Impact of Language Barriers on Complications and Mortality Among Immigrants With Diabetes: A Population-Based Cohort Study

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OBJECTIVE

Our objective was to examine the effect of language barriers on the risk of acute and chronic complications of diabetes and on mortality among immigrants.

RESEARCH DESIGN AND METHODS

Linked health and immigration databases were used to identify 87,707 adults with diabetes who immigrated to Ontario, Canada, between 1985 and 2005. These individuals were included in our cohort and stratified by language ability at the time of their immigration application. Primary end points included: one or more emergency department visit or hospitalization for *1*) hypo- or hyperglycemia, skin and soft tissue infection, or foot ulcer and *2*) a cardiovascular event or death between April 1, 2005, and February 29, 2012.

RESULTS

Our cohort was followed up for a median of 6.9 person-years. Immigrants with language barriers were older (mean age, 49 ± 15 vs. 42 ± 13 years; $P < 0.001$), more likely to have immigrated for family reunification (66% vs. 38%, $P < 0.001$), had less education (secondary school or less and no education, 82% vs. 53%; $P < 0.001$), and a higher use of health care (mean visits, 8.6 ± 12.1 vs. 7.8 ± 11.2; $P < 0.001$). Immigrants with language barriers were not found to have higher adjusted rates of diabetes complications (acute complications: hazard ratio [HR] 0.99, 95% CI 0.93–1.05; cardiovascular events or death: HR 0.95, 95% CI 0.91–0.99). Significant predictors included older age, being unmarried, living in a rural neighborhood, and having less education. Immigrants who were older (≥65 years) and who had arrived through family reunification had a lower risk of cardiovascular events or death (HR 0.88, 95% CI 0.81–0.96).

CONCLUSIONS

In a heterogenous immigrant population with universal insurance, language barriers were not found to increase the risk of diabetes complications. However, their effect may vary based on age at time of landing, education level, marital status, and neighborhood of settlement.

Diabetes is a chronic disease that affects an estimated 350 million people worldwide (1). Rates of diabetes are two- to fourfold higher among immigrants, and 80% of mortality attributable to diabetes occurs among individuals from low- and middle-income countries (2,3). Worldwide, diabetes rates continue to climb, fueled by a rise

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in obesity and sedentary lifestyles. For these reasons, along with the high and increasing rates of immigration to the U.S. and other developed countries, diabetes has become a major global health concern (2). Diabetes is associated with significant morbidity and places a tremendous burden on the health care system owing to frequent visits for acute and chronic complications (4). Half of all deaths from diabetes are attributable to cardiovascular causes (5).

Inequities in preventive screening, glycemic control, and higher rates of diabetes complications have been reported to vary by race and ethnicity, as well as among recent immigrants, due to barriers in health care access and use (6–10). These differences among immigrants have been found especially among women, the elderly, and lower income classes (4,6,7,9–11). Language barriers have been shown to decrease access to health care, adherence to treatment and follow-up (12), decrease self-reported health (13,14), and increase mortality among select immigrants (15). Professional interpreters improve communication, health care access and use, clinical outcomes, and satisfaction with care but are still underused in many parts of the world, including the U.S. (16,17). Though effective communication is critical for patient comprehension and self-management of diabetes, little is known about the effect of language barriers on acute and chronic complications or mortality among patients with diabetes.

Canada is well known for its universal health care access and multicultural and linguistic diversity. Indeed, approximately one-fifth of the country is foreign-born (18). This is higher than the rates in other Western nations, such as the U.S., Germany, and the U.K., but overall, numbers are comparable to several states and regions in these countries (19). Because Ontario has the largest share of immigrants (43%), there is a unique opportunity to study differences in diabetes complications among immigrants with and without language barriers. Our objective was to examine the effect of language barriers on the risk of acute and chronic complications of diabetes and mortality among the foreign-born.

RESEARCH DESIGN AND METHODS

We conducted a population-based retrospective cohort study using linked administrative health claims and immigration data to identify all emergency department (ED) visits and hospitalizations for diabetes complications among immigrants between 2005 and 2012. Because the Canadian health care system provides universal, public-funded, and single-payer coverage for all physician services, including hospital and laboratory services, these data are considered population-based and capture almost all of Ontario's 13.5 million residents. Health records were linked across multiple data sets for each individual by using an encrypted version of their health care number.

