



Original Article

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

Shaun Shepherd, MSc,^a Noah Ivers, MD, PhD,^{b,c} Madhu K. Natarajan, MD, MSc,^{e,f}
Jeremy Grimshaw, MBChB, PhD,^d Monica Taljaard, PhD,^d Zachary Bouck, MPH,^c and
J.D. Schwalm, MD, MSc^{a,e,f}

^a Department of Health Research Methods, Evidence, & Impact, McMaster University, Hamilton, Ontario, Canada

^b Institute of Health Policy, Management and Evaluation, University of Toronto, Toronto, Ontario, Canada

^c Women's College Hospital Institute for Health System Solutions and Virtual Care, Women's College Hospital, Toronto, Ontario, Canada

^d School of Epidemiology and Public Health, University of Ottawa, Ottawa, Ontario, Canada

^e Population Health Research Institute, McMaster University, Hamilton, Ontario, Canada

^f Hamilton Health Sciences, Hamilton, Ontario, Canada

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 Long-Term 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

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 Long-Term 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 d'intérêt des patients et l'adhésion des patients au traitement médicamenteux par des statines 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

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%.³⁻⁷ In Ontario, adherence to

preventative cardiovascular therapies is suboptimal with rehabilitation completion rates of < 30% and medication nonadherence 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}

Canada has one of the highest immigration rates in the world, with the province of Ontario receiving 56% of

Received for publication September 20, 2020. Accepted March 3, 2021.

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

Corresponding author: Dr J.D. Schwalm, Population Health Research Institute, 237 Barton Street, Hamilton, Ontario L8L 2 × 2, Canada.

Tel.: +1-905-577-1423; fax: +1-905-577-1474.

E-mail: schwalmj@mcmaster.ca

See page 921 for disclosure information.

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.^{13,14} Statistics Canada projects that immigrants will make up $\geq 30\%$ of the Ontario population over the next 2 decades.¹⁵

The literature suggests that immigrants who reside in Canada experience superior outcomes after MI compared with Canadian-born patients.¹⁶ This relative health advantage, known as the *Healthy Immigrant Effect*, has been attributed to Canada's national immigration system.¹⁷⁻¹⁹ 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.²⁰ Furthermore, patients < 65 years experienced greater adherence to statins compared with older patients in an investigation of statin efficacy and safety.²¹ These qualities are all factors associated with improved therapeutic adherence.^{17,18,22}

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.²³⁻²⁵ 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.²³ 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

significative en faveur des participants nés à l'étranger comparative-ment aux participants nés au Canada (rapport de cotes [RC] = 1,26; intervalle de confiance [IC] à 95 % : 0,91-1,68). Aucune différence significative quant à l'adhésion au traitement par des statines un an après un IM n'a été constatée entre les minorités visibles et les participants d'origine européenne (RC = 1,04; IC à 95 % : 0,72-1,51). Ni le statut d'immigrant (RC = 0,91; IC à 95 % : 0,72-1,15) ni le statut de minorité visible (RC = 0,97; IC à 95 % : 0,73-1,28) n'ont été associés à l'utilisation de la réadaptation cardiaque.

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.

phone calls were delivered first by an automated system to assess for risk of treatment nonadherence and followed up as needed by trained lay health workers.

Patient-reported data were collected for the ISLAND study via telephone calls by blinded research staff 12 months after MI.²³ 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.^{26,27} 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.^{28,29} Participation and completion of a cardiac rehabilitation program was evaluated using an approach validated against cardiac rehabilitation program reports.³⁰

For this substudy, statin medication adherence was defined as participants reporting no missed statin tablets assessed 1 month before outcome assessment.³¹ Cardiac rehabilitation completion was defined as patients who reported attending at least one of 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. Immigration 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.^{18,32,33}

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 collinearity 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.³⁴⁻³⁶ 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.

