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Understanding the participation in cervical screening of Muslim women in Victoria, Australia from record-linkage data

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ABSTRACT

Background: Prevention of cervical cancer through screening can significantly decrease incidence and mortality from the disease. This study investigates whether there are significant differences in participation in screening among women born in Muslim countries compared to women born in Non-Muslim countries and Australia.
Methods: Screening data from Jan 2000 to Dec 2013 from the Victorian Cervical Cytology Registry (VCCR) was linked probabilistically with hospital records containing country of birth information from the Victorian Admitted Episodes Dataset (VAED). Countries with more than 50 % of their population Muslim were categorised as Muslim countries. Age adjusted rates were calculated for women born in Muslim and Non-Muslim countries and compared with the Australian age adjusted rates. Logistic regression assessed the association between screening status and other factors which include principal diagnosis, country of birth, marital status, age and socio-economic status.
Results: Women born in Muslim countries (OR = 0.77, 95% CI = 0.75–0.78) and in other Non-Muslim countries (OR = 0.83, 95% CI = 0.82–0.84) had lower odds of participation in screening than Australian born women. Women born in Muslim countries (OR = 0.71, 95% CI = 0.69–0.74) and in other Non- Muslim countries (OR = 0.71, 95% CI = 0.69–0.72) admitted to the hospital for perinatal reasons had lower odds of participation in screening than Australian born women.
Conclusions: Future screening programs should incorporate ethnic diversity of the population, particularly Muslim immigrant community. There is also a need to focus on improving screening among older Muslim women.

1. Introduction

Cervical cancer is an important health problem for women around the world [1,2]. Worldwide, in 2013, 485,000 women were diagnosed with cervical cancer causing 236,000 deaths [3]. However, there are significant variations in the incidence and death rates for cervical cancer between developed and developing countries. The age-standardized incidence rates (ASIRs) and age-standardized death rates (ASDRs) per 100,000 in 2013 were higher in developing countries vs developed countries (ASIR, 15.70 vs 9.58; ASDR, 8.32 vs 3.96) [3]. Early detection of cancer or cancer precursor lesions through screening programs can improve survival rates and decrease death rates. For instance, organised screening programs in Australia have reduced cervical cancer incidence and death rates by 50 % [4]. On the contrary, developing countries face significant barriers towards setting up organised screening programs [5]. The introduction of prophylactic human papillomavirus (HPV) vaccine has the potential to reduce incidence and mortality of cervical cancer by approximately two-thirds [6]. However, screening remains an important strategy to prevent cervical cancer in both vaccinated and unvaccinated women.

Studies have found strong correlations between cancer screening participation and race and/or ethnic background. Several studies in multicultural societies, such as in the US, UK, and Canada, have found that ethnic minorities are less likely to participate in cancer screening than White women. In the US, Hispanic women utilize cervical cancer screening services less than White women [7]. In the UK two studies comparing White women with an ethnically diverse (e.g., Asian and Black women) sample revealed that white women are more likely to have Pap smears than other women [8,9]. Recent studies on Muslim women in the US have shown a noticeable disparity in the mortality

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rate and the diagnosis of cervical cancer [10]. Studies have found that lower cervical screening rates among American Muslims are associated with negative religious coping (e.g., viewing health problems as a punishment from God) [10], language barriers [11], and concern about modesty [12,13].

Aminisani et al. [14] investigated how screening practices vary based on regions of birth in Australia. They found that rates of cervical screening in NSW were lower among women born in Asia and the Middle-east than Australian-born women. They hypothesised that these differences reflect a higher concentration of Muslim women in these regions. Only a few studies [10,12] have investigated cervical screening participation among Muslim women. Most of these studies have used small scale survey data on screening participation.