Study Population

All adults older than the age of 20 years living in Ontario with a diagnosis of diabetes as of March 31, 2005, were identified using the Ontario Diabetes Database. The Ontario Diabetes Database is a validated cumulative administrative data registry created from hospital records and physician services claims, with a sensitivity of 86% and specificity of more than 97% in identifying people with diagnosed diabetes (20). Patients with diabetes are identified by two primary care visits or by one admission to the hospital for diabetes within a 2-year period.

Foreign-born individuals were identified from the Citizenship and Immigration Canada (CIC) database, a cumulative database that contains data on all individuals who have been granted permanent residency in Canada as of 1985. For the purposes of this study, "immigrants" were used to describe our cohort that comprised permanent immigrants and refugees with accepted claims who receive health care coverage under the Ontario Health Insurance Program. Because refugee claimants who are still awaiting a determination are not covered by this same plan, they were not included in our cohort. The CIC data were linked to the Registered Persons Database, a registry of all individuals eligible for health care coverage in Ontario, using a combination of deterministic and probabilistic linkage.

Immigrants with $<$3 years eligibility for health care services before the index date (March 31, 2005) were excluded from the cohort (n = 7,890). This was done to ensure that only immigrants eligible to receive health care services with comparable baseline information for comorbidities measured before the index date were included in the cohort. The Ontario Health Insurance Program does not cover tourists, temporary visitors, or those who no longer reside in Ontario, and they were not included in our cohort. Other exclusions included immigrants with a missing postal code (n = 327) and those who self-declared country of origin as "Canada" on their immigration application (n = 56). Immigrants who had a diagnosis of diabetes during the study period who did not meet these exclusions were retained in the final cohort (N = 87,707).

Main Exposure

The primary exposure variable in this study was the presence of a self-reported language barrier. Because English and French are both considered official languages in Canada, a language barrier was present if immigrants reported that they spoke neither English nor French at the time of their official immigration application.

Covariates

Other baseline immigration variables from the CIC database that were measured as potential confounders included sex, age at time of landing, immigration visa class, time since arrival, region of birth, mother tongue, urban versus rural neighborhood (based on postal code of residency at index), marital status, and level of education at the time of immigration. The CIC immigration visa class was determined by the class of the primary applicant and categorized as economic immigrants (individuals sponsored by the province, skilled workers, entrepreneurs, self-employed, and investors), family of economic immigrants, immigrants who arrived through family reunification, refugees (including government-assisted and privately sponsored refugees, refugees officially landed and their dependants), and "other." Immigrants in the "other" category comprised less than 2% of our cohort and included all other immigrant classes for whom data were available, including live-in caregivers and their family as well as immigrants who arrived on humanitarian grounds.

Socioeconomic status (SES) was measured based on median household income from the neighborhood at index and reported as income quintiles. Neighborhood income is a widely used

measure of SES that correlates well with individually derived measures (21). World region of birth was included to control for confounding based on ethnicity, as has been done by previous authors (2). It was based on a modified version of the World Bank schema (available at http://go.worldbank.org/FFZ0CTE2V0) to group individuals by ethnicity and to a lesser extent, when possible, language spoken rather than level of development of their home country; for example, Mexico was included with Latin America rather than the Caribbean, where there are multiple official languages. Australia and New Zealand were included with the Pacific area but only accounted for 37 individuals (<1% of the total cohort).

Age at the time of the diabetes diagnosis and duration of diabetes were also measured as continuous variables. Duration of diabetes was dichotomized to duration of ≤10 years and >10 years because individuals with diabetes for >10 years are considered at higher risk of complications from diabetes. Lastly, comorbidities measured included hypertension, chronic renal failure, and prior cardiovascular disease (myocardial infarction, congestive heart failure, unstable angina, coronary bypass graft surgery, percutaneous coronary intervention, stroke or transient ischemic attack) based on ICD-10 diagnostic and procedure codes reported within 3 years before the index date from the Canadian Institute for Health Information Discharge Abstract Database for hospitalizations. All administrative clinical data were separate from the immigrant-specific data that might have been collected between 0 and 20 years before the index date.

Utilization of health care resources was measured by number of outpatient primary care visits in the year before the index date as well as a resource utilization band ranging from 0 (no utilization) to 5 (highest utilization) created by the Johns Hopkins Adjusted Clinical Groups case-mix system (22). These were based on diagnostic codes for conditions other than diabetes listed in hospital records and physicians' services claims for the 3 years before the index date (23).

