Prostate Cancer Incidence Among Immigrant Men in Ontario, Canada: A Population-Based Retrospective Cohort Study

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ABSTRACT

Background: Prostate cancer incidence has been associated with various sociodemographic factors, such as race, income and age, but the association with immigrant status in Canada is unclear. In this population-based study, we compared age-standardized incidence rates for immigrant men from various regions of origin compared to long-term residents of Ontario, Canada for 2008-2016. **Methods**: We linked several provincial-level databases available at ICES, an independent, non-profit research institute. We determined age-standardized prostate cancer incidence rates, stratifying by immigrant status and region of origin. We used a log binomial model to estimate adjusted incidence rate ratios, with long-term residents as the reference group. We included age, neighbourhood income, and time since landing in the models. Models were repeated and limited to immigrant men in the cohort; these models included immigration admission category and time since landing in Canada. **Results**: There were 74,594 incident cases of prostate cancer in the study period, 6,742 of which were among immigrant men. Men who had immigrated from West Africa and the Caribbean had significantly higher incidence of prostate cancer than other immigrants and long-term residents: age-standardized incidence rates of 2.71 [95% CI 2.41-3.05] and 1.91 [95% CI 1.78-2.04] respectively. Immigrants from other regions, including East Africa and Middle-Southern Africa, had lower or similar incidence rates to long-term residents. Men from South Asia had the lowest adjusted rate ratio (0.47 [95% CI 0.45-0.50]. **Conclusion**: These findings suggest that describing all Black men as at higher risk of prostate cancer is likely inaccurate in the Canadian context.

INTRODUCTION

Prostate cancer is the 2nd most common cancer among men worldwide, and the most common cancer among men in 112 countries including Canada (1). In Canada, one in nine men will be diagnosed with prostate cancer during their lifetime and one in 29 will die from it (2). Ontario is Canada's largest province based on population with approximately 13 million people, and has the 2nd highest age-standardized incidence rate of prostate cancer of all Canadian provinces, reported at 121.8 cases per 100,000 (2).

Ontario also has a sizeable and diverse foreign-born population; 29% of the province's population are immigrants according to the 2016 Canada Census, coming from over 200 countries (3). It is important to understand where differences, if any, in prostate cancer risk for immigrants to ensure that we are best serving the healthcare needs of a very diverse population. However, very little is known about prostate cancer risk among immigrants in the Ontario or Canadian context. Incidence of breast and colorectal cancers have previously been found to differ significantly for immigrants versus long-term residents of Ontario, and to vary by region of origin and time in Canada (4), and it is reasonable to consider the same may hold true for prostate cancer. Although prostate cancer is pervasive worldwide, incidence rates vary widely from country to country (1), and may similarly vary widely for Ontario's immigrant men. As well, Black men are commonly considered to be at higher risk for prostate cancer (5-9). Race-based data are not systematically collected in Ontario or in Canada, but approximately half of Canada's Black population are immigrants, with the top countries of birth for Black Ontarians being Jamaica, Nigeria, Trinidad, Somalia, Ghana and Ethiopia (10).

Prostate cancer incidence has also been associated with other demographic factors. The risk of prostate cancer increases with age, such that 40% of all prostate cancer cases occur in men aged 60-69 years (2). Higher levels of socioeconomic status have been associated with increased incidence (11, 12). Therefore, in this population-based study, we aimed to describe and compare age-standardized incidence rates for immigrant men from various regions of origin compared to long-term residents of Ontario for 2008-2016, and to better understand the role of sociodemographic and health factors on prostate cancer incidence, specifically age, neighbourhood income quintile, immigration admission category, and years in Canada.

METHODS

This study was approved by the Research Ethics Board of Unity Health Toronto.