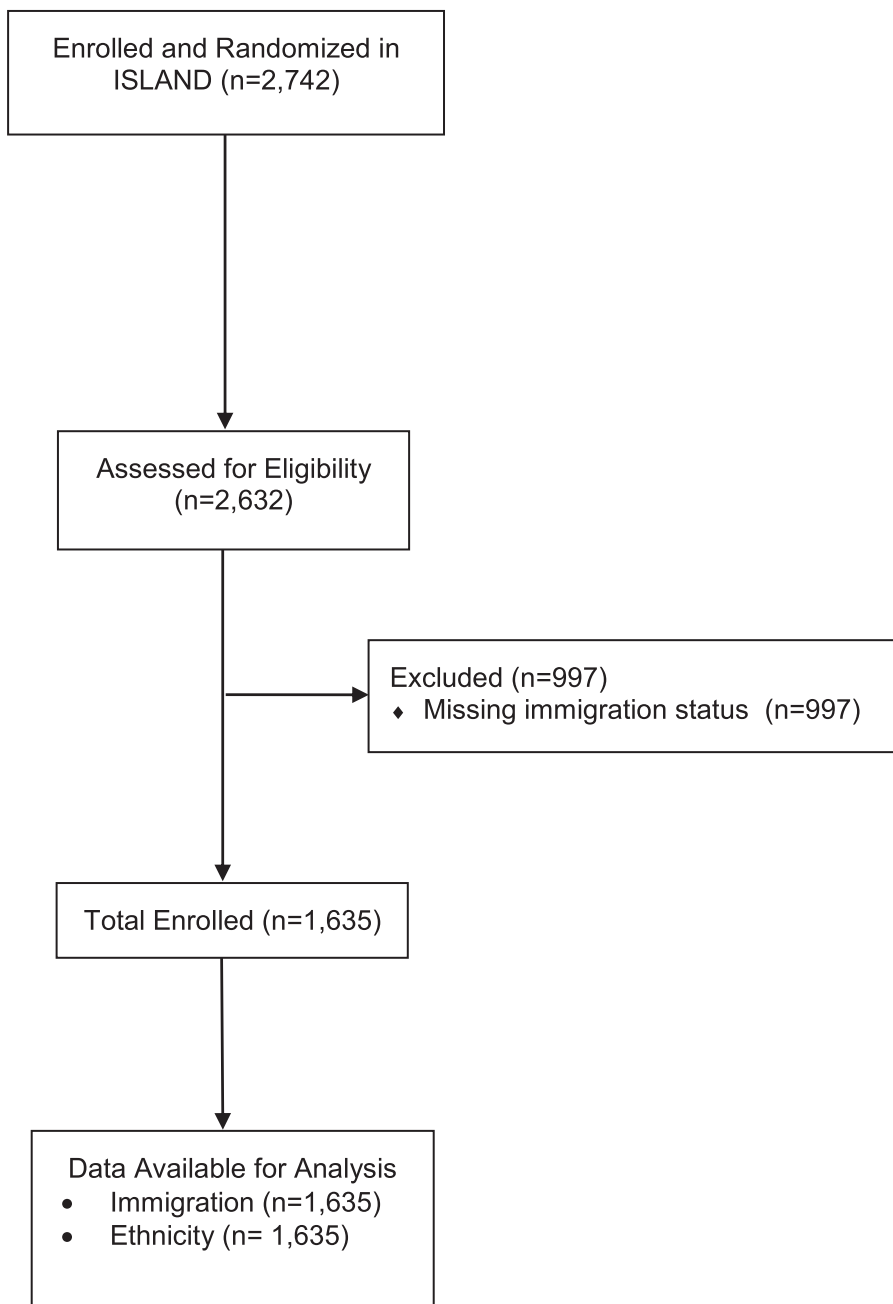


Figure 1. Participant flow diagram. ISLAND, Interventions Supporting Long-Term Adherence and Decreasing Cardiovascular Events.

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
Rurality				
Rural, n (%)	61 (10.43)	244 (23.42)	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 (5.34)	347 (21.22)	< 0.000

*P value assessed with Pearson's χ^2 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 (10% 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-.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 1

