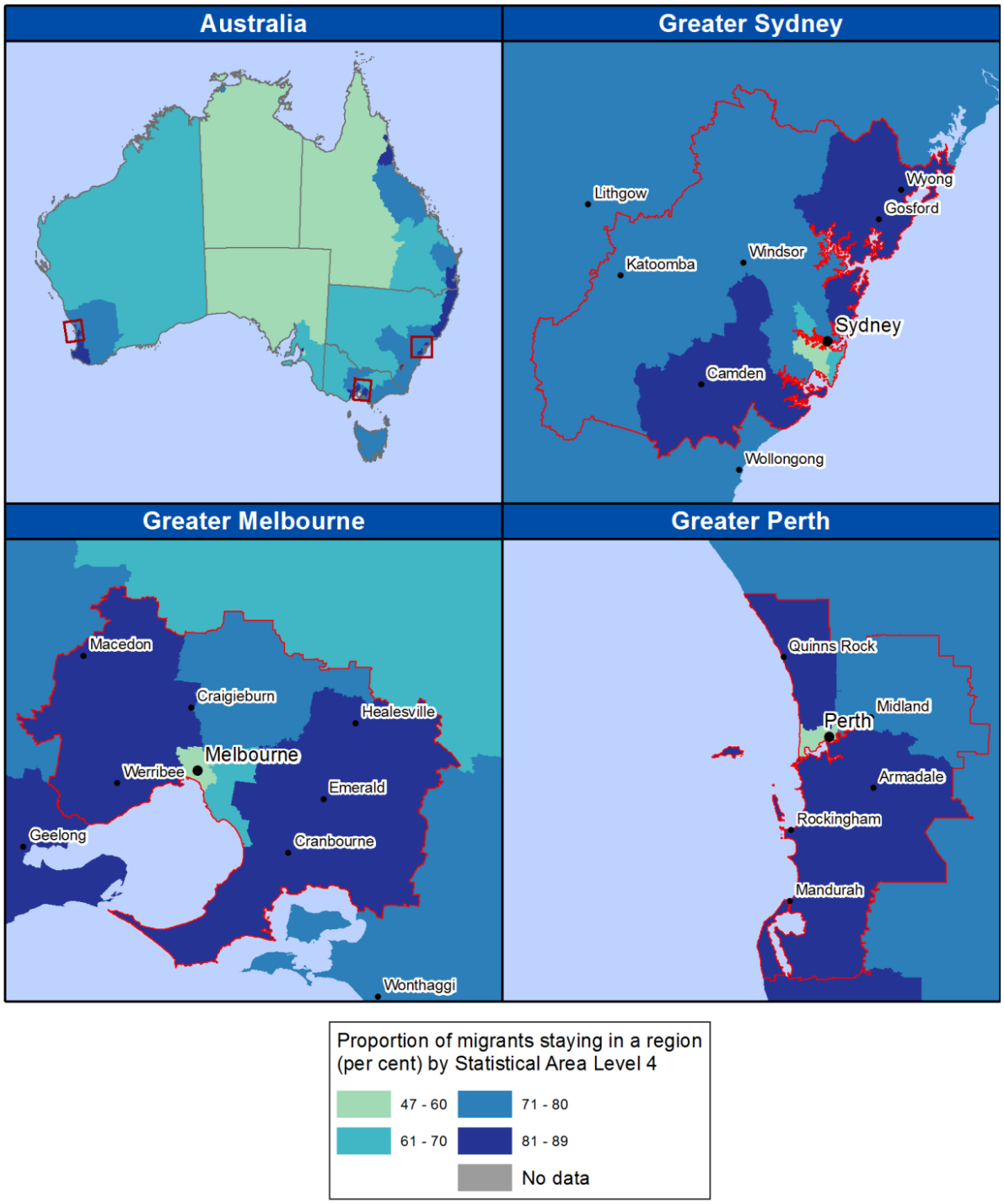


Figure 17. Proportion of migrants staying in a region by Statistical Area Level 4.
Source: Census data 2006 to 2011.

The first part of Box 1 shows that newly arrived migrants coming to Australia between 2006 and 2011 were most likely to locate within New South Wales and Victoria, with Greater Sydney being the most popular location for Family stream migrants and Skill stream migrants. South Australia and Western Australia stand out, as they have a much larger share of the skill cohort compared to their

share of the family cohort. By virtue of its more decentralized population, Queensland was the only jurisdiction to have comparable numbers of migrants living in and outside the state capital. For Australia overall, capital city migrants outnumbered non-capital city migrants by more than six to one.

With the passage of time, there has been significant interstate movement. This is shown in the second half of Box 1, which reports on interstate migration between 2006 and 2011. Using this measure, Queensland and Western Australia, with their stronger labour markets, were the main beneficiaries of this movement, largely at the expense of New South Wales and South Australia.

From a regional perspective, the ability to retain migrants within an area is especially challenging. Large areas of regional Australia have lost one-third or more of their migrants to other parts of Australia, or overseas, in just a five-year period—in other words, more than one-third of the overseas-born population that was counted in the 2006 Census of Population and Housing was elsewhere at the time of the 2011 Census. The only exceptions to this general rule were the more densely populated parts of South Eastern and South Western Australia that are relatively close to major cities (Figure 17), and those regional areas within Queensland that have significant mining investment. This implies that access to the amenities in major urban areas plus access to strong job markets are an important enabler of migrant retention.

Acknowledgements

The authors would like to acknowledge the many people from the Department of Immigration and Border Protection who contributed information and data to help in the preparation of this paper.

We would also like to acknowledge advice from within the department of Marianne Gomba, Janice Wykes, and Rachael Spalding, who reviewed the report, provided important additions, and were crucial in shaping the final product.

The late Professor Graeme Hugo was responsible for conceiving this report. We are therefore grateful for his early support and advice, plus the very practical support provided by Professor Peter McDonald, who helped see this paper through to its conclusion.

References

ABS (Australian Bureau of Statistics). 2011. *Census of Population and Housing Tablebuilder data*. Canberra: Australian Government.

———. 2014. *Australian Census Migrant Integrated Dataset*. Canberra: Australian Government.

Cully, M. 2011. Skilled Migration Policy: Recent Australian Reforms. *Migration Policy Practice* 1(1):4–7.

Customs (Australia Department of Customs). 2014. Operation Sovereign Borders Home Page. Canberra: Australian Government. http://www.customs.gov.au/site/operation-sovereign-borders.asp (retrieved April 30, 2014).

DFAT (Australia Department of Foreign Affairs and Trade). 2014. Australia's trade in goods and services 2014. Canberra: Australian Government. http://dfat.gov.au/about-us/publications/trade-investment/australias-trade-in-goods-and-services/Pages/australias-trade-in-goods-and-services-2014.aspx#exports (retrieved September 16, 2015).

DIAC (Australia Department of Immigration and Citizenship). 2009a. *Population Flows: Immigration Aspects 2008–09*. Canberra: Australian Government.

———. 2011a. Points Test for Certain Skilled Migration Visas, 1 July 2011. Canberra: Australian Government. http://www.immi.gov.au (retrieved June 2011).

———. 2011b. Strategic Review of the Student Visa Program, 30 June 2011. Canberra: Australian Government. https://www.border.gov.au/ReportsandPublications/Documents/reviews-and-inquiries/2011-knight-review.pdf (retrieved April 30, 2014).

———. 2012. *Innovation Points Test for the Business Innovation and Investment Program, August 2012*. Canberra: Australian Government.

———. 2013a. *Skill Select Booklet 11, July 2013*. Canberra: Australian Government.

———. 2013b. Temporary entrants and New Zealand citizens in Australia, December 2013. Canberra: Australian Government. https://www.border.gov.au/ReportsandPublications/Documents/statistics/temp-entrants-newzealand-dec13.pdf (retrieved April 30, 2014).

DIBP (Australia Department of Immigration and Border Protection). 2014a. Business Migration. Fact Sheet 27. Canberra: Australian Government. http://www.border.gov.au/about/corporate/information/fact-sheets/27business (retrieved April 30, 2014; September 11, 2015).

———. 2014b. Australia's Migration Trends (2013–14). Canberra: Australian Government. http://www.border.gov.au/about/reports-publications/research-statistics/statistics/live-in-australia/migration-programme/trends-2013-14 (retrieved September 16, 2015).

———. 2014c. Streamlined Student Visa Processing. Canberra: Australian Government. http://www.border.gov.au/Trav/Stud/Stre (retrieved September 11, 2015).

———. 2014d. *Filling the Gaps: Findings from a Survey of Subclass 457 Visa Holders and Their Employers*. Canberra: Australian Government.

———. 2014e. Key facts about immigration. Fact Sheet 2. Canberra: Australian Government. http://www.border.gov.au/about/corporate/information/fact-sheets/02key (retrieved April 30, 2014).

———. 2014f. State-specific regional migration. Fact Sheet 26. Canberra: Australian Government. http://www.border.gov.au/about/corporate/information/fact-sheets/26state (retrieved September 11, 2015).

———. 2014g. Australia's Migration Trends 2012–13. Canberra: Australian Government. http://www.border.gov.au/about/reports-publications/research-statistics/statistics/live-in-australia/migration-programme/trends-2012-13 (retrieved April 30, 2014).

———. 2015. Designated area migration agreements (DAMAs), August 2014. Canberra: Australian Government. http://www.border.gov.au/WorkinginAustralia/Documents/dama.pdf (retrieved September 16, 2015).

DSS (Australia Department of Social Services). 2013. Getting Settled: Women Refugees in Australia. Canberra: Australian Government. https://www.dss.gov.au/sites/default/files/documents/01_2014/sc_update_women_at_risk.pdf (retrieved April 30, 2014).

Dutton, P. 2015. Syrian Humanitarian Crisis. Media Release of the Minister for Immigration and Border Protection. Canberra: Australian Government. http://www.minister.border.gov.au/peterdutton/2015/Pages/syrian-humanitarian-crisis.aspx (retrieved September 17, 2015).