Data Sources: We used several databases available at ICES, an independent, non-profit research institute funded by an annual grant from the Ontario Ministry of Health and the Ministry of Long-Term Care. As a prescribed entity under Ontario's privacy legislation, ICES is authorized to collect and use health care data for the purposes of health system analysis, evaluation, and decision support. Secure access to these data is governed by policies and procedures that are approved by the Information and Privacy Commissioner of Ontario. ICES houses a secure array of Ontario's health-related administrative provincial-level data. Data include population demographics and health service use information on all Ontario residents who are eligible for the province's universal Ontario Health Insurance Plan (OHIP). All Canadian citizens, permanent residents/landed immigrants and refugees who live in Ontario are eligible for OHIP (13). All datasets are linked using unique encoded identifiers and analyzed at ICES.

We used the Immigration, Refugee and Citizenship Canada Permanent Resident (IRCC-PR) database, which includes demographic information on Ontario's immigrants and refugees who landed from 1985 onward, including country of origin, date of landing, and immigration admission category

(14). We also used the Ontario Cancer Registry, which includes all Ontario residents who have been newly diagnosed with cancer (except non-melanoma skin cancers), including the primary cancer site and diagnosis date. Other databases that we used included the Primary Care Population dataset, which is a bi-annual cohort of OHIP eligible Ontario residents with a date of last contact with the healthcare system within 7-9 years of index; the Registered Persons Database, which includes date of birth, sex, postal code, and dates of contact with the healthcare system; and the OHIP Database, which contains procedural and diagnostic codes claimed by physicians in the province.

Study Population: We used the Primary Care Population dataset to identify all men aged 20 years and over in the province of Ontario eligible for health care for each fiscal year in 2008-2016. We identified incident prostate cancer cases for each year by linking annual cohorts to the Ontario Cancer Registry. We defined men in the IRCC-PR database as immigrants, and those not in the IRCC-PR database as long-term residents (as this group would include men who immigrated before 1985). We categorized immigrant men by region of origin (i.e. Caribbean, Latin America, Western Europe, Eastern Europe and Central Asia, Middle East and North Africa, East Asia and the Pacific, West Africa, East Africa, Middle-Southern Africa, and Australia, New Zealand and the USA) based on country of birth. These regions reflect classifications by the World Bank (15), with sub-classifications of Sub-Saharan Africa reflecting the United Nations geoscheme (16).

Study Outcome: We determined age-standardized incidence rates (annual and for 2008-2016 overall) of prostate cancer, age-standardized against the 2016 Canadian Census population standard.

Study Variables: We examined other variables that reflected factors potentially relevant to differences in prostate cancer incidence: age (determined from the Registered Persons Database), neighbourhood income quintile – a proxy for socioeconomic status determined from linking the postal code of the

individual's home address from the Registered Persons Database to 2016 Census data on mean household income, and for immigrant men only, immigration admission category, also a likely indicator of socioeconomic status, categorized as economic (i.e. skilled workers, business class), family class (family reunification and sponsorship), and refugees or asylum seekers, and time since landing based on IRCC-PR data.

Analysis: First, we conducted descriptive analyses and calculated chi-square statistics to describe the study cohort, for each year and overall. We calculated age-standardized incidence rates for each year and overall, stratifying by immigrant status and region of origin. We then used a log binomial model to estimate adjusted incidence rate ratios, with long-term residents as the reference group. We included age, neighbourhood income, and time since landing in the models. Then models were repeated and limited to immigrant men in the cohort; these models included immigration admission category and time since landing in Canada as covariates.

RESULTS

Descriptive characteristics of the overall cohort (2008 to 2016) are shown in Table 1. Immigrant men tended to be younger than long-term residents, with men from Middle-Southern Africa having a median age of 41 years versus long-term residents' median age of 48 years. The proportion of men in each immigration admission category varied widely by region; 59.5% of Western European immigrants were economic class versus 22.6% for Caribbean immigrants. More than half (57.1%) of Eastern African immigrants came as refugees. Income quintile also varied widely. Caribbean, East African and West African men were the least likely to live in the highest income quintiles (7.1%, 7.4% and 6.4% respectively). Conversely, 28.5% of men from the USA, Australia and New Zealand lived in the highest income quintile. Men from the USA, Australia and New Zealand and men from South Asia had the lowest number of years since landing on average (mean 11.4 years and mean 11.8 years respectively versus mean 13.6 years for immigrant men overall).