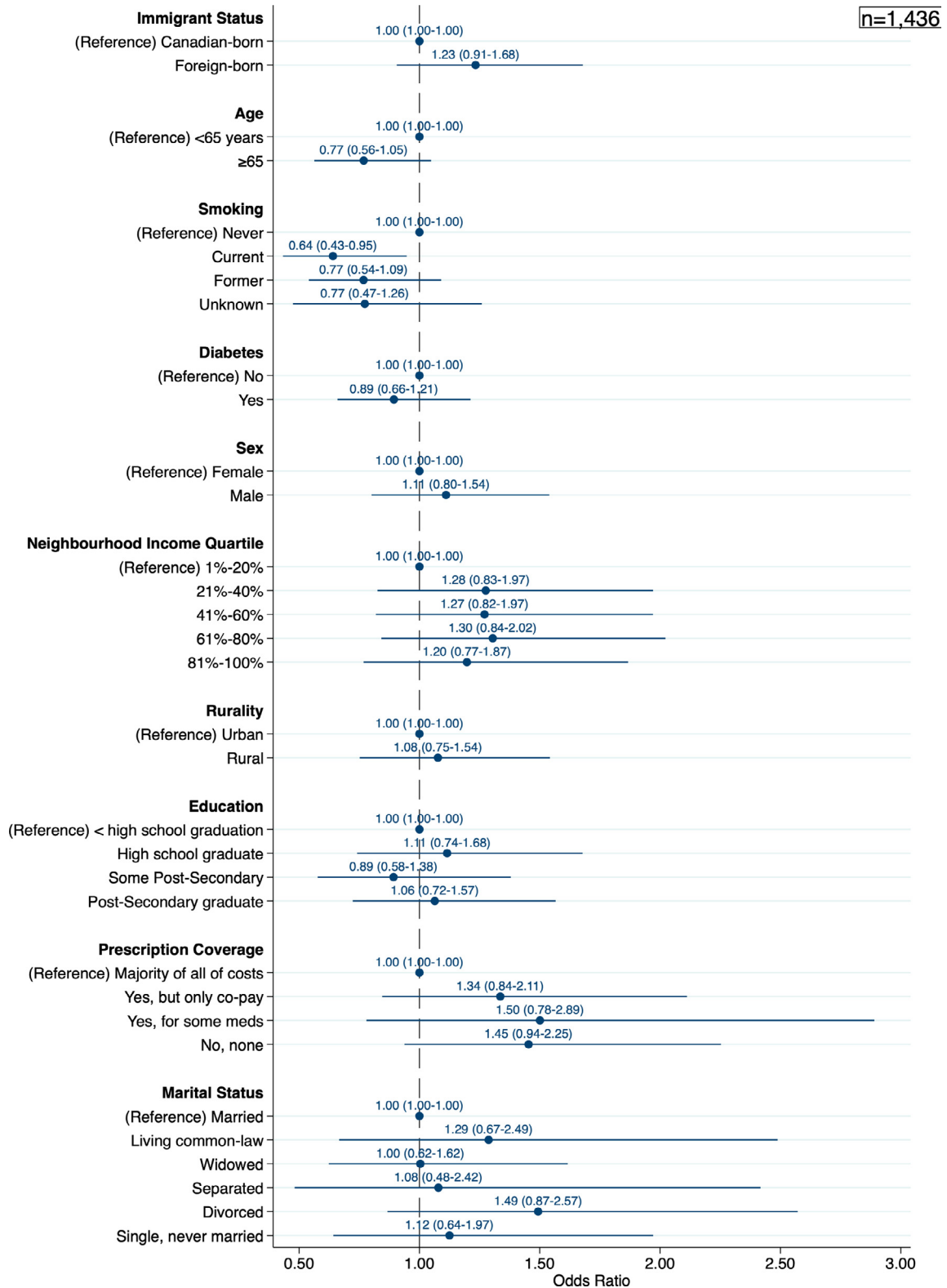


Figure 2. Adjusted odds ratio with 95% confidence intervals for statin adherence at 30 days before 1-year post–myocardial infarction by immigration status.

year after MI. 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.