DTWD (Department of Training and Workforce Development). 2015. Dependants of 457 visa holders. Perth WA: Government of Western Australia. http://www.eti.wa.edu.au/your-study-options/study-at-school/dependants-of-457-visa-holders (retrieved September 11, 2015).

Houston, A., P. Aristotle, and M. L'Estrange. 2012. Report of the Expert Panel on Asylum Seekers, August 2012. Canberra: Australian Government. http://expertpanelonasylumseekedpmc.gov.au (retrieved April 30, 2014).

Markus, A. 2013. Scanlon Foundation Surveys: Mapping Social Cohesion Survey 2013. Victoria (Australia): Monash University. http://scanlonfoundation.org.au/wp-content/uploads/2014/07/mapping-social-cohesion-national-report-2013.pdf (retrieved April 30, 2014).

NSW Government. 2014. Teach Rural Scholarships. Sydney: New South Wales Government, Department of Education and Communities. http://www.dec.nsw.gov.au/about-us/careers-centre/school-careers/teaching/our-programs-and-initiatives/teach-rural-scholarships (retrieved February 18, 2014).

OECD (Organisation for Economic Cooperation and Development). 2014. Stat Extracts, data for 2011. http://www.oecd.org/Index.aspx?DataSetCode=RFOREIGN (retrieved May 5, 2014).

Parliament of Australia. 2013. The subclass 457 Visa: A Quick Guide, 11 November 2013. Canberra: Parliament of Australia. http://www.aph.gov.au/About_Parliament/Parliamentary_Departments/Parliamentary_Library/pubs/rp/rp1314/QG/Subclass457Visa (retrieved April 30, 2014).

Price, C. 1999. Australian population: Ethnic origins. *People and Place* 7(4):12–16.

Rural Health (Rural Health Australia). 2014. Rural Health Workforce Strategy (RHWS) Incentive Programs. Victoria (Australia): Australian Government, Rural Health Workforce Australia. http://www.ruralhealthaustralia.gov.au/internet/rha/publishing.nsf/Content/RHWS_incentive_programs (retrieved February 18, 2014).

Tan, Y., S. Richardson, L. Lester, T. Bai, and L. Sun. 2009. *Evaluation of Australia's Working Holiday Maker (WHM) Program*. Canberra: Australian Government, Department of Immigration and Citizenship.

Aging and Society: Canadian Perspectives

by Mark Novak, Lori Campbell, and Herbert C. Northcott
7th edited edn, Toronto: Nelson Education Ltd., 2014
ISBN: 978-0-17-656226-7
Softcover, $114.81, 439 pp.

Reviewed by Andi Céline Martin
Faculty of Kinesiology and Health Studies, University of Regina

Aging and Society is a necessary textbook for gerontology students and instructors alike. Initially published in the 1990s, it has morphed from a historical perspective of aging to a full picture of aging, describing advantages as well as problems. Notably, the central theme of this new, seventh edition—successful aging—emphasizes the opportunities and advantages of later life; these themes make sense today more than ever. As the 21st century unfolds, Canada's population will have a record number of seniors (65+). These seniors will make new demands on Canada's healthcare, old age security pension, and accommodation resources. Positively, seniors also bring new pursuits, talents, and approaches to later life. Since more years of activity and good health have changed the landscape of old age, people young and old will need to understand the realities of aging in this new period.

Markedly, this text introduces the reader to all aspects of gerontology: the physical and psychological changes associated with aging, a historical view of institutions and society, caregiving, the use of technology, and death—all from a Canadian perspective. This text presents aging in the specific context of Canada's history and social life, not that of other countries. Thus, this text covers Canada's own geographic regions, social policies, cultures, and ethnic groups. Canada's social institutions, namely healthcare, social security, housing systems, and family and community life, are all explored. Importantly, this text does not just point out the negative stereotypes of aging or reiterate the fact that Canadian society needs improvement. Instead, this text provides the reader with information regarding what parts of the social system work for or against older people. What's more, this text doesn't just report facts about issues surrounding aging; instead, it helps the reader sort through and understand those facts.

Incorporating the most recent Census data, the new edition of this text explores the challenges that modern society faces with a rapidly aging population. Specifically, the textbook is divided in 5 parts, each containing between 2 and 5 chapters (14 chapters in total). Part 1, "Gerontology Today" (chapters 1 and 2), introduces the reader to the field of aging and describes the theories and methods gerontologists use when they study aging. Chapter 1 immediately captivates and engages the reader by debunking various myths that give rise to negative stereotypes about older people, such as "most older people feel depressed, lonely, and bored" (p. 4) and "most old people live in institutions" (p. 5). Each myth is followed by research-based evidence that addresses the myth and shines light on reality. Part 2, "Social Change" (chapters 3 and 4), looks at the changes in Canada's history and demographic

structure that led to population aging. Markedly, the seventh edition includes a new chapter (Chapter 4) that focuses on racial and ethnic diversity in the context of aging in Canada. Part 3, "Maturational Change" (Chapters 5 and 6), looks at individual aging—the physical, psychological, and developmental changes that come with age. Importantly, major theories of biological aging, chronic illness, gender, income effects of physical health in later life, and signs of successful aging are broken down and conveyed candidly. Part 4, "Institutional Change" (chapters 7–11), examines Canada's institutions, including the healthcare, social security, housing, and transportation systems. What's more, readers can expect to learn about the origins of retirement and alternatives to retirement, seniors' leisure-time activity patterns and use of transportation, the ecological model of housing, and changes to the Canada Pension Plan. Lastly, Part 5, "The Experience of Aging" (chapters 12–14), looks at the older person in relation to family and friends. Here, relationships in later life, the role of sexual orientations, and the future of informal supports are explored. Death, dying, and end-of-life issues are also explored, particularly with regard to how older people think about and experience loss, bereavement, widowhood, and death.

For instructors, the seventh edition of this text includes many new pedagogical features (e.g., charts, graphs, excerpts from a number of other publications) to engage students and provide a deeper understanding of how the topic relates to their lives and society as a whole. Notably, these features also help link generations by showing how a person's life has continuity and how generations rely on one another. What's more, *Aging and Society* also includes numerous research-based instructor resources that promote student engagement and higher-order thinking (e.g., interactive quizzes, short answer and critical thinking questions). The text also includes other valuable pedagogical features, such as chapter summaries, running glossaries, and exhibits that enhance the ease of use of the text and the reader's learning and retention. Finally, this text includes an extensive reference list of all sources used, as well as links to additional helpful websites. Specifically, this text comes with access to a website that helps students grasp the material and succeed in the course, with printable flashcards and application questions. A great feature of this book for instructors is that it provides advice regarding utilizing this text for a one- or two-term course. Specifically, each chapter starts with a list of learning objectives, and key issues and information are highlighted throughout the text.

Significantly, *Aging and Society* is extremely accessible; the reader can expect depth and detail without stumbling over scientific verbiage or academic prose. Moreover, the text is extremely colourful and well organized, charming the reader with photos of joyful seniors partaking in self-care practices (e.g., maintaining nutrition and social support), engaging in novel forms of exercise (e.g., yoga and tai chi), participating in leisure and recreation (e.g., skiing and dancing), and enjoying careers or retirement. Importantly, these photos also show the ethno-cultural diversity of seniors in Canada. Overall, this new edition seamlessly weaves its underlying theme—successful aging—from cover to cover by illustrating seniors who are happy and aging well while also not shying away from the perils of aging and mortality. Aging is a topic many try to avoid because it is not a pleasant one. Yet, aging is a topic that affects us all, and thus, one we should all educate ourselves on. Not only are we likely to reach old age ourselves, but also, we usually have someone in our life that falls in this category or soon will.

The Meaning of Human Existence

by Edward O. Wilson
New York: Liveright Publishing Corporation,
a division of W. W. Norton & Co, 2014
ISBN: 978-0-87140-100-7
Hardcover, $26.95, 208 pp.

Reviewed by Leslie Hayduk
Department of Sociology, University of Alberta

Casual browsers will undoubtedly be attracted by this book's embossed dust jacket, three inlaid plastic photo prints, an endorsement by a US Vice-President, and mention of Wilson as a Harvard professor emeritus and winner of two Pulitzer Prizes. Readers familiar with any of Wilson's twenty-plus prior books will be enticed by the dust jacket description of this as Wilson's "most philosophical work," which champions the possible unification of the humanities and sciences. Wilson posits we "now know enough about the universe and ourselves that we can begin to approach questions about our place in the cosmos and the meaning of intelligent life," and he optimistically concludes that "humanity holds a special position in the known universe."

This book's 15 chapters are clustered into five groups, whose index descriptions become clear only retrospectively. The initial chapters introduce the possibility of a friendly unification of the humanities and sciences. The following chapters describe humans as: perceptually constrained by evolutionary history, astronomically insignificant, earth-entrenched, and earth-bound. The later chapters on instinct, religion, and free-will are not blatantly philosophical. Wilson's philosophy is introduced almost imperceptibly in the preparatory chapters, and depends fundamentally on respecting the structured understandings provided by a variety of scientific fields. A second foundational understanding is that humans are not "driven by instinct in the manner of animals," because humans are among the few species benefiting substantially from within-group cooperation: "Within groups selfish individuals beat altruistic individuals, but groups of altruists beat groups of selfish individuals" (p. 33).

Wilson's philosophy is rendered incomplete by a pivotal dash of optimism: "In time, likely no more than several decades, we will be able to explain…the physical basis of human consciousness;" science has yet to discover "the physical nature of consciousness." Wilson's dependence on pending discoveries exposes philosophical holes but spotlights whole research areas whose currently unimagined and unrecognized structures might prove as revolutionary and philosophy-amending as have the existing sciences. The evolutionary history of the brain constitutes a confident scientific strand—but the exposed gap is between the brain and *experience*. By presuming whatever it is

that "could possibly pull away from the brain's machinery in order to create experiential scenarios and make decisions of its own," Wilson circumnavigates the necessity of explaining selfhood, but he is thereby cornered into dismissing the self's sensed dictatorial powers as an illusion foisted on us by our bodies.

