Original Article

Immigrants, Ethnicity, and Adherence to Secondary Cardiac Prevention Therapy: A Substudy of the ISLAND Trial

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ABSTRACT

Background: The objective of this study was to evaluate adherence to guideline-recommended cardiac secondary prevention therapies by immigration and ethnicity.

Methods: We conducted a retrospective substudy of the interventions Supporting LongTerm Adherence and Decreasing Cardiovascular Events (ISLAND) randomized controlled trial. A cohort of 1642 participants was analyzed. Patients were categorized based on their self-reported immigrant status as being Canadian or foreign born and based on their visual minority status (as European or a visual minority). We used logistic regression to examine associations between these patient characteristics of interest and patient adherence to statin medication 1 year after myocardial infarction (MI) and completion of cardiac rehabilitation, adjusting for age, sex, and comorbidities.

Results: The dataset included outcome data on 1049 (64%) Canadian-born patients and 593 (36%) immigrants. There were 347 (21%) who identified as a visual minority. We report a nonsignificant trend in statin adherence 1 year after MI favouring foreign-born participants compared with Canadian-born participants (odds ratio [OR], 1.26; 95% confidence interval [CI], 0.91-1.68). Visual minorities were found to have no significant difference in statin adherence rates of 15%-61% among post-MI populations.8-10 Low rates of therapeutic adherence to guideline-recommended therapy post-MI limit the benefits of therapy for patients who are at an elevated cardiovascular risk.11,12

Coronary artery disease is the leading cause of premature death and disability in Canada.1 Guideline-recommended preventative therapy for patients who have experienced a myocardial infarction (MI) includes the use of statins and participation in a cardiac rehabilitation program.2 Therapy with statins and cardiac rehabilitation has been found to reduce the risk of secondary cardiac events and cardiovascular-associated mortality by 20%-30%.2,7 In Ontario, adherence to preventative cardiovascular therapies is suboptimal with rehabilitation completion rates of < 30% and medication non-adherence rates of 15%-61% among post-MI populations.8-10

Canada has one of the highest immigration rates in the world, with the province of Ontario receiving 56% of the migrants to Canada.13-15 In Ontario, 50% of the population was born outside of Canada, of which nearly one in three is an immigrant.5

RÉSUMÉ

Contexte : L’objectif de cette étude était d’évaluer l’adhésion aux traitements recommandés dans les lignes directrices pour la prévention secondaire des maladies cardiaques, selon le statut d’immigrant et l’origine ethnique.

Méthodologie : Nous avons effectué une sous-étude rétrospective de l’essai contrôlé à répartition aléatoire ISLAND (interventions Supporting LongTerm Adherence and Decreasing Cardiovascular Events). Une cohorte de 1 642 participants a été analysée. Les patients ont été classés en catégories basées sur leur statut autodéclaré d’immigrant (personne née au Canada ou à l’étranger) ou de minorité visible (origine européenne ou minorité visible). En utilisant un modèle de régression logistique, nous avons examiné les corrélations entre ces caractéristiques et l’adhésion aux traitements médicamenteux par des statistiques un an après un infarctus du myocarde (IM) de même que l’utilisation de la réadaptation cardiaque, après ajustements selon l’âge, le sexe et les maladies concomitantes.

Résultats : L’ensemble de données comprenait des données sur les résultats obtenus chez 1 049 (64 %) patients nés au Canada et 593 (36 %) immigrants. De ce nombre, 347 (21 %) s’étaient identifiés comme étant des membres d’une minorité visible. Pour l’adhésion aux statines un an après un IM, nous avons observé une tendance non

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Ethics Statement: The study was approved by 9 research ethics boards. The research reported in this paper adhered to CONSORT guidelines.

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adherence 1 year after MI compared with participants of European ethnicity (OR, 1.04; 95% CI, 0.72-1.51). Neither immigration status (OR, 0.91; 95% CI, 0.72-1.15) nor visual minority status (OR, 0.97; 95% CI, 0.73-1.28) were associated with cardiac rehabilitation completion.

Conclusions: Our findings offer limited support that immigrants with >10 years of Canadian residency exposure experience greater adherence to statins 1 year after MI. Further research is required to better inform our understanding of secondary prevention strategy among immigrant populations.

