MA Research Paper

Sociology Department

February 2024

Pain Among Immigrants to Canada: Testing the Healthy Immigrant Effect

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PAIN AMONG IMMIGRANTS TO CANADA:
TESTING THE HEALTHY IMMIGRANT EFFECT

by

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A research paper accepted in partial fulfilment of the
requirements for the degree of
Master of Arts

Department of Sociology
The University of Western Ontario
London, Ontario, Canada

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2023

ABSTRACT

In Canada, immigrants compose roughly one quarter of the population. The health of immigrants and their descendants is key to understanding the future health profile of all Canadians. Current literature on the health of immigrants often uses self-rated health and has produced mixed results regarding the healthy immigrant effect (HIE). Using data from the 2022 NEST survey, my study tests the HIE using chronic pain as a measure of population health to investigate the differences in pain experience among immigrants compared to the Canadian-born population. My results support the HIE: immigrants are 28% less likely to experience pain than Canadian-born individuals. When accounting for immigrants' recency of arrival, recent immigrants are slightly less likely to experience pain than established immigrants compared with Canadian-born individuals, aligning with the health deterioration effect. These findings support the HIE using pain as a different measure of health in a Canadian context.

Keywords: chronic pain, immigrant, healthy immigrant effect, HIE, recency of arrival, Canada.

<u>Introduction</u>

In Canada, the United States, Australia and parts of Western Europe, a phenomenon exists called the healthy immigrant effect (HIE) (Vang et al., 2017). The HIE is a phenomenon where the health of immigrants, usually measured using self-rated health measures, is better than the native-born population at time of arrival (De Maio & Kemp, 2010) (Subedi & Rosenberg, 2014). The current HIE literature attributes this effect to the positive selective nature of the immigration process. This includes medical exams, and in Canada the point system, which is used to favour individuals with better human capital (De Maio & Kemp, 2010; Kwak, 2016; B. Newbold, 2005; Vang et al., 2017). However, this screening does not ensure that immigrants' health levels will remain consistent over time, or that their health needs will be met (B. Newbold, 2005). Interestingly, current research shows that immigrants' health advantage eventually converges with the native-born population and can even over-shoot and become worse than the native-born population's health with increased duration of residence (Vang et al., 2017). This is known as the health deterioration effect.

As of 2021, in Canada roughly one in four people (23%) are immigrants (Government of Canada, 2022). Immigrant health and their descendants are key in shaping the future health profile of Canadians, as immigrants' health status and health needs impact public health, public spending, and immigration policy (Vang et al., 2017). The health deterioration of immigrants helps us understand how the social determinants of health work in Canada, and how not only access to health care services but also social conditions, play a part in deteriorating health status (De Maio & Kemp, 2010). Immigrants are inseparable from the Canadian healthcare system (Subedi & Rosenberg, 2014).

Currently, a majority of research on the health of immigrants and the HIE uses self-rated measures of health. However, an emerging measure of population health is chronic pain. Chronic pain is defined as pain experienced on most days or every day in the previous 3 months, that extends past normal tissue healing time (Pitcher et al., 2019; Zelaya et al., 2020). In 2019, 20.4% of US adults had chronic pain and 7.4% of adults had chronic pain that frequently restricted life or work activities (Zelaya et al., 2020). Pain is also among one of the most common reasons adults seek medical care (Zelaya et al., 2020). Consequently, understanding pain in a sociological context can be very advantageous because pain reflects social conditions, sociopolitical context, and health-related beliefs of a society (Zajacova et al., 2021).

Therefore, a gap exists where the relationship between immigrant status and pain is not well known. What is known in HIE literature uses self-rated health measures. My study analyzes the relationship between Canada's immigrant population and pain as a measure of health to fulfill two purposes. The first is to investigate whether the differences in the experience of pain in the immigrant population in Canada versus the Canadian-born population align with the healthy immigrant effect. Secondly, whether immigrants' recency of arrival influences the experience of pain of immigrants compared with the Canadian-born population to understand the health deterioration effect as immigrants' length of stay increases. In order to address these gaps, in this analysis I use data from the 2022 NEST survey to estimate the association between immigrant status and pain in two robust Poisson regressions, where the latter accounts for immigrants' recency of arrival.

