Research Article

Cancer Epidemiology, Biomarkers & Prevention

Cervical Cancer Screening among Women from Muslim-Majority Countries in Ontario, Canada

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Abstract

Background: Immigrant women are less likely to be screened for cervical cancer in Ontario. Religion may play a role for some women. In this population-based retrospective cohort study, we used country of birth as a proxy for religious affiliation and examined screening uptake among foreign-born women from Muslim-majority versus other countries, stratified by region of origin.

Methods: We linked provincial databases and identified all women eligible for cervical cancer screening between April 1, 2012, and March 31, 2015. Women were classified into regions based on country of birth. Countries were classified as Muslim-majority or not.

Results: Being born in a Muslim-majority country was significantly associated with lower likelihood of being up-to-date on Pap testing, after adjustment for region of origin, neighborhood income, and primary care–related factors [adjusted relative risk (ARR), 0.93; 95% (confidence interval) CI, 0.92–0.93]. Sub-Saharan African women from Muslim-majority countries had the highest prevalence of being overdue (59.6%), and the lowest ARR for screening when compared with women from non–Muslim-majority Sub-Saharan African countries (ARR, 0.77; 95% CI, 0.76–0.79). ARRs were lowest for women with no primary care versus those in a capitation-based model (ARR, 0.28; 95% CI, 0.27–0.29 overall).

Conclusions: We have shown that being born in a Muslim-majority country is associated with a decreased likelihood of being up-to-date on cervical screening in Ontario and that access to primary care has a sizeable impact on screening uptake.

Impact: Screening efforts need to take into account the background characteristics of population subgroups and to focus on increasing primary care access for all. *Cancer Epidemiol Biomarkers Prev; 26(10); 1493–9. ©2017 AACR.*

Introduction

Disparities in cervical cancer screening are well documented in Canada, with foreign-born women being persistently less likely to be up to date on Pap testing (1–5). In particular, women from South Asia, the Middle East, and North Africa have a lower likelihood of appropriate cervical cancer screening than Canadian-born women and than immigrant women from other parts of the world (3, 4).

It is feasible that religion plays a role in these screening inequalities; Islam is a prevalent religion in the aforementioned world regions (6). Religion can affect health behaviors including screening, and Islamic faith has been shown to be associated with screening in other settings (7–9). Modesty may play a role in cervical cancer screening disparities for practicing Muslim women (8, 10, 11).

Exploring the role of religion in health behaviors is of particular importance, as Muslims are the fastest growing religious group worldwide and in North America (6). According to the 2011 National Household Survey, over 1 million Canadians identify as Muslim, 72% of who are foreign-born. In Ontario, the country's most populous province, there are nearly 600,000 residents who identify as Muslim, 69% of whom are foreign-born.

However, the ability to explore the relationship between religion and screening at a population level in Canada and in Ontario is hampered by the fact that religion is not routinely collected in administrative databases or in national or provincial surveys. In this population-based retrospective cohort study, we used country of birth as a proxy for religious affiliation and examined cervical cancer screening uptake among foreign-born women living in Ontario from Muslim-majority versus non–Muslim-majority countries, stratified by region of origin.

Materials and Methods

Study setting and context

Ontario is currently Canada's most populous province with approximately 13 million people. More than 25% of Ontario residents are foreign-born, with East Asia and South Asia being the most common source regions (Canada Census).

The Ontario Cervical Screening Program was established in 1997. Current program elements include invitation letters, information about normal tests results, and reminder letters when women are due for screening (12). Current provincial guidelines recommend that women have a Pap test once every three years

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starting at age 21 or at the onset of sexual activity, and continue until the age of 69 years (13).

Data sources

We used several provincial-level health administrative data housed at the Institute for Clinical Evaluative Sciences (ICES) to conduct this study. The Registered Persons Database (RPDB) includes the age, sex, and postal code of all Ontario residents who are eligible for the universal Ontario Health Insurance Plan (OHIP). The OHIP database contains procedural and diagnostic codes claimed by physicians in the province. The Immigration, Refugees and Citizenship Canada (IRCC) database consists of demographic information on Ontario's immigrants and refugees recorded on the date of issue of the landing visa, going back to 1985. The Ontario Cancer Registry documents all Ontario residents who have been newly diagnosed with, or died of, cancer. The Canadian Institute for Health Information (CIHI) Discharge Abstract Database contains clinical data from hospital discharges. The Client Agency Program Enrolment (CAPE) database is updated annually and identifies all Ontarians who are enrolled with a physician in a patient enrollment model (PEM), and the Corporate Physicians' Database records of which family physicians participate in these PEMs. PEMs were instituted as part of Ontario's recent primary care reform and are based on a system where patients are formally rostered to physicians, and physicians are compensated through either primarily fee-for-service or primarily capitation depending on the specific type of model they participate in (14–16). These models also provide financial incentives for cancer screening (14–16). The ICES Physicians' Database records demographic information about Ontario's physicians who are in active practice. These datasets were linked using unique encoded identifiers and analyzed at ICES. This study was approved by the institutional review board at Sunnybrook Health Sciences Centre, Toronto, Canada.