The following immigration factors and other baseline variables were hypothesized to potentially modify the effect of language on both outcomes: age at time of landing, sex, immigrant class, income quintile, education level, time since immigration, marital status, duration of diabetes, and resource utilization band. There was limited evidence for collinearity between income quintile and language barriers as demonstrated by a low variance inflation factor. Lastly, age at time of landing was also dichotomized to <65 years and ≥65 years for several reasons. Universal drug coverage in Canada begins for seniors at age 65 years. Before this age, coverage may depend on SES or private insurance. We also wanted to look at the effect of language barriers in older age as both a confounder and effect modifier.

Outcomes

Our cohort was followed up to the first event from April 1, 2005, until February 29, 2012, for two primary end points: acute diabetes complications and cardiovascular event or death based on records from administrative data sets (Supplementary Data). Multiple events for the same end point were not recorded in this study. Subjects were censored if they died, were no longer eligible for health care services, or when the study period ended. The first primary end point consisted of at least one ED visit or hospitalization for an acute complication of diabetes, including hyper- or hypoglycemia, skin and soft tissue infection, or foot ulcer. The effect of language barriers on medication compliance and follow-up was felt to be secondary to the same causal pathway for both of these outcomes, and they were therefore analyzed individually and then combined when no significant differences were found. Our second primary end point included at least one ED visit or hospitalization for a cardiovascular condition (myocardial infarction, congestive heart failure, unstable angina, transient ischemic attack or stroke) or all-cause mortality.

Statistical Analysis

We compared baseline characteristics between immigrants with and without language barriers using χ^2 and *t* tests. We used Cox proportional hazards modeling to examine the effect of a language barrier on the risk of combined acute complications and cardiovascular events or all-cause mortality. Although age at time of landing explained most of the confounding, all immigration variables and comorbidities except for age at time of diabetes diagnosis were included in our final model. Age at time of diabetes diagnosis was not included due to multicollinearity from having also included age at time of landing, which both relied on birth date. Immigration factors and other baseline variables hypothesized as modifying the effect of language on both outcomes were tested for significant interaction, and stratified analyses were run for those that were significant. Immigrants with missing data on potential confounding variables were included in the data analysis, and missing data are reported in the results. All calculations were performed using SAS 9.3 software (SAS Institute, Cary, NC), and used a two-sided type 1 error rate of 0.05 as the threshold for statistical significance. All of the data are held at the Institute for Clinical Evaluative Sciences in Toronto, Ontario, and use its protocols to safeguard confidentiality. The Sunnybrook Health Sciences Centre Research Ethics Board reviewed the study.

Sensitivity Analyses

Because language barriers may have a greater effect on the health of new immigrants, we completed a sensitivity analysis to test the potential effect of excluding immigrants with health care eligibility of less than 3 years (*n* = 7,890) versus less than 1 year (*n* = 2,018).

RESULTS

The study included 87,707 immigrants with diabetes. Our cohort was followed up for a median of 6.9 person-years for time to first acute complication (total time of follow-up of 563,254 person-years) and median of 6.9 person-years for time to first cardiovascular disease event or all-cause mortality (total time of follow-up of 558,300 person-years). Only 1% of our cohort lost eligibility for health services during the follow-up period. Approximately 38% of all immigrants spoke neither English nor French at time of their immigration (only 0.1% spoke French). Immigrants with language barriers were older at the time of landing and at index (with a median age of 62 vs. 52 years). Immigrants with language barriers were also more likely to be female or to have immigrated for family reunification, had less education, and had higher use of health care at baseline based on primary

care visits and resource utilization band (Table 1). Immigrants with missing data on variables collected at time of immigration or time of entry into the cohort accounted for <4% of the total cohort.

A higher percentage of immigrants with language barriers experienced acute complications (8.0% vs. 7.3%, $P < 0.001$) and a cardiovascular event or all-cause mortality (18.4% vs. 13.8%, $P < 0.001$). There was a higher unadjusted rate of either end point among immigrants with language barriers; however, these differences were largely eliminated after adjusting for baseline characteristics (Table 2). Sensitivity analyses that included immigrants with less than 1 year of health care coverage (n = 94,035) yielded similar results for acute complications (adjusted hazard ratio [HR] 0.98, 95% CI 0.92–1.04) and for cardiovascular events/all-cause mortality (HR 0.95, 95% CI 0.91–0.99).

Significant predictors that increased the risk of acute complications included older age, male sex, presence of hypertension, chronic renal failure, prior cardiovascular disease, longer duration of diabetes, being unmarried, living in a rural neighborhood, and having less education (Fig. 1). Significant predictors that increased the risk of cardiovascular events or all-cause mortality were similar but did not include living in a rural neighborhood (Fig. 2). Time living in Ontario was not an important predictor of the risk of complications.