There were 74 594 incident cases of prostate cancer in the study period, 6 742 of which were among immigrant men. Figure 1 displays the age-standardized incidence rates for each fiscal year from 2008 to 2016 for long-term residents and for immigrant men stratified by region of origin. Men who had immigrated from West Africa and from the Caribbean consistently had higher incidence rates than other immigrant groups and long-term residents; in every fiscal year, West African men had the highest rates and Caribbean men had the second highest rates. Men from South Asia and East Asia consistently had the lowest incidence rates. Table 2 and Figure 2 display age-standardized incidence rates for all fiscal years combined. Overall, immigrant men had a lower incidence rate than long-term residents (134.9 [95% confidence interval 131.6-138.3] vs. 184.4 [95% CI 183.0-185.8]), but the highest rates were seen among men from Western Africa (475.3 [95% CI 385.7-579.4]) and the Caribbean (313.1 [95% CI 289.7-337.8]). Men from South Asia and East Asia had the lowest incidence rates (88.6 [95% CI 83.3-94.1] and 104.0 [95% CI 98.4-109.8] respectively).

In adjusted analyses for the overall population (Table 3), significantly higher incidence rate ratios were seen for immigrant men from Western Africa (ARR 2.71 [95% CI 2.41-3.05]) and the Caribbean (ARR 1.91 [95% CI 1.78-2.04]) versus long-term residents. Significantly lower incidence rate ratios were seen for men from East Africa (ARR 0.76 [95% CI 0.66-0.88], East Asia and the Pacific (ARR 0.55 [95% CI 0.52-0.58]), Eastern Europe and Central Asia (ARR 0.84 [95% CI 0.79-0.89]), the Middle East and North Africa (ARR 0.72 [95% CI 0.66-0.78]), and South Asia (ARR 0.47 [95% CI 0.45-0.50]). Neighbourhood income quintile and age group were also associated with incidence in adjusted analyses (Table 3). As income quintile increased, incidence rate ratios increased (ARR for quintile 5 1.22 [95% CI 1.20-1.25]). Compared to men age 60-69 years, men 70 years and over had higher rate ratios (with the highest value seen for men 70-79 years: ARR 1.37 [95% CI 1.35-1.39]). and men under 60 years had lower rate ratios.

In adjusted analyses for immigrant men only (Table 3), similar patterns were seen although the income gradient was less pronounced (ARR for quintile 5 1.11 [1.02-1.20]). Men who had been in Canada longer than 5 years had lower adjusted rate ratios than men who had been in Canada 5 years or less, peaking at ARR 0.92 [95% CI 0.84-1.00] for men in Canada for 16-20 years. Immigration admission category was not associated with prostate cancer incidence.

DISCUSSION

In this population-based study, we found that men who have immigrated from West Africa and from the Caribbean have significantly and persistently higher incidence of prostate cancer than other immigrants and long-term residents of Ontario: age-standardized incidence rates of 2.71 [95% CI 2.41-3.05] and 1.91 [95% CI 1.78-2.04] respectively, representing a 171% and 91% higher incidence rate than long-term residents. Immigrants from other major regions of the world either had lower or similar incidence rates to long-term residents, with men from South Asia having the lowest adjusted rate ratios (ARR 0.47 [95% CI 0.45-0.50]. We also found that higher neighbourhoood income quintile and advancing age were both associated with higher incidence of prostate cancer and that, among immigrants, being in Canada for five years or less was associated with higher incidence.

Although we did not examine race in this study (Ontario does not collect the data to allow researchers to do so at the provincial level), our findings suggest that describing Black men as a group at higher risk of developing prostate cancer, as is common practice , is likely an oversimplification and inaccurate in the Canadian context. We found that immigrants from the Caribbean and West Africa had the highest incidence of prostate cancer, but that immigrants from East Africa and from Middle & Southern African countries had lower incidence compared to long-term residents. Many immigrants from the Caribbean and from these African sub-regions would be grouped together in the single racial category of Black, but showed a diversity of incidence rates in this study. In the US context, African-