This book's greatest strength is to contextualize personal meaningful experiential life within scientifically grounded observations about everything from the ants under our feet to the expanse of the universe. Wilson masterfully casts a scientific fishnet whose mesh is fine enough to sieve bacteria yet strong enough to ensnare galaxies—but human experience acts like the water escaping the scientific fishnet. The unreconciled gap between the physical and experiential may disappoint readers believing there is "an answer," but it may also intrigue junior academics embarking on their personal gap-bridging quest. As long as experience escapes science, science will have difficulty melding with the humanities. Consider the science-experience gap, and the necessity of experience, when Wilson says free will exists "if not in the ultimate reality, then at least in the operational sense necessary for sanity and thereby for the perpetuation of the human species" (p. 170). *The Meaning of Human Existence* beckons academic neophytes to write a companion treatise titled *On Existence and Experienced Meaning*.

This book progressively confronts *unexamined* religious tenacity. "So it came to pass" that the early tweaks will likely escape everyone except those with practiced sensibilities. Religion is eventually presented as biologically, genetically, and neurologically rooted. The suggestion that "faith is biologically understandable" elbows purity of belief from its pedestal as the exclusive mode of understanding religion, just as neurology elbows personal experience from its pedestal as the exclusive mode of understanding meaningful life. This disruption has unresolved consequences. When one's personal sense of good and evil, and right and wrong, is displaced as a trustworthy foundation, prescriptions for how humans ought to proceed lose their personal moral compass. If evolutionary history determined our sense of what is socially good and laudable, trusting our personal sense of a desired future amounts to following the past. Striving for what one personally thinks ought to preferentially materialize must then unavoidably constitute continuance of what transpired in the past—as when Wilson casts his "vote for existential conservatism, the preservation of biological human nature as a sacred trust" and votes against using "science to mess around with the wellspring of this" (p. 60). Aspiring to "plan a more rational" human future without "domesticating human nature" (p. 180) perpetuates rationalities and desires that are either residues of physical and evolutionary history, or are things which escape Wilson's scientific net.

Wilson implicitly challenges sociologists to seek and evaluate alternatives to his view that "the origin of the human condition is best explained by the natural selection for social interaction—the inherited propensities to communicate, recognize, evaluate, bond, cooperate, compete" and form "the deep warm pleasure of belonging to your own special group" (p. 75). Demographers are also implicitly challenged to extend beyond investigating population dynamics as *people-dynamics* to investigating *population-genetic-dynamics*. Birth, death, and immigration are radically re-conceptualized, if taken as referring to the heterogeneous collections of genes packaged in individuals, rather than focusing on whole-persons as our analytical units. Genes typically are not born and do not die in synchrony with personal birth and death. The co-evolution of genes and culture entangles genetics with both sociology and demography. Demographers are also likely to be challenged by Wilson's transgression of the taboo against considering "policies aiming for an optimum people density, geographic distribution, and age distribution" (p. 177). The corresponding conversations are far from over.

Some ponderable conversation extensions:

1. Why challenge religion or any misconception, if misconception is what our evolutionary history bequeathed? If the "best way to live in this real world is to free ourselves of demons and tribal gods" (p. 158), and gods, demons, and tribalism have "biological origins" (p. 158), the instigator is not the demons or gods, but the underlying biology. If logic and rationality are also biologically based, this amounts to pitting parts of biology against other parts of our biology. If logic and rationality are not biologically based, Wilson's unification of science and the humanities remains unfulfilled.
2. If physical evolution progressively produced human consciousness and self-awareness, different species' evolutionary paths may have provided them assorted versions of consciousness and self-awareness. Books titled *The Meaning of Non-human Existence*, or the *Existence of Non-human Meaning* might be required, to avoid anthropocentrically misclassifying these as truncated versions of the human path.
3. What is the sense of *we*-humans, given that individuals are merely genetically homologous, rather than genetically identical? Migratory integration of sub-populations mixes genetic histories and produces greater individual genetic heterogeneity, and less between-individual uniformity. This portends a blossoming genetic future (it produces greater genetic diversity for evolution to scrutinize) but simultaneously weakens our personal empathy with the "we" in *we*-humans. In what sense, or in what senses, are *we* "Alone" or are *we* "Free" (p. 173).

This is a book worth more than reading—it is worth pondering.

The Dawn of Canada's Century: Hidden Histories

edited by Gordon Darroch
Montreal & Kingston: McGill-Queen's University Press, 2014
ISBN: 978-0-7735-4252-5
Softcover, $100, 524 pp.

Reviewed by Peter Gossage
Department of History, Concordia University (Montreal)

The "hidden histories" evoked in Gordon Darroch's subtitle are those revealed by census micro-data, in particular the five per cent random sample of Canadian dwellings listed in the 1911 manuscript census, as assembled and digitized by the Canadian Century Research Infrastructure (CCRI) project. Financed by a major infrastructure grant from the Canadian Foundation for Innovation, CCRI is a multi-partner, interdisciplinary initiative designed to assemble robust, publicly accessible national samples based on the nominal schedules from the five Canadian censuses taken between 1911 and 1951. "Canada's century," of course, is a reference to Sir Wilfrid Laurier's oft-quoted (and misquoted) claim about Canada's bright twentieth-century future. "Canada has been modest in its history," intoned the prime minister in 1904, "although its history has been heroic in many ways. But its history, in my estimation, is only commencing. It is commencing in this century. The nineteenth century was the century of the United States. *I think we can claim that it is Canada that shall fill the twentieth century*. (Cheers.)"[1]

Whether or not the twentieth century would belong to Canada, the Laurier years (1896 to 1911) were certainly characterized by massive economic, social, and political changes. This was *a nation transformed*, to borrow from the title of an influential survey of the period:[2] *economically*, by a new phase of industrial-capitalist development and by a booming international trade in wheat and other staple commodities; *socially*, by urbanization and its attendant array of challenges and inequalities; *geographically*, by the expansion of prairie agriculture, necessitating the creation of two new provinces in 1905; and *demographically* in several ways, but especially by immigration, which reached levels never imagined during the National Policy years of Sir John A. Macdonald—and which, by expanding the field of immigrant recruitment beyond the traditional British and American sources (although these remained the strongest) into continental Europe, presaged the multicultural Canada of the more recent past.

1. Sir Wilfrid Laurier to the First Annual Banquet of the Canadian Club, Ottawa, 18 January 1904. Transcription online at http://www.canadahistory.com/sections/documents/Primeministers/laurier/docs-thecanadaclub.htm, consulted 24 July 2015. Emphasis added.
2. Robert Craig Brown and Ramsay Cook, *Canada 1896–1921: A Nation Transformed*. The Canadian Centenary Series vol. 14 (Toronto: McClelland & Stewart 1974).

Darroch, the distinguished York University sociologist, and the interdisciplinary group of contributors he has assembled,[3] have chosen not so much to challenge this widely accepted meta-narrative as to dig deeply into its tenets and assumptions, in their attempt to unearth some hidden dimensions of this familiar story of transformation at "the dawn of Canada's century." They do so by bringing the full power of the CCRI microdata to bear on a wide range of issues, from the meanings attached to the census-taking exercise itself through more standard demographic analyses of immigration, ethnic and linguistic diversity, urban development, labour force participation, voting patterns, and the position of Aboriginal people in Canada, to the kinds of family- and household-based topics that have animated one important stream of Canadian social history since the 1970s.[4]

At the heart of this enterprise is the 1911 census sample, which was the most recent publicly accessible set of CCRI microdata when this anthology went to press.[5] Almost all of the sixteen chapters make some use of this remarkable data set, which contains detailed information about over 372,000 individuals living in all of Canada's nine provinces and two territories in 1911. Many of them juxtapose the 1911 CCRI sample with other, comparable data sets, including the five per cent sample of the 1901 Canadian census assembled by the Canadian Families Project[6] and the full transcription of the 1881 Canadian census compiled by the Mormons and now housed by the *Projet de recherche en démographie historique* (PRDH) at l'Université de Montréal. Scholars of a less quantitative bent will particularly enjoy another feature of the CCRI's data infrastructure, which is used to good effect by several of the authors in this collection. Known as the "contextual database," this is a collection of contemporary commentaries on the "organization, execution, and reception" of Canada censuses from 1911 to 1951, drawn from both parliamentary debates and from newspapers (almost 170 of them), and yielding some 16,000 individual records.[7]

Darroch has organized these sixteen essays into five thematic sections. Part I features a pair of introductions: a general one by the editor that draws in interesting ways on translation theory and frames the census—and even more, the CCRI sample, as "the outcome of successive acts of translation" (p. 6)—and a more technical one by Byron Moldofsky, which outlines the CCRI's approach to geo-coding census information, including the choice of the census subdistrict as the basic spatial unit available for the location, analysis, and mapping of these microdata. Part II focuses on "Canadian Diversities" and is comprised, appropriately, of four rather diverse essays: Evelyn Ruppert's analysis of the "Infrastructure of Census Taking" in 1911, with its refreshing emphasis on the technologies and the people involved in preparing the census (beginning with Minister of Agriculture Sydney Fisher, who was apparently counted twice); Adam J. Green's discussion of the debate over why "Canadian" was not accepted by census takers as an acceptable response to their question about "racial or tribal

3. At least five disciplines are represented by the twenty-four authors of the sixteen essays collected here: history, sociology, geography, economics, and demography.
4. See, for instance, the pioneering studies by Michael Katz and Bettina Bradbury: M.B. Katz, *The People of Hamilton, Canada West: Family and Class in a Mid-nineteenth-century City* (Cambridge: Harvard University Press 1975; B. Bradbury, *Working Families: Age, Gender, and Daily Survival in Industrializing Montreal* (Toronto: McClelland & Stewart 1993).
5. The 1921 manuscript census, and hence the CCRI's four per cent sample, became available for public consultation in 2013, after the expiry of the 92-year moratorium mandated by federal law.
6. This was a team based at the University of Victoria that included Darroch and several other contributors to this volume, namely Chad Gaffield, Lisa Dillon, Danielle Gauvreau, Eric W. Sager, and Peter Baskerville. For a similar anthology based on the Canadian Families Project, see Sager and Baskerville (eds.) *Household Counts: Canadian Households and Families in 1901* (Toronto: University of Toronto Press 2007).
7. The contextual database is available on-line at https://ccri.library.ualberta.ca/en1911census/contextual/index.html (consulted 27 July 2015).

origins"; an exploration, co-authored by Chad Gaffield, Moldofsky, and Katharine Rollwagen, of the way the language question was posed and interpreted in 1911—so ambiguously, it turns out, that census officials chose to suppress the results rather than risk fuelling linguistic tensions; and Gustave Goldman's disarmingly straightforward account of Canada's Aboriginal people in 1911, which uses the same language variables discussed in the previous chapter to explore, among other topics, "linguistic assimilation" among First Nations people, many of whom had been exposed to the trauma of residential schools.