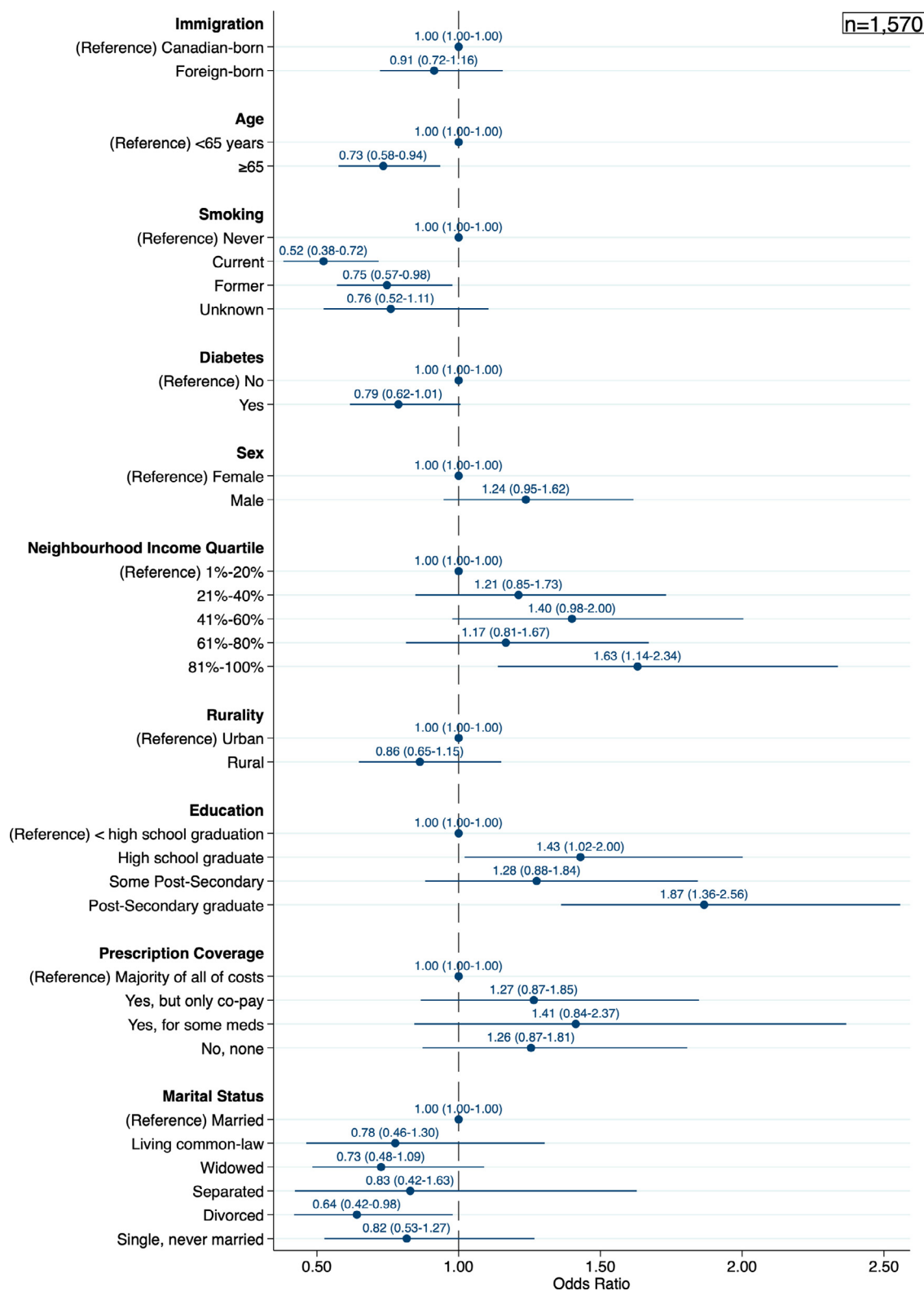


Figure 3. Adjusted odds ratio with 95% confidence intervals for statin adherence at 7 and 30 days before 1-year post–myocardial infarction by ethnicity.

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.⁴¹ reported that major

cardiovascular risk factors, including smoking status and diabetes, were more prevalent among long-term Ontario residents compared with recent immigrants.⁴¹ Participants with a postsecondary education were significantly more