<u>Literature Review</u>

The Healthy Immigrant Effect

While current literature on the HIE exists, it presents mixed results regarding the health status of immigrants in relation to the HIE. While some studies say an effect does exist, other studies find no statistically significant differences. Subedi and Rosenberg's study (2014) used data from the 2011 Canadian Community Health survey to look at whether statistically significant differences exist in the socioeconomic characteristics and health outcomes of recent immigrants (who had less than 10 years of residency in Canada) and more established immigrants (who had more than 10 years of residency in Canada), and how the deteriorating health status of immigrants to Canada could be interpreted (Subedi & Rosenberg, 2014). Assessing self-reported health status, this study found that established immigrants were more likely to report poor health in comparison to recent immigrants (Subedi & Rosenberg, 2014). Only 7 % of recent immigrants reported poor health as opposed to 17 % of established immigrants (Subedi & Rosenberg, 2014). This study attributed this decline in health to the increased duration of residence where immigrants' lifestyle behaviours converge to those of the Canadian-born population, known as the lifestyle change hypothesis (Subedi & Rosenberg, 2014). Statistically significant differences were observed for variables such as alcohol consumption, where 70 % of established immigrants reported a consumption of alcohol in the past year compared to only 56 % of recent immigrants (Subedi & Rosenberg, 2014). This reinforced the lifestyle change hypothesis. Overall, this study concluded that a HIE does exist in Canada where a statistically significant difference in health status exists between recent immigrants, who have better health status than more established immigrants (Subedi & Rosenberg, 2014).

Loi and Hale's (2019) study looked at the role of material deprivation in the health convergence of immigrants to the native-born population in Italy. The study also found when comparing recent immigrants (who have lived in Italy for less than 5 years) to the native-born population, they were 50 to 70 % less likely to report chronic morbidity, and poor/very poor health (Loi & Hale, 2019). The immigrants who had been in Italy for 10+ years (established immigrants) were as likely to report poor health as native-born individuals (Loi & Hale, 2019). Overall, the study found a HIE for recent immigrants who had lived in Italy for 0-4 years, and they found an immigrant-native health convergence for immigrants with a longer duration of residence, which may be explained by material deprivation (Loi & Hale, 2019).

Newbold's (2005) longitudinal study on the health status and health care of immigrants in Canada, Newbold looked at self-assessed health of Canada's immigrant population. Foreign-born individuals over the age of 20 in 4 different age cohorts were studied, and period of arrival was controlled to highlight the HIE. This study found that overall, 10 % of immigrants reported fair or poor health in comparison to 9 % of the native-born population, which suggested worse health among the foreign-born population (B. Newbold, 2005). It was also found that the health status was not significantly different between foreign and native-born individuals, which informed the notion that HIE using self-assessed health is more apparent than a real existing phenomenon.

In McDonald and Kennedy's (2004) study about the HIE in relation to health status and health service use of immigrants to Canada, the authors used self-assessed physical health and incidence of chronic medical conditions as their two indicators of health. This study found a HIE and an unhealthy convergence in Canada when using chronic medical conditions as the health indicator but not for self-assessed health (McDonald & Kennedy, 2004). This indicates that the HIE is better assessed when avoiding the use of the participant's perception of their health.

While most of the current HIE literature is consistent with an existence of HIE in Canada, some studies have shown mixed results in understanding the healthy immigrant effect using self-rated measures of health, and some studies show that self-rated health was not significantly different between the foreign-born and native-born individuals (McDonald & Kennedy, 2004; B. Newbold, 2005; Vang et al., 2017). These studies have suggested that measuring chronic conditions such as chronic pain can produce a better understanding of the health of immigrants (Bousmah et al., 2019; McDonald & Kennedy, 2004; K. B. Newbold, 2005; Vang et al., 2017). This demonstrates that a gap of literature exists where investigation into the HIE in Canada using measures other than self-perceptions of health is needed. Using pain as a measure of health can fill this gap in literature.

Pain and Immigrants

In the existing literature, the study of chronic pain is typically analyzed clinically using the biomedical model. The biomedical definition of pain is that it is an unpleasant sensory and emotional experience that is associated with actual or potential tissue damage (Mittinty et al., 2018; Zajacova et al., 2021). However, as highlighted in Zajacova and her colleagues' (2021) research, the sociological study of pain is not very prevalent, even though it provides many benefits. Pain is a sensitive and holistic measure of health and well-being, which is useful in measuring unique and specific populations (Zajacova et al., 2021). It is representative of chronic conditions, and pain and pain treatment also reflects and holds implications for public policy (Zajacova et al., 2021). Pain also has implications in the workplace as it increases absenteeism, and on the family as it hinders the ability to perform in social roles of a parent or partner, which can lead to stress, resentment and anger, across the family (Zajacova et al., 2021). Pain is a useful tool in understanding the health of individuals and populations, and it holds consequences

in all areas of an individual's life. There is a need to understand pain more as it will add to an understanding of the health landscape in a unique way.