American men have been found to have a higher incidence of prostate cancer, the cause of which is not well understood and has been speculated to be due to social, economic and environmental disparities as well as potential genetic differences (1)(5)(5-7, 17). If biology does play a role, and considering that race is a social construct, not a biological one (18), our findings suggest that future research and current discourse in this field should focus on understanding if there are particular population genetic subgroups of West African origin that have a higher predisposition for developing prostate cancer (recognizing that the Caribbean is largely populated by descendants of West African victims of the transatlantic slave trade (7, 19, 20)). Such a focus on ancestry and change in discourse may be more fruitful than erroneously viewing all Black men as a singular population genetic group at equal risk of prostate cancer. Our findings also suggest that efforts should be made in Ontario to raise awareness about prostate cancer among Caribbean and West African men, and to raise awareness about the higher incidence for these men among primary care providers.

Although the Canadian literature is limited, these results are in line with other studies. McDonald et al. used Canadian Census data and found that immigrant men overall had lower incidence of prostate cancer than Canadian-born men, and that immigrant men from the Americas (the Caribbean was not a separate group) had the highest odds ratio for prostate cancer (1.588, p-value <0.01) and that men from South Asia (OR 0.67, p-value 0.01) and other Asian nations (0.506, p-value <0.01) had the lowest when compared to immigrant men born in the US (21). In the Canadian province of Alberta, Chinese immigrants have been found to have lower prostate cancer incidence than Canadian-born men (22). Looking at international data, Sung et al found that African-American men and men in the Caribbean have the highest incidence rates globally, and suggested that West African ancestry modulates prostate cancer risk (1). They found men from South Central Asia had the lowest ASIRs (1). In Sweden, men from the Caribbean and from Middle Africa had increased incidence; immigrant men overall had decreased incidence (23).

Our finding that incidence rate increased as income quintile increased is in line with the literature, and may reflect increased screening for prostate cancer and/or lifestyle factors among men of higher socioeconomic status (11, 12, 24-26). We also found that men who have been in Canada the shortest amount of time had higher incidence of prostate cancer, which is not in line with the concept of the healthy immigrant effect (4, 21). The healthy immigrant effect refers to the observation that immigrants are in relatively better health on arrival in Canada (or the country of immigration) than native-born Canadians, and that immigrant health eventually converges to that of native-born levels after years spent in Canada (21). Our finding of shorter time in Canada being associated with higher prostate cancer incidence is also in contrast to other studies. For example, in Sweden, immigrant men had higher risk of prostate cancer with longer time in the country (23, 27). McDonald et al found that immigrant men overall exhibit convergence to Canadian-born levels for diagnosis of prostate cancer (21). The reasons for our results cannot be elucidated from these data but warrant further study. One hypothesis worth exploration is that there may have been increased medical investigations, such as prostate-specific antigen testing, during the initial arrival and immigration period to Ontario in more recent years.

This population-based study is the first we are aware of to examine prostate cancer incidence for immigrant men by region of origin in Canada, however it has several limitations. First, the IRCC-PR database does not include immigrants who migrated to another province before Ontario or those who arrived before 1986. Both groups would have been misclassified as long-term residents of the province. However, this misclassification would bias toward the null. Second, we did not look at differences based on country of origin. There may still be sizeable differences in prostate cancer incidence within one world region. For example, although the top two countries in the world for prostate cancer incidence (Guadeloupe and Martinique) are in the Caribbean, the number three country

is Ireland (28). Future research in the Canadian context should explore this question. Third, it is possible that healthcare providers and men themselves may have been more vigilant on screening for and identifying prostate cancer among certain ethnic groups considered to be at higher risk, leading to diagnostic suspicion bias (1). As noted, this increased vigilance has also been proposed as an explanation for the association between higher income and increased prostate cancer incidence (29). Thus, future research should also explore differences between immigrants and long-term residents in use of prostate cancer screening, stage of diagnosis and importantly mortality in the Canadian context.

CONCLUSION

In this population-based study in Ontario, Canada, the age-standardized incidence rate of prostate cancer from 2008 to 2016 was consistently and significantly higher among immigrant men from West African and Caribbean countries than among other immigrant men and than long-term residents of the province. Future research in Canada needs to recognize this difference and focus on further understanding prostate cancer risk and epidemiology, including stage of diagnosis and mortality, for these men.