In this study, we analysed the cancer screening participation behaviour of women born in countries with predominantly Muslim populations (hereafter Muslim countries, see Appendix A) compared to other women, using probabilistically linked data from Victoria, Australia. The focus of this study is on women born in Muslim countries because of their significant presence and growth in Australia and their unique socio-cultural aspects. Muslim immigrant communities have significant ethnic and racial diversity and their health behaviour is influenced by religious beliefs and values [15]. Between 2006 and 2011, Islam was the second fastest growing religion in Australia and nearly 62 percent of the Muslims in Australia were born overseas [16]. We investigate whether there are significant differences in apparent screening participation among women born in Muslim countries compared to women born in Non-Muslim countries and Australia. This study is one of the first studies to investigate cervical screening rates of women born in Muslim countries across the racial and ethnic diversity of the community. Unlike previous studies based on small scale survey data, this study uses Victorian cervical screening registry data which includes all women screening in Victoria, Australia. Thus, this paper contributes to the broader knowledge of screening participation of women born in Muslim countries, an understudied population group in Australia and in the world.

2. Methodology

2.1. Sample

In order to obtain screening records for a cohort of Victorian women by country of birth (not available in routine registry data), screening data for women in Victoria from the Victorian Cervical Cytology Registry (VCCR) was matched with hospital records containing country of birth information from the Victorian Admitted Episodes Dataset (VAED). Following ethical approval (Ethic Approval Reference- ADF/11/4510) and data custodian approval, the Victorian Data Linkage (VDL) unit used a standard probabilistic data linkage protocol, with separation of identifying linkage variables from analytic variables in each data set designed to preserve privacy. Records included in the linkage were for the period from 1 st Jan 2000 to 31 st Dec 2013 for women aged 15 years or over. We have selected the last two years (2012–2013) as our study time period. We calculated the screening rates for the last two years of data to maximise the potential usefulness of our findings for local policy makers i.e. to reflect screening behaviour in the most recently available time period in the analysis. It is also more likely to reflect the current demographics of women residing in Victoria rather than the older data.

After completion of the data linkage, VDL advised the researchers which individuals' analytic variables from each data set belonged together via anonymised linkage keys. Where a woman was identified across both data sets (i.e. was admitted to the hospital and had a screening record), she was identified as a screening participant. Women for whom no records could be matched were assumed not to have participated in screening. We defined a participant as screened in this way because we assume that woman who has at least one episode in VCCR dataset, has participated in the screening program. Variables used for linkage were date of birth, postcode, and Medicare number (Australia's universal health insurance identifier) as name and address were not available in the VAED. Records that were successfully linked to the VCCR dataset were the women who had apparently screened. We use the term 'apparent screening rates (ASR)' to reflect that the data linkage process will underestimate actual screening rates due to the limitations of the available identifying variables.

Analytic variables from VCCR included details from each screening episode, postcode and age at time of each test and from VAED included country of birth, marital status, preferred language, age at each admission, principal diagnosis (by ICD10AM code), insurance and hospital status. We categorised women according to their country of birth as women born in Muslim countries, women born in Australia and women born in other Non-Muslim countries. We defined Muslim countries using the percentage of Muslim population obtained from The World Fact Book of the Central Intelligence Agency (CIA) [17]. Countries where more than 50 % of their population are Muslim were categorised as Muslim countries. Names of the countries labelled as Muslim are listed in Appendix A.

The screening date used in the analysis is based on the first episode of screening for women with multiple episodes in the study time period of interest (2012–2013). We considered the first episode because it indicates a screening visit and the subsequent episodes indicate follow-up visits. Women with hysterectomies or who had died prior to the time period of interest were excluded from the cohort. After applying these exclusions, there were 77,876 women who identified their country of birth from Muslim countries; 1,298,494 women as Australia; and 422,091 women from other Non-Muslim countries (see Table 1).