Age at time of landing and immigration class were both significant effect modifiers of the relationship between language barrier and risk of cardiovascular disease or all-cause mortality (P = 0.0013 and P = 0.001 for interactions between language barrier and age group ≥65 years and family reunification class, respectively). After adjusting for baseline covariates, the risk of cardiovascular events or all-cause mortality appeared to be lower only among immigrants with language barriers who were older than the age of 65 who had immigrated for the purpose of family reunification (HR 0.88, 95% CI 0.81–0.96; Supplementary Fig. 1). Having a language barrier was not associated with an increased risk of cardiovascular events or all-cause mortality among all other categories of immigrants (Supplementary Fig. 1). Age group and immigration class were also not significant effect modifiers on the

Table 1—Demographic characteristics among immigrants with and without language barriers

	Immigrants (N = 87,707)		
	No language barrier (n = 54,151)	Language barrier (n = 33,556)	P value
Age at time of landing (years)	42.3 ± 13.1	48.6 ± 15.0	<0.001
Age at index (years)	54 ± 13	60 ± 15	<0.001
Female sex	23,349 (43.1)	19,778 (58.9)	<0.001
Mother tongue			
English	17,051 (31.5)	24 (0.1)	<0.001
French	160 (0.3)	0 (0.0)	
Other	36,930 (68.2)	33,532 (99.9)	
Region of birth			
Caribbean	7,923 (14.6)	171 (0.5)	<0.001
East Asia and Pacific + Australia/ New Zealand	10,645 (19.7)	10,172 (30.3)	
East Europe and Central Asia	2,406 (4.4)	4,141 (12.3)	
Latin America and Mexico	6,087 (11.2)	1,699 (5.1)	
North Africa and Middle East	3,339 (6.2)	2,468 (7.4)	
South Asia	16,935 (31.2)	12,197 (36.3)	
Sub-Saharan Africa	4,172 (7.7)	903 (2.7)	
Western Europe and U.S.	2,623 (4.9)	1,784 (5.3)	
Missing	21 (0.0)	20 (0.1)	
Time since landing (years)	11.5 ± 4.6	11.8 ± 4.3	<0.001
Missing	262 (0.5)	16 (0.0)	
Immigration class			
Economic			
Principal	16,402 (30.3)	2,884 (8.6)	<0.001
Family	6,216 (11.5)	2,750 (8.2)	
Family reunification	20,817 (38.4)	22,157 (66.0)	
Refugee	9,226 (17.0)	5,243 (15.6)	
Other	952 (1.8)	35 (0.1)	
Missing	538 (1.0)	487 (1.5)	
Level of education			
No education	856 (1.6)	4,272 (12.7)	<0.001
Secondary school or less	27,699 (51.2)	23,211 (69.2)	
Trade/apprenticeship, certificate/ diploma	9,400 (17.4)	3,051 (9.1)	
University degree or higher	13,156 (24.3)	2,726 (8.2)	
Missing	3,040 (5.6)	296 (0.9)	
Marital status			
Single	11,386 (21.0)	4,052 (12.1)	<0.001
Married	37,667 (69.6)	24,281 (72.4)	
Widowed or divorced	5,090 (9.4)	5,223 (15.6)	
Missing	8 (0.0)	0 (0.0)	
Income quintile of neighborhood of settlement			
Q1 (lowest income)	18,522 (34.2)	11,453 (34.1)	<0.001
Q2	13,087 (24.2)	8,842 (26.3)	
Q3	10,376 (19.2)	6,365 (19.0)	
Q4	7,363 (13.6)	4,246 (12.7)	
Q5 (highest income)	4,746 (8.8)	2,622 (7.8)	
Missing	57 (0.1)	28 (0.1)	
Comorbidities			
Hypertension	34,377 (63.5)	23,772 (70.8)	<0.001
Chronic renal failure	1,751 (3.2)	1,152 (3.4)	0.108
Prior cardiovascular disease*	9,572 (17.7)	7,122 (21.2)	<0.001
Diabetes-related characteristics			
Age at diagnosis (years)	48.2 ± 12.58	54.6 ± 14.0	<0.001
Duration of diabetes			
<2 years	12,210 (22.5)	6,853 (20.4)	<0.001
2–5 years	16,306 (30.1)	9,933 (29.6)	
5–10 years	15,517 (28.7)	10,373 (30.9)	