Despite existing knowledge of the health of immigrants using self-rated health, not much is known about the experience of pain among immigrants, while also accounting for foreign-born individuals' recency of arrival. What little is known is derived from qualitative studies and focuses on specific chronic conditions or particular immigrant groups.

In a study by Mustafa and their colleagues (2020), the experiences of chronic pain were studied in immigrant Indian-Canadian women. The findings indicate that immigrants report higher pain intensity than non-immigrants. Culture and pain have a relationship in which culture shapes how a person perceives pain, communicates it, copes with it and what their beliefs surrounding pain are. As immigrants all come from diverse backgrounds with closer ties to their country of origin's culture, their understanding of their own pain can shape their pain experience. Mustafa and their colleagues used a qualitative study to understand body pain in the context of lived and felt spaces, relationships, and time. They found that pain spreads throughout Indian-Canadian women's bodies due to workload, which is a sign of deterioration, and that the weather change from India to Canada has affected their experience of pain. They also found that family pressures lead to stress and this prioritization of family, and the neglect of self contributes to their experience of pain. Finally, Mustafa and her colleagues found that their experience of pain was constant and increasing in intensity with time. This study also informed the need for more culturally sensitive healthcare as an emerging theme was that immigrant's comfort and trust in treatment was associated with their sense of belonging and social connectedness, and this was not found to be prevalent in Canadian healthcare. This study is missing a quantitative

understanding of the experience of pain of this immigrant population (Indian-Canadian women) and how the time of arrival can influence this experience.

Bui and their colleagues (Bui et al., 2011) analyzed the relation of acculturation with self-reported chronic back and neck problems among US-born and foreign-born Latinos. Their findings suggested that higher reporting of chronic back or neck problems was found among more acculturated Latino-Americans independent of health status, obesity and the presence of depression. They also found that being US-born, being part of third or greater generation, and reporting good or excellent English proficiency, were all associated with a significantly higher risk of reporting chronic back or neck problems in the past 12 months (Bui et al., 2011). The authors' measure of acculturation was based on the percentage of their life spent in the US and English proficiency however their findings suggest that there was no significant association found between proportion of lifetime spent in the US and the report of chronic back or neck problems in the US, which is contradictory to other literature findings. This again reinforces the mixed HIE findings in current literature.

In a study by Dragioti and her colleagues (2020), the immigration status of immigrants to Sweden was studied to examine whether an association exists with chronic pain, chronic widespread pain, and severe chronic pain at a follow-up two years later. It was found that chronic pain, as well as an increased risk for a chronic pain outcome was highly prevalent among first generation immigrants two years after baseline data collection. This study found that characteristics that may play a role in immigrants' chronic pain include financial difficulties, depression and anxiety. This study reemphasized the findings found in Mustafa and their colleagues' work, in which there is a higher prevalence of pain in foreign-born individuals rather than native-born individuals. Despite the study's recognition of the HIE, surprisingly, the

findings did not coincide with the HIE. Although this could do with the region, this is an important gap to fill in the literature, as more findings are needed for a better understanding, as the study noted the inconclusiveness on the topic of chronic pain in immigrants in relation to the HIE.

The relationship between immigrant status and pain is not well understood. Most of the literature regarding pain is researched along racial and ethnic lines and in a qualitative analysis. A gap exists where pain in the immigrant population needs to be studied quantitatively, to understand the debated HIE more using measures other than self-rated health, especially in a Canadian context. This leads to my research question:

Research Question

What are the differences in the experiences of pain in the immigrant population in Canada in comparison to the Canadian-born population?

Data and Methods

This study is based on the 2022 Network for Economic and Social Trends (NEST) Omnibus Survey. The NEST survey is a nationally representative survey which targets the Canadian population of 18 and older individuals geographically distributed and who were participating in an ongoing Leger Opinion Panel. This panel relies on probability-based methods of random selection of adult residents of Canada selected by age, gender and regional factors using traditional and telephone methodologies. The data was collected from July to August of 2022, the respondents received a single email invite, 2,527 responses were recorded. Sample weights were added to ensure the sample was representative of the population in reference to the most recent

Canadian Census data by region, age, and gender within each region. The analytic sample are adults aged 18 and over with no missing information.

Measures

Immigrant status

The independent variable is immigrant status. This variable is used as a dichotomy (Canadian-born vs foreign-born), and is also trichotomized into: Canadian-born, foreign-born and lived in Canada for 0-15 years (recent immigrants), and foreign born and lived in Canada 15+ years (established immigrants). Immigrant status was measured by asking the respondents two questions. The first question was whether respondents were born in Canada, having the options of yes or no. If no was chosen, the subsequent question was in what year did the respondent come to live in Canada, where they were able to list the year, which ranged from 1938 to 2021.