Part III is framed around the theme of "Social Spaces [and] Historical Places," but the three essays collected here are also united by a methodology, as each author seeks to draw meaningful inferences from multivariate analyses based on at least two sets of census microdata, including from 1911. Hence Darroch uses multinomial logistic regression to tease out the relative impact of independent variables such as birthplace (foreign-born versus Canadian-born) and region on household structure, with special attention to extended-family households and those sheltering non-kin co-residents. Lisa Dillon focuses, as in her earlier work, on the elderly, in a context here where intergenerational cooperation and co-residence are expected to have been in decline. She finds only subtle changes, however, between 1901 and 1911, but with some strong regional variations, particularly in the probability that an elderly woman might head her own household, which was significantly higher in Ontario than elsewhere. For their part, Danielle Gauvreau and Patricia Thornton offer a detailed analysis of the ethnic diversity in Quebec in 1881 and 1911—demonstrating the inadequacy of some well-worn clichés around both French-Canadian "homogeneity" and the proverbial "two solitudes"—while carefully situating various derived measures of ethnoreligious segregation and mixing at several levels, including, most interestingly, the household. From these "places and spaces" the discussion turns in Part IV (somewhat confusingly at first brush) to "Locales in Transition" (for these are nothing if not places and spaces!), with three essays focusing on specific communities, all located east of the Ottawa River. These are:

1. A general portrait of Trois-Rivières and its population at the dawn of the century, drawn by Claude Bellavance and France Normand from their 100 per cent samples of the local population at every census date from 1852 through 1911 (the potential thus offered for testing the smaller samples collected by the CFP and CCRI is not wasted);
2. An intriguing examination by Terry Quinlan and Sean Cadigan of district-by-district voting patterns in the 1948 referendums on Confederation—as correlated with data from the 1945 Newfoundland census[8] and with additional attention to the 1911 census returns for St. George's Bay—that exemplifies "the changing, more Canadian-oriented nature of the population overall" (p. 314) and, therefore, the regional patterns of support for Confederation in 1948; and
3. A detailed study by Marc St-Hilaire, Laurent Richard, and Richard Marcoux of a cohort of about 1,500 children, located in the 1871 manuscript census for Quebec City and then traced through four subsequent census returns, all the way to 1911—within a life-course perspective and with particular emphasis on the factors associated with an individual's likelihood of leaving the community from one census date to another. The most salient factor, as it turns out, was *ethno-religious identity*, as Irish Catholics in particular—their traditional sources of employment on the waterfront in serious decline—left the city in droves, contributing to what these authors call its "French-Canadianization."

8. These scholars benefit from the fact that the pre-Confederation Newfoundland enumerations are not subject to the same 92-year blackout as the post-1921 Canadian censuses.

The anthology closes with a series of four essays (Part V) grouped around the theme "Markets and Mobility: Class, Ethnicity, and Gender"—and once again, the 1911 CCRI census sample is in the spotlight. In their chapter, Kris Inwood, the late Mary McKinnon, and Chris Minns offer a new analysis of labour market dynamics in the two decades from 1891 to 1911, with special emphasis on immigration, education, and language; there is an interesting discussion here of the educational and career attainments of Ontario anglophones versus Quebec francophones, for instance, with the benefit of the data on wages and earnings first collected for the 1901 and 1911 censuses. Sociologists Charles Jones and Stella Park then approach the 1911 census with a view towards unpacking the data it contains on what they call "ancestral origins" (this the "racial or tribal origins" census question that was critiqued so thoroughly by Green in an earlier chapter) and their relationship to employment and earnings—as mediated most significantly by geography, since wages were significantly higher in the west than anywhere else in Canada. Eric W. Sager adds social class to this mix, as is possible given the presence of questions about each individual's relationship to the means of production (employee, employer, or working on own account) on the 1901 and 1911 enumerations. Based in part on his detailed study of immigrant and ethnic dispersal and clustering in the industrial community of Hamilton, Ontario, Sager concludes that "class and gender were fundamental to the material condition of both immigrants and people born in Canada in a way that ethnicity was not" (p. 499), and thereby creates something of a dissonance with the previous chapter and its strong emphasis on "ancestral origins." Peter Baskerville, finally, moves the discussion in a new direction by focusing on the questions about life insurance that were asked, for the first and only time, in 1911 and which reveal a strong pattern whereby French-Canadian parents in Quebec, including members of the working class, were much more likely than others to take out life insurance policies on their *children*. Whether this was simply a practical response to the high mortality risks associated with infancy and childhood in urban Quebec (a decent burial cost money, after all) or something more profoundly cultural, associated with changing attitudes toward the value of children's lives (as Viviana Zelizer has argued for the United States) is a fascinating question, and one that the author explores with his accustomed energy and rigour.

Globally, this is a useful and well-conceived collection that has been skillfully edited by Darroch and nicely packaged by McGill-Queen's University Press. There is a recurrent and necessary emphasis on the key dimensions of Canadian diversity in the 20th century as they were taking shape in its opening decades. The questions of "race," ethnicity, religion, and language, as well as the distinction between immigrants and those born on Canadian soil, are especially salient and powerful, and they are approached here from many different and generally complementary angles. Demographers, sociologists, geographers, and others steeped in social-science methods will certainly appreciate the strong emphasis on census microdata and the multivariate analyses they allow (ten of the sixteen chapters feature regression models of one kind or another). Some of my fellow historians and our students—who are, it would seem, increasingly allergic to numbers and statistics, since the spread of post-structuralism and related approaches in the 1990s—may find this somewhat daunting. They might therefore choose to overlook this detailed and sophisticated empirical study of Canadian society at the dawn of "our" century, as revealed primarily through the census-taking project of the federal state, and "translated" for research purposes into a coherent, usable, and publicly accessible sample by the CCRI team. But they will run a significant risk if they do: ignoring not just some of the "hidden histories" that underlie the ambitious nation-building project of the Laurier years, but also some valuable and unexpected insights into the very fabric of 20th-century society, with all its new layers and complexities, as it was emerging in this formative period of Canadian history.

The Parasite-Stress Theory of Values and Sociality, Infectious Disease, History and Human Values Worldwide

by Randy Thornhill and Corey L. Fincher
New York: Springer Science & Business Media, 2014
ISBN 978-3319080390
Hardcover, $209, 449 pp.

Reviewed by Farid Pazhoohi
Department of Animal Science, Shiraz University, Iran

In their book *The Parasite-Stress Theory of Values and Sociality*, Randy Thornhill, Distinguished Professor at The University of New Mexico, and Corey L. Fincher, Assistant Professor at University of Warwick, present a new interpretation of human values and cultural behaviors, on the basis of ecological variations in parasite-stress prevalence across and within nations.

The first chapter of the volume is a detailed introduction outlining the contents. Before delineating their theory in upcoming chapters, in the second chapter Thornhill and Fincher discuss their philosophical viewpoints on scientific investigation in general, and evolutionary science in particular. First, the chapter compares philosophical and scientific methods of knowing, concerning exploration of the universe and its function. In particular, in this chapter the authors challenge philosophical aesthetics and argue that pure philosophical reasoning cannot discover causes of nature without scientific testing. The authors further argue that due to personal differences in values (biased common sense, intuition, and emotional validation of ideas), human pure reasoning, thinking, and deduction are biased, and that aesthetic philosophy cannot empirically falsify or verify hypotheses. They also argue that all areas of science that deal with life and living beings are evolutionary in essence, and that humans are evolved animals and living beings—hence, that all studies of humans are evolutionary and biological studies.

Next, the authors explain the enculturation process and review different theories on cultural learning. They assert that "enculturation of the individual is an active ontogenetic process of choice of information from the environment that yields reproductive competence in the local culture" (p. 36). In the other words, they propose that the ontogeny of people is designed to choose ideas, ways of thinking, and attitudes and values that are ancestrally adaptive social navigations in the local culture. They claim that cultural acquisitions are local psychological adaptations that are caused by infectious disease–related ecological adversities that design people ontogeny.

