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Abstract

Background: Medical screening plays a role in explaining the healthy immigrant effect (HIE) among immigrants newly landed in Canada. The 2002 *Immigration and Refugee Protection Act* (IRPA) modernized immigration selection by exempting certain immigrant categories (e.g., refugees and certain family-class immigrants) from inadmissibility on health grounds. This study examines the HIE in the IRPA era by sex, with a focus on those categories affected by the IRPA.

Data and methods: The linked Canadian Community Health Survey (CCHS)-Longitudinal Immigration Database (IMDB) was used to compare sex-specific age-standardized proportions of four health measures between Canadian-born and immigrants aged 20 to 65, overall and by duration since landing. Immigrants who landed within three years of the surveys from 2007 to 2014 were examined by sex and immigrant category. Logistic regression was used to further compare the HIE in the same immigrant sub-groups to the Canadian-born, controlling for age and selected confounders.

Results: This study found the HIE in most selected measures for immigrants overall, as well as for those recent immigrants arriving under the IRPA, including the family class. Among refugees, the HIE was observed only in less severe chronic conditions; this was especially the case among females. As expected, a strong HIE was observed among economic-class principal applicants. These health advantages persisted even after adjustment for socioeconomic and health factors. For self-rated health, the advantage existed for some groups only after full adjustment.

Interpretation: This study is a first look at the healthy immigrant effect under the 2002 *Immigration and Refugee Protection Act* by immigration category. Results corroborate the existing literature on the presence of the HIE among immigrants: the HIE was found to be much weaker among refugees.

Keywords: immigrant category, refugee, health, Canada, *Immigration and Refugee Protection Act*, IRPA

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In 2016, immigrants to Canada accounted for 7.5 million people, or almost 22% of the Canadian population.¹ According to Immigration, Refugees and Citizenship Canada (IRCC), almost one million immigrants will be admitted from 2018 to 2020.² Given the growth in Canada's immigrant population, it becomes increasingly important to monitor immigrant health. The well-established literature on the Healthy Immigrant Effect (HIE) finds immigrants to be healthier than the Canadian-born population at their time of arrival, but observes that this health advantage, possibly due to difficulties in adjusting to new environment, stress and/or adoption of risky health behaviors³, diminishes over time.⁴⁻⁷ Meanwhile, in addition to the Canadian immigration point system, which tends towards the selection of individuals with higher human capital, such as education and language skills for the economic class of immigrants, systematic selection through medical screening tests and positive self-selection were two of the important explanations for the initial health advantage of most immigrants.

The 1976 *Immigration Act* reaffirmed the requirement for immigrants to undergo a medical examination; those deemed to reasonably be expected to cause excessive demand on the health care system were denied immigration status.⁸ The *Immigration and Refugee Protection Act* (IRPA) of 2002 modernized this by exempting certain immigrant categories (such as refugees and selected groups within the family class) from this medical admissibility test (see Appendix 1).⁹ Recently, while only about 1,400 applicants out of 525,000 potential immigrants (about 0.3%) annually were deemed inadmissible to Canada for health reasons by IRCC post-IRPA,¹⁰ the effect of positive self-selection is hard to quantify. The number of potential

immigrants who did not apply for immigration as a result of the need for medical screening and an admissibility assessment is not known. However, given that about 27% of potential immigrants were exempted in recent years under the IRPA from the excessive demand inadmissibility ground on health or social services,¹⁰ it is important to provide insights on the health impact of the IRPA exemption by using a newly linked database that includes immigrant categories. This excessive demand was originally evaluated in accordance to a monetary threshold of \$6,604 per year for five years, an amount based on the average cost for Canadian per capita on health and social services.¹¹

Linking the Canadian Community Health Survey (CCHS) to the Longitudinal Immigration Database (IMDB) provides opportunities to explore the impact of the IRPA on the HIE across immigrant categories. This study, based on the CCHS-IMDB linked database, offers a first look at the HIE among selected immigrants arriving under the IRPA by comparing these results with those for their Canadian-born counterparts. Three questions are examined separately by sex, as follows: First, has the HIE at time of arrival disappeared under IRPA for those landing in Canada within 3 years of the survey from 2007 to 2013? Second, what is the pattern of HIE by immigrant category, especially for those selected IRPA-affected categories (who landed in Canada within three years)? Thirdly, would the HIE disappear after one had adjusted for confounding factors?

