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Inadequate screening for retinopathy among recent immigrants with type 2 diabetes despite universal health care: A population-based study

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ABSTRACT

Aims: To examine retinopathy screening and treatment rates for recent immigrants compared to non-immigrants in a universal health care system.

Methods: Linked health care and immigration databases were used to identify all 771,564 adults diagnosed with diabetes between 1996 and 2007, in Ontario, Canada. The cohort was stratified by their immigration status and followed until 2013 for retinopathy screening and treatment visits.

Results: Retinopathy screening rates were low, and recent immigrants were considerably less likely to receive screening than long-term residents (≥ 1 examination within 1 year: 37.5% vs. 50.5%, adjusted OR 0.76 [95% CI, 0.75–0.77]; ≥ 3 examinations within 6 years: 46.6% vs. 61.9%, adjusted OR 0.77 [95% CI, 0.76–0.79]). Immigrants were also less likely to receive surgical treatment for retinopathy, but adjustment for the frequency of screening attenuated these differences.

Conclusions: Despite universal access to physician services, only half of all individuals with newly-diagnosed type 2 diabetes received retinopathy screening within the first year, and recent immigrants were markedly less likely to be screened. After adjusting for screening rates, gaps in surgical treatment for retinopathy were attenuated, suggesting that treatable retinopathy may be being missed among recent immigrants because of inadequate screening.

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1. Introduction

Diabetic retinopathy is the most common microvascular complication of type 2 diabetes (Kohner et al., 1998), affecting an estimated 93 million people worldwide (Yau et al., 2012). In the United States, diabetic retinopathy contributes to more than 10,000 new cases of blindness annually, and is the most common cause of avoidable blindness (legal and functional) among working aged people (Yau et al., 2012). The overall age-standardized prevalence of retinopathy among diabetic patients is estimated at 35% (Yau et al., 2012). The recent Global Burden of Disease study revealed an alarming increase in blindness (27%) and visual impairment (67%) due to diabetic retinopathy between 1990 and 2010. This meta-analysis also identified that the age-standardized prevalence of diabetic retinopathy-related blindness and visual impairment was higher in sub-Saharan Africa and South Asia compared to all other regions examined (Leasher et al., 2016). Fortunately, primary prevention with intensive glycemic control, blood pressure regulation, and early detection and timely treatment

can attenuate the risk for vision loss due to diabetic retinal disease (Aiello et al., 2015; Matthews, Stratton, Aldington, Holman, & Kohner, 2004).

Many patients already have retinopathy when they are diagnosed with type 2 diabetes. In the UK Prospective Diabetes Study, 38% of subjects had evidence of diabetic retinopathy at diagnosis, compared to only 11.5% having neuropathy and 1.9% having proteinuria (UK Prospective Diabetes Study Group, 1998). In a more recent UK study, the incidence rate of diabetic retinopathy in the first two years following diabetes diagnosis was 47.7 cases per 1000 patient years (Martin-Merino, Fortuny, Rivero-Ferrer, & Garcia-Rodriguez, 2014). Accordingly, diabetes guidelines recommend that individuals diagnosed with type 2 diabetes should have a comprehensive eye examination at diagnosis to rule out pre-existing retinopathy, and individuals with established diabetes should have ongoing examinations to screen for incident retinopathy (American Diabetes Association, 2017; Canadian Diabetes Association Clinical Practice Guidelines Expert Committee, 2013). However, compliance with this recommendation is under-achieved, and retinopathy screening rates have been found to be particularly low among ethnic/racial minorities in the United States (Nsiah-Kumi, Ortmeier, & Brown, 2009; Shi, Zhao, Fonseca, Krousel-Wood, & Shi, 2014). Although many

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barriers to screening have been identified, lack of access to health care for minorities is commonly cited (Elish, Royak-Schaler, Passmore, & Higginbotham, 2007; Lu, Serpas, Genter, Anderson, & Campa, 2016).

Within both the United States and Canada, the risk for diabetes is higher among immigrants compared to long-term residents (Creatore et al., 2010; Oza-Frank, Chan, Liu, Burke, & Kanaya, 2013; Shiu, 2014). While immigrants in the United States experience inequities in health service utilization and health outcomes (Institute of Medicine, 2002; Lanting, Joung, Mackenbach, Lamberts, & Bootsma, 2005; National Committee for Quality Assurance, 2010), Canada's universal health care system mitigates some of these disparities. Several studies have demonstrated that primary care and diabetes care for immigrants is equivalent to the Canadian-born population (Creatore, Booth, Manuel, Moineddin, & Glazier, 2012; Muggah, Dahrouge, & Hogg, 2012; Shah et al., 2012). However, it is uncertain whether this absence of disparities extends to specialized diabetes care. The goal of this study was to determine whether recent immigrants with incident type 2 diabetes received similar screening and required similar surgical treatment for diabetic retinopathy as long-term residents, in a universal health care system where financial barriers to accessing specialized care are reduced.