Chapter 3 begins by highlighting the importance of *immunity* and *infectious diseases* as underlying causes of evolutionary selection. Thornhill and Fincher define two immune systems for humans: (1)

the classical immune system, that is, the biological structures and mechanisms of defense against parasites; and (2) the behavioural immune system, which is defined as *infectious disease avoidance behavior* and the way humans cope with them when they are afflicted. The second system is the main focus of this volume. In discussing the geographical localization of parasite-host co-evolution, the authors argue that "host defense works most effectively, or only, against local parasite species, strains, or genotypes, but not against those evolving in nearby host groups. Hence, out-groups may often harbor novel parasites that cannot be defended against very well, or at all, by an individual or his or her immunologically similar in-group members. Out-group individuals pose the additional infectious-disease threat of lacking knowledge of local customs, manners, and norms in general, many of which may prevent infection from local parasites" (p. 61). Hence, in ecological settings where disease stress is high, there are adaptive preferences and values that are more inclined toward ethnocentrism, xenophobia, philopatry (the absence of dispersal away from the natal range for reproduction), and conservatism in order to avoid parasite stress from the out-groups. On this basis, the authors assume that as parasite stress declines, the tendency toward contacting out-group individuals, and tolerating their values and belief systems, increases.

In the fourth chapter, the authors review the traditionally proposed and alleged causes for cross-cultural variations in values by other scientists. They assert that the parasite-stress theory of values is not an alternative to the traditional scientific approach toward cultural differences (notably climate and wealth), but complementary. For example, they consider the spectrum from collectivism to liberalism by reviewing the traditional research on these topics, and argue that according to the parasite-stress theory of sociality, all the differences between these two ideological poles "are caused proximately by the greater parasite prevalence in collectivist regions than in individualist locales" (p. 88). They show that the characteristics of collectivists and individualists—conservatism/liberalism, self-concept, reasoning styles, social network, intersexual relationships, hierarchy, honor and norms, the pace of life, language, governmental systems, resource distribution, economics, civil conflict, religiosity, and other values that correlate with collectivism versus individualism—are caused by a given region's *level of parasite adversity*. In the other words, collectivism (in contrast to individualism) functions as a defense against infectious disease, and is more adaptive in cultures where the prevalence of parasites is higher.

From the fifth chapter on, the authors go through detailed explanations and elaborate on what they have briefly explained in the previous chapters so far. Thornhill and Fincher deal with collectivism-individualism, family ties, and philopatry regarding the parasite-stress theory of values (chapter 5). They reason that countries with low parasite stress are more individualistic than countries with high parasite stress, which tend to adhere to more collectivistic attitudes. Additionally, they hypothesize that high philopatry (reduced dispersal) is an adaptation for avoiding contact with novel parasites by limiting the transactions and alliances with out-group individuals. This denotes that the reciprocity is conditional, meaning that reciprocity is more beneficial under low-risk conditions.

Based on the parasite-stress theory of values, Thornhill and Fincher hypothesize that the underlying causes for cross-cultural differences regarding the importance attributed to physical attractiveness for mate selection, as well as engagement in monogamous/polygamous marriages, are dependent on the local prevalence of parasite stress (chapter 6). Additionally, they consider other mating-related factors, such as frequency and intensity of polygamy, marital divorce, inbreeding, and male sexual competition, to be also influenced by the regional parasite stress.

The next chapter focuses on the personality characteristics of extraversion/introversion and openness to experience (neophilia; chapter 7). According to the parasite-stress theory values, extro-

version and higher levels of openness are prevalent under ecological conditions of low infectious disease adversity, while introversion and lower levels of openness under ecological conditions of higher prevalence of infectious disease. Next, the authors review the related literature about interpersonal violence, homicide, and lethal and non-lethal aggression against romantic partners (chapter 8). Here, they also argue that interpersonal violence and homicide are positively correlated with parasite prevalence.

After reviewing the hypotheses explaining cross-cultural differences in religiosity, Thornhill and Fincher argue that there is a positive association between religiosity and parasite stress, cross-nationally and across the US states (chapter 9). Moreover they hypothesize that variation in values pertaining to cross-national autocracy-democracy are also related to the level of parasite prevalence (chapter 10). "Political systems are proximate manifestations of the human behavioral immune system and its range of values, evoked by variable parasite stress. In terms of evolutionary or ultimate causation, political systems are the product of natural selection that favored the conditional expression of the features of the behavioral immune system that allow ancestrally adaptive social navigation under variable amounts of parasite stress in the local environment" (p. 298).

In the next chapter, the parasite-stress theory of economics is presented, and it is argued that variable parasite stress across regions accounts for regional variation in economic productivity, as infectious diseases and parasite stress (1) cause morbidity and hence reduce people's capability to produce; (2) increase regional collectivistic tendency, which reduces innovativeness and interregional diffusion of innovations; and (3) has negative effect on cognitive ability, which reduces innovativeness and, thus, economic wellbeing in a region (chapter 11). Finally, the parasite-stress theory of values explains the frequencies of the major types of within-nation intergroup conflict, such as civil war, coups, and revolutions (chapter 12). It is argued that parasite stress and collectivism in the countries of the world would promote ethnocentrism and xenophobia (antagonism toward out-group members), which would cause all the major types of within-region civil conflict per se.

The Parasite-Stress Theory of Values and Sociality is a very interesting and well-written volume that definitely contributes greatly to all human behavioral sciences, and opens new windows for an evolutionary perspective toward the political, economic, and social sciences. This volume is an essential read for anyone who is interested in evolutionary approaches to behavioral and social sciences, and a must for experts and students of the evolutionary sciences and of the anthropology and philosophy of science.

The Hope of the Country with a Large Population: Theories and Practices of China's Population Transformation

by Xueyuan Tian
Social Sciences Academic Press (China) and
Heidelberg: Springer-Verlag Berlin, 2014
ISBN 978-3-642-40831-1
Hardcover, $99, 296 pp.

Reviewed by Jing Shen
University of Lethbridge

The Hope of the Country with a Large Population focuses mainly on China's population trends and policies in the 1990s. With significant demographic changes in the present Chinese society, a historical review of demographic composition and development in the past three decades could always be helpful in terms of deepening one's understanding of the demographic structure and policies in China today.

This book includes seven chapters. The first chapter covers the theoretical framework of the book. In this chapter, the author focuses on the New Population Theory proposed by Ma Yinchu, and articulates the legitimacy of China's one-child policy that was strictly implemented from the end of the 1970s to the 1990s. The second chapter describes China's demographic structure in the 1990s, in which period the Chinese population was relatively young, so that the one-child policy contributed positively to the national economy. The third chapter focuses on population aging and elder care, particularly regarding the rapid speed, high level, and accumulated growth of aging, as well as the unbalanced distribution of the aging population between rural and urban areas. The fourth chapter discusses the population flow from the rural to urban area as the main characteristic of China's urbanization process in the 1990s. From chapters 5 to 7, the author turns his attention to population policies. In addition to re-emphasizing the suitability of the one-child policy in the context of China's changing demographic structure in the 1990s, the author also makes an attempt to predict China's demographic development based on the influences of the one-child policy.

Certainly, the Chinese population has changed tremendously since the 2000s. For example, the growth of the elder population has been much more rapid than what was predicted by the author. In fact, the most recent change in the one-child policy that allows a couple—if one of them is an only child—to have a second child has shown the government's concern about the fast-aging population in the current society. Urbanization does not seem to follow the "special S-curve" path pointed out by author, either. On the contrary, regional disparities and the rural-urban gap have worsened since the early 2000s. The increasing social inequalities have, in turn, caused socio-demographic consequences that the author failed to predict in this book. For instance, a comparative study based on data

drawn from the China General Social Surveys between 2005 and 2010 shows that self-reported health has worsened among the disadvantaged, including women, elders, and rural residents, as economic inequality increased (Bian and Shen 2015). While mortality due to malnutrition and/or poor medical conditions has decreased significantly since the socioeconomic reforms, mortality due to heart diseases, cancer, and other pollution-related diseases has increased drastically. These new challenges cannot be addressed by a traditional population policy that simply emphasizes quantity control.

Regardless, with its focus on population trends and policies in the 1990s, this book provides useful historic evidence that makes sense of the demographic issues in the present Chinese society. Further research that focuses on comparing this book and studies on population issues after the 2000s would be of great importance for us to understand the historic background, status quo, and trajectory of China's demographic development.

Reference

Bian, Y.J., and J. Shen. 2015. Felt-suffering and its social variations in China, in *World Suffering and Quality for Life*, edited by R. Anderson. Dordrecht: Springer Netherlands, p. 187–202.

The Limits to Growth Revisited

by Ugo Bardi
Briefs in Energy, Energy Analysis, New York: Springer, 2011
ISBN 978-1-4419-9416-8
Softcover, $49.95, 119 pp.

Reviewed by Thomas K. Burch
Population Research Group/Department of Sociology
University of Victoria

Someone once described the British novelist E.M. Forster as "the wisest of men in the fewest of words." Reading this book reminded me of that comment. In just over 100 pages, an Italian chemist gives a lucid and balanced re-evaluation of the famous/notorious "Limits to Growth" project, first published in 1972 and revised as late as 2004. The study was sponsored by the Club of Rome with the aim of analysing the "world predicament," and suggesting policies that might deal with it. The central message was that our current world system was on inherently unsustainable paths, that endless exponential growth—in population, resource use, food production, consumption, pollution, etc.—was likely to lead to major breakdowns in the early to middle decades of the 21st century. The authors' policy prescription was for unprecedented international co-operation in order to overhaul the system, a task that they recognized as extremely difficult. The book covers much of the same ground as Naomi Klein's recent bestseller, *This Changes Everything: Capitalism vs. Climate Change*, but more briefly and more narrowly, as a re-evaluation of one particular scientific study and analytic genre.

By Bardi's account, the study first received much positive acclaim, and then was trashed—notably by economists—and largely ignored. More recently there has been renewed interest and a more sympathetic hearing, as the study is seen to have continuing relevance to current environmental, demographic, economic, and political instabilities.

In twelve brief chapters, the University of Florence professor (1) explains the role of models in science and the character of "systems dynamics" models—essentially, systems of differential equations solved numerically by computer; (2) gives simple concrete examples of such a model, dealing with the British coal industry and the rise and fall of the whaling industry in the 19th century; (3) describes the World Model, the main tool of the Limits to Growth study; (4) details and evaluates scientific and political criticisms of the model; (5) considers mineral resources as possible limits to growth, and the potential role of technology in coping with such limits; and (6) describes a revival of world modelling, seen as a much-needed analytical tool for dealing with worldwide economic and environmental problems.