Continued on p. 193

Table 1—Continued

	Immigrants (*N* = 87,707)		
	No language barrier (*n* = 54,151)	Language barrier (*n* = 33,556)	*P* value
>10 years	10,099 (18.6)	6,384 (19.0)	
Missing	19 (0.0)	13 (0.0)	
Health care utilization			
Outpatient visits in year before index with primary care for any diagnosis	7.8 ± 11.2	8.6 ± 12.1	<0.001
Resource utilization band			
Nonusers	1,214 (2.2)	934 (2.8)	<0.001
Health users	825 (1.5)	392 (1.2)	
Low morbidity	3,740 (6.9)	1,898 (5.7)	
Moderate morbidity	30,327 (56.0)	17,691 (52.7)	
High morbidity	13,242 (24.5)	9,100 (27.1)	
Very high morbidity	4,803 (8.9)	3,541 (10.6)	

Data are presented as mean ± SD or *n* (%). *Myocardial infarction, congestive heart failure, unstable angina, coronary bypass graft surgery, percutaneous coronary intervention, stroke, transient ischemic attack.

relationship between language barrier and risk of acute complications.

CONCLUSIONS

Our study found that immigrants with language barriers were more likely to experience an avoidable ED visit or hospitalization for an acute complication of diabetes, a cardiovascular event, or death from any cause than immigrants without language barriers. However, after adjustment for baseline characteristics, there was a similar risk of acute complications and slightly lower risk of cardiovascular events or death among immigrants with language barriers. Furthermore, immigrants for whom the language barrier seemed to have a protective effect were seniors who had immigrated for the purpose of family reunification. In fact, other important predictors that decreased the risk of diabetes complications included being married, living in an urban center, and having more education.

These results have important clinical, research, and policy implications because they suggest that language barriers do not independently increase the risk of diabetes complications. Still, their effect may vary based on important premigration variables, such as older age, lower education level, being unmarried, and immigrating for purposes of family reunification or as a refugee, as well as postmigration settlement in a rural neighborhood. In fact, all of these predictive variables suggest that the risk of social isolation is an important factor to consider among immigrants with diabetes.

This is among the first studies, to our knowledge, to evaluate the effect of language barriers on acute and chronic complications of immigrants with diabetes. Using population-based, comprehensive data, from linked administrative databases, our study adds to the existing literature by demonstrating how language barriers affect rates of major complications and death among a diverse group of immigrants. Although previous studies have demonstrated language barriers are associated with worse outcomes, most of these studies were done among a homogenous group of immigrants or where access to immigration variables that are known to affect access and use were not available (12,13,15).

A limitation of these data that may have attenuated the effect of language barriers on complications in our cohort is in the use of self-declared language ability as recorded at the time of immigration. Although self-reported language barriers are often used to measure language barriers (13,14,24,25), other unmeasured variables may possibly affect how immigrants answer this question when they complete their immigration application. For example, principal applicants from the economic class are required to demonstrate language ability to be eligible for entry, whereas those who immigrate for family reunification are not. Because all immigrant classes were included, various degrees of language barriers may be present in our cohort. Moreover, some immigrants may have improved their language ability during the period of outcome ascertainment. Despite differences in pre- and postmigration factors, a previous study demonstrated that persistent language barriers were associated with poor self-reported health and health decline (25). However, only 4–6% of the cohort in that study reported an improvement in their language proficiency over 4 years (25). Therefore, the likelihood that language proficiency

Table 2—Risk of complications for immigrants with diabetes by language barrier (*N* = 87,707)

	N	No. events	Person-years	Event rate*	Unadjusted model HR (95% CI)	Full model** HR (95% CI)
Acute complications[a]						
Language barrier	54,151	2,684	212,959	1.26	1.12 (1.06–1.17)	0.99 (0.93–1.05)
No language barrier	33,556	3,953				1.00
Cardiovascular event[b] or death						
Language barrier	54,141	6,200	210,327	2.95	1.37 (1.33–1.42)	0.95 (0.91–0.99)
No language barrier	33,556	7,485				1.00

[a]Acute complications include hypo- or hyperglycemia, soft tissue ulcer, or infection. [b]Cardiovascular event includes unstable angina, myocardial infarction, congestive heart failure, transient ischemic attack, stroke. *Number of events per 100 person-years. **Adjusted for age at landing, sex, years in Canada, baseline comorbidities (hypertension, cardiovascular disease, chronic renal failure), SES, neighborhood at index date, country of origin, immigrant class, level of education, marital status, number of primary care visits, resource utilization band.