Canada’s immigrants in 2017. Statistics Canada projects that immigrants will make up ≥ 30% of the Ontario population over the next 2 decades. The literature suggests that immigrants who reside in Canada experience superior outcomes after MI compared with Canadian-born patients. This relative health advantage, known as the Healthy Immigrant Effect, has been attributed to Canada’s national immigration system. Successful immigration applicants tend to have some combination of postsecondary education, high-skilled employment experience, significant family relations to Canada, and a spouse who can communicate in English. Furthermore, patients < 65 years experienced greater adherence to statins compared with older patients in an investigation of statin efficacy and safety. These qualities are all factors associated with improved therapeutic adherence.

There is a paucity of evidence addressing post-MI therapeutic adherence among foreign-born immigrants within a Canadian context. Therefore, the objective of this substudy of the Interventions Supporting Long-Term Adherence and Decreasing Cardiovascular Events (ISLAND) is to evaluate adherence to statin medications and completion of cardiac rehabilitation one year post-MI by immigration status and ethnicity status.

Methods

The ISLAND study was a multicentre, pragmatic randomized trial designed to compare the performance of sequential educational reminders for improving adherence to guideline-recommended therapies after MI. Details of the ISLAND study methods have been previously reported. The ISLAND study was approved by research ethics boards at 9 participating centres.

Briefly, the ISLAND cohort includes adult Ontario residents who had a coronary angiography after MI with evidence of coronary artery disease. In this substudy, we included those with completed 1-year follow-up outcome data who also reported their immigration and ethnicity status at the 12-month post-MI follow-up assessment.

The ISLAND interventions were previously reported. In brief, participants were randomly assigned to arm 1, usual care; arm 2, postal materials encouraging adherence to secondary prevention treatments sent 5 times over the year after their cardiac event; or arm 3, postal materials plus phone calls. The significant en faveur des participants nés à l’étranger comparative

Conclusions: Nos résultats montrent, de façon limitée, que l’adhésion au traitement par des statines un an après un IM est meilleure chez les immigrants qui vivent au Canada depuis plus de dix ans. D’autres recherches sont nécessaires pour améliorer nos connaissances sur les stratégies de prévention secondaire auprès des populations d’immigrants.

Patient-reported data were collected for the ISLAND study via telephone calls by blinded research staff 12 months after MI. During these calls, participants’ adherence to statins and completion of a prescribed cardiac rehabilitation program were evaluated using previously validated approaches. Researchers determined statin persistence using open-ended questions, as this method has been validated against pharmacy dispensing data. An adaptive version of the Brief Medication Questionnaire was used to assess missed statin dosages in the last 30 days using an approach previously validated for statins. Participation and completion of a cardiac rehabilitation program was evaluated using an approach validated against cardiac rehabilitation program reports.

For this substudy, statin medication adherence was defined as participants reporting no missed statin tablets assessed 1 month before outcome assessment. Participation in the rehabilitation components with formal reassessments at the program’s conclusion.

Immigration and ethnicity were also self-reported during the 12-month post-MI follow-up assessment. Immigrant status was defined as foreign-born or Canadian-born based on the reported origin of birth. Non-European ethnicities were pooled into a visual minority category. The approach used to categorize immigration and visual minority status exposures are consistent with those of contemporary publications.

Statistical analysis

Multivariable logistic regression methods were used to evaluate the association between the variables of interest (immigrant and visual minority status) and the outcomes, accounting for potential confounders. We modelled immigrant-status and visual minority status separately for ease of interpretation and because of concerns regarding colinearity of these variables. Age (binary), sex, diabetes, smoking, neighbourhood income quartile, rurality, education, prescription coverage, and marital status were included in each model, regardless of statistical significance, as they are associated with the 2 outcomes. The binary age variable was determined based on the threshold for prescription insurance coverage.
under the Ontario Drug Benefit program. Confounders were determined by a literature review and were evaluated for multicollinearity. Stepwise procedures were not used, as such procedures may produce an in-sample model with limited generalizability to the target population.37

All analyses were performed using 2-sided tests at the 0.05 level of significance. Final results are expressed as odds ratios in each group along with 2-sided 95% confidence intervals (CIs). Complete-case analysis was used to minimize bias in from missing data. All analyses were performed using Stata version 13.1.

Results
A total of 1802 ISLAND trial participants from 9 cardiac centres in Ontario provided data regarding cardiac rehabilitation completion, and 1499 provided data regarding medication adherence. A total of 991 (37.7%) participants who completed outcome assessments were excluded from the study for missing immigration exposure. A total of 1624 participants were included in the analysis (Fig. 1). Among immigrants, the average number of years since immigrating into Canada was 40.8 ± 17.9 years. Ten percent of immigrant participants had immigrated to Canada in ≤ 10 years.