Study population

We used the RPDB to identify all women who were eligible for healthcare coverage and who were no younger than 21 years on April 1, 2012, and no older than 69 years on March 31, 2015. Ontario's universal health insurance program provides health care coverage to all permanent residents and refugees. Women were excluded if they had a history of cervical, endometrial or ovarian cancer, hysterectomy, or death before March 31, 2015.

Using the IRCC database, women were classified into regions of origin based on country of birth. A modified version of the World Bank classification system was used (3, 17). For women who were born in South Asia, the Middle East & North Africa, Eastern Europe & Central Asia, Sub-Saharan Africa, and East Asia & the Pacific, countries were classified as Muslim-majority (50% or more of the country's estimated 2010 population identifying as Muslim) or not, using data from the Pew Research Center (18). Other world regions did not have any countries that could be classified as Muslim-majority and were not included.

Outcomes

We defined a binary outcome, whereby women were categorized as being up-to-date on cervical cancer screening or not, based on whether or not they had at least one Pap test in the three-year study period. Physician claims were used to define Pap tests based on a previously validated algorithm (19).

Study variables

Other variables included in analyses were women's language ability at the time of landing (English, French, both official languages, or neither), their neighborhood income quintile based on postal code and 2006 Canadian Census data, their designated immigrant class at the time of landing (economic, family, refugee, or other), whether their primary care physician was a Canadian versus international medical graduate, whether their primary care physician was male versus female, and whether the woman was a part of a PEM, and if so, what type. Women whose physician was not in a PEM were classified as being in traditional fee-for-service.

Analysis

We used descriptive statistics to characterize the study population. We used bivariate and multivariate Poisson regression with robust error variance to examine differences in cervical cancer screening uptake for the population, as our outcome was not rare. Analyses were conducted for the study population as a whole, and stratified by region of origin. We stratified by region of origin to reduce unmeasured confounders that might exist if comparing women from different regions of the world with different cultures and economies. Region of origin was included as a variable in regression analysis for the study population as a whole. All statistical tests were performed at the 5% level of significance, were two-sided, and were carried out using SAS Version 9.4 (SAS Institute).

Results

Table 1 describes the characteristics of the 761,019 immigrant women in the study population, stratified by region of origin and by Muslim-majority status. Characteristics of the 3 million long-term residents (women who were either born in Canada or immigrated before 1985) are also presented for comparison. The largest numbers of immigrants came from South Asia and East Asia and the Pacific. The Middle East and North Africa had the largest number and proportion of women from Muslim-majority countries. More immigrant women lived in poorer neighborhoods than long-term residents, with 59.3% of Sub-Saharan African women from Muslim-majority countries living in the lowest income quintile. Immigrant women were more likely to see a foreign-trained physician, particularly women from South Asia, and were more likely to have no primary care. Muslim-majority Eastern European/Central Asian countries had the highest proportion of women who arrived as refugees (5%).

More than 47% of immigrant women in the study population were overdue for Pap testing (Fig. 1). Within each region of origin, women from Muslim-majority countries had a higher prevalence of being overdue than women from non–Muslim-majority countries, although this difference was negligible for women from East Asia and the Pacific. More than 59% of Sub-Saharan African women from Muslim-majority countries were overdue for screening. In contrast, only 43.0% of Eastern European and Central Asian women from non–Muslim-majority countries were overdue.

We conducted bivariate analyses stratified by region of origin to inform our multivariable analyses (Table 2). Screening was

Table 1A. Descriptive characteristics of 761,019 Ontario foreign-born women and 3 million long-term residents of Ontario eligible for cervical cancer screening in study population on April 1, 2012