Data and methods

Data sources

The Immigrant Landing File (ILF) is an administrative census of landed immigrants in Canada with information on age, sex

and other immigrant-related characteristics (e.g., immigrant categories) for all years since 1980. The Longitudinal Immigration Database (IMDB) is a database that combines the ILF and tax files in Canada. Both the ILF and the IMDB have no health-related information.^{12,13}

The CCHS annual components include cross-sectional information on health, behaviours and health care use for the non-institutionalized household population aged 12 and older.¹⁴ First conducted in 2001 (cycle 1.1), the CCHS was repeated every two years until 2005 (cycle 3.1) (n=130,000 each cycle). From 2007 onward, the CCHS was conducted annually (n=65,000). Annual components of the CCHS cycle 2.1, cycle 3.1, 2007 to 2014, plus two focus content cycles related to mental health in 2002 and 2012, were in-scope for the linkage.¹⁵ Overall, about 84% of these CCHS respondents agreed to share their responses and to link them with other data sources.

This CCHS-ILF linkage was conducted under the Social Data Linkage Environment (SDLE) at Statistics Canada through a dynamic relational database of basic personal identifiers, the Derived Record Depository (DRD).¹⁶ Specifically, close to 6.7 million of 6.9 million eligible ILF records between 1980 and 2013 (97%) were either found in the DRD through common identifiers or added to the DRD as new contributors.¹⁷ Likewise, about 95% of respondents who agreed to share-link their CCHS records from 2001 to 2014 were linked to the DRD.¹⁸ In total, 39,420 CCHS respondents were linked to the ILF, and hence the IMDB, through the DRD.

Of the 46,905 CCHS respondents who self-reported as immigrants arriving between 1980 and 2013, 37,610 were linked to the IMDB (a linkage rate of 80%).¹⁵ Those immigrants arriving before 1980 were excluded. Special share-link weights and bootstrap weights were used to adjust for non-agreement to link. Validation analysis indicated that the linked CCHS-IMDB file is representative of immigrant cohorts by immigration category. No outstanding

socio-economic discrepancies were detected between the linked file and the CCHS or IMDB.¹⁹

Study cohort creation and definition

Since immigrants before 2004 would likely be arriving under a mixture of pre-IRPA and IRPA regimes, this study used a pooled cohort of CCHS respondents for 2007 to 2014 (n= 427,650) linked to the IMDB for 1980 to 2013. Some 33,760 unlinked CCHS self-reported immigrants and 3,700 individuals with unidentifiable immigrant status were dropped from this pooled cohort resulted in an initial study cohort of 24,910 IMDB immigrants (defined as those who were linked to the IMDB) and 365,275 Canadian-born.

Following previous research that used the CCHS to examine the HIE,^{4,5,20} this study looks at CCHS respondents aged from 20 to 65, and excludes those residing in the territories, those having a Body Mass Index (BMI) of less than 10 or greater than 50, students, pregnant women, or those for whom information on the selected health behaviour risk factors is missing. After all exclusions, the final study cohort has 15,980 IMDB immigrants and 200,165 Canadian-born, representing some 16 million population in total.

Outcome and immigration-related variables

Following previous CCHS-based research to study the HIE, this study used four health measures, which include two sets of chronic diseases, overweight, and self-rated health (SRH).^{4,5} First, respondents were classified as having a non-life-threatening chronic condition (at least one of asthma, back pain, high blood pressure, migraine, ulcer, and arthritis; grouped under Chronic A) or a more serious chronic condition (at least one of heart disease, cancer, diabetes, and Crohn's disease; grouped under Chronic B) on the basis of their answers to questions about long-term chronic health conditions diagnosed by a health professional. Second, "overweight" is defined

as having a BMI of 25 or more (which includes "obese"). The BMI is calculated by dividing self-reported weight in kilograms by self-reported height in metres squared. Finally, SRH is considered low when the response to a five-point question on health (given a range of "excellent" to "poor") was either "poor" or "fair."

Immigrant status and time since landing were based on IMDB records. Duration since landing, defined as the difference between the IMDB landing year and the CCHS survey year, was categorized as recent (those surveyed within 3 years of landing), medium-term (from 4 to 9 years) and long-term (10 years and more).²⁰ Taken together, the recent immigrants surveyed between 2007 and 2014 were those who arrived under IRPA while medium-term and long-term immigrants arrived under mixed regimes before and after IRPA. The linkage also found "pre-landing immigrants" who were CCHS respondents surveyed as temporary residents in Canada before officially landing as immigrants; these were included as immigrants.