Figure 1. Participant flow diagram. ISLAND, Interventions Supporting Long-Term Adherence and Decreasing Cardiovascular Events.
Table 1. Sociodemographic Characteristics of the participants by immigration status

| Variable                | Foreign-born (n = 593) | Canadian-born (n = 1049) | Total (N = 1641) | P value* |
|-------------------------|------------------------|--------------------------|------------------|----------|
| Age (y)                 |                        |                          |                  |          |
| Mean (95% CI)           | 64.97 (63.9, 66.0)     | 65.3 (64.6, 66.0)        | 65.2 (64.6, 65.8) | 0.570    |
| ≥ 65, n (%)             | 310 (52.4)             | 537 (51.2)               | 837 (52.6)       |          |
| Sex                     |                        |                          |                  |          |
| Female, n (%)           | 135 (22.8)             | 317 (30.2)               | 452 (27.5)       | 0.001    |
| Rural, n (%)            | 61 (10.4)              | 244 (23.4)               | 305 (18.75)      | < 0.001  |
| Income quintile         |                        |                          |                  |          |
| 1%-20%, n (%)           | 106 (17.9)             | 207 (19.7)               | 313 (19.1)       | 0.569    |
| 21%-40%, n (%)          | 122 (20.6)             | 216 (20.6)               | 338 (20.6)       |          |
| 41%-60%, n (%)          | 123 (20.8)             | 192 (18.3)               | 315 (19.2)       |          |
| 61%-80%, n (%)          | 132 (22.3)             | 217 (20.7)               | 349 (21.3)       |          |
| 81%-100%, n (%)         | 108 (18.2)             | 210 (20.0)               | 318 (19.4)       |          |
| Education level         |                        |                          |                  |          |
| Less than high school, n (%) | 107 (18.1)          | 259 (24.7)               | 366 (22.3)       | < 0.001  |
| High school graduate, n (%) | 135 (22.8)          | 258 (24.6)               | 393 (24.0)       |          |
| Some postsecondary, n (%) | 87 (14.7)            | 189 (18.0)               | 276 (16.8)       |          |
| Postsecondary graduate, n (%) | 256 (43.2)        | 340 (32.4)               | 596 (36.3)       |          |
| Marital status          |                        |                          |                  |          |
| Married, n (%)          | 419 (70.8)             | 635 (60.5)               | 1054 (64.2)      | < 0.001  |
| Common-law, n (%)       | 14 (2.4)               | 68 (6.5)                 | 82 (5.0)         |          |
| Widowed, n (%)          | 57 (9.6)               | 120 (11.4)               | 177 (10.8)       |          |
| Separated, n (%)        | 17 (2.9)               | 32 (3.1)                 | 49 (3.0)         |          |
| Divorced, n (%)         | 45 (7.6)               | 96 (9.2)                 | 141 (8.6)        |          |
| Single, never married, n (%) | 28 (4.7)            | 95 (9.1)                 | 123 (7.5)        |          |
| Visible minority status |                        |                          |                  |          |
| Visible minority, n (%) | 291 (49.66)            | 56 (3.44)                | 347 (21.22)      | < 0.000  |

*P value assessed with Pearson’s χ² test.

Table 1 outlines the baseline characteristics of the participants by immigration status (foreign-born versus Canadian-born). Five hundred ninety-three participants identified as foreign-born versus 1049 as Canadian-born. There was a smaller proportion of women (23% vs 30%; P < 0.01), rural residence (16% vs 23%; P < 0.01), and participants with less than a high school education (18% vs 25%; P < 0.01) in the foreign-born versus Canadian-born groups, respectively. Moreover, we found a greater proportion of foreign-born participants were likely to have third-party insurance that covers most or all prescription medication costs (16% vs 9%; P < 0.01), be lifelong nonsmoker (47% vs 30%; P = 0.01), or be married (71% vs 61%; P = 0.01) when compared with Canadian-born participants.

Figure 2 highlights the model for our comparison of statin adherence at 12 months between foreign-born and Canadian-born participants. Foreign-born participants experienced greater adherence to statins (odds ratio [OR], 1.24; 95% CI, 0.91-1.68) than Canadian-born participants. The odds of statin adherence was reduced among participants 65 years or older (OR, 0.77; 95% CI, 0.56-1.05) when compared with participants 65 and younger and current smokers (OR, 0.64; 95% CI, 0.43-0.95) when compared with nonsmokers.