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Disclosures

The authors have no conflicts of interest to declare.

Author Contributions

AL, JB and GD conceived and designed the study. AL, SA and GD provided oversight to the analysis plan. SS analyzed and all authors interpreted the data. AL drafted the manuscript and all authors critically revised the manuscript for important intellectual content. SS had full access to all the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis.

Data Availability Statement

The dataset from this study is held securely in coded form at ICES. While legal data sharing agreements between ICES and data providers (e.g., healthcare organizations and government) prohibit ICES from making the dataset publicly available, access may be granted to those who meet pre-specified criteria for confidential access, available at www.ices.on.ca/DAS (email: das@ices.on.ca). The full dataset creation plan and underlying analytic code are available from the authors upon request,

understanding that the computer programs may rely upon coding templates or macros that are unique to ICES and are therefore either inaccessible or may require modification.

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Table 1. Descriptive characteristics of overall study cohort, Ontario, Canada (2008-2016).

VARIABLE	Caribbean	East Africa	East Asia & Pacific	Eastern Europe & Central Asia	Latin America	Middle East and North Africa	Middle-Southern Africa	South Asia	Western Africa	Western Europe	USA, Australia & New Zealand	Long-term residents	TOTAL
	N 529,651	N 289,254	N 1,969,550	N 1,065,676	N 634,289	N 846,259	N 78,052	N 2,151,654	N 146,040	N 544,498	N 153,710	N 36,754,786	N 45,163,419
ADGs													
0-5	478,464 (90.3%)	257,640 (89.1%)	1,793,362 (91.1%)	967,137 (90.8%)	563,669 (88.9%)	730,025 (86.3%)	70,545 (90.4%)	1,840,505 (85.5%)	128,973 (88.3%)	500,119 (91.8%)	142,250 (92.5%)	32,320,263 (87.9%)	39,792,952 (88.1%)
6-9	46,568 (8.8%)	28,160 (9.7%)	161,963 (8.2%)	89,346 (8.4%)	64,002 (10.1%)	103,060 (12.2%)	6,733 (8.6%)	280,660 (13.0%)	15,480 (10.6%)	40,331 (7.4%)	10,394 (6.8%)	3,908,070 (10.6%)	4,754,767 (10.5%)
10+	4,619 (0.9%)	3,454 (1.2%)	14,225 (0.7%)	9,193 (0.9%)	6,618 (1.0%)	13,174 (1.6%)	774 (1.0%)	30,489 (1.4%)	1,587 (1.1%)	4,048 (0.7%)	1,066 (0.7%)	526,453 (1.4%)	615,700 (1.4%)
Age													
Mean ± SD	42.9 ± 13.4	42.9 ± 13.6	46.0 ± 15.5	45.0 ± 14.2	43.9 ± 13.7	43.2 ± 14.6	42.3 ± 14.1	44.1 ± 14.6	42.5 ± 12.0	44.5 ± 13.7	43.3 ± 14.4	48.7 ± 17.6	47.9± 17.2
Median (IQR)	42 (32-51)	42 (32-52)	45 (34-55)	45 (34-55)	43 (33-53)	43 (31-52)	41 (31-51)	42 (33-53)	43 (33-52)	44 (34-53)	42 (32-53)	48 (34-62)	47 (34-60)
Immigration admission category													
Economic class	119,936 (22.6%)	67,747 (23.4%)	1,137,941 (57.8%)	508,464 (47.7%)	181,875 (28.7%)	471,661 (55.7%)	41,446 (53.1%)	1,048,987 (48.8%)	45,357 (31.1%)	323,774 (59.5%)	55,450 (36.1%)	N/a	4,002,638 (8.9%)
Family Class	376,427 (71.1%)	51,471 (17.8%)	632,136 (32.1%)	213,367 (20.0%)	269,545 (42.5%)	136,677 (16.2%)	12,393 (15.9%)	693,638 (32.2%)	58,951 (40.4%)	188,731 (34.7%)	92,755 (60.3%)	n/a	2,726,091 (6.0%)
Refugee	23,024 (4.3%)	165,062 (57.1%)	158,333 (8.0%)	331,121 (31.1%)	167,899 (26.5%)	228,069 (27.0%)	21,959 (28.1%)	381,704 (17.7%)	36,406 (24.9%)	26,697 (4.9%)	3,851 (2.5%)	n/a	1,544,125 (3.4%)
Other	10,264 (1.9%)	4,974 (1.7%)	41,140 (2.1%)	12,724 (1.2%)	14,970 (2.4%)	9,852 (1.2%)	2,254 (2.9%)	27,325 (1.3%)	5,326 (3.6%)	5,296 (1.0%)	1,654 (1.1%)	n/a	135,779 (0.3%)
Income quintile													
1 (lowest)	173,267 (32.7%)	131,476 (45.5%)	486,560 (24.7%)	233,729 (21.9%)	185,944 (29.3%)	211,773 (25.0%)	20,401 (26.1%)	591,574 (27.5%)	57,843 (39.6%)	90,107 (16.5%)	23,085 (15.0%)	6,535,312 (17.8%)	8,741,071 (19.4%)