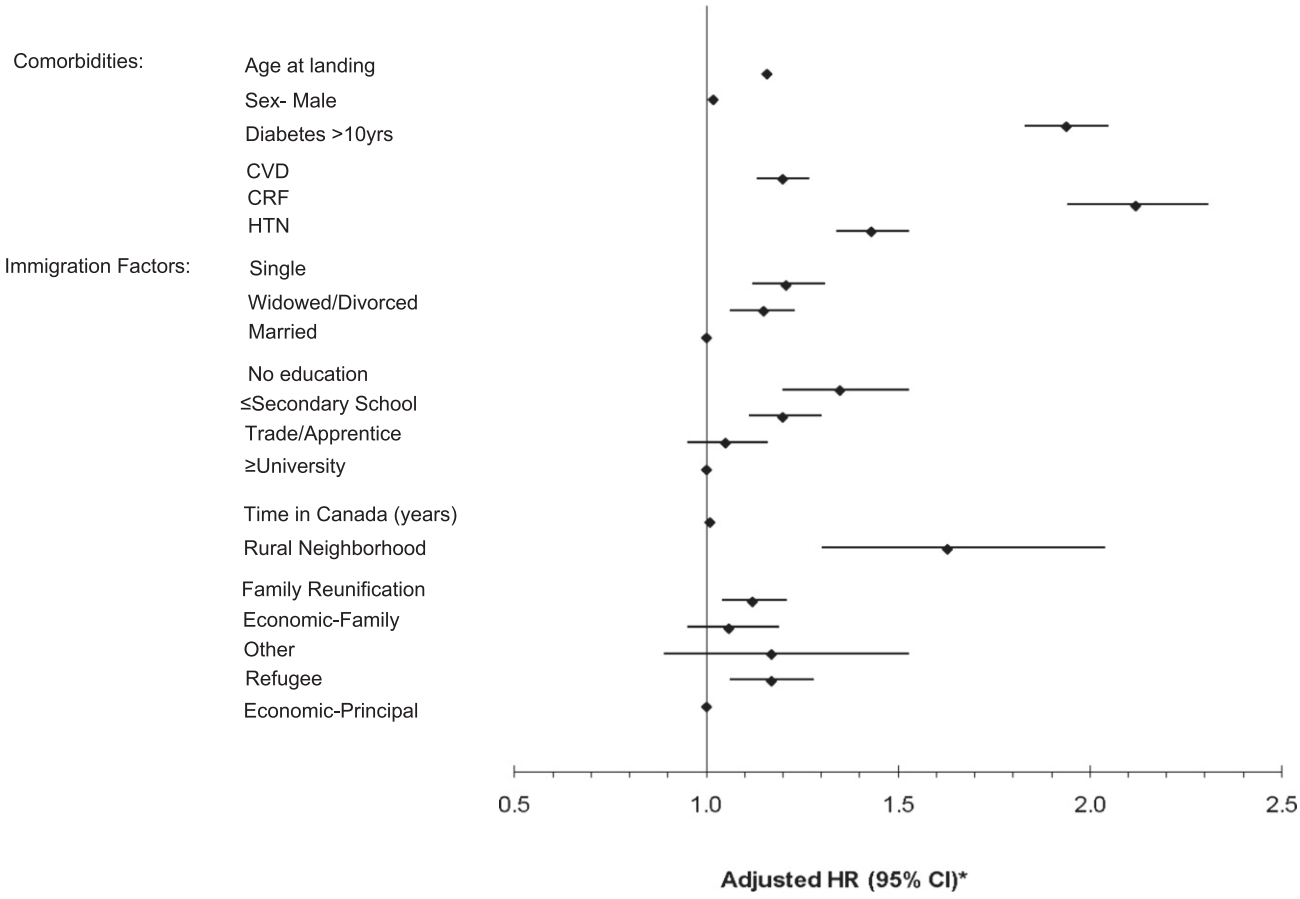

Figure 1—Baseline predictors of acute complication of diabetes among immigrants with language barriers (*N* = 87,707). *Adjustment for all variables listed, as well as language barrier, SES, country of origin, number of primary care visits in the previous year, and resource utilization band. CRF, chronic renal failure; CVD, cardiovascular disease; HTN, hypertension.

may have improved in a significant subset of our cohort is not currently supported by the literature. Our cohort included immigrants with a wide spectrum in language ability, and dichotomizing this variable is a limitation of the data.