Pain

The dependent variable is the experience of pain. Respondents were asked about their pain experiences in the past 30 days, responding from a list of categories ranging from "never to always" about how often they experienced pain. Pain experience is dichotomized into: did experience pain often in the past month, and did not experience pain often in the past month.

Covariates

Key sociodemographic characteristics that are commonly associated with overall health are included as controls, as these characteristics may influence the experience of pain. This includes age, gender, race/ethnicity, education and annual household income. Age was trichotomized as 18-44 (reference), 45-64, and 65+. Gender was also trichotomized: female (reference), male, and including a third identification of "other gender". Race/ethnicity is

measured in 9 categories: white (reference), Black, East Asian, Latin American, Middle Eastern, South Asian, Southeast Asian, Indigenous, and other. Education levels are categorized as high school diploma (reference), college/some university, undergraduate university, and postgraduate education. Annual household income levels are categorized as followed: $0-30,000 (reference), $30,001-60,000, $60,001-90,000, $90,001-150,000 and more than $150,000.

Analysis

To analyze the relationship between immigrant status and the experience of pain, a bivariate and two multivariate analyses were conducted. First, I present bivariate descriptives of all covariates and the outcome for immigrant status in two groups. Next, robust Poisson regressions estimate the association between immigrant status and pain. In the first of the two regressions, I analyze Canadian-born and foreign-born individuals' pain experience with multiple models. Model 1 looks at unadjusted baseline results, then I control for demographic variables of age and gender (Model 2); controlling for race/ethnicity (Model 3); and adjusting for SES using income and education (Model 4). A second robust Poisson regression accounts for immigrants' recency of arrival. The regression estimates pain experience for Canadian-born, foreign-born and lived in Canada for 0-15 years (recent immigrants), and foreign-born and lived in Canada for 15+ years (established immigrants). This regression investigates whether recency influences the experience of pain of immigrants, which tests the healthy immigrant effect.

Results

Table 1: Demographic and socioeconomic characteristics by immigrant status: by percentage

Variable	Immigrant Status	
	Canadian-born	Foreign-born
Age		
18-44	43.36	42.83
45-64	34.05	32.06
65+	22.59	25.11
Gender		
Female	51.32	48.88
Male	47.87	50.45
Other gender	0.82	0.67
Education		
High school diploma	18.90	8.07
College/Some university	42.69	29.60
Undergraduate university	27	35.55
Postgraduate education	11.41	25.78
Income		
0-30,000	16.02	12.11
30,001 to 60,000	22.30	23.32
60,001 to 90,000	21.10	23.77
90,001 to 150,000	27.39	28.92
More than 150,000	12.81	11.43
Race/Ethnicity		
White	83.77	39.33
Black	1.49	4.94
East Asian	4.85	19.78
Latin American	0.48	3.15
Middle Eastern	0.38	5.17
South Asian	1.39	12.58
Southeast Asian	1.10	10.79
Indigenous	2.98	0.22
Other	3.55	4.04

Table 2: Prevalence ratios of pain as a function of immigrant status (2 groups)

Variable	Model 1 (base)	Model 2 (age, gender)	Model 3 (age, gender, race)	Model 4 (age, gender, race, education, income)
Immigrant status				
Canadian-born (ref)	1	1	1	1
Foreign-born	0.62***(0.107)	0.62***(0.105)	0.69***(0.115)	0.72**(0.115)
Age				
18-44 (ref)		1	1	1
45-64		1.65***(0.079)	1.61***(0.081)	1.59***(0.081)
65+		1.97***(0.082)	1.84***(0.086)	1.77**(0.236)
Gender				
Female (ref)		1	1	1
Male		0.76***(0.065)	0.77***(0.065)	0.80***(0.065)
Other gender		1.88**(0.227)	1.84**(0.233)	1.77**(0.236)
Education				
High school diploma (ref)				1
College/Some university				1.07(0.083)
Undergraduate university				0.78*(0.107)
Postgraduate education				0.86(0.126)
Income				
0-30,000(ref)				1
30,001 to 60,000				0.98(0.092)
60,001 to 90,000				0.87(0.100)
90,001 to 150,000				0.75**(0.102)
More than 150,000				0.74*(0.133)
Race/Ethnicity				
White(ref)			1	1
Black			1.04(0.275)	1.00(0.279)
East Asian			0.39***(0.247)	0.41***(0.244)
Latin American			0.59(0.519)	0.57(0.503)
Middle Eastern			0.86(0.391)	0.87(0.397)
South Asian			1.13(0.212)	1.21(0.209)
Southeast Asian			0.96(0.167)	0.97(0.265)
Indigenous			1.27(0.167)	1.17(0.168)
Other			1.02(0.163)	1.01(0.165)