Immigration categories include economic-class principal applicant, economic-class spouse or dependent, family class, refugee, and other immigrants. IRPA-affected immigrants, the focus of this study, are recent immigrants arriving under those categories exempted from the medical admissibility test, such as refugees (including both Convention refugees and protected persons) and members of the family class (excluding parents and grandparents). Since this study cohort includes only respondents aged 65 or younger, most parents and grandparents in the family class are already excluded. "Protected persons," defined under the *Geneva Convention* relating to the status of refugees, include individuals "in need of protection" that may not meet the legal definition of Convention refugee. Individuals can apply through the asylum claimant process from within Canada to become a "protected person." The decision regarding the granting of "protected person" status is made in Canada through a judicial process.

Selected socioeconomic status and health risk variables

In regard to income, respondents were classified according to whether they fell into the lower 50% of the deciles on the basis of their adjusted household income ratio at the national level. Respondents were classified as home owners if they

lived in a dwelling owned by a member of the household. “Ethnicities” refers to the self-identified cultural / racial background as follows: White, Black, Asian, or other.

For health risk factors, “smoker” includes daily and occasional smokers, as well as former smokers who had quit smoking less than one year before. “Physically inactive” respondents were those with a calculated total daily energy expenditure of less than 1.5 kcal/kg/day. “Dietary risk” was captured by daily consumption of fewer than five servings of fruits and vegetables or eating fruits and vegetables fewer than five times per day.^{21, 22}

Methods

Cohort characteristics were first presented by immigrant status and sex, with a focus on recent immigrants arriving under the IRPA. To examine the presence of the HIE under the IRPA, age-standardized proportions (ASPs) of four health outcomes for overall immigrants, by duration since landing, and then by immigrant category among recent immigrants, were compared to those of the Canadian-born population, by sex. Proportions were standardized to the 2011 National Household Survey for three age groups: 20 to 39, 40 to 54, and 55 to 65.²³ Statistical testing for differences in ASPs was done by conducting an adjusted Wald Test using the Canadian-born as reference.

Logistic regression was used to examine the HIE by sex for the four health outcomes, controlling for age, socioeconomic status and selected health risk factors, in two steps. The first step was to use the Canadian-born and the immigrant subsample to derive the odds ratios to evaluate the HIE overall and by duration since immigration, with a focus on recent immigrants who landed under the IRPA between 2007 and 2014. The second step was to use the Canadian-born and the recent immigrant cohort to estimate the odds ratios to examine the HIE by immigrant category, with a focus on IRPA-affected immigrants, namely, refugees and the family class.

All analyses were conducted in Stata/MP (version 14) and weighted with CCHS combined share-link weights and the bootstrap weights for the variance estimation.^{15, 24}

Results

Descriptive characteristics

To simplify, the term “immigrants” refers to “IMDB immigrants” in the analysis results under both the Results and Discussion sections. Among the estimated 2.6 million immigrants (17% of the study cohort), about 14% were recent immigrants (Table 1). Immigrants were slightly younger, while recent immigrants were at least seven years younger, than their Canadian-born counterparts. The breakdown is as follows: 15% of male immigrants and 12% of female immigrants were refugees; 27% of male immigrants and 33% of female immigrants were family-class immigrants. About 2% of these immigrants were “pre-landing,” i.e., those interviewed as temporary residents. More recent immigrants landed as economic-class principal applicants, and fewer belonged to IRPA-affected categories, than was the case for immigrants overall.

Socio-demographically, a higher proportion of male immigrants than Canadian-born males were married and lived in households with higher education. Proportionally more male immigrants than Canadian-born males were in the lower half of the household income distribution. Females exhibited a similar socioeconomic differential by immigrant status. Yet, while more male but fewer female immigrants were employed, fewer immigrants than Canadian-born owned their homes.

Health-wise, immigrants, regardless of sex, were less likely to be smokers but were more likely to be physically inactive than Canadian-born respondents. The dietary behaviours of immigrants and Canadian-born were similar.

What is already known on this subject?

- The difference in health outcomes of immigrants to Canada varies by duration since landing
- Recent immigrants tended to have the best health. This may be due to medical screening and the admissibility test required by immigration authorities or to other factors.
- Recent policy changes under the 2002 *Immigration and Refugee Protection Act* exempt refugees and certain family-class members from medical admissibility requirements.
- Little research has been done to examine the health of those affected refugees and certain family-class members since the policy changes came into effect. This is due in part to lack of data.

What does this study add?

- Results show that the health advantage observed among those aged 20 to 65 has persisted among most recent immigrants, by category, who entered Canada under the new Act.
- This advantage is notable among the family class vs. those born in Canada for most selected health measures.
- For refugees, the health advantage is observed only among females with less severe chronic conditions while, as expected, a strong healthy immigrant effect was observed among economic-class principal applicants.