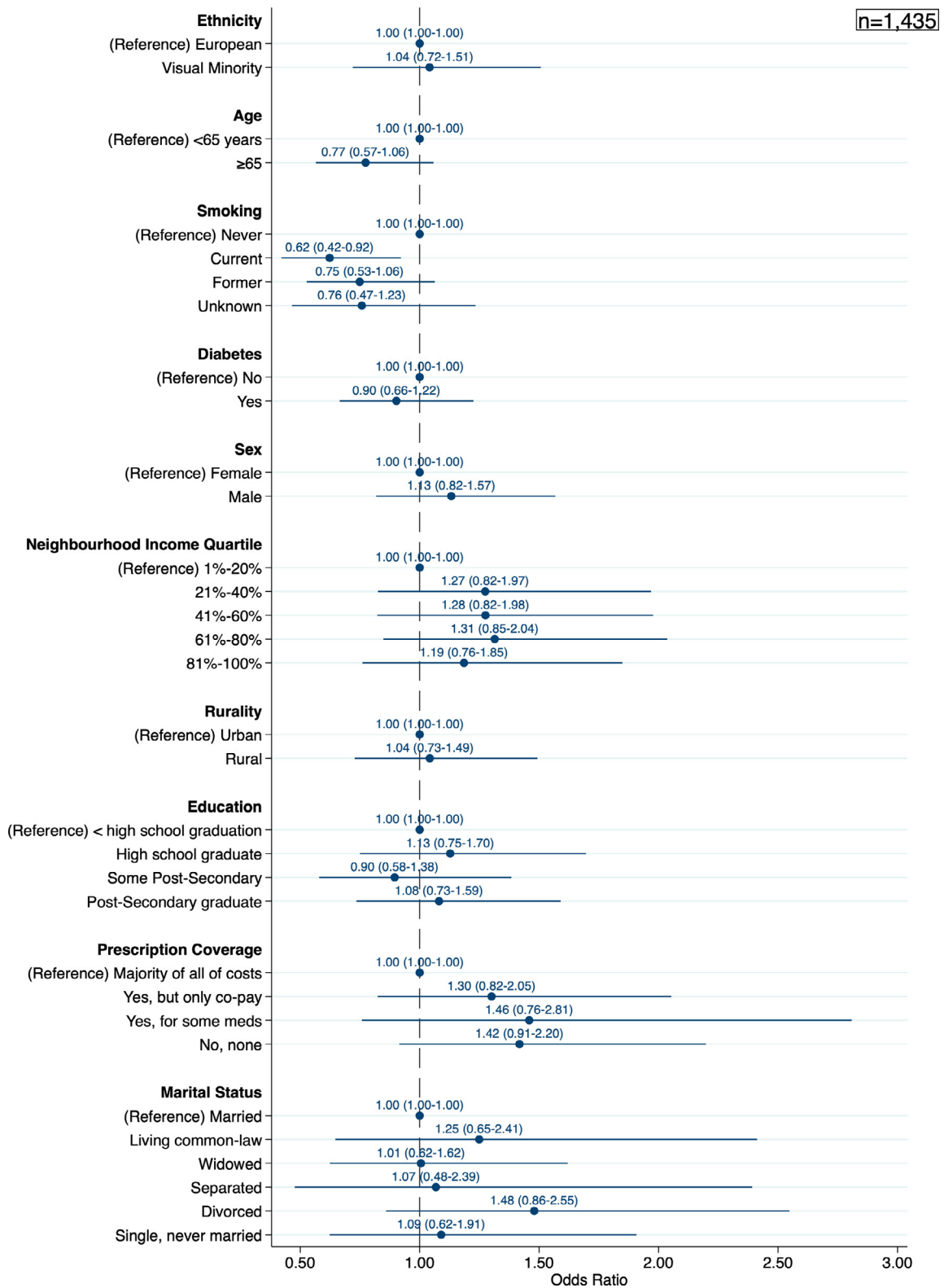


Figure 4. Adjusted odds ratio with 95% confidence intervals for cardiac rehabilitation completion at 1 year after myocardial infarction by immigration status.

likely to complete cardiac rehabilitation. Education level is reported in the literature as a predictor for cardiac rehabilitation participation and enrollment.^{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