VAED dataset has Statistical Local Area (SLA) information. For VCCR dataset, we derived the SLA of each woman by using the Postal Code to SLA correspondence file from the Australian Bureau of Statistics (ABS) [18]. We then estimated their socio-economic status from the SLA by using the Socio-Economic Indexes for Areas (SEIFA), in particular the Index of Relative Socio-Economic Advantage and Disadvantage (IRSAD Deciles) [19]. Socio-economic status was derived using IRSAD Deciles that we classified into five categories- Low, Low-Medium, Medium, High Medium and High. Marital status was divided into seven different categories: Never Married, Widowed, Divorced, Separated, Married, De Facto and Not Stated/Inadequate. Those who have their SLA available in the VCCR dataset, we used the SLA at the time of the Pap test and those who were not in the VCCR dataset, we used the SLA from VAED dataset.

Successful VCCR-VAED linkage depends on women having been admitted to hospital. This might be expected to bias the cohort towards women who have worse health and potentially greater contact with the health system. This potential bias would be offset by the fact that many women in the cohort would have only been admitted to hospital to give birth. Thus, to measure the effect of this bias due to hospital admission we divided our sample into two separate cohorts – women admitted for perinatal reason and women admitted for other disease condition.

Age is defined as the age of a women on the 31st December 2012. We first calculated the age of a woman from the VAED dataset. We calculated age from the admission date and the age at the time of admission available in the VAED dataset. For women with a screening record in the VCCR dataset, we have also calculated their age on the same date (31st December, 2012). After calculating age from VCCR dataset, if there was any age difference for a woman between the two datasets (VAED and VCCR), we excluded the record from the cohort.

We linked VAED data with the Victorian Cervical Cytology Register (VCCR) dataset according to their (women's) specific project id. This project id is unique to every woman participant and is known as a linkage key variable provided by VDL, enabling us to connect the datasets together. The linked dataset included women aged 15–70 years. We identify the women who did not screen as the women who appear in the VAED dataset but did not have a matching record in the VCCR

Table 1
Descriptive statistics of cohort of 1,798,461 women admitted to hospital at least once in Victoria during the period 2000–2013 by country of birth (women born in Australia, Muslim and Non–Muslim countries).
(Source: Victorian Admitted Episodes Database).

	Australia		Muslim		Non-Muslim	
	N	%	N	%	N	%
Age						
15-19	45,229	3.5%	891	1.1%	2,875	0.7%
20-24	102,749	7.9%	4,424	5.7%	15,113	3.6%
25-29	137,044	10.6%	9,739	12.5%	38,790	9.2%
30-34	148,822	11.5%	12,047	15.5%	51,665	12.2%
35-39	158,253	12.2%	10,705	13.8%	48,596	11.5%
40-44	166,849	12.9%	9,288	11.9%	46,283	11.0%
45-49	126,353	9.7%	7,992	10.3%	42,757	10.1%
50-54	114,466	8.8%	6,743	8.7%	41,019	9.7%
55-59	103,702	8.0%	5,914	7.6%	40,336	9.6%
60-64	95,618	7.4%	5,424	7.0%	44,040	10.4%
65-69	84,696	6.5%	4,044	5.2%	43,473	10.3%
70	14,713	1.1%	665	0.9%	7,144	1.7%
Total	1,298,494	100.1%	77,876	100.2%	422,091	100.0%
Marital status						
Never Married	415,720	32.0%	13,232	17.0%	75,207	17.9%
Widowed	19,812	1.5%	2,138	2.8%	10,902	2.6%
Divorced	51,197	3.9%	2,380	3.1%	18,443	4.4%
Separated	26,944	2.1%	1,557	2.0%	8,752	2.1%
Married	663,484	51.1%	56,055	72.0%	284,656	67.4%
De Facto	96,994	7.5%	1,683	2.2%	18,798	4.5%
Not stated/ inadequate	24,343	1.9%	831	1.1%	5,333	1.3%
Total	1,298,494	100.0%	77,876	100.2%	422,091	100.2%
Socioeconomic status						
Low	131,795	10.2%	15,391	19.8%	54,332	12.9%
Low-Medium	269,582	20.8%	14,391	18.5%	73,106	17.3%
Medium	248,080	19.1%	11,280	14.5%	58,140	13.8%
High-Medium	383,872	29.6%	21,941	28.2%	135,306	32.1%
High	265,165	20.4%	14,873	19.1%	101,207	24.0%
Total	1,298,494	100.1%	77,876	100.1%	422,091	100.1%
Reason for hospital admission (principal diagnosis code)						
Other reasons	843,849	65.0%	39,939	51.3%	259,497	61.5%
Pregnant/ childbirth/ perinatal reasons[a]	454,645	35.0%	37,937	48.7%	162,594	38.5%
Total	1,298,494	100.0%	77,876	100.0%	422,091	100.0%