Age-standardized proportion comparison between Canadian-born and immigrant respondents by duration

For both sexes, the HIE was observed in the selected health measures (with the exception of low SRH) for immigrants, especially recent arrivals under the IRPA (Table 2). For example, the ASP for Chronic B was 11.8% (95% confidence interval (CI)=11.5 to 12.1) among Canadian-born males, 10.4% (95% CI=9.3 to 11.5) among IMDB male immigrants overall, and 4.8% (95% CI=1.5 to 8.0) among IRPA recent arrivals.

Multivariate comparison between the Canadian-born and immigrants by duration

The age-adjusted logistic regression results for either sex echoed the above-mentioned ASPR results, as expected. However, the odds ratios of low SRH for male immigrants became significantly lower than that for the Canadian-born population after full adjustment for socioeconomic and health risks adjustment (e.g., OR= 0.41, 95% CI from 0.23 to 0.70 for recent immigrants) (Table 3). Note that results with and without health risk adjustments

were very similar (data not shown). By contrast, for females, the odds ratio for SRH associated with immigrants after full adjustment remains insignificant (OR = 0.91, 95% CI from 0.75 to 1.11), though the odds ratio for recent immigrants was significantly lower by duration (OR = 0.40, 95% CI from 0.25 to 0.65).

Pre-landing immigrants were significantly less likely to report chronic diseases than the Canadian-born after full adjustment. For example, for males, the odds ratio for Chronic A was 0.45 (95% CI from 0.24 to 0.85), and the odds ratio

Table 1
Percentage distribution of selected characteristics, by sex, aged 20 to 65 in CCHS-IMDB 2007 to 2014, Canadian-born and immigrants (recent and overall)

	Male (N = 8,355,000)			Female (N = 7,887,000)		
	Canadian-born	IMDB immigrant		Canadian-born	IMDB immigrant	
		All	Recent immigrant		All	Recent immigrant
Population size (N)	7,005,000	1,350,000	177,000	6,563,000	1,324,000	180,000
Sample size (n)	94,845	7,550	985	105,810	8,430	1,115
Percent of total population (%)	84	16	2	83	17	2
Mean age (years)	43	42	36	44	42	36
	column percentage (%)					
Immigrant-related variables						
Immigrant landing duration						
Pre-landing	...	2	2	...
Recent (0 to 3 years)	...	13	100	...	14	100
Medium-term (4 to 9 years)	...	25	23	...
Long-term (10 years or more)	...	60	61	...
Immigration category						
Economic-class principal applicant	...	35	45	...	20	31
Economic-class spouse / dependent	...	18	18	...	30	29
Family class	...	27	24	...	33	27
Refugee	...	15	8	...	12	7 ^E
Other immigrant	...	5	4 ^E	...	4	6 ^E
Socio-economic characteristics						
Married or common-law	67	76	79	67	74	81
University degree and above - at household level	30	54	60	32	54	60
Employment status						
Employed	83	88	86	75	70	61
Unemployed	4	5	6	3	6	13 ^E
Not in labour force	12	7	8 ^E	22	23	27
Low 50% household income	33	59	72	40	62	70
Homeowner	76	67	33	76	65	37
Ethnicity						
White	93	28	28	93	26	21
Black	0	9	7 ^E	0	9	8
Asian	2	52	51	1	55	60
Other	5	11	14	5	10	12
Health risk factors						
Smoker	32	24	23	27	8	9 ^E
Physically inactive	44	56	58	46	61	61
Dietary risk	72	70	68	56	56	62

... not applicable

^E use with caution

Notes: Weighted counts rounded to the closest 1000, unweighted counts rounded to the closest 5; all proportion differences between linked immigrant and Canadian-born reported are statistically significant at a 95% confidence interval level, with the exception of consumption of fruits and vegetables and not in labour force.

Source: Canadian Community Health Survey linked to the Longitudinal Immigration Database file, 2007 to 2014, Statistics Canada.