	South Asia		Middle East & North Africa		Eastern Europe & Central Asia		Sub-Saharan Africa		East Asia & Pacific		
Variables	**Muslim majority**	**Non-Muslim majority**	**Muslim majority**	**Non-Muslim majority**	**Muslim majority**	**Non-Muslim majority**	**Muslim majority**	**Non-Muslim majority**	**Muslim majority**	**Non-Muslim majority**	**Ontario long-term residents**
	N = 66,499	*N* = 144,185	*N* = 75,647	*N* = 2,644	*N* = 12,669	*N* = 151,707	*N* = 13,218	*N* = 39,745	*N* = 4,199	*N* = 250,506	*N* = 3,081,253
Mean age ± SD	38.21 ± 10.77	40.38 ± 11.50	39.37 ± 11.43	38.81 ± 11.21	39.54 ± 10.92	41.92 ± 11.49	38.14 ± 10.70	39.42 ± 10.66	42.56 ± 10.87	41.96 ± 10.90	43.04 ± 13.06
Median age (IQR)	37 (30–46)	39 (31–48)	39 (30–48)	37 (30–46)	39 (31–47)	42 (33–51)	38 (29–46)	39 (31–47)	43 (35–51)	42 (34–50)	43 (32–54)
Income quintile, *n* (%)											
1 - Low	23,907 (36.0%)	38,418 (26.6%)	18,269 (24.2%)	341–345[a]	3,644 (28.8%)	29,461 (19.4%)	7,833 (59.3%)	14,977 (37.7%)	726–730[a]	60,563 (24.2%)	520,327 (16.9%)
2	13,236 (19.9%)	37,871 (26.3%)	13,620 (18.0%)	371 (14.0%)	2,520 (19.9%)	28,116 (18.5%)	2,340 (17.7%)	7,937 (20.0%)	899 (21.4%)	60,653 (24.2%)	576,375 (18.7%)
3	12,298 (18.5%)	34,926 (24.2%)	15,191 (20.1%)	456 (17.2%)	2,292 (18.1%)	30,196 (19.9%)	1,363 (10.3%)	6,635 (16.7%)	882 (21.0%)	49,960 (19.9%)	610,149 (19.8%)
4	11,768 (17.7%)	22,039 (15.3%)	16,625 (22.0%)	779 (29.5%)	2,520 (19.9%)	35,367 (23.3%)	1,185 (9.0%)	5,819 (14.6%)	955 (22.7%)	45,343 (18.1%)	671,946 (21.8%)
5 - High	5,199 (7.8%)	10,792 (7.5%)	11,750 (15.5%)	694 (26.2%)	1,663 (13.1%)	28,242 (18.6%)	477 (3.6%)	4,274 (10.8%)	719 (17.1%)	33,046 (13.2%)	690,033 (22.4%)
Missing	91 (0.1%)	139 (0.1%)	192 (0.3%)	1–5[a]	30 (0.2%)	325 (0.2%)	20 (0.2%)	103 (0.3%)	11–15[a]	941 (0.4%)	12,423 (0.4%)
Primary care model, *n* (%)											
Primarily fee-for-service model	40,277 (60.6%)	87,911 (61.0%)	36,948 (48.8%)	1,146 (43.3%)	6,375 (50.3%)	61,436 (40.5%)	5,960 (45.1%)	19,135 (48.1%)	2,217 (52.8%)	140,184 (56.0%)	994,439 (32.3%)
Primarily capitation model #1	11,507 (17.3%)	27,389 (19.0%)	18,984 (25.1%)	891 (33.7%)	3,503 (27.7%)	53,949 (35.6%)	3,569 (27.0%)	12,005 (30.2%)	1,018 (24.2%)	51,887 (20.7%)	1,509,919 (49.0%)
Primarily capitation model #2	109 (0.2%)	218 (0.2%)	349 (0.5%)	7 (0.3%)	39 (0.3%)	1,300 (0.9%)	66 (0.5%)	376 (0.9%)	21 (0.5%)	703 (0.3%)	94,753 (3.1%)
Traditional fee-for-service	5,201 (7.8%)	12,075 (8.4%)	6,283 (8.3%)	157 (5.9%)	1,147 (9.1%)	15,682 (10.3%)	1,379 (10.4%)	3,429 (8.6%)	289 (6.9%)	20,112 (8.0%)	185,612 (6.0%)
Other model	214 (0.3%)	578 (0.4%)	214 (0.3%)	9 (0.3%)	31 (0.2%)	729 (0.5%)	40 (0.3%)	295 (0.7%)	34 (0.8%)	1,529 (0.6%)	63,323 (2.1%)
No primary care	9,191 (13.8%)	16,014 (11.1%)	12,869 (17.0%)	434 (16.4%)	1,574 (12.4%)	18,611 (12.3%)	2,204 (16.7%)	4,505 (11.3%)	620 (14.8%)	36,091 (14.4%)	233,207 (7.6%)

[a]Exact counts suppressed for privacy reasons in at least one of the cells.

Table 1B. Descriptive characteristics of 761,019 Ontario foreign-born women and 3 million long-term residents of Ontario eligible for cervical cancer screening in study population on April 1, 2012