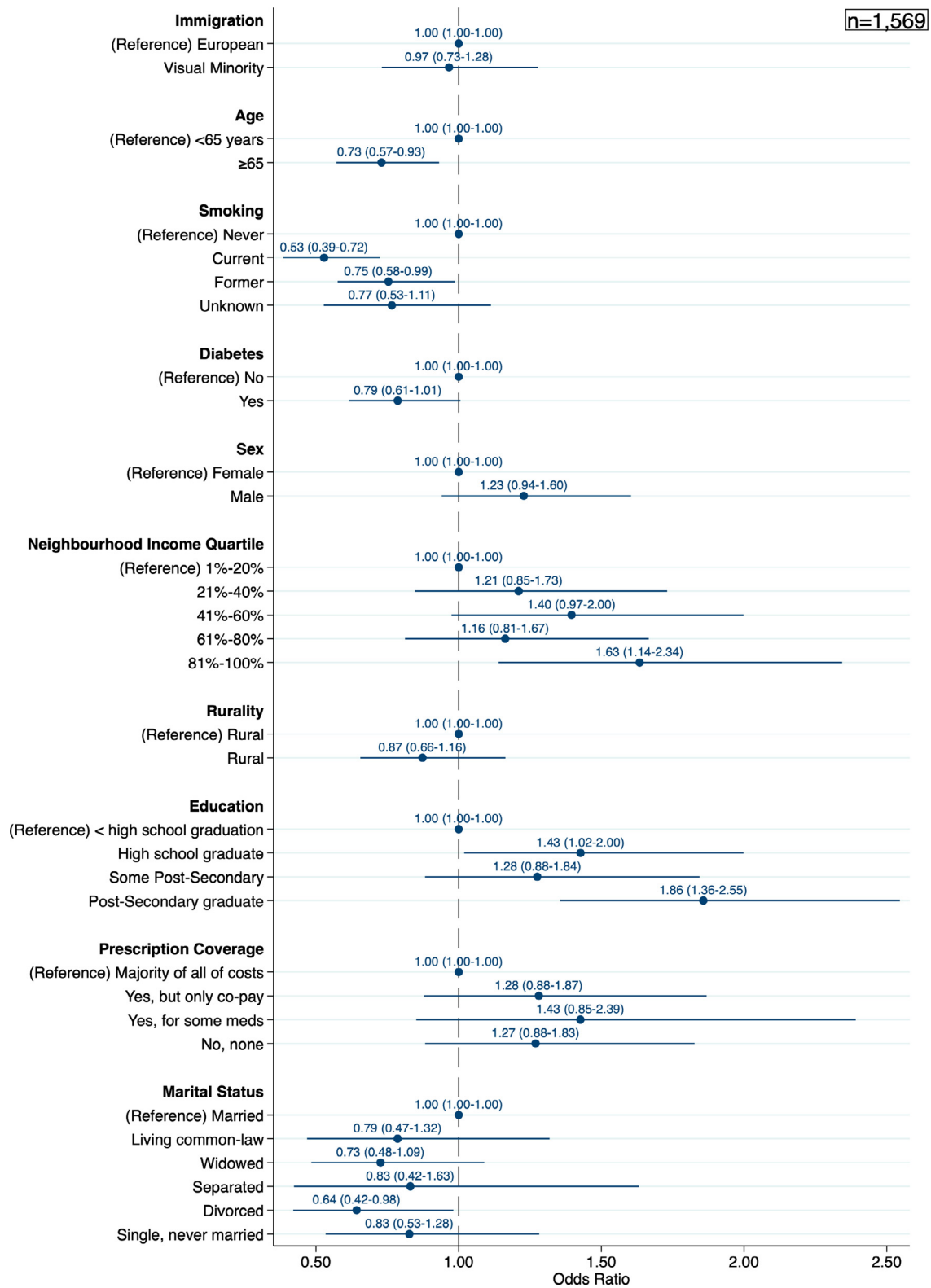


Figure 5. Adjusted odds ratio with 95% confidence intervals for cardiac rehabilitation completion 1 year after myocardial infarction.

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.⁵¹ 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.²⁴ and The SEARCH Collaborative Group²⁵ 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.

Acknowledgements

All authors declare support from MOHLTC for the submitted work. N.M.I. declares support from the Canadian Institutes of Health Research and MOHLTC and the Ontario Strategy for Patient-Oriented Research Support Unit during the conduct of the study, and now holds a Canada Research Chair (tier 2) in implementation of evidence-based practice, as well as a clinician scholar award from the University of Toronto Department of Family and Community Medicine; J.M. G. is supported by a Canada Research Chair in knowledge transfer and uptake, outside the submitted work; the other authors declare no financial relationships with any organisations that might have an interest in the submitted work; and

no other relationships or activities that could appear to have influenced the submitted work.

Funding Sources

The study was funded by the Ontario Ministry of Health and Long Term Care (MOHLTC) Health System Research Capacity Award grant No 06683.

Disclosures

The authors have no conflicts of interest to disclose.

References

1. Naghavi M, Abajobir AA, Abbafati C, et al. Global, regional, and national age-sex specific mortality for 264 causes of death, 1980-2016: a systematic analysis for the Global Burden of Disease Study 2016. *Lancet* 2017;390:1151-210.
2. Smith Jr. SC, Benjamin EJ, Bonow RO, et al. AHA/ACCF secondary prevention and risk reduction therapy for patients with coronary and other atherosclerotic vascular disease: 2011 update: a guideline from the American Heart Association and American College of Cardiology Foundation. *Circulation* 2011;124:2458-73.
3. Heran BS, Chen JM, Ebrahim S, et al. Exercise-based cardiac rehabilitation for coronary heart disease. *Cochrane Database Syst Rev* 2011; CD001800.
4. Long-Term Intervention with Pravastatin in Ischaemic Disease Study Group. Prevention of cardiovascular events and death with pravastatin in patients with coronary heart disease and a broad range of initial cholesterol levels. *N Engl J Med* 1998;339:1349-57.
5. Sacks FM, Pfeffer MA, Moye LA, et al. The effect of pravastatin on coronary events after myocardial infarction in patients with average cholesterol levels. Cholesterol and Recurrent Events Trial investigators. *N Engl J Med* 1996;335:1001-9.
6. Taylor RS, Brown A, Ebrahim S, et al. Exercise-based rehabilitation for patients with coronary heart disease: systematic review and meta-analysis of randomized controlled trials. *Am J Med* 2004;116:682-92.
7. Scandinavian Simvastatin Survival Study Group. Randomised trial of cholesterol lowering in 4444 patients with coronary heart disease: the Scandinavian Simvastatin Survival Study (4S). *Lancet* 1994;344:1383-9.
8. Moran AE, Forouzanfar MH, Roth GA, et al. The global burden of ischemic heart disease in 1990 and 2010: the Global Burden of Disease 2010 study. *Circulation* 2014;129:1493-501.
9. Cortes O, Arthur HM. Determinants of referral to cardiac rehabilitation programs in patients with coronary artery disease: a systematic review. *Am Heart J* 2006;151:249-56.
10. Dafoe W, Arthur H, Stokes H, Morrin L, Beaton L. Canadian Cardiovascular Society Access to Care Working Group on Cardiac R. Universal access: but when? Treating the right patient at the right time: access to cardiac rehabilitation. *Can J Cardiol* 2006;22:905-11.
11. Varenhorst C, Jensen K, Jernberg T, et al. Duration of dual antiplatelet treatment with clopidogrel and aspirin in patients with acute coronary syndrome. *Eur Heart J* 2014;35:969-78.
12. Gislason GH, Rasmussen JN, Abildstrom SZ, et al. Long-term compliance with beta-blockers, angiotensin-converting enzyme inhibitors, and statins after acute myocardial infarction. *Eur Heart J* 2006;27:1153-8.