*p < 0.05; **p < 0.01; ***p < 0.001

Table 3: Prevalence ratios of pain as a function of immigrant status (3 groups)

Variable	Model 1 (base)	Model 2 (age, gender)	Model 3 (age, gender, race)	Model 4 (age, gender, race, education, income)
Immigrant status				
Canadian-born (ref)	1	1	1	1
Foreign-born 0-15 years	0.44***(0.217)	0.55**(0.217)	0.55**(0.232)	0.57*(0.233)
Foreign-born 15+ years	0.71***(0.118)	0.65***(0.116)	0.74*(0.123)	0.77*(0.124)
Age				
18-44 (ref)		1	1	1
45-64		1.64***(0.079)	1.60***(0.081)	1.58***(0.081)
65+		1.95***(0.226)	1.80***(0.087)	1.72***(0.088)
Gender				
Female (ref)		1	1	1
Male		0.76***(0.065)	0.77***(0.065)	0.80***(0.065)
Other gender		1.87**(0.226)	1.81**(0.231)	1.74**(0.234)
Education				
High school diploma (ref)				1
College/Some university				1.07(0.083)
Undergraduate university				0.78*(0.107)
Postgraduate education				0.87(0.126)
Income				
0-30,000				1
30,001 to 60,000				0.98(0.092)
60,001 to 90,000				0.87(0.100)
90,001 to 150,000				0.75**(0.102)
More than 150,000				0.73*(0.133)
Race/Ethnicity				
White			1	1
Black			1.07(0.276)	1.033(0.279)
East Asian			0.38***(0.248)	0.41***(0.25)
Latin American			0.58(0.518)	0.58(0.503)
Middle Eastern			0.91(0.392)	0.92(0.397)
South Asian			1.18(0.210)	1.27(0.209)
Southeast Asian			0.99(0.26)	1.00(0.266)
Indigenous			1.27(0.167)	1.17(0.17)
Other			1.01(0.164)	1.00(0.166)

*p < 0.05; **p < 0.01; ***p < 0.001

Demographic and socioeconomic characteristics

Table 1 presents the demographic and socioeconomic characteristics of respondents by immigrant status. Of the respondents, around 43% of both Canadian-born (43.36%) and foreign-born (42.83%) were aged 18-44. 22.6% of Canadian-born individuals and 25% of foreign-born individuals were aged 65+. In both groups there were roughly 50% females and 50% males with 0.82% of Canadian-born individuals and 0.67% of foreign-born identifying as other gender. In education level, of the Canadian-born population, 42.7% completed college/some university and 11.4% completed postgraduate education. Compared with the foreign-born population, 35.6% had completed undergraduate university and 25.8% had completed postgraduate education. Income levels of both groups were similar, where 16.0 % of Canadian-born individuals and 12.1% of foreign-born individuals reported $0-$30,000 of annual household income. The largest proportions of both groups reported an annual household income of $90,001 to $150,000: 27.4% Canadian-born individuals and 28.9% of foreign-born. The majority of Canadian-born (83.7%) reported to be of white race/ethnicity whereas less than 40% of the foreign-born individuals reported to be white (39.3%). The remaining proportions are East Asian (19.8%), South Asian (12.6%), and Southeast Asian (10.8%).

Table 2 Results

Table 2 presents prevalence ratios of pain as a function of immigrant status, categorized as foreign-born versus Canadian-born individuals. In baseline model 1, foreign-born individuals are 38% less likely to report feeling pain often in the past month than Canadian-born individuals (PR=0.62, p<0.001).

In model 2, the prevalence ratio remained at 0.62, so in controlling for demographic characteristics, gender and age do not influence the association between the experience of pain of foreign-born individuals. Additionally, those of older age, women and other gender were associated with higher pain.

Model 3 adds race/ethnicity. Foreign-born individuals were 31% less likely (PR = 0.69, p<0.001) compared with the Canadian-born population to experience pain often in the past month. East Asian people were the only race/ethnicity to have statistically significant results, being 61% less likely (PR=0.39, p<0.001) to experience pain than white people. When accounting for race, the likelihood for the foreign-born population experiencing pain becomes larger in comparison to model 2, suggesting race/ethnicity influences the difference in the experience of pain of immigrants.