	South Asia		Middle East & North Africa		Eastern Europe & Central Asia		Sub-Saharan Africa		East Asia & Pacific		
Variables	**Muslim majority**	**Non-Muslim majority**	**Muslim majority**	**Non-Muslim majority**	**Muslim majority**	**Non-Muslim majority**	**Muslim majority**	**Non-Muslim majority**	**Muslim majority**	**Non-Muslim majority**	**Ontario long-term residents**
Physician sex, *n* (%)											
Female	34,146 (51.3%)	59,399 (41.2%)	29,172 (38.6%)	954 (36.1%)	4,398 (34.7%)	62,746 (41.4%)	3,648 (27.6%)	13,429 (33.8%)	1,713 (40.8%)	83,053 (33.2%)	1,304,823 (42.3%)
Male	22,912 (34.5%)	68,493 (47.5%)	33,389 (44.1%)	1,249 (47.2%)	6,633 (52.4%)	69,639 (45.9%)	7,273 (55.0%)	21,652 (54.5%)	1,853 (44.1%)	130,286 (52.0%)	1,529,332 (49.6%)
Missing	9,441 (14.2%)	16,293 (11.3%)	13,086 (17.3%)	441 (16.7%)	1,638 (12.9%)	19,322 (12.7%)	2,297 (17.4%)	4,664 (11.7%)	633 (15.1%)	37,167 (14.8%)	247,098 (8.0%)
Physician training, *n* (%)											
International	37,080 (55.8%)	91,231 (63.3%)	38,949 (51.5%)	626 (23.7%)	5,505 (43.5%)	64,669 (42.6%)	4,943 (37.4%)	15,926 (40.1%)	1,321 (31.5%)	81,890 (32.7%)	687,194 (22.3%)
Domestic	19,978 (30.0%)	36,661 (25.4%)	23,612 (31.2%)	1,577 (59.6%)	5,526 (43.6%)	67,716 (44.6%)	5,978 (45.2%)	19,155 (48.2%)	2,245 (53.5%)	131,449 (52.5%)	2,146,961 (69.7%)
Missing	9,441 (14.2%)	16,293 (11.3%)	13,086 (17.3%)	441 (16.7%)	1,638 (12.9%)	19,322 (12.7%)	2,297 (17.4%)	4,664 (11.7%)	633 (15.1%)	37,167 (14.8%)	247,098 (8.0%)
Language ability, *n* (%)											
English	38,400 (57.7%)	87,848 (60.9%)	40,713 (53.8%)	1,885 (71.3%)	6,506 (51.4%)	72,025 (47.5%)	8,193 (62.0%)	28,028 (70.5%)	3,554 (84.6%)	142,631 (56.9%)	—
French	74 (0.1%)	172 (0.1%)	2,310 (3.1%)	16–20[a]	101–105[a]	1,661–1,665[a]	331 (2.5%)	2,231–2,335[a]	1–5[a]	296–300[a]	—
Both	443 (0.7%)	809 (0.6%)	5,907 (7.8%)	116–120[a]	465 (3.7%)	10,544 (7.0%)	265 (2.0%)	3,033 (7.6%)	29–33[a]	1,144 (0.5%)	—
Neither	27,582 (41.5%)	55,349 (38.4%)	26,717 (35.3%)	620 (23.4%)	5,596 (44.2%)	67,470 (44.5%)	4,429 (33.5%)	6,452 (16.2%)	611 (14.6%)	106,429 (42.5%)	—
Missing	0 (0.0%)	7 (0.0%)	0 (0.0%)	1–5[a]	1–5[a]	1–5[a]	0 (0.0%)	1–5[a]	0 (0.0%)	1–5[a]	—
Immigrant class, *n* (%)											
Economic	30,538 (45.9%)	56,071 (38.9%)	38,633 (51.1%)	1,819 (68.8%)	6,220 (49.1%)	74,969 (49.4%)	1,046 (7.9%)	12,994 (32.7%)	2,274 (54.2%)	121,382 (48.5%)	—
Family	23,115 (34.8%)	70,648 (49.0%)	18,983 (25.1%)	675 (25.5%)	3,402 (26.9%)	48,328 (31.9%)	2,951 (22.3%)	12,985 (32.7%)	1,583 (37.7%)	80,485 (32.1%)	—
Refugee	1,730 (2.6%)	4,327 (3.0%)	1,036 (1.4%)	1–5[a]	637 (5.0%)	1,243 (0.8%)	452 (3.4%)	1,163 (2.9%)	21–25[a]	3,172 (1.3%)	—
Other	10,681 (16.1%)	13,004 (9.0%)	15,977 (21.1%)	136–140[a]	2,348 (18.5%)	27,067 (17.8%)	8,769 (66.3%)	12,552 (31.6%)	286–290[a]	41,056 (16.4%)	—
Missing	435 (0.7%)	135 (0.1%)	1,018 (1.3%)	6 (0.2%)	62 (0.5%)	100 (0.1%)	0 (0.0%)	51 (0.1%)	27 (0.6%)	4,411 (1.8%)	—

[a]Exact counts suppressed for privacy reasons in at least one of the cells.