Diabetic outcomes among immigrants with persistent language barriers may be greater than those found in our cohort. Although we are one of few authors to use this data set (10), a limitation is that there is little reliability data or precision metrics available on the CIC data. Also, we may have been unable to assess the importance of language barriers among new arrivals to Canada because of insufficient power. More than 65% of immigrants in this cohort had been in Canada for more than 10 years, and therefore, their proficiency in speaking English likely improved over time. However, a sensitivity analysis that included immigrants with less than 3 years of eligibility for health care services demonstrated similar results. Moreover, we did not detect any interaction between language barriers and the amount of time spent in Canada. We are unable to make any definitive conclusions about the relationship between SES and language barriers. There was limited evidence for collinearity and no significant effect modification; however, the measurement of SES in this cohort was based on extremely small neighborhood units, which likely decreased the ability to capture a mixture of income levels. Although the vast majority of adults older than the age of 20 years with diabetes have type 2 diabetes, we could not distinguish type 1 diabetes from type 2 diabetes. Our findings are also not generalizable to refugee claimants and temporary visitors, such as students, who were not included in our cohort. Lastly, our findings may not be generalizable to health care systems that do not provide any universal health care coverage as offered in Canada. Our study is relevant, however, to the U.S. health care system, where recent immigrants may be covered by Medicare or Medicaid. Moreover, universal access in Canada does not guarantee equal access to care, and disparities still exist in Canada (26).

There are several reasons to explain why language barriers were not found to independently increase the risk of diabetes complications among immigrants. First, although a large proportion of our immigrants originated from the East Asia and Pacific region and South Asia, our cohort was quite diverse in age, period of immigration, immigration class, languages spoken, and ethnicities. Previous studies that have found language barriers to be associated with worse outcomes were demonstrated mostly among Spanish-speaking immigrants in the U.S. (12,24,27,28). It is therefore possible that the effect of language barriers varies among different ethnicities and cultural groups.