Due to rounding, percentages may not always appear to add up to 100%*
[a] ICD-10-AM code for Pregnancy/Childbirth/Perinatal reasons: (O00-O99) and (P00-P96).

Table 3
Association of screening status with various factors (principal diagnosis, country of birth, marital status, age and socio-economic status) (N = 1,833,977).

Variables	Odds Ratio	Std. Err. *	P-value	95% CI*
Reason for hospital admission (Principal diagnosis)				
Admitted for pregnancy/ child birth/ perinatal reasons	1.57	0.00	< 0.01	1.55-1.58
Other reasons (ref)				
Country of birth				
Muslim	0.77	0.00	< 0.01	0.75-0.78
Non-Muslim	0.83	0.00	< 0.01	0.82-0.84
Not classified	0.46	0.00	< 0.01	0.45-0.47
Australian (ref)				
Marital status				
Never married	0.60	0.00	< 0.01	0.60-0.61
Widowed	0.87	0.01	< 0.01	0.85-0.89
Divorced	0.85	0.01	< 0.01	0.83-0.86
Separated	0.70	0.01	< 0.01	0.69-0.72
De facto	0.86	0.01	< 0.01	0.85-0.87
Not stated/inadequately described	1.21	0.01	< 0.01	1.18-1.23
Married (ref)				
Age				
15-19	0.47	0.01	< 0.01	0.46-0.48
20-24	1.01	0.01	0.1	1.00-1.03
25-29	0.83	0.01	< 0.01	0.82-0.84
30-34	0.90	0.01	< 0.01	0.89-0.91
35-39	0.95	0.01	< 0.01	0.94-0.96
45-49	1.20	0.01	< 0.01	1.19-1.22
50-54	1.35	0.01	< 0.01	1.33-1.37
55-59	1.23	0.01	< 0.01	1.22-1.25
60-64	1.04	0.01	< 0.01	1.02-1.05
65-69	0.79	0.01	< 0.01	0.78-0.81
70	0.33	0.01	< 0.01	0.32-0.35
40-44 (ref)				
Socio-economic status				
Low	0.82	0.00	< 0.01	0.81-0.83
Low-Medium	0.94	0.00	< 0.01	0.93-0.94
Medium	1.05	0.00	< 0.01	1.04-1.06
High	0.99	0.00	0.02	0.98-1.00
High-Medium (ref)				
Constant	0.64	0.00	< 0.01	0.63-0.65

* Std.Err. - Standard Error, *95%CI- 95% Confidence Interval.

Table 2
Estimated apparent screening rates (ASR) of hospitalized cohort by country of birth (women born in Australia, Muslim and Non–Muslim countries) in 2012–2013.