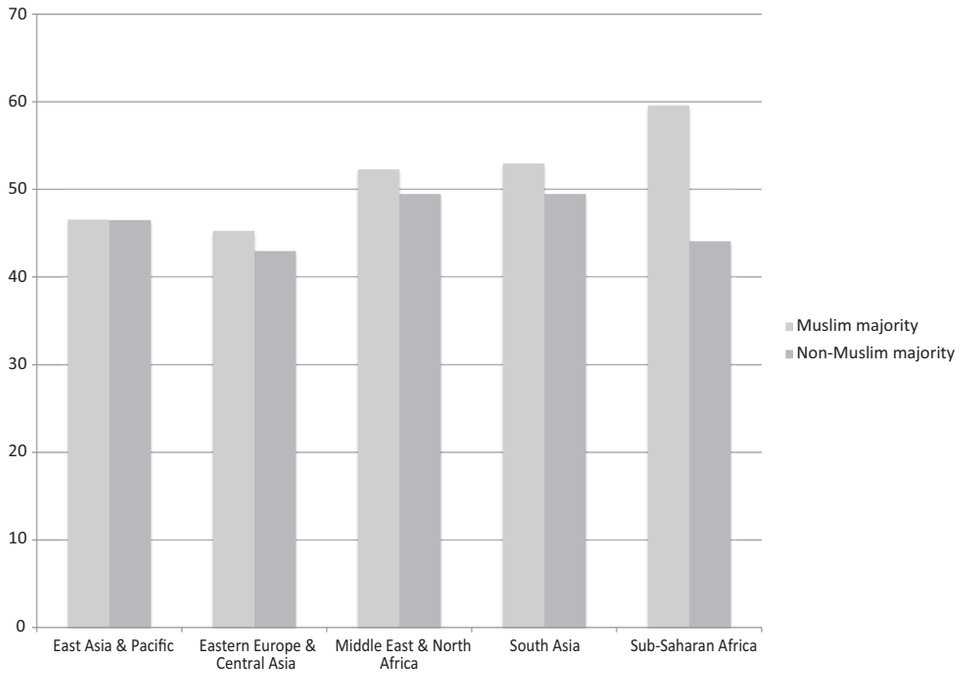

Figure 1.
Proportion of women overdue for cervical cancer screening by region of origin and Muslim-majority status of country of origin.

associated with income and with physician sex, whereby having a male physician decreased the likelihood of screening. Seeing an international medical graduate tended to slightly decrease the likelihood of screening across regions and having no family physician/no primary care was associated with the most significant decreases in likelihood of screening.

Multivariable analyses demonstrated that being born in a Muslim-majority country was associated with a small but statistically significant decrease in the likelihood of cervical cancer screening for immigrant women in the overall study population [adjusted relative risk (ARR) of screening, 0.93; 95% confidence interval (CI), 0.92–0.93; Table 3]. This finding also held true for women from South Asia, Eastern Europe and Central Asia, and Sub-Saharan Africa. The difference was most profound for women from Sub-Saharan Africa (ARR of screening, 0.77; 95% CI, 0.76–0.79). Interestingly, income was not associated with screening for Sub-Saharan African women in multivariable analysis, although it was for all other groups. Primary care also was independently associated with screening, and seemed to have the most profound impact on screening. Not having a female physician, being in a traditional fee-for-service model, and lack of primary care were all independently associated with lower likelihood of screening across all groups. For women with no primary care, ARRs ranged from 0.25 (95% CI, 0.22–0.28) for women from the Middle East and North Africa to 0.40 (95% CI, 0.35–0.46) for women from Sub-Saharan Africa. Patients of foreign medical graduates tended to have lower screening, although this did not hold true for all groups. Women who arrived in Canada as refugees, in the family class designation, or in other designations had higher likelihood of screening than women in the economic class designation. Region of origin was also associated with screening, with women from South Asia being particularly vulnerable to inadequate screening in comparison with the reference group, women for East Asia and the Pacific.

Discussion

In this population-based retrospective cohort study, we used a proxy for religious affiliation to explore the relationship between Muslim affiliation and cervical cancer screening for foreign-born women in Ontario. We found that being born in a Muslim-majority country was significantly associated with lower likelihood of being up-to-date on Pap testing, even after adjustment for region of origin, neighborhood income, and primary care–related factors. As well, within most regions of origin, being born in a Muslim-majority country was associated with lower likelihood of screening. Sub-Saharan African women from Muslim-majority countries had the highest prevalence of being overdue for screening, and the lowest ARR for screening when compared with their peers from non–Muslim-majority countries. Women from South Asia had the lowest ARR of screening overall among world regions, in line with previous literature (3, 4). Other factors independently associated with screening for women in our study population included neighborhood income, immigrant class, having a family physician, sex and region of training of the family physician, and primary care model.