Model 4 accounts for age, gender, race, and SES, which is controlled for using annual household income and education level. After controlling for SES, foreign-born individuals are 28% less likely (PR=0.72**) compared with the Canadian-born population to experience pain. When adjusting for SES, the likelihood of foreign-born individuals experiencing pain often in the past month in comparison to the Canadian-born population becomes larger compared to the last 3 models. This suggests education and income explain some of the association between pain experience and immigrants. Additionally, those with a higher education level showed statistically significant results. Individuals with an undergraduate degree are 22% less likely to experience pain compared to those who are the least educated with a high school diploma. The results also suggest that income influences the association between immigrant status and pain experience. Those with more than $90,000 annual household income are roughly 25% less likely to

experience pain compared to the most disadvantaged group who have a household income of $0-$30,000.

After controlling for relevant demographic and socioeconomic variables, foreign-born individuals are overall less likely to experience pain than their Canadian-born counterparts, suggesting that immigrant status influences the experience of pain.

Table 3 Results

Table 3 presents the results of the robust Poisson regression models estimating prevalence ratios of pain as a function of immigrant status, accounting for other covariates. In this table, immigrant status accounts for recency of arrival. Each model looks at pain as a function of immigrant status in three categories; Canadian-born (reference group), foreign-born and lived in Canada for 0-15 years (recent immigrants), and foreign-born and lived in Canada for 15+ years (established immigrants).

Model 1 presents unadjusted baseline results. Recent immigrants are 56% less likely and established immigrants are 29% less likely than Canadian-born individuals to experience pain (PRs = 0.44, $p<0.001$ and 0.71, $p<0.001$ respectively).

Model 2 controls for demographic variables of age and gender. The PR for recent immigrants is 0.55, meaning they are 45% less likely to experience pain compared with Canadian-born individuals. The PR for established immigrants in model 2 is 0.65, meaning they are 35% less likely to experience pain than Canadian-born individuals. Individuals aged 45-64 are 65% more likely than those aged 18-44 to experience pain (PR=1.64, $p<0.001$). Individuals aged 65+ are almost 2 times as likely as 18–44-year-olds to experience pain (PR=1.95, $p<0.001$). Men are about 25% less likely to experience pain than women (PR=0.76, $p<0.001$) and those

who identify as other gender are 87% more likely to experience pain than women (PR=1.87, p<0.01). These results suggest when accounting for age and gender, the likelihood of recent immigrants experiencing pain often in the past month compared to the Canadian-born population becomes larger compared to the baseline model 1 (Model 1 PR=0.44, p<0.001; Model 2 PR=0.55, p<0.01). However, the likelihood of established immigrants experiencing pain attenuates when adding age and gender in the analysis (Model 1 PR =0.71, p<0.001; Model 2 PR=0.65, p<0.001). This overall suggests age and gender explain some of the relationship between immigrant status and pain experience.

Model 3 controls for age, gender and race. When adding race, recent immigrants are 45% less likely (PR=0.55, p<0.01) and established immigrants are 26% less likely (PR=0.74, p<0.05) to experience pain compared with Canadian-born individuals. Among race groups, East Asians were the only statistically significant group. East Asians were 62% less likely (PR=0.38, p<0.001) to experience pain compared to white people. Compared to model 2, the likelihood of pain experience of established immigrants becomes larger (Model 2 PR=0.65 vs Model 3 PR=0.74), but the likelihood of pain experience of recent immigrants remains the same. This suggests that race explains some of the association between established immigrants and pain experience, but race does not influence the association between the experience of pain of recent immigrants.

Finally, model 4 controls for SES through education level and annual household income. Recent immigrants are 43% less likely to experience pain (PR=0.57, p<0.05) and established immigrants are 23% less likely to experience pain (PR=0.77, p<0.05) in comparison to Canadian-born individuals. For education, individuals with undergraduate university completion showed statistical significance, where they were 22% less likely to experience pain (PR=0.78,

p<0.05) than those with a high school diploma. As for income, those with $90,000-$150,000 and an income of more than $150,000 were roughly 25% less likely to experience pain (PR=0.75, p<0.01 and 0.73, p<0.05 respectively) than those with $0-$30,000. Overall, education and income explain some of the association between immigrant status and pain experience. When SES is adjusted for, the likelihood of recent and established immigrants experiencing pain often in the past month becomes larger compared with the previous 3 models.