Australia				Muslim				Non- Muslim			
Age	Unscreened/ Screened	Total (Pop. dist.[a])	ASR	Age	Unscreened/ Screened	Total (Pop. dist.[a])	ASR	Age	Unscreened/ Screened	Total (Pop. dist.[a])	ASR
15-19	37,700/ 7,529	45,229 (3.5%)	16.7%	15-19	803/88	891 (1.1%)	9.9%	15-19	2,544/331	2,875 (0.7%)	11.5%
20-24	67,486/35,263	102,749 (7.9%)	34.3%	20-24	3,443/981	4,424 (5.7%)	22.2%	20-24	12,069/3,044	15,113 (3.6%)	20.1%
25-29	91,145/45,899	137,044 (10.6%)	33.5%	25-29	7,066/2,673	9,739 (12.5%)	27.5%	25-29	28,778/10,012	38,790 (9.2%)	25.8%
30-34	91,148/57,674	148,822 (11.5%)	38.8%	30-34	7,878/4,169	12,047 (15.5%)	34.6%	30-34	34,494/17,171	51,665 (12.2%)	33.2%
35-39	92,400/65,853	158,253 (12.2%)	41.6%	35-39	6,645/4,060	10,705 (13.8%)	37.9%	35-39	29,919/18,677	48,596 (11.5%)	38.4%
40-44	96,990/69,859	166,849 (12.9%)	41.9%	40-44	5,508/3,780	9,288 (11.9%)	40.7%	40-44	27,486/18,797	46,283 (11.0%)	40.6%
45-49	71,817/54,536	126,353 (9.7%)	43.2%	45-49	4,695/3,297	7,992 (10.3%)	41.3%	45-49	24,448/18,309	42,757 (10.1%)	42.8%
50-54	65,132/49,334	114,466 (8.8%)	43.1%	50-54	3,978/2,765	6,743 (8.7%)	41.0%	50-54	23,403/17,616	41,019 (9.7%)	43.0%
55-59	62,143/41,559	103,702 (8.0%)	40.1%	55-59	3,713/2,201	5,914 (7.6%)	37.2%	55-59	24,305/16,031	40,336 (9.6%)	39.7%
60-64	61,274/34,344	95,618 (7.4%)	35.9%	60-64	3,656/1,768	5,424 (7.0%)	32.6%	60-64	28,222/15,818	44,040 (10.4%)	35.9%
65-69	59,259/25,437	84,696 (6.5%)	30.0%	65-69	2,932/1,112	4,044 (5.2%)	27.5%	65-69	30,368/13,105	43,473 (10.3%)	30.2%
70	12,414/2,299	14,713 (1.1%)	15.6%	70	574/91	665 (0.9%)	13.7%	70	6,080/1,064	7,144 (1.7%)	14.9%
Total	**808,908/489,586**	**1,298,494 (100.0%)**	**37.7%**	**Total**	**50,891/26,985**	**77,876 (100.0%)**	**34.7%**	**Total**	**272,116/149,975**	**422,091 (100.0%)**	**35.5%**

[a] Pop dist.- Population Distribution.