Our findings suggest that Muslim affiliation plays a role in cervical cancer screening in Ontario, but that the relationship is not straightforward and is modified by world region. This is likely due to differences in cultural values and norms, over and above religious values and norms. Religion and culture are closely related, and Islam likely takes on different cultural elements in different ethnoracial groups. Although it is not possible for us to determine those cultural elements from this study, we have identified that coming from Muslim-majority countries does decrease the likelihood of screening. Further research, including qualitative work, is needed to determine whether religious affiliation is truly an independent risk factor and if so, to determine how our health care system can better accommodate Muslim women's needs. Such work would importantly need to recognize

Table 2. Bivariate analyses using Poisson regression (with robust error variance) where relative risks (95% CIs) represent the risk of screening

Variables	South Asia	Middle East & North Africa	Eastern Europe & Central Asia	Sub-Saharan Africa	East Asia & Pacific
Income quintile	RR (95% CI)	RR (95% CI)	RR (95% CI)	RR (95% CI)	RR (95% CI)
1 vs. 5 (highest)	0.94 (0.92–0.95)	0.84 (0.82–0.86)	0.86 (0.85–0.87)	0.90 (0.87–0.92)	0.94 (0.93–0.95)
2 vs. 5	0.99 (0.97–1.00)	0.89 (0.87–0.91)	0.95 (0.94–0.96)	0.94 (0.91–0.97)	1.00 (0.99–1.02)
3 vs. 5	1.02 (1.00–1.04)	1.02 (1.00–1.04)	1.00 (0.98–1.01)	0.98 (0.95–1.02)	1.03 (1.01–1.04)
4 vs. 5	1.02 (1.00–1.04)	1.00 (0.98–1.03)	1.04 (1.02–1.05)	1.03 (1.00–1.07)	1.04 (1.03–1.06)
Physician sex					
Male vs. female	0.87 (0.87–0.88)	0.89 (0.88–0.90)	0.91 (0.90–0.92)	0.91 (0.90–0.92)	0.89 (0.88–0.89)
No physician vs. female	0.27 (0.27–0.28)	0.26 (0.25–0.27)	0.28 (0.27–0.29)	0.35 (0.33–0.36)	0.26 (0.26–0.27)
Canadian medical graduate?					
No vs. yes	1.01 (1.01–1.02)	0.94 (0.93–0.96)	0.99 (0.98–1.00)	0.97 (0.95–0.98)	0.97 (0.96–0.98)
No physician vs. yes	0.29 (0.29–0.30)	0.26 (0.25–0.27)	0.29 (0.28–0.30)	0.36 (0.35–0.38)	0.28 (0.27–0.29)
Immigration class					
Family vs. economic	1.18 (1.16–1.19)	1.20 (1.18–1.22)	0.99 (0.99–1.00)	1.04 (1.02–1.06)	1.16 (1.15–1.17)
Other vs. economic	1.16 (1.14–1.17)	1.11 (1.09–1.13)	1.00 (0.98–1.01)	0.92 (0.90–0.94)	1.15 (1.13–1.16)
Refugee vs. economic	1.12 (1.09–1.15)	1.14 (1.07–1.21)	1.00 (0.96–1.04)	0.96 (0.92–1.01)	1.23 (1.20–1.27)
Language ability					
English vs. both	1.04 (0.98–1.10)	1.09 (1.05–1.12)	1.00 (0.98–1.02)	0.96 (0.93–0.99)	1.01 (0.95–1.06)
French vs. both	1.21 (1.07–1.37)	1.19 (1.13–1.25)	1.01 (0.97–1.06)	1.05 (1.01–1.10)	0,91 (0.80–1.03)
Neither vs. both	1.07 (1.01–1.13)	1.08 (1.04–1.11)	1.01 (0.99–1.02)	0.88 (0.84–0.91)	1.03 (0.97–1.08)
Enrollment model					
Primarily fee-for-service model vs. primarily capitation model #1	0.98 (0.97–0.99)	0.95 (0.93–0.96)	0.99 (0.98–1.00)	0.99 (0.98–1.01)	0.98 (0.98–0.99)
Primarily capitation model #2 vs. primarily capitation model #1	1.00 (0.91–1.10)	1.00 (0.92–1.10)	1.03 (0.99–1.07)	1.11 (1.03–1.19)	1.01 (0.95–1.07)
Other model vs. primarily capitation model #1	1.03 (0.97–1.10)	1.00 (0.90–1.12)	0.99 (0.93–1.04)	1.11 (1.02–1.20)	1.12 (1.08–1.16)
Traditional fee-for-service vs. primarily capitation model #1	0.89 (0.88–0.91)	0.79 (0.76–0.81)	0.91 (0.90–0.93)	0.86 (0.83–0.88)	0.89 (0.88–0.90)
No primary care vs. primarily capitation model #1	0.27 (0.27–0.28)	0.25 (0.24–0.26)	0.26 (0.26–0.27)	0.35 (0.33–0.36)	0.26 (0.25–0.26)

the diversity that exists within Canada's Muslim community. We have also identified a group, Sub-Saharan women from Muslim-majority countries, who are particularly vulnerable to underscreening. Again, further research, including qualitative research, will be needed to identify the barriers and potential facilitators to screening for this particular group and how the health care system can better address these.

Region of origin has been shown to be associated with cervical cancer screening in Ontario (3, 4), but our findings demonstrate the importance of exploring potential sociodemographic factors that might impact or modify this relationship. South Asian–born women have previously been shown to be the most vulnerable to underscreening (4, 19), as was observed here when only examining region of origin, but by stratifying by religion, we were able to identify another cultural group with even higher unmet needs.