Figure 3 summarizes the logistic regression model for 12-month statin adherence by ethnicity. Visual minorities showed no significant difference in statin adherence (OR, 1.04; 94% CI, 0.72-1.51) compared with European ethnicities. Participants 65 years of age and older trended toward lower odds of statin adherence (OR, 0.77; 95% CI, 0.57-1.06). Current smokers reported a statistically significant 38% reduction in the statin adherence odds (OR, 0.62; 95% CI, 0.42-0.92) compared with participants with no history of smoking.

The final adjusted model for cardiac rehabilitation completion by immigration status is reported in Figure 4. We found no association between immigration status and completion of cardiac rehabilitation.

Figure 5 highlights the model cardiac rehabilitation completion odds by ethnicity. Visual minorities reported no difference in the odds of cardiac rehabilitation completion compared with European participants. Participants 65 years and older were at a statistically significant 27% reduction in the odds of completing cardiac rehabilitation (OR, 0.73; 95% CI, 0.57-0.93) compared with participants < 65 years. A statistically significant odds reduction of adherence to cardiac rehabilitation of 47% and 25% was reported for current (OR, 0.53; 95% CI, 0.39-0.72) and former smokers (OR, 0.75; 95% CI, 0.58-0.99), respectively, when compared with participants with no history of smoking. A trend favouring reduced odds of cardiac rehabilitation completion was found for people with diabetes (OR, 0.79; 95% CI, 0.61-1.01). We found that participants with either a high school diploma (OR, 1.43; 95% CI, 1.02-2.00) or a postsecondary degree (OR, 1.86; 95% CI, 1.36-2.55) experienced a statistically significant increase of 43% and 86%, respectively, in the odds of cardiac rehabilitation completion compared with participants with less than a high school degree. We report that divorced participants experienced a statistically significant 36% reduction in the odds of cardiac rehabilitation completion (OR, 0.64; 95% CI, 0.42-0.98) when compared with married participants.

Discussion

Nonadherence to guideline-recommended secondary therapies, including statins and cardiac rehabilitation, is associated with increased mortality and morbidity.38-40 Our data show that, compared with the Canadian-born population, Foreign-born immigrants trended toward greater statin adherence.
We found no significant difference in statin adherence between visual minorities and European participants. Our study is promising, as it offers support to the notion that English-speaking immigrants are equally, if not more, adherent to statins for secondary cardiac prevention compared with Canadian-born patients. No difference with respect to cardiac rehabilitation completion was noted when comparing immigration status or ethnicity.

**Figure 2.** Adjusted odds ratio with 95% confidence intervals for statin adherence at 30 days before 1-year post-myocardial infarction by immigration status.
Our results are consistent with those of previous studies that have reported statin adherence and cardiac rehabilitation participation outcomes in ethnic and immigrant populations. For example, Chiu et al.\(^4\) reported that major cardiovascular risk factors, including smoking status and diabetes, were more prevalent among long-term Ontario residents compared with recent immigrants.\(^4\) Participants with a postsecondary education were significantly more
likely to complete cardiac rehabilitation. Education level is reported in the literature as a predictor for cardiac rehabilitation participation and enrollment.\cite{42,43} Furthermore, our study offers support for the healthy immigrant effect as supported by the relatively greater likelihood of statin adherence among immigrants.

The outcomes of our study are limited by the effects of language bias. Only participants who could communicate in

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**Figure 4.** Adjusted odds ratio with 95% confidence intervals for cardiac rehabilitation completion at 1 year after myocardial infarction by immigration status.

| Ethnicity       | Odds Ratio (95% CI) |
|-----------------|---------------------|
| European        | 1.00 (1.00-1.00)    |
| Visual Minority | 1.04 (0.72-1.51)    |

| Age             | Odds Ratio (95% CI) |
|-----------------|---------------------|
| <65 years       | 1.00 (1.00-1.00)    |
| ≥65             | 0.77 (0.57-1.06)    |

| Smoking         | Odds Ratio (95% CI) |
|-----------------|---------------------|
| Never           | 1.00 (1.00-1.00)    |
| Current         | 0.82 (0.42-1.62)    |
| Former          | 0.75 (0.52-1.06)    |
| Unknown         | 0.76 (0.47-1.23)    |

| Diabetes        | Odds Ratio (95% CI) |
|-----------------|---------------------|
| No              | 1.00 (1.00-1.00)    |
| Yes             | 0.90 (0.60-1.32)    |