A discussion of so much substance in 100 pages might suggest superficiality. But Bardi is nowhere superficial. Rather, he writes in tight scientific prose—but not so technical as to baffle the non-scientific reader—with frequent graphs and diagrams, and specific references to a large (10 pages) and varied bibliography.

Bardi shows that much of the criticism of "Limits to Growth" was based on a misunderstanding of the nature and purpose of systems dynamics models (some was based on cherry-picking of the data, some on outright mistaken readings of tables). The original authors were careful to note that their quantitative results for the future were not predictions, but simply the logical outcomes of their model and assumed inputs, what have come to be known as "scenarios." But, as Bardi makes clear, the results were "robust"—over a wide range of assumptions about such things as proven mineral reserves and technological progress, the qualitative result is always the same. The world system is heading for serious trouble; only the extent of that trouble and its timing are in doubt.

As before, some will dismiss Bardi as a "doomsayer." But as he points out, Cassandra's dire predictions in ancient Greece came true. A look at the state of the world today suggests one needn't look to the future for elements of doom; they're here already.

In chapter 9, on "Mineral Resources as Limits to Growth," there is a perceptive account of the definitional games some critics of the study played in order to suggest never-ending abundance of resources, culminating in economist Julian Simon's assertion that they were essentially infinite. Chapter 10 provides a similar discussion of the limits to technology as a solution to all our problems, questioning economist Solow's and computer scientist/futurologist Kurzweil's conviction that technology will continue to increase exponentially. Bardi notes, for example, that once a transistor consists of a single atom, a physical limit has been reached. He also reminds us that often as not, new technologies do have negative side effects. For example, the more energy we produce and use, the more thermal pollution (e.g., fossils fuels, CO_2 and global warming): "Pollution is a necessary consequence of everything we do—including fighting pollution." Fracking has increased oil and gas production, but it also can cause earthquakes. In late August, the British Columbia government revealed that BC had experienced many fracking-related quakes, including two at 4.4 on the Richter scale, apparently a world record.

Even though the book is only four years old, many things have changed in the interim, so that in some ways it seems dated. He speaks of our being in a period of sustained high prices for oil, whereas the current price of conventional crude is less than $40 oil as I write. Bardi didn't anticipate the rapid spread of "horizontal fracking," which has led to the US suddenly becoming one of the largest producers of oil in the world. Nor did he foresee that the Saudis would gear their production to maintain market share, rather than to keep prices high, or that slightly declining growth in the Chinese economy would affect prices on the demand side.

By the same token, many of our environmental problems are even worse than when he wrote—drought, ocean acidification, melting glaciers and polar ice, and rising sea levels, to name a few. And recent studies suggest that per capita agricultural production may have begun to decline, as was envisioned by the Limits to Growth models. The very fact that so much could change so quickly is a reminder that our world system is just that—a system, a complex dynamic system with many feedback loops and non-linear relationships. Not everyday thinking, nor even the linear multivariate models so beloved of empirical social scientists, can give us an adequate understanding of our world.

Given the pace of change, a revised edition of this book would be welcome, to take account of recent developments and at the same time correct some small but annoying inconsistencies between the text references and the bibliography.

Bardi reminds us that the *Limits to Growth* study was conceived and implemented in the early 1970s, at a time when computers and analytic software were still relatively new. It would be surprising if one could not find flaws. Nevertheless, it pioneered a new way of thinking that is sorely needed in our study of current problems. Bardi correctly notes that all of us, including key decision makers, work with models about how the world works. But these are often poor models, typically static and linear, with vague and untested assumptions. *Limits to Growth* was open and specific about its assumptions, and the model was available for all to see, in contrast to those of many of its critics. It was, in short, a good scientific first step. It's our loss that it was not treated as such, especially by economists and demographers.

Page for page, Bardi's book is one of the most informative I have read in a long time. I would recommend it to anyone with an interest in our common future or in the methodology of science in general, and social science in particular.

The Social Metabolism: A Socio-Ecological Theory of Historical Change

By Manuel González de Molina and Víctor M. Toledo
Environmental History Series Vol. 3, Springer, 2014
ISBN: 978-3-319-06357-7
Hardcover, $129, 355 pp.

Reviewed by Lorne Tepperman
Department of Sociology, University of Toronto

I confess I came to this book with certain incorrect expectations. I had just published a book called *Flows: A Network Approach to Social Inequality*, and thought that this book by Molina and Toledo, like mine, would be about population, migration, and renewal processes. From this standpoint, reading it seemed like a natural next step.

The book arrived, and to my surprise, the book seemed densely written and full of unfamiliar scholarship. Moreover, the book isn't (mainly) about population, migration, or renewal processes; it is about environmental sustainability, as viewed from a historical and theoretical perspective. Said another way, the book sets out to create a history-based theory of ecological sustainability, linking this theory to earlier theories about society, most notably to theories of Karl Marx and Marxian-influenced writers.

Taken aback, I started doing research on the topic. I looked at other papers by Professor Molina and his colleagues, and found that they were straightforward, unlike this book. Then I researched the notion of "social metabolism" and found a burgeoning literature on this concept, again tracing back to Marx (in *Das Kapital*). Gradually, I came to realize that I already knew something about this topic, but viewed in a different conceptual framework. So I started translating.

The notion of "social metabolism" here refers to a set of exchanges *between* the natural and human environments and, further, *within* the natural and human environments, as well. In other words, metabolism is concerned with natural and human systems, their functioning, and their interdependence and interaction. Moreover, the notion of ecological "sustainability" comes down to the old notion of "equilibrium." Thus, the authors are theorizing about the nature of ecosystem sustainability in relation to human behaviour, particularly under conditions of capitalist industrialization.

It turns out that Marx (in *Das Kapital* and the *Grundrisse*) expressed views on this matter: for example, in *Das Kapital* Marx talks about the tendency of cities and towns to exploit the surrounding countryside. This process of exploitation—notably, a large-scale extraction of food—eventually depletes the soil and requires the development of new fertilizers. Even human excrement is insufficient for the task, since it is not transported from city to countryside for this purpose.

Leaving aside this and other important observations about the material nature of human life, I am reminded of my old teacher, Talcott Parsons. No one was more persuaded than Parsons of the value of studying social systems and their exchanges with other social systems. He was also interested in the study of social subsystems and their exchange with one another—for example, how the *adaptive* subsystem organizes relations between society and its natural environment, largely through the economy; how the *goal attainment* or *political* subsystem sets goals for the adaptive subsystem and, under ideal conditions, ensures a balance between nature and humanity; how the *integrative* or *legal* subsystem imposes limits on the goal attainment subsystem, ensuring that societal rules, and not merely political interests, govern our behaviour; and finally, how the (awkwardly named) *pattern maintenance* subsystem regulates all of the other systems, by calling them to account in terms of underlying social values, via processes of socialization and ritual affirmation.

Parsons is wrongly thought to have believed that equilibrium was guaranteed, or that everyone would behave as they should—but he did not think these foolish things. He was not astonished at the human failure to achieve a balance with Nature, but he did not feel compelled to delve into *Das Kapital* for theoretical supports. In fact, Parsons based his study of social systems largely on systemic thinking about the human body by Cannon: how the different organs relate to one another and achieve a functioning equilibrium under constantly changing external conditions.

No stranger to material existence, Parsons might also have referred back to Malthus, and would have found the later system modelling by Meadows et al. (in *The Limits to Growth*) to be completely persuasive. Since the publication of Malthus's *Essay on Population* in 1798, people have been noting the imbalance between human reproductive capacities and the natural capacities to feed all these people. And at least for the last fifty years, they have been debating whether this problem is caused by, or merely exacerbated by, capitalism and the attendant consumerist ethic.

So far, there is a standoff on this question, since theorists have been unable to agree on whether any societies have ever industrialized under conditions other than capitalism. Many claim that China and the USSR never actually tested Communist theory, that they were rather examples of state capitalism, not true Communism; others might make a similar claim about fascist Germany, Italy, or Japan.

In short, industrialization has always led to an imbalance between human and natural systems, with humans often using their technology recklessly in order to wring the greatest comfort and profitability out of Mother Nature. This continues to happen at breakneck speed all over the world today, in societies with a variety of social, cultural, and political regimes.

It is not to say that we do not need a good theory of the interaction between human and natural systems if we are to attain "sustainability" (that is, equilibrium in our current abuses of the environment, or even a reduction). And a historical materialist approach would likely be useful, as compared with Parsons' value-based, idea-driven theory. However, this question about equilibrium, and this system approach to it, is not new, and it does not derive from Marx wholly, or even mainly.

Why mention Parsons, or even Malthus, then? Simply for the reason that theories of human systems—like those associated with Parsons and Malthus—have been good at understanding stability and equilibrium, but not good at understanding change, or the reasons why equilibrium-seeking systems change from within. For example, Malthus famously failed to foresee the Demographic Transition (e.g., voluntary fertility decline in the face of new opportunities and declining mortality rates) that largely invalidated his theory. Parsons, on the other hand, looking for an internal mechanism to explain social change, had to resort to an evolutionary approach that rested on the assumption of expansionary value systems (like capitalism and this-worldly Protestantism). Otherwise, Parsons—like

Malthus—was obliged to view systemic change in terms of unforeseeable and uncontrollable changes intruding from outside the system, e.g., wars, famines, epidemics, new technological discoveries, and the often unexplainable "breakdown" of values, norms, or mechanisms for dispute resolution.