As in previous studies (3, 20, 21), the importance of primary care in cancer screening was evident from our findings. Regardless of religion, culture, or ethnicity, it seems that women need good connections to primary care to facilitate screening and that this might be the most important way to improve screening uptake. Our results suggest that targeted interventions need to be put into place to increase cervical cancer screening rates among male and foreign-trained family physicians. Also, as primary care reform continues in Ontario, policymakers should take note of the higher screening rates we observed among immigrant women who are part of new primary care enrolment models than for their peers who are still in traditional fee-for-service care, or more dramatically, for their peers who are not connected to primary care at all.

The results of this study are in line with other literature looking at religion and cancer screening. In two U.S. studies, Padela and colleagues found that Muslim women who viewed health problems as a punishment from God were less likely to undergo cervical cancer screening and that Muslim women who used religion to cope with daily stressors were less likely to undergo breast cancer screening (9, 22). Another study found that Muslim women reported low rates of cervical cancer screening, partially due to modesty and embarrassment (23). It is important to note that Islam is not the only religion that has been shown to be associated with cancer screening. Christian religious beliefs, specifically among African American women, have been suggested to decrease the likelihood of breast cancer screening in the context of the view that God works in place of medicine (24, 25).

This study has several limitations. First, we were unable to look at religion at the individual level. Being from a Muslim-majority country does not equate to being Muslim, and there might be systemic differences in who immigrates to Canada versus who remains in the home country. Data sources that provide individual-level sociodemographic information such as religion and ethnicity are currently lacking in Canada. Accordingly, we believe that our current method provides the best proxy available at this time. Second, we were unable to explore religion for Canadian-born and long-term residents of the province. Future research should include Canadian-born Muslim women where possible. Third, the number of women from non–Muslim-

Table 3. Multivariable Poisson regression with robust error variance, where ARRs represent the risk of screening

ARRs (95% CIs)	Overall	South Asia	Middle East & North Africa	Eastern Europe & Central Asia	Sub-Saharan Africa	East Asia & Pacific
Muslim majority vs. non-Muslim majority (reference)	0.93 (0.92–0.93)	0.94 (0.93–0.95)	0.98 (0.95–1.02)	0.97 (0.95–0.98)	0.77 (0.76–0.79)	0.99 (0.96–1.01)
Age (years), continuous	1.00 (1.00–1.00)	1.00 (1.00–1.00)	1.00 (1.00–1.00)	0.99 (0.99–1.00)	1.00 (1.00–1.00)	1.00 (1.00–1.00)
Income quintile						
1 vs. 5 (highest)	0.93 (0.93–0.94)	0.96 (0.95–0.98)	0.89 (0.87–0.91)	0.90 (0.89–0.92)	0.98 (0.95–1.01)	0.94 (0.93–0.95)
2 vs. 5	0.97 (0.96–0.98)	0.99 (0.97–1.00)	0.92 (0.90–0.94)	0.97 (0.95–0.98)	0.98 (0.95–1.01)	0.98 (0.97–0.99)
3 vs. 5	0.99 (0.99–1.00)	1.00 (0.99–1.02)	1.00 (0.98–1.02)	0.99 (0.98–1.00)	1.00 (0.97–1.03)	1.00 (0.99–1.01)
4 vs. 5	1.01 (1.01–1.02)	1.01 (0.99–1.02)	1.00 (0.98–1.02)	1.02 (1.01–1.03)	1.04 (1.01–1.08)	1.02 (1.01–1.03)
Physician sex						
Male vs. female	0.89 (0.89–0.90)	0.87 (0.86–0.88)	0.89 (0.87–0.90)	0.92 (0.91–0.93)	0.92 (0.91–0.94)	0.89 (0.88–0.90)
No physician vs. female	0.89 (0.86–0.92)	0.80 (0.73–0.88)	0.92 (0.81–1.04)	0.92 (0.86–0.97)	0.84 (0.74–0.96)	0.93 (0.89–0.98)
Canadian medical graduate?[a]						
No vs. yes	0.98 (0.97–0.98)	0.99 (0.98–1.00)	0.95 (0.94–0.96)	1.00 (0.99–1.01)	0.97 (0.95–0.99)	0.97 (0.96–0.98)
Immigration class						
Family vs. economic	1.08 (1.07–1.08)	1.10 (1.09–1.11)	1.14 (1.12–1.16)	0.99 (0.99–1.00)	1.08 (1.06–1.11)	1.11 (1.10–1.11)
Other vs. economic	1.03 (1.02–1.04)	1.07 (1.05–1.08)	1.05 (1.03–1.07)	0.99 (0.98–1.00)	1.02 (0.99–1.04)	1.07 (1.06–1.08)
Refugee vs. economic	1.06 (1.04–1.07)	1.03 (1.01–1.06)	1.08 (1.02–1.15)	1.00 (0.96–1.04)	1.03 (0.98–1.08)	1.15 (1.12–1.18)
Language ability						
English vs. both	0.98 (0.96–0.99)	1.00 (0.95–1.06)	1.03 (1.00–1.06)	0.99 (0.97–1.00)	0.98 (0.95–1.01)	0.96 (0.91–1.01)
French vs. both	1.07 (1.04–1.09)	1.19 (1.05–1.33)	1.08 (1.03–1.13)	1.03 (0.99–1.07)	1.09 (1.05–1.15)	0.88 (0.78–1.00)
Neither vs. both	0.96 (0.94–0.97)	0.96 (0.91–1.02)	0.98 (0.95–1.01)	0.96 (0.95–0.98)	0.93 (0.90–0.97)	0.96 (0.91–1.01)
Enrollment model						
Primarily fee-for-service model vs. primarily capitation model #1	0.99 (0.98–0.99)	0.98 (0.97–0.99)	0.95 (0.94–0.97)	0.99 (0.98–1.00)	1.00 (0.99–1.02)	0.99 (0.98–1.00)
Primarily capitation model #2 vs. primarily capitation model #1	1.01 (0.98–1.04)	0.99 (0.90–1.09)	1.00 (0.91–1.09)	1.02 (0.98–1.06)	1.05 (0.97–1.13)	0.99 (0.94–1.05)
Other model vs. primarily capitation model #1	1.03 (1.01–1.06)	0.98 (0.92–1.04)	0.97 (0.87–1.09)	0.98 (0.92–1.03)	1.03 (0.95–1.12)	1.10 (1.06–1.14)
Traditional fee-for-service vs. primarily capitation model #1	0.89 (0.89–0.90)	0.89 (0.88–0.91)	0.81 (0.78–0.83)	0.93 (0.91–0.94)	0.88 (0.86–0.91)	0.90 (0.89–0.91)
No primary care vs. primarily capitation model #1	0.28 (0.27–0.29)	0.32 (0.29–0.36)	0.25 (0.22–0.28)	0.28 (0.26–0.30)	0.40 (0.35–0.46)	0.25 (0.24–0.27)
World region[a]						
Europe & Central Asia vs. East Asia & Pacific	1.03 (1.03–1.04)	—	—	—	—	—
Middle East & North Africa vs. East Asia & Pacific	0.97 (0.96–0.98)	—	—	—	—	—
South Asia vs. East Asia & Pacific	0.91 (0.90–0.92)	—	—	—	—	—
Sub-Saharan Africa vs. East Asia & Pacific	0.97 (0.96–0.98)	—	—	—	—	—