In this analysis, after controlling for demographic and socioeconomic variables and including recency of arrival in the understanding of immigrants, recent immigrants and established immigrants are both less likely to experience pain in comparison to Canadian-born individuals. However, recent immigrants are slightly less likely to experience pain than established immigrants. Additional to the table 1 results, these results suggests that recency of arrival influences pain experience among foreign-born individuals differently despite controls, as this pattern remained consistent throughout each model.

Discussion

The phenomenon commonly known as the healthy immigrant effect has been widely investigated. However, existing research has yielded mixed results and often use self-rated health measures. This study tested the healthy immigrant effect in a Canadian context by using the experience of pain as a measure of population health among the immigrant population, while also accounting for immigrants' recency of arrival. Thus, this study's purposes were twofold: to investigate whether the differences of the experience of pain in the immigrant population in Canada versus the Canadian-born population align with the healthy immigrant effect, and whether immigrants' recency of arrival influence the experience of pain among recent versus established immigrants in comparison to the Canadian-born population.

The results suggest that when estimating the likelihood of pain experience among foreign-born individuals compared with the Canadian-born population controlling for all demographic and socioeconomic characteristics, the foreign-born population was 28% less likely to experience pain. When distinguishing immigrant groups based on recency of arrival, both recent immigrants and established immigrants were both less likely to experience pain than Canadian-born individuals. Recent immigrants were 43% less likely and established immigrants were 23% less likely than Canadian-born people. Hence, after controlling for all demographic and socioeconomic characteristics, recent immigrants were slightly less likely to experience pain of the two immigrant groups compared with the Canadian-born population. In both regressions, the most highly educated higher income earners experienced the least pain. The higher educated experienced 13-22% less pain, and the higher income earners experienced 25-27% less pain compared with the Canadian-born population. Additionally, women, those identifying as "other gender", and older age individuals reported a higher likelihood of experiencing pain in both regressions. Those identifying as "other gender" and those aged 65+ were almost 2 times more likely to experience pain compared with Canadian-born individuals.

While HIE literature is mixed, my findings support most of HIE findings that foreign-born individuals are less likely to experience pain as a measure of health compared with the Canadian-born population. Similar to Subedi and Rosenberg's (2014) study, established immigrants were more likely to report poor health compared to recent immigrants. Additionally, in Loi and Hale's (2019) study, when comparing recent immigrants to the native-born population they were 50-70% less likely to report chronic morbidity and poor/very poor health. This is similar to my study, where recent immigrants were 45-55% less likely to report pain experience compared to the Canadian-born population. Loi and Hale's (2019) study also found that

established immigrants and the native-born population have similar likelihoods in reporting poor health, which is consistent with health deterioration literature on convergence. Contrastingly, although recent immigrants reported less likely to experience pain, my study found that established immigrants are still less likely to report experiencing pain compared with the Canadian-born population. This suggests some support for the health deterioration effect but not to the extent of convergence or overshoot effects compared with the Canadian-born population.

My findings are also consistent with literature on immigrants' experience with pain and chronic conditions, where the foreign-born population are less likely to experience pain than the native-born population (Bui et al., 2011; Dragioti et al., 2020). Bui and their colleagues (2011) found that higher reports of chronic back or neck problems were associated with acculturated Latino-Americans aligning with my results that suggest that established immigrants had a larger likelihood of experiencing pain than recent immigrants compared with Canadian-born individuals, also supporting health deterioration literature. However, they found that using proportion of lifetime as a one of the measures of acculturation yielded no significant association with reports of chronic back or neck problems. Contrastingly, this study's use of immigrants' time of arrival produced statistically significant differences in immigrants' pain experience.

A possible explanation to immigrants reporting less pain overall is due to Canada's immigration policy. Canada's immigration system performs on a point system with a positive selective nature, thereby choosing candidates with better human capital (De Maio & Kemp, 2010; Kwak, 2016; B. Newbold, 2005; Vang et al., 2017). The point system favours individuals who are young, have higher education levels and have better employment experience, which are all associated with better health behaviours (De Maio & Kemp, 2010; Kwak, 2016; Vang et al., 2017). Additionally, a medical exam is performed on applicants, favouring healthier individuals

in order to minimize health care costs and public health risks to the receiving country (Vang et al., 2017). This is one explanation as to why immigrants overall report less pain than Canadian-born individuals, as the immigration process only selects the healthiest individuals with better human capital.