13. Statistics Canada. Immigration and ethnocultural diversity: Key results from the 2016 Census. *The Daily*. Statistics Canada; 2017 October 25. p. 1–8.
14. The United Nations Department of Economic and Social Affairs. Monitoring Global Population: International migrant stock 2017. In: Population Division, ed.
15. Statistics Canada. Immigration and Diversity: Population Projections for Canada and its Regions, 2011 to 2036. Statistics Canada; 2017 January 25 Catalogue no. 91-551-X.
16. Tu JV, Chu A, Rezai MR, et al. Incidence of major cardiovascular events in immigrants to Ontario, Canada: The CANHEART Immigrant Study. *Circulation* 2015;132:1549–59.
17. Kwak K. An evaluation of the healthy immigrant effect with adolescents in Canada: Examinations of gender and length of residence. *Soc Sci Med* 2016;157:87–95.
18. Vang ZM, Sigouin J, Flenon A, Gagnon A. Are immigrants healthier than native-born Canadians? A systematic review of the healthy immigrant effect in Canada. *Ethn Health* 2017;22:209–41.
19. Battaglini A, Chomienne MH, Plouffe L, Torres S, van Kemenade S. [Immigrant health in Canada: current state of knowledge, interventions and issues]. *Glob Health Promot* 2014;21:40–5.
20. Government of Canada. Immigrate to Canada. Available at: <https://www.canada.ca/en/immigration-refugees-citizenship/services/immigrate-canada.html>. Accessed March 3, 2021.
21. Tikkanen MJ, Holme I, Cater NB, et al. Comparison of efficacy and safety of atorvastatin (80 mg) to simvastatin (20 to 40 mg) in patients aged < 65 versus ≥ 65 years with coronary heart disease (from the Incremental DEcrease through Aggressive Lipid Lowering [IDEAL] study). *Am J Cardiol* 2009;103:577–82.
22. Kwak K, Rudmin F. Adolescent health and adaptation in Canada: examination of gender and age aspects of the healthy immigrant effect. *Int J Equity Health* 2014;13:103.
23. Ivers N, Schwalm J-D, Witteman H, et al. Interventions Supporting Long-term Adherence and Decreasing cardiovascular events (ISLAND): pragmatic randomized trial protocol. *American Heart J* 2017;190:64–75.
24. ClinicalTrials.gov. Interventions to Support Long-Term Adherence and Decrease Cardiovascular Events Post-Myocardial Infarction (ISLAND): ClinicalTrials.gov identifier: NCT02382731.
25. Ivers NM, Schwalm J-D, Bouck Z, et al. Interventions supporting long term adherence and decreasing cardiovascular events after myocardial infarction (ISLAND): pragmatic randomised controlled trial. *BMJ* 2020;369:m1731.
26. Ivers NM, Schwalm JD, Grimshaw JM, et al. Delayed educational reminders for long-term medication adherence in ST-elevation myocardial infarction (DERLA-STEMI): protocol for a pragmatic, cluster-randomized controlled trial. *Implement Sci* 2012;7:54.
27. McAlister FA, Fradette M, Majumdar SR, et al. The Enhancing Secondary Prevention in Coronary Artery Disease trial. *Can Med Assoc J* 2009;181:897–904.
28. Svarstad BL, Chewning BA, Sleath BL, Claesson C. The Brief Medication Questionnaire: a tool for screening patient adherence and barriers to adherence. *Patient Educ Couns* 1999;37:113–24.
29. Nieuwkerk PT, Nierman MC, Vissers MN, et al. Intervention to improve adherence to lipid-lowering medication and lipid-levels in patients with an increased cardiovascular risk. *Am J Cardiol* 2012;110:666–72.
30. Kayaniyl S, Leung YW, Suskin N, Stewart DE, Grace SL. Concordance of self- and program-reported rates of cardiac rehabilitation referral, enrollment and participation. *Can J Cardiol* 2009;25:e96–9.
31. Bermingham M, Hayden J, Dawkins I, et al. Prospective analysis of LDL-C goal achievement and self-reported medication adherence among statin users in primary care. *Clin Ther* 2011;33:1180–9.
32. Gushulak BD, Pottie K, Hatcher Roberts J, et al. Migration and health in Canada: health in the global village. *Can Med Assoc J* 2011;183:E952–8.
33. Setia MS, Quesnel-Vallee A, Abrahamowicz M, Tousignant P, Lynch J. Access to health-care in Canadian immigrants: a longitudinal study of the National Population Health Survey. *Health Soc Care Commun* 2011;19:70–9.
34. Cohen MJ, Shaykevich S, Cawthon C, Kripalani S, Paasche-Orlow MK, Schnipper JL. Predictors of medication adherence postdischarge: the impact of patient age, insurance status, and prior adherence. *J Hosp Med* 2012;7:470–5.
35. Rodriguez F, Cannon CP, Steg PG, et al. Predictors of long-term adherence to evidence-based cardiovascular disease medications in outpatients with stable atherosclerotic disease: findings from the REACH Registry. *Clin Cardiol* 2013;36:721–7.
36. Molfenter TD, Bhattacharya A, Gustafson DH. The roles of past behavior and health beliefs in predicting medication adherence to a statin regimen. *Patient Prefer Adherence* 2012;6:643–51.
37. Smith G. Step away from stepwise. *Journal of Big Data* 2018;5:32.
38. Rasmussen JN, Chong A, Alter DA. Relationship between adherence to evidence-based pharmacotherapy and long-term mortality after acute myocardial infarction. *JAMA* 2007;297:177–86.
39. Shalev V, Chodick G, Silber H, Kokia E, Jan J, Heymann AD. Continuation of statin treatment and all-cause mortality: a population-based cohort study. *Arch Intern Med* 2009;169:260–8.
40. Rublee DA, Chen SY, Mardekian J, Wu N, Rao P, Boulanger L. Evaluation of cardiovascular morbidity associated with adherence to atorvastatin therapy. *Am J Ther* 2012;19:24–32.
41. Chiu M, Austin PC, Manuel DG, Tu JV. Cardiovascular risk factor profiles of recent immigrants vs long-term residents of Ontario: a multi-ethnic study. *Can J Cardiol* 2012;28:20–6.
42. Dunlay SM, Witt BJ, Allison TG, et al. Barriers to participation in cardiac rehabilitation. *Am Heart J* 2009;158:852–9.
43. Brady S, Thomas S, Nolan R, Brooks D. Pre-coronary artery bypass graft measures and enrollment in cardiac rehabilitation. *J Cardiopulm Rehabil* 2005;25:343–9.
44. Knowles V. *Strangers at Our Gates: Canadian Immigration and Immigration Policy, 1540-2006*. Toronto: Dundurn; 2007.
45. Statistics Canada. Data Tables. 2016 Census of Population. Statistics Canada Catalogue no. 98-400-X2016346.
46. Nemes S, Jonasson JM, Genell A, Steineck G. Bias in odds ratios by logistic regression modelling and sample size. *BMC Med Res Methodol* 2009;9:56.
47. Higgins JP, Altman DG, Gotzsche PC, et al. The Cochrane Collaboration's tool for assessing risk of bias in randomised trials. *BMJ* 2011;343:d5928.
48. Saunders CL, Abel GA, El Turabi A, Ahmed F, Lyrtzapoulos G. Accuracy of routinely recorded ethnic group information compared with self-reported ethnicity: evidence from the English Cancer Patient Experience survey. *BMJ Open* 2013;3.