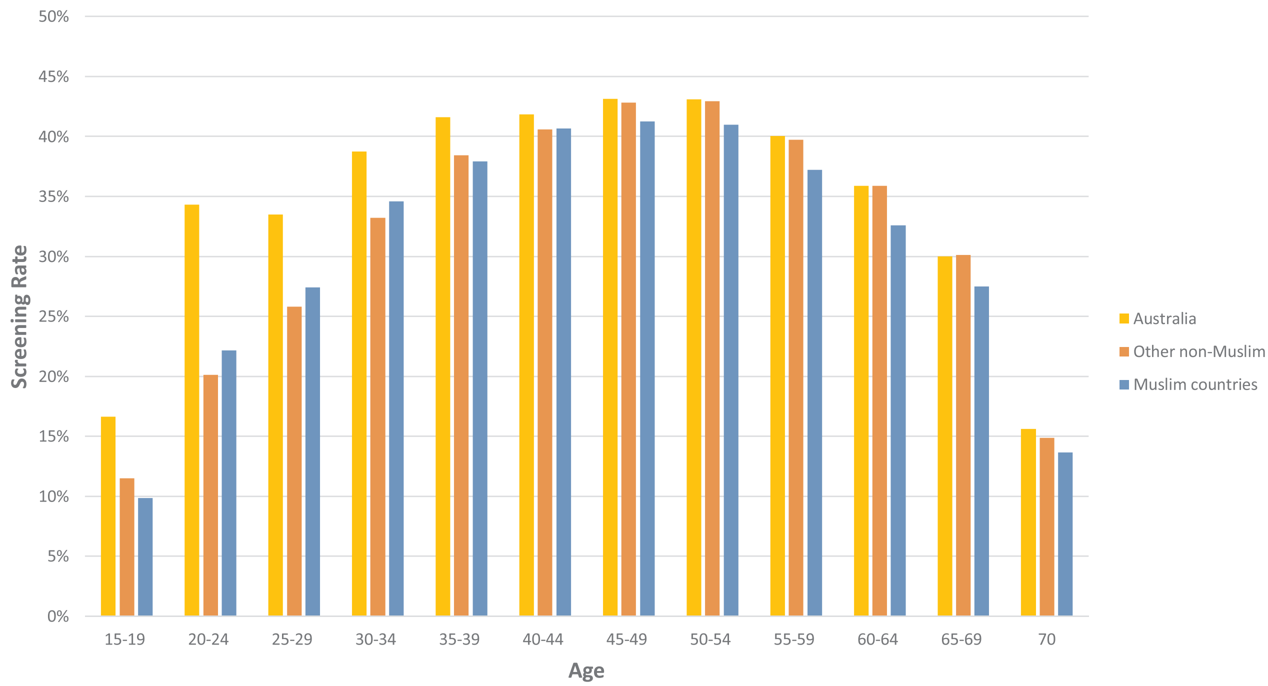

Fig. 1. Apparent screening rates (ASR) of women per their age born in Australia, Muslim and Non–Muslim countries in 2012–2013.

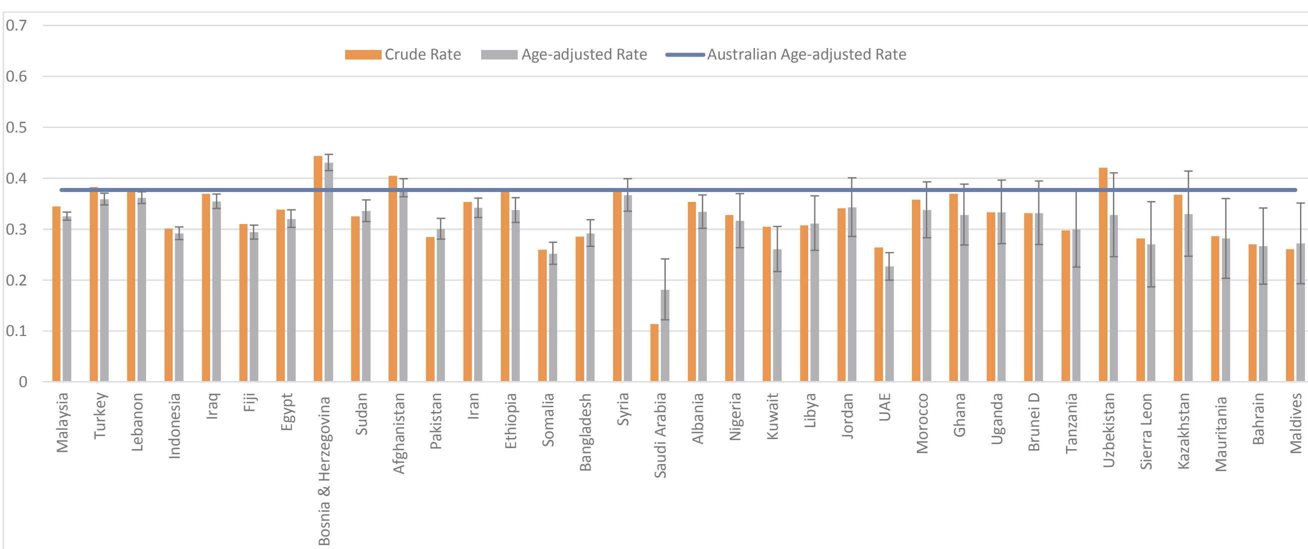

Fig. 2. Apparent screening rates (ASR) for women born in Muslim countries adjusted for age (Countries have been sorted by number of women in descending order).

dataset.