However, the difference in the experience of pain among recent immigrants, who report less pain than established immigrants in comparison to Canadian-born individuals, can be explained by converging lifestyle behaviours between immigrants and native-born individuals. New immigrants arrive in Canada with lifestyle behaviours similar to their country of origin. The longer their duration of residence in Canada, the more their culture and lifestyle behaviours converge to Canada's (Subedi & Rosenberg, 2014). When acculturating, immigrants adopt Canadian lifestyle behaviours, which can include poor food and eating habits, reduced mobility, and an increased use of tobacco and alcohol (Subedi & Rosenberg, 2014). These adopted lifestyle changes and behaviours can negatively affect immigrants' health. This can possibly inform why recent immigrants report slightly less pain experience than established immigrants compared with Canadian-born individuals.

It is also commonly described in literature that barriers to healthcare services is one of the causes of deteriorating health among new immigrants (Newbold, 2005; Subedi & Rosenberg, 2014). Barriers to healthcare services can be due to discrimination, lack of culturally sensitive care, and policy. Canadian policy states that in several provinces like British Columbia, New Brunswick and Quebec, a 3-month waiting period is instated before a newcomer to Canada is covered by a provincial health plan (Lebrun, 2012). These are just a few reasons why pain experiences may differ between recent and established immigrants, as lifestyle behaviours

converge with a Canadian lifestyle, and barriers to healthcare services to new immigrants may also explain why their health deteriorates.

Limitations

First, the main limitation to this study is that it is a cross-sectional study, so no causal explanations can be derived from the associations between immigrant status and pain experience. Likewise, pain differences in recent versus established immigrants may not only be attributable to length of stay. A longitudinal study should be included in future research to clarify causal relationships between length of stay and pain experience.

Furthermore, limitations emerge with the use of the data source. Firstly, the response rate of the NEST survey is 2,527. This is a smaller response rate, which may affect the results of the analyses. Subsequently, recency of arrival was included in the analysis to understand how duration of residence in a country can create differences between pain experiences among foreign-born individuals which can help explain how an immigrant's health and well-being changes. This allows for the health convergence or overshoot aspect of HIE to be studied. In most literature, a stronger HIE is seen for recent immigrants who have lived in the country for 10 years and less than for established immigrants who have had a longer duration of residence of 10 years +. This makes the common cut-off point for dividing the recency of immigration to be 10 years (De Maio & Kemp, 2010; Vang et al., 2017, Subedi & Rosenberg, 2014). In this study, I chose 15 years as the cut-off point due to my smaller sample size to ensure a sufficient number of observations in each category: 149 recent immigrants and 295 established immigrants. However, there is precedent in dividing recency of arrival by 15 years, where studies like Alang and colleagues'(2015) study on self-rated health of immigrants in the USA, and Koya and Egede's (2007) study on cardiovascular disease risk factors among immigrants to the USA,

categorize a long and established length of stay to be 15+ years (Alang et al., 2015; Koya & Egede, 2007). Despite this precedent, this difference in categorizing length of stay makes it difficult to compare my results with other results found in HIE literature.

Subsequently, another limitation to the study pertaining to the data is the measurement of the frequency of pain. In my study, pain experience is measured by pain frequency in the previous 30 days, however, pain literature often includes the previously validated measure of frequency of pain in the previous 3 months, which is widely used. This also makes it more challenging to compare results in other studies due to the difference in measures.

Future directions

Future research should include a longitudinal study that may be able to make casual links between differences in pain experience among recent and established immigrants to inform health deterioration literature more deeply. Moreover, a deeper analysis that focuses on race/ethnicity would yield important findings. East Asians were the only statistically significant racial/ethnic group to be less likely to experience pain compared with the reference group, which should be explored. Additionally, race explained the association between established immigrants and pain experience but did not influence the pain experience of recent immigrants. This indicates an interesting distinction that would explore the social determinants of health. Therefore, future directions should examine differences in pain experience among immigrants that may exist across specific ethnic groups.

Conclusion

Despite these limitations, this study extended previous literature of the contested healthy immigrant effect, by using pain experience as a different measure of population health in a Canadian context. This study supports the healthy immigrant effect by reporting results that after

controlling for demographic and socioeconomic characteristics, immigrants overall report to be

28% less likely to experience pain compared with Canadian-born individuals. When accounting

for recency of arrival, recent immigrants are slightly less likely to experience pain than

established immigrants (43% and 23% less likely, respectively) compared with the Canadian-

born population. This aligns with the health deterioration aspect of the HIE, which states that as

length of residence increases, the health of immigrants starts to converge to the health of the

native-born individuals. This study overall informed the phenomenon of the healthy immigrant

effect in a Canadian context using pain experience, a unique measure of population health. As

immigrant health is key in understanding the future health profile of Canadians, understanding a

different dimension of health can improve the overall health of all Canadians.

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