So, a test of the theory in this ambitious, magisterial book by Molina and Toledo—to the extent that it provides a theory and not merely what another teacher, George Homans, used to call "orienting statements"—is whether it can account for change in the key relationship between humanity and nature. For his part, like Malthus and Parsons, Marx was also notoriously bad at predicting change; and if the Molina-Toledo theory of social metabolism is based on Marxist insights, it will be no better at predicting change than earlier system-based theories.

What can we agree on, then? First, this book is about an important problem on which rests the survival of humanity; that itself is enough reason to read the book. Second, in seeking answers, this book is right to examine the troubled relationship between human and natural systems. Third, a search for answers must rely on historical data about *material*—and not merely *ideational*—variables. People, unlike ideas, die in more than a metaphorical sense. Fourth, in order to be useful, this book must do more than urge us to embrace the problem, castigate capitalism, or call for a frugal pattern of consumption. Such exhortations, time has shown, will ultimately be insufficient.

As Molina and Toledo rightly point out, the problem of a faulty social metabolism will fall unequally on different subpopulations of humanity, at least in the short term. The poorest and most vulnerable will suffer soonest and worst; but they will push back. Indeed, as the authors note, we already see an abundance of political protest movements forming around issues of food shortage, water shortage, deforestation, and soil degradation. People are starving, and they are fighting back. In many instances, wars erupt between haves and have-nots, and between tribal groups that are differentially blessed by advantage. More dramatically, the have-nots are fleeing war zones, and the world is awash in refugees. Here, then, is a system-produced source of system change!

Currently, some in the privileged West are debating whether these desperate migrants are truly refugees or merely "economic opportunists"—conventional immigrants looking for better jobs, housing, and social services, and jumping the queue to gain opportunities in the West. This is an ugly debate, and perhaps one to which there is no right answer. If the world's social metabolism breaks down, we will all be in danger, and soon we would all be refugees. As the authors point out, these problems are not merely local, nor merely regional; they are global, and they will not be solved through market pricing mechanisms. Read this book.

Diversity Explosion: How New Racial Demographics are Remaking America

by William Frey
Washington: Brookings Institution Press, 2015
ISBN: 978-0-81572-398-1
Softcover, $29.95, 224 pp.

Reviewed by Alain Bélanger
Institut national de la recherche scientifique, Montreal

William Frey is a well-known demographer, with almost four decades of experience studying immigration, internal migrations, and racial composition at different geographic scales in the United States. He is definitely well-positioned to describe the recent changes in the racial make-up of the USA, and to analyze the immediate and future implications brought by the "explosive growth of new racial minorities"—Hispanics, of course, but Asians and multiracial persons as well.

Diversity Explosion is written for a large audience. Specialists will nevertheless appreciate the remarkable effort made at synthesis. According to the author, most people are aware of this ethnic growth—after all, it is visible in most metropolitan areas, including their suburbs—but a few can adequately figure out its scale. Frey's goal is to communicate the magnitude of the new racial demographic shift and its potential to the common layman. This goal is successfully achieved, thanks to the effective prose of the author and the abundance of tables, figures, and maps that richly illustrate the book.

By way of introduction, the first chapter presents an overview of the long-term changes (1970–2050) in racial composition of the USA. It also sets the stage for the rest of the book, by presenting the different population groups that will be under focus and the geographical typology used to describe their spatial diffusion. An emphasis is put on four different groups: Hispanics, the largest minority group, which is still rapidly growing; Asians, a more recent minority but an even faster-growing group; Blacks, the traditional minority group, whose growth is slower due to less net migration; and finally, the aging, almost stagnant, and soon declining white population.

The second chapter compares the age structures of the different population groups, and describes the emerging cultural generation gap. In this chapter, the author discusses the paradoxical schools of thought on how to address the issue of the aging white baby-boomer population and the coming ethnically diverse new generations. While the older generations favour smaller government, less taxes, and fewer social support programs, the younger tend to support increased government spending on education, health, and social welfare. The penultimate chapter of the book returns to a consideration of the divergent views and focuses on the importance of minority votes on recent

(and forthcoming) presidential campaigns. Chapter 3 takes a spatial perspective and illustrates the American racial geographic spatial patterns using several colour maps.

The core of the book (chapters 4 to 7) is very descriptive. Each of the chapters focuses on one of the four population groups. The chapters on Hispanics and Asians follow similar narrative structure, presenting the different countries of origin of the studied population, a socio-demographic profile contrasted to the white population's profile, and a brief spatial analysis. The chapter dedicated to the black population takes another approach and focuses on their internal migration patterns. It shows that although there are important moves from the Rusted Belt states to the New Sun Belt states, the migration is highly selective of the most educated. Chapter 7 reports on the white population, thoroughly describing the internal migration patterns while contrasting the new white flight with the earlier one. The white flight that occurred in the 1950s and 1960s is defined as white families moving from central cities to mushrooming suburbs, and the new white flight involves moves to newer and smaller areas of more distant outer suburbs and exurbs. At the macro scale, the new white flight is characterized by North-to-South moves. Due to low natural increase and low net international migration, the internal migration is almost a zero-sum game for the white population; the growth in attractive regions is contingent to population declines in less attractive regions.

Chapters 8 and 9 take a different geographic scale and look at the mobility between cities and suburbs, as well as at neighborhood segregation. It demonstrates that new minorities, particularly Hispanics, now dominate city and suburban growth in the largest metropolitan areas. Yet, whites still constitute the majority in the suburbs of the top 100 largest metropolitan areas, but minorities have been the majority in their central cities since the 2000 Census. In the Melting Pot areas (where large number of new immigrants are landing), there is evidence that neighborhood racial segregation is declining, perhaps because the new minorities are not as stigmatized as Afro-Americans. Although black/white neighbourhood segregation is also generally declining, the pace of this decline has been very slow since 1990, particularly in less attractive northern cities such as Milwaukee, Cleveland, or Detroit. In these areas, demographic inertia and aging in place conjugate with the new black flight, and outmigration of its better-educated segments to the New Sun Belt, to maintain a concentration of black children in high-poverty areas. Furthermore, Hispanic and Asian segregation indexes are stagnant, because the spatial integration of long-term residents is mitigated by higher segregation levels among new immigrants. Yet, segregation levels among these ethnic groups remain lower than those of the Afro-American population.

Immigration alters the population in many aspects: demographic, spatial, political, cultural, and socio-economic. Frey admirably covers the first three elements of this list, but less well the last two. The general tone of the book is positive and optimistic. Like many other authors, Frey celebrates racial and ethnic diversity and anticipates the achievement of a new post-racial society. In his view, large cohorts of new immigrants are much needed, if only to prevent a decline in the labour force population. He believes that they will fully integrate and rapidly reach the mainstream productivity level, though the facts he describes and discusses speak the opposite. He recognizes that conflicts may arise between a growing young minority population and an aging white population over public resources. He further recognizes that racial segregation is still very important in the USA, which has implications on the quality of the education that minorities are receiving, and consequently on their future well-being. Frey recognizes that there are continuing sharp social and economic divides between the disadvantaged minority group members and the white population, and that the recent recession has exacerbated economic disparities between whites and minorities. Yet, he believes that America is on the cusp of great change, and that the (white) population will soon both embrace

and nurture the diversity. Somehow, in light of these assertions, Frey's conclusion appears more like wishful thinking than an evidence-based deduction. Socio-economic inequalities between blacks and whites might have decreased to a certain extent since the early 1960s, but fifty years after the Civil Rights Laws, racial inequalities are nowadays still very prevalent. Yet, the former was a time when the State was socially more involved in the economy. Since Reagan's era, neoliberal policies and laissez-faire economics are on the rise in most of the Western world, and perhaps even more in the USA. Incidentally, economic inequalities are also on the rise. In the context of increasing fiscal austerity, deregulation, free trade, globalization, and outsourcing of manufacturing jobs, it is difficult to foresee how the needed political and economic actions necessary to reduce racial and ethnic differences in poverty can be put forward, and how less educated minorities can access better-paid and rewarding jobs.

Counterfactual and Causal Inference: Methods and Principles for Social Science Research

by Stephen L. Morgan and Christopher Winship
2nd edn, New York: Cambridge University Press, 2015
ISBN 978-1-107-69416-3
Softcover, $43.95, 504 pp.

Reviewed by Peter Messeri
Mailman School of Public Health. Columbia University (New York)

Stephen L. Morgan and Christopher Winship's 2007 book *Counterfactual and Causal Inference*—along with Shadish, Cook, and Campbell's *Experimental and Quasi-Experimental Designs for Generalized Causal Inference* and Angrist and Pischke's *Almost Harmless Econometrics*—take pride of place in my personal quantitative methods library. A common theme uniting these texts is the embrace of the counterfactual approach to causal inference and analysis.

The attraction of the counterfactual framework for causal inference is that it presents a mathematically elegant definition of causal effects that dispenses with the spatial-temporal constant conjunction definition of causality. The counterfactual framework imagines that individuals may occupy multiple causal states and each has multiple potential outcomes, one for each causal state. The causal effect for an individual is then defined as the difference in his or her potential outcomes for two causal states. Since an individual can occupy only one causal state at a time, only one potential outcome can be observed as the actual realization of the outcome. The potential outcomes for the remaining causal states are the unobserved counterfactuals. Although this definition rules out identification of causal effects for individuals, the simple but rigorous mathematical definition of causal effects, and the clearly articulated identification problem, have proven to be extraordinarily fruitful in motivating the development of new lines of research into innovative methods for estimating various population-averaged causal effects.

In 2007, Morgan and Winship published the first comprehensive textbook on the counterfactual approach. It is therefore of great interest to discover what new material the authors added to the second edition of *Counterfactual and Causal Inference*, published eight years later. Befitting a field of research with an actively growing literature, the second edition page size increased by 29 percent, and the number of pages of text from 290 to 450. The authors have done their due diligence in updating the book's references. Indeed, I counted 231 entries published between 2007 and 2014 in the book's 49-page bibliography.