2	128,653 (24.3%)	55,738 (19.3%)	479,606 (24.4%)	196,724 (18.5%)	157,504 (24.8%)	159,145 (18.8%)	11,884 (15.2%)	524,889 (24.4%)	33,274 (22.8%)	113,249 (20.8%)	26,812 (17.4%)	7,117,317 (19.4%)	9,004,795 (19.9%)
3	116,933 (22.1%)	43,783 (15.1%)	392,267 (19.9%)	209,583 (19.7%)	131,328 (20.7%)	161,064 (19.0%)	12,532 (16.1%)	510,422 (23.7%)	28,004 (19.2%)	108,795 (20.0%)	28,433 (18.5%)	7,312,052 (19.9%)	9,055,196 (20.0%)
4	72,929 (13.8%)	36,727 (12.7%)	362,229 (18.4%)	245,483 (23.0%)	97,800 (15.4%)	178,241 (21.1%)	14,900 (19.1%)	351,117 (16.3%)	17,577 (12.0%)	113,792 (20.9%)	31,586 (20.5%)	7,688,061 (20.9%)	9,210,442 (20.4%)
5 (highest)	37,869 (7.1%)	21,530 (7.4%)	248,888 (12.6%)	180,157 (16.9%)	61,713 (9.7%)	136,036 (16.1%)	18,335 (23.5%)	173,652 (8.1%)	9,342 (6.4%)	118,555 (21.8%)	43,794 (28.5%)	8,102,044 (22.0%)	9,151,915 (20.3%)
Years since landing													
Mean ± SD	15.4 ± 8.0	14.3 ± 7.9	13.5 ± 7.5	15.4 ± 7.1	15.3 ± 8.4	12.7 ± 7.6	13.1 ± 8.3	11.8± 7.0	12.0 ± 7.5	15.8 ± 8.9	11.4 ± 8.4	n/a	13.6 ± 7.7
Median (IQR)	17 (9-22)	15 (8-21)	13 (7-19)	16 (10-21)	16 (8-22)	12 (6-19)	12 (6-20)	11 (6-17)	12 (6-18)	17 (8-23)	10 (4-18)	n/a	13 (7-20)

Table 2. Age-standardized incidence rates per 100,000 for prostate cancer for the overall cohort and stratified by region of origin, Ontario Canada (2008-2016).

	Age-standardized incidence rate per 100,000 [95% confidence interval]
Overall cohort	178.8 [177.6-180.1]
Caribbean	313.1 [289.7-337.8]]
East Africa	144.0 [122.2-168.4]
East Asia & Pacific	104.0 [98.4-109.8]
Eastern Europe & Central Asia	154.1 [143.8-165.0]
Latin America	167.7 [153.1-183.3]
Middle East and North Africa	131.5 [120.7-143.0]
Middle-Southern Africa	194.0 [149.8-247.1]
South Asia	88.6 [83.3-94.1]
Western Africa	475.3 [385.7-579.4]
Western Europe	176.7 [160.7-193.9]
USA, Australia & New Zealand	173.0 [143.1-207.4]
All immigrants	134.9 [131.6-138.3]
Long-term residents	184.4 [183.0-185.8]

Table 3. Adjusted incidence rate ratios for overall study population (n=45,163,419) and for immigrants (n=8,408,633) in the cohort only, adjusted for variables listed in the table.