Table 2
Age standardized proportions (ASP) of four health measures by sex, immigrant status and immigrant landing duration, aged 20 to 65[†]

ASP of health measure	Chronic A [§]			Chronic B ^{††}			Overweight (BMI ≥ 25)			Low self-rated health		
	ASP	95% confidence interval		ASP	95% confidence interval		ASP	95% confidence interval		ASP	95% confidence interval	
		from	to		from	to		from	to		from	to
Male												
Canadian-born [†]	43.5	43.0	44.0	11.8	11.5	12.1	64.5	64.0	65.0	9.4	9.1	9.7
IMDB immigrant	33.6*	32.0	35.2	10.4*	9.3	11.5	52.7*	50.9	54.5	9.1	8.0	10.1
Immigrant landing duration^{§§}												
Recent (0 to 3 years)	25.5*	18.4	32.6	4.8*	1.5	8.0	50.7*	43.9	57.5	5.5^E	2.7	8.2
Medium-term (4 to 9 years)	33.2*	28.9	37.4	10.9 ^E	7.1	14.6	54.3*	49.7	58.9	8.5 ^E	5.1	12.0
Long-term (10 years or more)	34.9*	32.9	36.9	10.9	9.7	12.1	53.2*	51.1	55.4	9.7	8.4	11.0
Female												
Canadian-born	50.3	49.7	50.8	14.7	14.4	15.1	47.0	46.5	47.5	9.8	9.5	10.1
IMDB immigrant	43.2*	41.4	45.0	10.3*	9.1	11.5	37.5*	35.8	39.2	10.5	9.4	11.6
Immigrant landing duration^{††}												
Recent (0 to 3 years)	40.7*	35.1	46.2	8.7*^E	4.5	12.9	37.0*	30.8	43.2	8.2^E	4.2	12.2
Medium-term (4 to 9 years)	42.6*	38.5	46.7	9.7*	6.8	12.6	38.7*	34.6	42.7	9.2*	6.6	11.8
Long-term (10 years or more)	45.6*	43.4	47.7	10.6*	9.3	12.0	38.6*	36.4	40.8	11.8	10.4	13.2

^E use with caution

* significantly different from reference category (p<0.05)

[†] reference category

[†] standardized to 2011 National Household Survey population aged 20 to 65, based on 20-to-39, 40-to-54, and 55-to-65 age groups.

[§] Chronic A is defined as having at least one of the following chronic conditions: asthma, back pain, high blood pressure, migraine, ulcer, and arthritis.

^{††} Chronic B is defined as having at least one of the following chronic conditions: heart disease, cancer, diabetes, and Crohn's disease.

^{§§} ASPs for pre-landing immigrants are suppressed given the poor quality of estimates.

Notes: sample excludes full-time and part-time students, pregnant women, residents in territories, those who had a BMI greater than 50 or less than 10, and those about whom information on smoking, physical activity or diet is missing; all estimation applied share-link subset bootstrap weights to account for complex survey design. BMI=body mass index.

Source: Canadian Community Health Survey linked to the Longitudinal Immigration Database file, 2007 to 2014, Statistics Canada.

for Chronic B was 0.12 (95% CI from 0.02 to 0.75).

Multivariate comparison between the Canadian-born and IRPA-affected immigrants

The age-adjusted odds ratios show that, for both sexes, members of the family class were significantly less likely to report adverse health conditions except for SRH (Table 4). However, the odds of low SRH among women recently arriving under the family-class category became significantly lower than those for their Canadian counterparts after full adjustment (OR = 0.44, 95% CI from 0.20 to 0.98). In contrast, the odds for refugees of all health outcomes were not significantly different from those for their Canadian-born counterparts, with the exception of Chronic A, especially for females.

Discussion

This is the first study using the CCHS-IMDB linkage database. It examines the health of immigrants by

immigrant category in the IRPA era. Since the IRPA exempted only select immigrant categories, such as refugee and certain family class, from the medical admissibility test, it is important to have health outcomes by immigrant category. A recent study based on pooled 2000-2012 CCHS cycles found that immigrants who arrived in the 1990s through the early 2000s were found to be healthier on arrival than Canadian-born, but that this HIE was not observed for more recent cohorts after 2006.²⁰ This loss in HIE could be IRPA-related. However, health data by immigrant category would be needed in order to evaluate this hypothesis.

Few previous Statistics Canada surveys have included information by immigrant category, with the important exception of the Longitudinal Survey of Immigrants to Canada (LSIC). The LSIC tracked settlement and health changes over time from 2000 to 2005 for the year 2000 immigrant cohort. The LSIC provides a rare glimpse of the pre-IRPA health outcome by immigrant category. It found that refugees had the highest health

risk among all immigrant categories and were more likely than other immigration categories to move away from good health.²⁵⁻²⁷ However, direct comparison to the Canadian-born population was not possible in the LSIC.²⁷⁻³¹ The linking of the CCHS to the IMDB offers a first look at the HIE after implementation of the IRPA with direct comparison to the Canadian-born population.