Under the counterfactual rubric, Morgan and Winship bring together several strands of research, dating from the 1970s. The most prominent is the counterfactual approach to causal inference and matching estimators developed in statistics, and the parallel development of the potential outcomes approach to counterfactual causal inference and instrumental variable estimators in economics. Finally, there is Judea Pearl's (2009) singular contribution of a graph-theoretic approach to causality.

The greatly expanded second edition goes into greater depth on topics found in the original edition, and adds new material, but it maintains the organization of topics covered in the original edition. A short introduction chronicles the history of causal analysis in the social sciences—the rise and overreach of the "Age of Regression" analysis and the subsequent emergence of the counterfactual/potential outcomes approach. The book's second section presents basic concepts and definition of counterfactuals, potential outcomes, and average causal effects. It continues with a comprehensive introduction to Judea Pearl's directed acyclic graphs, or DAGs, which the authors wisely choose to refer to, less mysteriously, as *causal graphs*.

The bulk of the remaining book is divided into two sections that focus on methods for estimating causal effects. The first presents matching algorithms and regression methods for estimating casual effects when conditioning on observable variables is sufficient to identify the causal effect of interest. This section incorporates Pearl's "back-door" criteria for determining when causal effects are identified by observed variables. The next major section covers identification of causal effects when conditioning on observables is ineffective. It begins with a new chapter on potential outcome models, and causal graphs incorporating latent variables for selection and effect heterogeneity, followed by an expanded treatment of instrumental variable methods and natural experiments. The section then turns to Pearl's front-door criteria for identification of causal effects that specifies an exhaustive and isolated set of intervening causal mechanisms. It concludes with the potential outcomes approach to time series analysis, panel data methods, selection bias models, and sensitivity analysis.

The book concludes with major objections to the counterfactual approach, and the authors' rejoinders and a brief account of how the counterfactual approach fits within a more general mode of causal inquiry in the social sciences.

The mathematics required to grasp the book's content are covered in a first semester applied probability and statistics course, as well as familiarity with principles of regression analysis and rigorous program evaluation. Derivation of mathematical formulation and descriptions of the construction of causal graphs are followed by lengthy textual exposition intended to unpack the mathematical formulations and explain graphic representations. Despite Morgan and Winship's straightforward exposition, the more complex arguments are not always easy to follow and require careful reading in order to pick up the subtleties packed into the text. Many "demonstrations" are scattered throughout the text that present simulations or substantive examples which concretely illustrate the more abstract principles.

The second edition's most substantial enhancement is the increased prominence given to Pearl's contribution to the causal inference literature. A central theme of the second edition is to confer coequal and complementary status on causal graphs and potential outcomes approaches for identifying causal effects and formulating more cogent causal models. Every counterfactual application covered in the text has both a potential outcomes mathematical derivation and casual graph representation. The expanded coverage given to casual graphs makes the second edition a much better how-to manual than the first in constructing causal graphs and their application for diagnosing and solving identification problems.

Other new and expanded topics to be found in the second edition include elaboration of effective methods of regression analysis in the estimation of average treatment effects, a chapter on causal graphs and potential outcome perspectives applied to selection and unmeasured effect heterogeneity, interpretation of instrumental variables in the presence of individual-level heterogeneity, recent developments in estimating local average treatment effects, the virtues of intervening mechanisms for deep explanations, and use of multiple pre-treatment observations to model causal effects.

My reservations are relatively few and mostly address what is missing in the book. Although the first chapter summarizes six studies that we are told are used as examples throughout the book, concrete illustrations are mainly drawn from James Coleman's study of the effect of Catholic school education on learning, and an instrumental variable study of school vouchers and learning. There are good reasons for the heavy reliance on the Coleman study, as he was the acknowledged master in empirical tests of carefully specified theoretical models. The large critical secondary literature and Coleman's rejoinders provide a rich empirical reservoir for concrete illustrations of the plausibility of common model assumptions and causal specifications. However, an understanding of the common and unique challenges confronting the counterfactual approach across disciplines would be better served by more illustrations drawn from the life course, public health, job training, and voting studies summarized in the introduction.

Despite the detailed presentation of casual graphs, I would have liked more causal graphs from actual rather than hypothetical studies. This is particularly true for the exposition of a *collider*, a seemingly innocuous variable that is determined by two or more causally antecedent variables. With the collider, they form part of a blocked back-door pathway. When unrelated determinants—the independent variables, if you will—are conditioned on the collider, the dependent variable, the seemingly counterintuitive result, is to induce an association between the independent variables and unblock the previously blocked back-door pathway. An analyst that unwittingly adds a collider under the mistaken belief that it will control for latent variable confounders—for example, adding a lagged outcome to the list of observed independent variables—may have the opposite effect of creating new confounding. Now the authors persuasively demonstrate that Pearl's logic is impeccable for diagnosing a potentially flawed strategy to identify casual effects. However, the logic is not easy to grasp, and more concrete illustrations from actual rather than hypothetical situations would have been a more convincing demonstration of the practical rather than the theoretical importance of the collider.

For clarity of theoretical exposition, the text restricts model specification to binary causal variables and interval or continuous outcomes. Discussion of extension of casual variables with ordinal or multiple states is generally limited, although the authors do refer the interested reader to the relevant literature. There was no discussion of the state of the art, if any, of extensions to outcomes that are constructed from binary, count, or survival data.

The second edition of *Counterfactuals and Causal Inference* should be part of the personal library of any social scientist who is engaged in quantitative research. For those with a copy of the first edition, purchase of the second edition is indeed well worth the investment. I would hold on to your copies of the first edition. In my opinion, the second edition entails a more rigorous treatment of similar material covered in the original text; for good reason, it is now an intermediate textbook suitable for advanced graduate seminars on causal analysis, whereas the original edition remains a suitable textbook for an undergraduate or a first-year graduate quantitative methods course that requires a nontechnical introduction to current concepts in causal analysis.

Additional References

Angrist, J.D., and Joro-Steffen Pischke. 2009. *Mostly Harmless Econometrics: An Empiricist's Companion*. Princeton: Princeton University Press.

Pearl, J. 2009. *Causality: Models, Reasoning and Inference*. 2nd ed. Cambridge (UK): Cambridge University Press.

Shadish, W.R., T.D. Cook, and D.T. Campbell. 2001. *Experimental and Quasi-Experimental Designs for Generalized Causal Inference*. Boston: Houghton Mifflin.

Gender and International Migration, from the Slavery Era to the Global Age

by Katharine M. Donato and Donna Gabaccia
New York: Russell Sage Foundation, 2015
ISBN: 978-0-87154-546-6
Softcover, $37.50, 254 pp.
e-book ISBN: 978-ooo1-61044-847-5

Reviewed by Lorna R. Marsden
York University (Toronto)

This is an extraordinarily important and useful book for population experts as well as social scientists in general. As our television screens document the sorrowful exodus of masses of people out of the Middle East into Europe and elsewhere, this study helps to put this crisis into context. In fact, it is more than helpful. It is crucial reading if we are to understand our current situation in the history of Western population movements.

Donato and Gabaccia have cast a wide net and taken the long view. The long view is to follow studies of migration, mostly into the Americas, from the sixteenth century to the early twenty-first century. This casts a new light on the questions of the migration of women, popularly viewed as a recent development. The wide net is to have examined the work not only of demographers but also historians, linguists, and social scientists of many kinds. They gather up many studies of the movements of people, providing new insights usually ignored in demographic studies.

We follow a fascinating story derived from the analysis of flows of migrants, and then, in a later section, from the analysis of stocks. This approach sounds rather dull and routine, but it is far from that. In fact these chapters, which make up the bulk of the book, are downright exciting. They are rich with hypotheses about why migrations were male-dominant, male-predominant, or gender-balanced. Their lengthy examination of the Trans-Atlantic Slave Trade Database casts light on our understanding of nuances of the trade, and makes explicit the importance of looking at both stock and flow data. In the "proletarian migrations" from 1800 to the mid-1920s, and subsequent twentieth-century migrations, they draw upon International Migrations data and, later, UN and ILO data, despite their limitations. All sources of data used are described in detail. For students of demography who struggle with the tangled and inadequate data issues on migration, they raise very important questions about results obtained from using only one data set. For example, the consequences for both sending and receiving countries of labor force participation, intermarriage, and languages emerge from different types of historical, economic, and stock and flow data, and begin to differentiate the migration patterns of women from those of men. This study is a splendid example of how a wide range of disciplines can help us understand the analysis of population movements in the 21st century. It also

helps us see why the periodic hysteria about refugee and economic migrations that emerge in some receiving countries is misguided.

To use this short monograph with students, first I would have them read carefully both the Introduction and Part I of the book. In these first 52 pages, the authors pack in so much sophisticated understanding of the transition of sex-based data into gender analysis; of the complexities of migration data, which is no minor headache; and of the sobering fate of women demographers in North America prior to the 1960s that those pages alone justify buying this book.

On this latter point, they distinguish between those North American women researchers working in "state science" as compared to "social science" in the first half of the twentieth century. Having myself seen the work of Irene Tauber in the Office of Population Research at Princeton University in the mid-1960s, it is good to now see the work of her generation of women statisticians used in relation to the feminist school that "completely rejected the epistemological foundation of the women's statisticians' research on sex and migration" (p. 28). The authors revive the meaningful use of migration data through their theoretical discussion in a brief but clear and compelling analysis of "the gender challenge," and in subsequent use of both sex and gender concepts throughout the chapters that follow. It is a model that could be usefully employed in re-reading earlier migration studies.

No doubt, debates will flourish among readers of this work. Fine points will be made. Quibbles will arise with the data, theory, analyses, and the titles used on some of the figures and tables. Good—that's how real scholarship works. But if you have the slightest interest in looking at our Canadian population situation and data with fresh eyes and putting our migration history into the context of the rest of the Western world, or in helping your students understand the sex-gender differences, read this monograph.