Overall study population	Adjusted rate ratio	p-value	Immigrants in the study cohort	Adjusted rate ratio	p-value
Region of origin			Region of origin		
Caribbean	1.91 [1.78-2.04]	<.0001	Caribbean	2.06 [1.72-2.45]	<.0001
East Africa	0.76 [0.66-0.88]	0.0002	East Africa	0.85 [0.68-1.06]	0.148
East Asia & Pacific	0.55 [0.52-0.58]	<.0001	East Asia & Pacific	0.60 [0.50-0.71]	<.0001
Eastern Europe & Central Asia	0.84 [0.79-0.89]	<.0001	Eastern Europe & Central Asia	0.94 [0.79-1.12]	0.485
Latin America	0.95 [0.87-1.02]	0.201	Latin America	1.04 [0.87-1.25]	0.665
Middle East and North Africa	0.72 [0.66-0.78]	<.0001	Middle East and North Africa	0.80 [0.66-0.95]	0.0135
Middle-Southern Africa	1.14 [0.91-1.41]	0.252	Middle-Southern Africa	1.27 [0.97-1.67]	0.0854
South Asia	0.47 [0.45-0.50]	<.0001	South Asia	0.52 [0.44-0.62]	<.0001
Western Africa	2.71 [2.41-3.05]	<.0001	Western Africa	3.01 [2.46-3.68]	<.0001
Western Europe	0.95 [0.87-1.04]	0.251	Western Europe	0.95 [0.87-1.04]	0.251
USA, Australia & New Zealand	0.91 [0.78-1.07]	0.255	USA, Australia & New Zealand	1 (reference)	
Long-term residents	1 (reference)				
Income quintile			Income quintile		
1 (lowest)	1 (reference)		1 (lowest)	1 (reference)	
2	1.08 [1.06-1.11]	<.0001	2	1.03 [0.96-1.10]	0.413
3	1.13 [1.10-1.16]	<.0001	3	1.06 [0.99-1.14]	0.112
4	1.17 [1.14-1.19]	<.0001	4	1.13 [1.05-1.21]	0.0016
5 (highest)	1.22 [1.20-1.25]	<.0001	5 (highest)	1.11 [1.02-1.20]	0.0136
Age group (years)			Age group (years)		
<50	0.01 [0.01-0.01]	<.0001	<50	0.01 [0.01-0.01]	<.0001
50-59	0.31 [0.30-0.32]	<.0001	50-59	0.30 [0.28-0.31]	<.0001
60-69	1 (reference)		60-69	1 (reference)	
70-79	1.37 [1.35-1.39]	<.0001	70-79	1.43 [1.34-1.52]	<.0001
80+	1.04 [1.02-1.07]	0.0005	80+	0.96 [0.87-1.06]	0.424
			Immigrant admission category		
			Economic class	1 (reference)	

			Family class	1.01 [0.95-1.07]	0.712
			Refugee	0.94 [0.87-1.01]	0.106
			Other	0.93 [0.77-1.12]	0.448
			Years since landing		
			0-5 years	1 (reference)	
			6-10 years	0.77 [0.70-0.84]	<.0001
			11-15 years	0.78 [0.71-0.85]	<.0001
			16-20 years	0.92 [0.84-1.00]	0.0432
			21+ years	0.88 [0.81-0.95]	0.0013

Figure Legends.

Figure 1. Age-standardized incidence rates per 100,000 for prostate cancer in Ontario for fiscal years (FY) 2008-2016, stratified by region of origin

Figure 2. Age-standardized incidence rates per 100,000 for prostate cancer for the overall cohort and stratified by region of origin, Ontario Canada (2008-2016). Error bars represent 95% confidence interval.