Three points bear noting. First, the findings from this study reaffirmed the HIE hypothesis for recent immigrants as well as for immigrants aged 20 to 65 overall, in terms of the presence of selected chronic conditions and being overweight. Second, with respect to IRPA-affected immigrants, the HIE was observed for family-class immigrants, except for SRH. The HIE was observed for refugees only in Chronic A, particularly for females. This inconclusive observation of the HIE among refugees could perhaps be attributed to the fact that refugees were by definition involuntary migrants who came to Canada to seek protection from wars, natural disasters, or persecution on the

Table 3

Age and fully adjusted odds ratio of logistic regression on four health measures, by sex, immigrant status and immigrant landing duration, aged 20 to 65

Reference: Canadian-born	Chronic A [†]						Chronic B [‡]					
	age adj.	95% confidence interval		full adj. [§]	95% confidence interval		age adj.	95% confidence interval		full adj. [§]	95% confidence interval	
		from	to		from	to		from	to		from	to
Male												
IMDB immigrants	0.63***	0.59	0.68	0.67***	0.60	0.74	0.86*	0.76	0.97	0.71***	0.61	0.83
Immigrant landing duration												
Pre-landing	0.45*	0.25	0.83	0.45*	0.24	0.85	0.15*	0.03	0.93	0.12*	0.02	0.75
Recent (0 to 3 years)	0.49***	0.39	0.61	0.48***	0.38	0.60	0.42***	0.27	0.66	0.30***	0.18	0.48
Medium-term (4 to 9 years)	0.60***	0.51	0.70	0.63***	0.54	0.75	0.87	0.65	1.16	0.69*	0.52	0.93
Long-term (10 years or more)	0.68***	0.62	0.75	0.73***	0.64	0.82	0.92	0.80	1.06	0.80**	0.67	0.94
Female												
IMDB immigrants	0.72***	0.66	0.78	0.76***	0.68	0.84	0.64***	0.56	0.73	0.62***	0.52	0.73
Immigrant landing duration												
Pre-landing	0.41***	0.26	0.66	0.41***	0.25	0.66	0.28	0.06	1.27	0.25	0.05	1.16
Recent (0 to 3 years)	0.55***	0.45	0.67	0.53***	0.42	0.66	0.52**	0.33	0.82	0.45**	0.27	0.73
Medium-term (4 to 9 years)	0.66***	0.57	0.76	0.69***	0.58	0.82	0.53***	0.40	0.71	0.49***	0.36	0.66
Long-term (10 years or more)	0.80***	0.72	0.87	0.85**	0.76	0.95	0.70***	0.61	0.82	0.69***	0.58	0.82

Reference: Canadian-born	Overweight (BMI ≥ 25)						Low self-rated health					
	age adj.	95% confidence interval		full adj. [§]	95% confidence interval		age adj.	95% confidence interval		full adj. [§]	95% confidence interval	
		from	to		from	to		from	to		from	to
Male												
IMDB immigrants	0.61***	0.57	0.66	0.77***	0.69	0.85	0.95	0.84	1.09	0.78*	0.64	0.96
Immigrant landing duration												
Pre-landing	0.72	0.46	1.15	0.92	0.56	1.50	0.85	0.25	2.87	0.66	0.21	2.13
Recent (0 to 3 years)	0.51***	0.42	0.63	0.65***	0.52	0.81	0.65	0.40	1.07	0.41**	0.23	0.70
Medium-term (4 to 9 years)	0.67***	0.58	0.78	0.86	0.72	1.02	0.86	0.62	1.21	0.67*	0.48	0.94
Long-term (10 years or more)	0.61***	0.55	0.67	0.75***	0.67	0.85	1.04	0.89	1.21	0.91	0.72	1.14
Female												
IMDB immigrants	0.67***	0.62	0.72	0.69***	0.63	0.76	1.07	0.95	1.22	0.91	0.75	1.11
Immigrant landing duration												
Pre-landing	0.38***	0.23	0.62	0.39***	0.24	0.66	0.11**	0.03	0.43	0.08***	0.02	0.31
Recent (0 to 3 years)	0.62***	0.51	0.77	0.60***	0.48	0.75	0.64	0.41	1.01	0.40***	0.25	0.65
Medium-term (4 to 9 years)	0.66***	0.57	0.76	0.68***	0.58	0.8	0.84	0.65	1.08	0.61**	0.45	0.83
Long-term (10 years or more)	0.70***	0.63	0.77	0.72***	0.65	0.8	1.26**	1.10	1.46	1.15	0.94	1.41

* significantly different from reference category ($p < 0.05$)

** significantly different from reference category ($p < 0.01$)

*** significantly different from reference category ($p < 0.001$)

[†] Chronic A is defined as having at least one of the following chronic conditions: asthma, back pain, high blood pressure, migraine, ulcer, and arthritis.