49. Klein DJ, Elliott MN, Haviland AM, et al. A comparison of methods for classifying and modeling respondents who endorse multiple racial/ethnic categories: a health care experience application. *Med Care* 2019;57:e34–41.
50. Siddiqi A, Ornelas IJ, Quinn K, Zuberi D, Nguyen QC. Societal context and the production of immigrant status-based health inequalities: a comparative study of the United States and Canada. *J Public Health Policy* 2013;34:330–44.
51. Statistics Canada. Canadian Community Health Survey - Annual Component (CCHS). Statistics Canada; 2018.
52. Shah BR, Chiu M, Amin S, Ramani M, Sadry S, Tu JV. Surname lists to identify South Asian and Chinese ethnicity from secondary data in Ontario, Canada: a validation study. *BMC Med Res Methodol* 2010;10:42.
53. Mulder AB, van Lijf HJ, Bon MA, et al. Association of polymorphism in the cytochrome CYP2D6 and the efficacy and tolerability of simvastatin. *Clin Pharmacol Ther* 2001;70:546–51.
54. Albert MA, Glynn RJ, Fonseca FA, et al. Race, ethnicity, and the efficacy of rosuvastatin in primary prevention: the Justification for the Use of Statins in Prevention: an Intervention Trial Evaluating Rosuvastatin (JUPITER) trial. *Am Heart J* 2011;162. 106-14 e102.
55. Prisant LM, Downton M, Watkins LO, et al. Efficacy and tolerability of lovastatin in 459 African-Americans with hypercholesterolemia. *Am J Cardiol* 1996;78:420–4.
56. Yip VL, Pirmohamed M. Expanding role of pharmacogenomics in the management of cardiovascular disorders. *Am J Cardiovasc Drugs* 2013;13:151–62.