| Sex             | Odds Ratio (95% CI) |
|-----------------|---------------------|
| Female          | 1.00 (1.00-1.00)    |
| Male            | 1.13 (0.82-1.57)    |

| Neighbourhood Income Quartile | Odds Ratio (95% CI) |
|-------------------------------|---------------------|
| 1%–20%                        | 1.00 (1.00-1.00)    |
| 21%–40%                       | 1.27 (0.82-1.97)    |
| 41%–60%                       | 1.28 (0.82-1.98)    |
| 61%–80%                       | 1.31 (0.85-2.04)    |
| 81%–100%                      | 1.19 (0.76-1.85)    |

| Rurality         | Odds Ratio (95% CI) |
|-----------------|---------------------|
| Urban           | 1.00 (1.00-1.00)    |
| Rural           | 1.04 (0.73-1.49)    |

| Education        | Odds Ratio (95% CI) |
|-----------------|---------------------|
| < high school graduation | 1.00 (1.00-1.00) |
| High school graduate | 1.13 (0.75-1.70) |
| Some Post-Secondary | 0.90 (0.58-1.38) |
| Post-Secondary graduate | 1.06 (0.73-1.50) |

| Prescription Coverage | Odds Ratio (95% CI) |
|-----------------------|---------------------|
| Majority of all costs | 1.00 (1.00-1.00)   |
| Yes, but only co-pay  | 1.30 (0.82-2.05)   |
| Yes, for some meds    | 1.46 (0.76-2.81)   |
| No, none              | 1.42 (0.64-2.80)   |

| Marital Status      | Odds Ratio (95% CI) |
|---------------------|---------------------|
| Married             | 1.00 (1.00-1.00)    |
| Living common-law   | 1.25 (0.65-2.41)    |
| Widowed             | 1.01 (0.62-1.62)    |
| Separated           | 1.07 (0.48-2.39)    |
| Divorced            | 1.48 (0.86-2.65)    |
| Single, never married | 1.09 (0.62-1.91)   |

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English were included in our study. The exclusion of participants who were unable to communicate in English may bias our results toward an overestimation of the effect size in favour of greater adherence to therapy. However, the effect of this language bias may be minimal. Canada’s immigration system favours immigrants proficient in either English or French.44 Canadian census data from 2016 report that 86% of Ontario residents can conduct a conversation in English.45 Therefore, the English-language competence of our study population is reasonably representative of the Ontario
population. Further limits to our study include the relatively small sample population. The small size of our sample population reduces our ability to detect a true population effect. 46 The use of patient self-report methods may bias our results. 47 However, patient self-report methods are widely used in the literature for evaluating patient ethnicity and immigration status. 48–50 Self-reported methods are used to measure ethnicity and immigration status in the Canadian Community Health Survey (CCHS), a cross-sectional national administrative dataset. 41 Self-reported ethnicity has been validated against the CCHS among South Asian and Chinese ethnicities. 52

Other limitations to our reported outcomes include the potential confounding effects of statin tolerability and efficacy and differential secondary MI risk profiles. Statin tolerability and efficacy may be variable among different ethnic cohorts; however, the data are mixed. 53–56 Adherence to guideline-recommended secondary therapies among immigrants and ethnic cohorts may be modified by cardiac risk profile. Mulder et al. 54 and The SEARCH Collaborative Group 25 have reported that genetic predispositions are associated with patient tolerability to statin therapy. The findings from these studies suggest that disparity in statin adherence between ethnicities and immigrants is biologically plausible.

Our study found no associations between either immigration status or ethnicity to adherence to guideline-recommended preventative therapies after MI. Further research is warranted on the effect of Canadian residency duration on therapeutic adherence to secondary cardiac therapy after MI. Studies of larger population sizes are required to assess the influence of the healthy immigrant effect on patient adherence to secondary cardiac therapy after MI.

Conclusion

Immigrants who have lived in Canada for > 10 years trended toward improved statin adherence 12 months after MI compared with Canadian-born patients; however, this trend was not statistically significant. We found no association between statin adherence and ethnicity. There was no association in cardiac rehabilitation completion rates when patient’s immigration or ethnicity were considered. These findings can be used to inform population-level knowledge translation interventions for secondary cardiovascular care. Our study offers weak evidence against the use of immigrant status as a target for post-MI educational reminders that use either phone calls or postal materials.

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Disclosures

The authors have no conflicts of interest to disclose.

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