[a]No "no physician" category for Canadian medical graduates. "No physician" values for Canadian medical graduate and physician sex were identical as they are the result of linkage to the physician database, as such only estimates for one can be generated in the multivariate model.
[b]Only included in overall model.

majority Middle Eastern/North African countries and from Muslim-majority East Asian and Pacific countries was relatively small. This limits the power of our findings for those regions but is also an accurate reflection of the demographics of those regions. Fourth, we did not explore the roles of other religions, such as Christianity, Judaism and others, as it relates to the differences in screening that we observed. For example, the only country in the Middle East and North Africa that was not a Muslim-majority country was Israel, a country where Judaism is the predominant religion. In other world regions, comparison countries may have been largely Christian. If religious affiliation is collected on a broad scale in Canada or Ontario, it may be possible to explore the role of religions in general in future research. Fifth, the IRCC data includes only immigrants who landed in Ontario from 1985 onward. This means when an immigrant lands in other provinces and then moves to Ontario we were unable to identify them as an immigrant using these data. Finally, we did not examine length of stay in this analysis and it is feasible that women here for longer periods of time might have had higher screening uptake.

Conclusions

We have shown that being born in a country where the majority of citizens identify as Muslim is associated with a decrease in the likelihood of being up-to-date on cervical cancer screening for immigrant women. Women from Sub-Saharan African Muslim countries are at particular risk of underscreening. Future research is needed to explore this relationship in a culturally safe manner and more individual-level data sources are needed to accurately explore this question at the population level. Regardless of religion, our findings also suggest that increased access to primary care will improve cancer screening uptake.

Disclosure of Potential Conflicts of Interest

No potential conflicts of interest were disclosed.

Disclaimer

The opinions, results, and conclusions are those of the authors and are independent from the funding sources. No endorsement by ICES or the Ontario Ministry of Health and Long-Term Care is intended or should be inferred. Parts

of this material are based on data and information compiled and provided by CIHI. However, the analyses, conclusions, opinions, and statements expressed herein are those of the author, and not necessarily those of CIHI. Parts of this material are based on data and information provided by Cancer Care Ontario (CCO). The opinions, results, view, and conclusions reported in this article are those of the authors and do not necessarily reflect those of CCO. No endorsement by CCO is intended or should be inferred. Immigration data was obtained from the Immigration, Refugees and Citizenship Canada database held at ICES.

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