2.2. Statistical methods

The aims of the analysis are to determine the differences in screening participation among women born in different countries and whether any such observed differences are moderated by the cause of hospital admission. Descriptive analysis was performed to estimate the percentage of women in the hospital cohort of different age ranges, marital status, socio-economic status, purpose of visit to the hospital and screening participation (Tables 1 and 2). Logistic regression analysis was applied to assess the association between apparent screening status and other factors. Age adjusted rates were calculated for women born in Muslim and Non-Muslim countries and compared with the Australian age adjusted rates. The factors used as independent variables in the multiple logistic regression model include: principal diagnosis, country of birth, marital status, age and socio-economic status and the factor used as dependent variable is whether they have participated in cervical screening or not (Table 3). To understand the relationship among the variables in the logistic regression model, interaction tests were conducted. All the statistical analyses were done by using the software package Stata/SE version 12.1. $P < 0.05$ was considered to be statistically significant.

3. Results

Table 1 shows the descriptive statistics for women by country of birth. There were 77,876 women born in Muslim countries; 1,298,494 women born in Australia; and 422,091 women who were born in other Non-Muslim countries. The age distribution of the women were similar; numbers of Muslim born women in the 30 – 34 year group were higher than for Australian born women. Women born in Muslim countries had

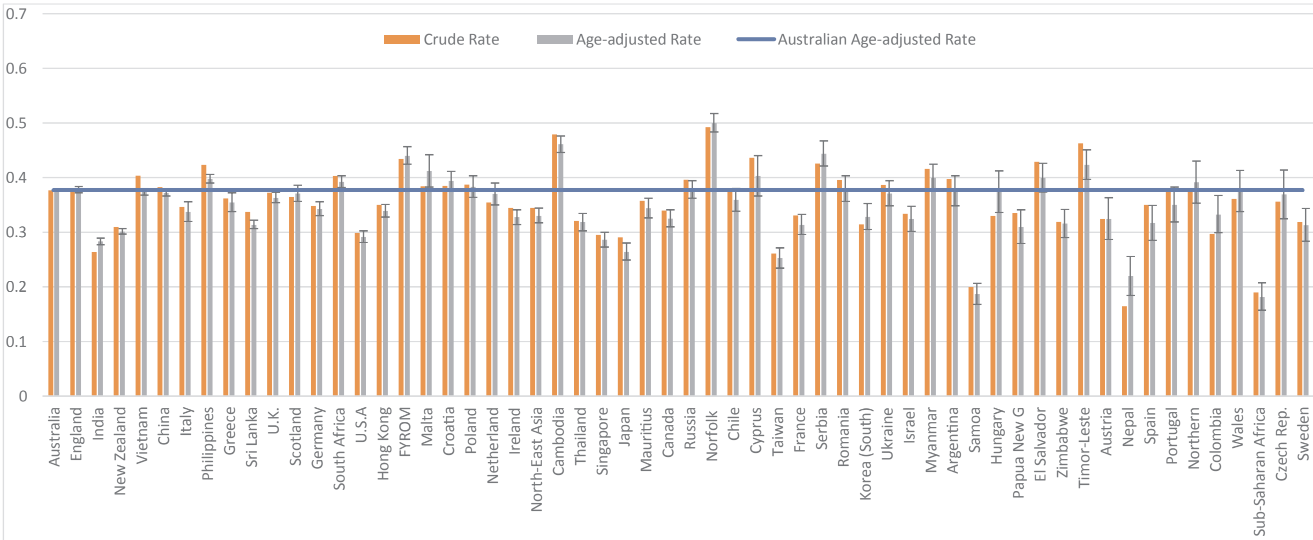

Fig. 3. Apparent screening rates (ASR) for women born in Non-Muslim countries adjusted for age (Countries have been sorted by number of women in descending order).

Table 4
Interaction test for Country of Birth and Reason for hospital admission (Principal Diagnosis) (controlled for age, marital and socio-economic status) (N = 1,833,977).