2. Subjects and methods

2.1. Design and data sources

We performed a population-based cohort study by linking multiple health care databases from Ontario, Canada's most populous province. Databases included the physician services database, which records all fee-for-service reimbursement claims submitted by physicians and optometrists; a demographic database for all residents; and the Permanent Resident Database from Immigration, Refugees and Citizenship Canada, a registry of all immigrants to Ontario since 1985. We also used the Ontario Diabetes Database (ODD), a validated administrative data-derived registry of all people with diabetes (Hux, Ivis, Flintoft, & Bica, 2002). Individuals enter the database when they have a hospitalization bearing an ICD-9 or ICD-10 diagnosis code for diabetes mellitus, or if they have two physician claims within two years with the diagnosis code for diabetes mellitus. Any claims proximal to a parturition hospitalization record are excluded, to ensure gestational diabetes is not captured. Because Ontario has universal public-funded health insurance, these datasets capture virtually all care delivered to all of Ontario's residents, with no missing data. Individuals are linked between databases and across time using a unique coded identifier.

All Ontario adults aged ≥ 30 years who were diagnosed with diabetes between 1996 and 2007 were identified. Because the ODD does not differentiate between types of diabetes, younger individuals were excluded because they would have been more likely to have type 1 diabetes, where retinopathy screening recommendations after diagnosis are different. Individuals who had lived in Ontario for < 2 years were excluded, as we would have been unable to differentiate incident from prevalent diabetes in a new resident lacking prior health claims data.

The primary exposure variable in this study was immigration status, which was classified as "recent immigrants" (those recorded in the Permanent Resident Database), and "long-term residents" (those who were Canadian-born or who immigrated prior to 1985). Recent immigrants were further sub-divided into 8 groups based on country of origin (Arab, Caribbean, East Asia, Europe, Latin America, South Asia, Southeast Asia or Other).

Using the physician services database, we identified retinopathy screening visits with an ophthalmologist or optometrist after diabetes diagnosis. Because the study was conducted using population-level claims data, we could not ascertain the prevalence of retinopathy itself. Instead, we ascertained surgical treatment for retinopathy, defined as any claim from an ophthalmologist for laser photocoagulation or vitrectomy. Patients were followed until December 31, 2013.

2.2. Statistical analysis

We determined the proportion of recent immigrants and long-term residents who had ≥ 1 retinopathy screening visit within 1 year of diabetes diagnosis, and ≥ 3 screening visits within 6 years of diabetes diagnosis. These measures represent, respectively, early screening soon after diagnosis with type 2 diabetes, and regular ongoing screening for patients with established disease, both of which are recommended by clinical practice guidelines (American Diabetes Association, 2017; Canadian Diabetes Association Clinical Practice Guidelines Expert Committee, 2013). Patients who died within 1 year or 6 years of diagnosis, respectively, were excluded from these analyses. To determine the independent impact of immigration status on screening, we used logistic regression to adjust for age, sex, income (determined ecologically based on neighborhood-level household income, divided into quintiles), rural residence, ophthalmology visits within 2 years prior to diabetes diagnosis (to account for other preexisting eye disease), and baseline hypertension. The cumulative incidence of the first retinopathy screening examination was plotted for both groups. Cox proportional hazards regression was used to compare recent immigrants and long-term residents on the incidence of laser photocoagulation and of vitrectomy after diagnosis, adjusting for age, sex, income, rural residence, preexisting eye disease, and hypertension (as a time-varying covariate). Individuals were censored at death or the end of follow-up. Additional Cox models adding adjustment for screening visits (as a time-varying count variable) were fit for each surgical treatment. All statistical calculations were performed using SAS Enterprise Guide version 6.1 (SAS Institute, Cary, NC).

2.3. Ethics

The study was approved by the Research Ethics Board of Sunnybrook Health Sciences Centre, Toronto.

3. Results

This study included 771,564 individuals diagnosed with diabetes in Ontario between 1996 and 2007 who met the inclusion and exclusion criteria. Within the cohort, 90,643 (11.7%) were recent immigrants. Baseline characteristics are presented in Table 1. Long-term residents were older (60.1 vs. 52.3 years at diabetes diagnosis), more likely to have had ophthalmological visits prior to diagnosis (58.1% vs. 37.2%), and more likely to have hypertension

Table 1
Baseline characteristics of patients newly diagnosed with diabetes.

	Recent immigrants	Long-term residents	P
n	90,643	680,921	
Age, years	52.3 \pm 13.2	60.1 \pm 13.8	<0.001
Sex			0.549
Male	47,908 (52.9%)	359,170 (52.7%)	
Female	42,735 (47.1%)	321,751 (47.3%)	
Income			<0.001
Lowest	32,071 (35.4%)	141,930 (20.8%)	
Second-lowest	21,896 (24.2%)	146,236 (21.5%)	
Middle	16,718 (18.4%)	137,381 (20.2%)	
Second-highest	12,255 (13.5%)	130,490 (19.2%)	
Highest	7610 (8.4%)	121,535 (17.8%)	
Missing	93 (0.1%)	3349 (0.5%)	
Rural residence			<0.001
Yes	609 (0.7%)	89,643 (13.2%)	
No	89,960 (99.2%)	580,469 (85.2%)	
Missing	74 (0.1%)	10,809 (1.6%)	
Ophthalmology visit within 2 years prior to diagnosis	38,629 (42.6%)	395,640 (58.1%)	<0.001
Hypertension	36,508 (40.3%)	359,006 (52.7%)	<0.001

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