[‡] Chronic B is defined as having at least one of the following chronic conditions: heart disease, cancer, diabetes, and Crohn's disease.

[§] fully adjusted to socio-economic characteristics, including married or living common-law, university graduate and above education at household level, employment status, household income decile, home ownership, ethnicity, and health behavioural risk factors.

Notes: sample excludes full-time and part-time students, pregnant women, residents of the territories, those who had a BMI greater than 50 or less than 10, and those about whom information on smoking, physical activity or diet is missing; all regressions applied share-link subset weights and bootstrap weights to account for complex survey design.

Source: Canadian Community Health Survey linked to the Longitudinal Immigration Database file, 2007 to 2014, Statistics Canada.

basis of race, religion, etc. As expected, a strong health advantage was observed among economic-class principal applicants. Third, this study adjusted for socioeconomic and health risk factors in the multivariate model. Overall, results with and without adjustments for health risk did not change the conclusion (data not shown). Full adjustment changed the age-adjusted results somewhat in selected cases.

The HIE in terms of SRH was observed for recent immigrants but not for all IRPA-affected immigrant categories (especially refugees). This partially reflects that SRH is a multi-dimension health indicator and captured both physical and mental health. SRH is also a more subjective measure than chronic conditions and overweight.^{32,33}

The exemption set out in the inadmissibility clause of the IRPA may take time to implement given the operational chal-

lenges. For example, since the coverage and pricing of prescription drugs vary across provinces, it is difficult to conduct medical admissibility tests according to the predetermined threshold.^{34,35} Ongoing policy refinement to align with current health and social service costs in Canada (e.g. upward adjustment to the excessive demand threshold from \$6,604 to \$19,812 per year since April 2018) could have health implications that require continuous monitoring of immigrant

health.³⁶ Updating the CCHS-IMDB linked data in the future would be useful. Since hospital records have already been linked to the CCHS, adding hospital records to the CCHS-IMDB framework would provide more objective health care use surveillance.³⁷

Limitations and strengths

Cycle 1.1 of the CCHS was excluded from this linkage because no approval was granted to link to non-health data at the time of the survey.¹⁵ Hence, pre-IRPA baseline health information by immigration category was not available. The moderate sample size of recent

immigrants in the analytic cohort limited the number of covariates (geographic area, country of origin, etc.) that could be added to the regression models. This sample size limitation may not be a concern if the CCHS-IMDB linkage is updated in the future.

Like all self-reported survey responses, self-reported health measures

Table 4
Age and fully adjusted odds ratio of logit regression on four health measures by sex and immigration category, recent immigrants compared to Canadian-born, aged 20 to 65

Reference: Canadian-born	Chronic A [†]						Chronic B [‡]					
	age adj.	95% confidence interval		full adj. [§]	95% confidence interval		age adj.	95% confidence interval		full adj. [§]	95% confidence interval	
		from	to		from	to		from	to		from	to
Male												
Immigration category												
Economic-class principal applicant	0.42***	0.30	0.59	0.44***	0.31	0.62	0.36**	0.19	0.71	0.4*	0.20	0.81
Economic-class spouse / dependent	0.49*	0.29	0.86	0.5*	0.28	0.90	0.49	0.15	1.57	0.51	0.15	1.75
Family class	0.5**	0.30	0.82	0.44**	0.25	0.76	0.18***	0.07	0.47	0.15***	0.05	0.44
Refugee	0.51	0.21	1.24	0.38*	0.16	0.93	1.39	0.23	8.46	1.15	0.20	6.77
Other immigrant	1.13	0.43	3.01	1.01	0.41	2.48	0.71	0.03	16.22	0.69	0.03	15.37
Female												
Immigration category												
Economic-class principal applicant	0.54**	0.37	0.79	0.54**	0.35	0.82	0.27**	0.11	0.65	0.27**	0.10	0.70
Economic-class spouse / dependent	0.46***	0.31	0.68	0.46***	0.31	0.70	0.50	0.19	1.30	0.45	0.17	1.22
Family class	0.66*	0.46	0.95	0.67*	0.46	0.99	0.31*	0.10	0.92	0.28*	0.09	0.85
Refugee	0.31**	0.14	0.69	0.24***	0.11	0.53	1.45	0.42	5.02	1.09	0.30	3.92
Other immigrant	0.91	0.39	2.14	0.86	0.36	2.07	1.82	0.29	11.31	1.71	0.28	10.55
Overweight (BMI ≥ 25)												
Reference: Canadian-born	age adj.	95% confidence interval		full adj. [§]	95% confidence interval		age adj.	95% confidence interval		full adj. [§]	95% confidence interval	
		from	to		from	to		from	to		from	to
Male												
Immigration category												
Economic-class principal applicant	0.49***	0.37	0.66	0.64**	0.47	0.87	0.65	0.30	1.43	0.51	0.22	1.16
Economic-class spouse / dependent	0.42**	0.25	0.72	0.58	0.32	1.04	0.47	0.17	1.29	0.32*	0.12	0.91
Family class	0.56**	0.37	0.85	0.56**	0.37	0.86	0.59	0.13	2.78	0.29	0.06	1.47
Refugee	0.65	0.35	1.21	0.68	0.34	1.33	1.45	0.51	4.14	0.48	0.15	1.57
Other immigrant	0.79	0.30	2.12	0.83	0.30	2.27	0.27	0.07	1.12	0.18*	0.04	0.78
Female												
Immigration category												
Economic-class principal applicant	0.58*	0.37	0.90	0.63*	0.40	0.99	0.09***	0.03	0.27	0.06***	0.02	0.19
Economic-class spouse / dependent	0.71	0.50	1.02	0.76	0.51	1.12	0.68	0.22	2.07	0.36	0.12	1.14
Family class	0.48***	0.32	0.71	0.46***	0.30	0.69	0.79	0.38	1.65	0.44*	0.20	0.98
Refugee	1.02	0.41	2.53	0.66	0.27	1.63	0.76	0.17	3.35	0.29	0.06	1.33
Other immigrant	0.78	0.30	2.04	0.69	0.25	1.84	2.82	0.91	8.78	2.09	0.58	7.59