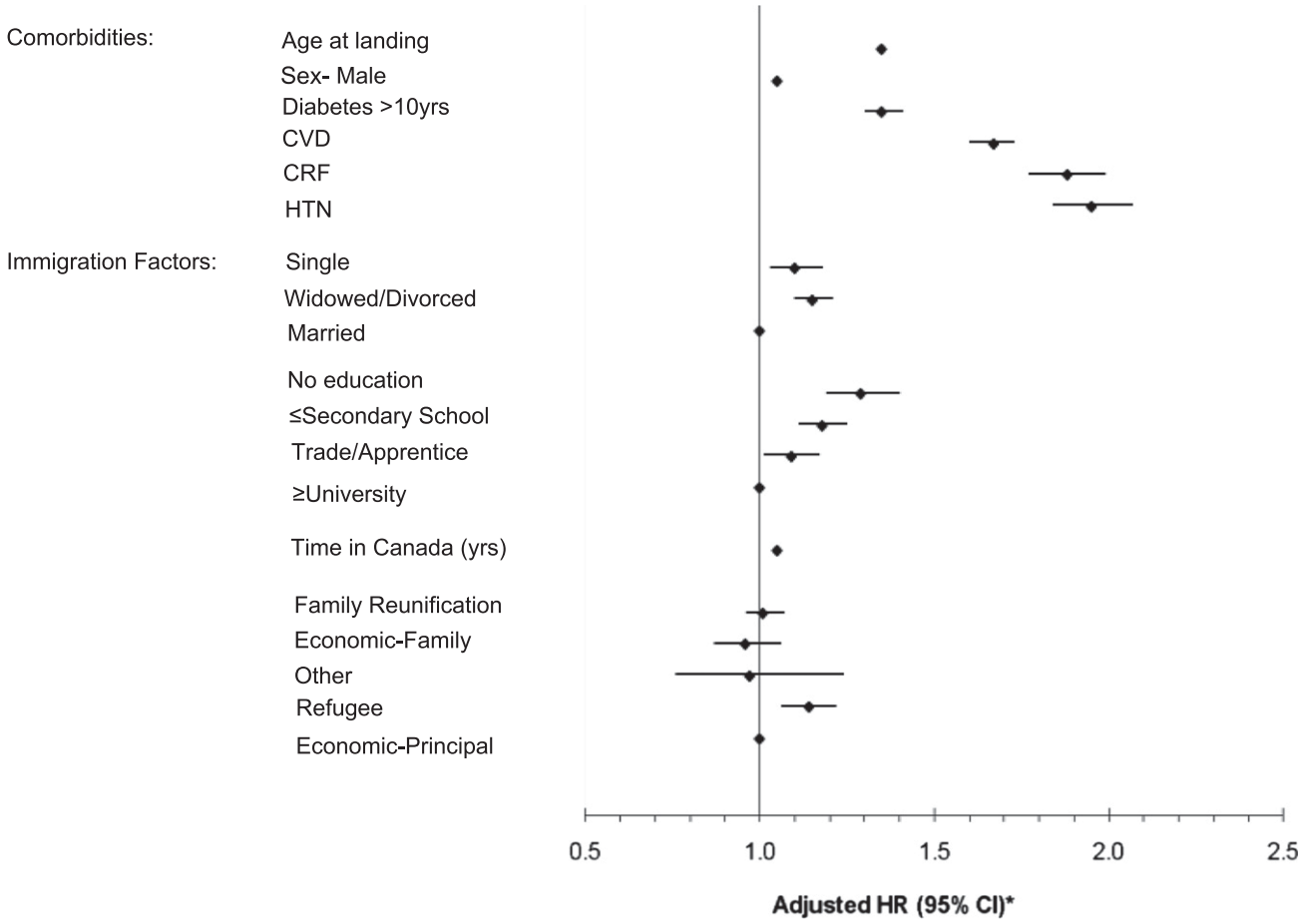

Figure 2—Baseline predictors for risk of cardiovascular events or all-cause mortality among immigrants with language barriers (*N* = 87,707). *Adjustment for all variables listed, as well as language barrier, SES, country of origin, number of primary care visits in the previous year, and resource utilization band. CRF, chronic renal failure; CVD, cardiovascular disease; HTN, hypertension.

Second, immigrants with language barriers in our cohort had higher levels of primary care use and were more likely to be high users of health care at index. This is consistent with a previous study of a similar population that demonstrated that immigrants with language barriers had higher rates of outpatient physician visits compared with immigrants without language barriers (4). Likewise, a retrospective cohort study conducted in the U.S. found that non–English-speaking patients with diabetes were just as or more likely to receive diabetes care, including glycemic testing, dietary consultations, and physician visits, than English-speaking patients, owing to more frequent visits and laboratory testing (29). The higher use of physician visits has also been demonstrated among screening practices for patients with diabetes (10). Notably, a higher number of ED visits or hospitalizations have not been found among immigrants with language barriers (27). It is therefore possible that immigrants with language barriers are receiving more outpatient care and may be less likely to present to the hospital with complications from their diabetes.

The use of family members, access to language-concordant physicians, and professional interpreters may have improved communication for immigrants with language barriers and was not captured in our cohort. Previous studies have shown that immigrants with language-concordant physicians have improved glycemic control and outcomes compared with those without (24,28). Family members who can act as translators may serve a similar role. This could explain why older immigrants in our study who immigrated through family reunification were less likely to have cardiovascular complications or die during follow-up. In contrast, immigrants who were unmarried were more likely to have complications. Other studies have found marital status is an important predictor of health (30,31). Language barriers may therefore not only affect health care access and use, but its effect may vary in the presence of a supportive family (9). The presence of social isolation among older immigrants with language barriers may be a stronger contributor to complications from diabetes, especially among immigrants who are unmarried. Professional interpreters may overcome such barriers but are not commonly available in Canada and are often underused in countries such as the U.S., leaving many immigrants with language barriers relying on their family to communicate with their health care team (17). Because rates of immigration and diabetes are increasing worldwide, the need to understand the effect of language barriers on complications from diabetes is relevant to clinicians, researchers, and policy makers.

Immigrants with language barriers have higher rates of acute and chronic complications of diabetes, including death. However, these higher rates are largely attributed to baseline differences. Immigrants who are older, unmarried, less educated, who arrive through family reunification or as refugees, and who settle in rural neighborhoods appear to be at a higher risk of complications from diabetes. Because immigrants constitute a complex and growing population, those with language barriers will pose an ongoing challenge to health systems globally. Our study suggests that in a heterogenous immigrant population with universal insurance, the effect of language barriers on complications among immigrants with diabetes cannot be studied independently of other pre- and postmigration variables. Further research is needed to better understand how social isolation may affect transitions for immigrants and, ultimately, health outcomes. In this way, clinicians and policy makers can better identify groups of immigrants who may be more vulnerable to language barriers.

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