*significantly different from reference category (p < 0.05)

** significantly different from reference category (p < 0.01)

***significantly different from reference category (p < 0.001)

[†]Chronic A is defined as having at least one of the following chronic conditions: asthma, back pain, high blood pressure, migraine, ulcer, and arthritis.

[‡]Chronic B is defined as having at least one of the following chronic conditions: heart disease, cancer, diabetes, and Crohn's disease.

[§]fully adjusted to socio-economic characteristics, including married or living common-law, university graduate and above education at household level, employment status, household income decile, home ownership, ethnicity, and health behavioural risk factors.

Notes: sample excludes full-time and part-time students, pregnant women, residents of the territories, those who had a BMI greater than 50 or less than 10, and those about whom information on smoking, physical activity or diet is missing; all regressions applied share-link subset weights and bootstrap weights to account for complex survey design.

Source: Canadian Community Health Survey linked to the Longitudinal Immigration Database file, 2007 to 2014, Statistics Canada.

are subjective, and possibly biased by sociocultural factors, such as stigma, and non-random measurement errors, such as memory recall bias. For immigrants, especially recent immigrants, it might be more challenging to understand the concepts intended to be captured in health-related questions given existing language barriers and differences in cultural background. The obstacles mentioned above might also lead to under-diagnosis of chronic conditions if respondents' access to health care services is limited.³⁸⁻⁴⁰

The strength of this study is that the richness of the health data in the CCHS is now enhanced by linking to the IMDB. This provides a more comprehensive

picture of health by immigration category relative to the Canadian-born population since the exemption to inadmissibility on health grounds set out in the IRPA was implemented, in 2002.

Conclusion

This study is a first look at the healthy immigrant effect after the change in the immigration regulatory framework (IRPA). This study, based on a newly linked dataset, measured the HIE by selected chronic conditions and overweight, both overall and for recent arrivals under the IRPA. Results vary by immigrant category, with stronger HIE for family-class immigrants and much

weaker HIE for refugees, a group that may require further health monitoring.

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Appendix 1

Immigration and Refugee Protection Act, PART 1 Immigration to Canada, DIVISION 4 Inadmissibility, Section 38 (page 40)

Health grounds

- 38 (1) A foreign national is inadmissible on health grounds if their health condition
- (a) is likely to be a danger to public health;

- (b) is likely to be a danger to public safety; or
- (c) might reasonably be expected to cause excessive demand on health or social services.

Exception

- (2) Paragraph (1)(c) does not apply in the case of a foreign national who
- (a) has been determined to be a member of the family class and to be the spouse, common-law partner or child

of a sponsor within the meaning of the regulations;

- (b) has applied for a permanent resident visa as a Convention refugee or a person in similar circumstances;
- (c) is a protected person; or
- (d) is, where prescribed by the regulations, the spouse, common-law partner, child or other family member of a foreign national referred to in any of paragraphs (a) to (c).