Variables	Odds Ratio	Std. Err. *	P-value	95% CI*
Country of birth				
Muslim	.83	.01	< 0.01	.81-.85
Non-Muslim	.94	0	< 0.01	.93-.95
Australian (ref)				
Reason for hospital admission (Principal diagnosis)				
Admitted for pregnancy/ child birth/ perinatal reasons	1.68	.01	< 0.01	1.67-1.70
Other reasons (ref)				
Interaction terms				
Muslim and admitted for pregnancy/ child birth/perinatal reasons	.84	.01	< 0.01	.81-.87
Non-Muslim and admitted for pregnancy/ child birth/perinatal reasons	.74	.01	< 0.01	.73-.75

* Std.Err. - Standard Error, *95%CI- 95% Confidence Interval.

the highest percentage of married women and women admitted to hospital for pregnancy, childbirth or perinatal reasons.

Apparent cervical screening rates were estimated for the last two years of the dataset (2012–2013) and included a total of 1,833,977 women after applying all the exclusions. Table 2 shows the apparent screening rates (ASR) of women born in Australia, Muslim countries and other Non-Muslim countries in the time period of 2012–2013. The overall apparent screening rates (ASR) was lower (34.7 %) among women born in Muslim countries in comparison with women born in Australia (37.7 %) and other Non-Muslim countries (35.5 %). Women aged 45–49 years had the highest apparent screening rates (ASR) among women born in both Australia (43.2 %) and Muslim countries (41.3 %) but in case of women born in Non-Muslim countries, women aged 50–54 years had the highest apparent screening rates (ASR) (43.0 %). Among the other age groups, the apparent screening rates (ASR) was lower among women born in Muslim countries than Australian born women.

Table 3 presents the results of the logistic regression model which considered the relationship between screening participation and country of birth adjusted for potential confounders. We selected potential confounders (marital status, age and socio-economic status) as these factors have been reported in the previous literature to affect screening participation [10,14]. We separately analysed screening participation rates amongst women admitted for childbirth and women admitted for other reasons in order to assess whether there was a difference for these groups (i.e., generally healthy women admitted for childbirth compared to women with medical conditions). Previous studies have found that women who were admitted to the hospital for childbirth were more likely to participate in screening than other women [20,21]. Women born in Muslim countries had lower odds of participating in screening than either women born in Australia or in non-Muslim countries. The odds of being screened were higher among the age groups of 45–49 years, 50–54 years, and 55–59 years in comparison to the reference age group of 40–44 years. Women in the medium socioeconomic category had higher odds of participating in screening than women in the high-medium category. The odds of participating in screening were lower for women who were never married, widowed, divorced and separated compared to married women. We have run likelihood ratio tests to determine the overall significance of each variable and all the variables came out significant (P-value < 0.01).

Fig. 1 shows the apparent screening rates (ASR) for women born in Australia, Muslim and other Non-Muslim countries according to their age categories. From the age group of 20–24 years to 30 – 34 years, apparent screening rates (ASR) were higher among the women born in Muslim countries than the women born in Non-Muslim countries but lower than the rates among Australian born women. Above age 35 years, across all age categories, women born in Muslim countries had lower apparent screening rates (ASR) than the women born in Australia and other Non-Muslim countries.

Fig. 2 shows the apparent screening rates (ASR) for women born in Muslim countries adjusted for age. Women born in most Muslim countries had lower apparent screening rates (ASR) than their Australian counterparts. Screening rates for women born in UAE, Saudi Arabia, Indonesia, Bangladesh, Pakistan and Somalia were significantly lower than the Australian age adjusted rate. Turkey, Lebanon, Iraq, Syria, Afghanistan, Bosnia & Herzegovina and Ethiopia had similar or higher apparent screening rates (ASR) than the Australian age adjusted rate.

Fig. 3 shows the apparent screening rates (ASR) for women born in Non-Muslim countries adjusted for age. In this figure, we can see that most of the countries had apparent screening rates (ASR) either above or closer to the Australian age adjusted rate. India, New Zealand, Sri Lanka, U.S.A., Thailand, Singapore and Taiwan were Non-Muslim countries with lower apparent screening rates (ASR) than the Australian

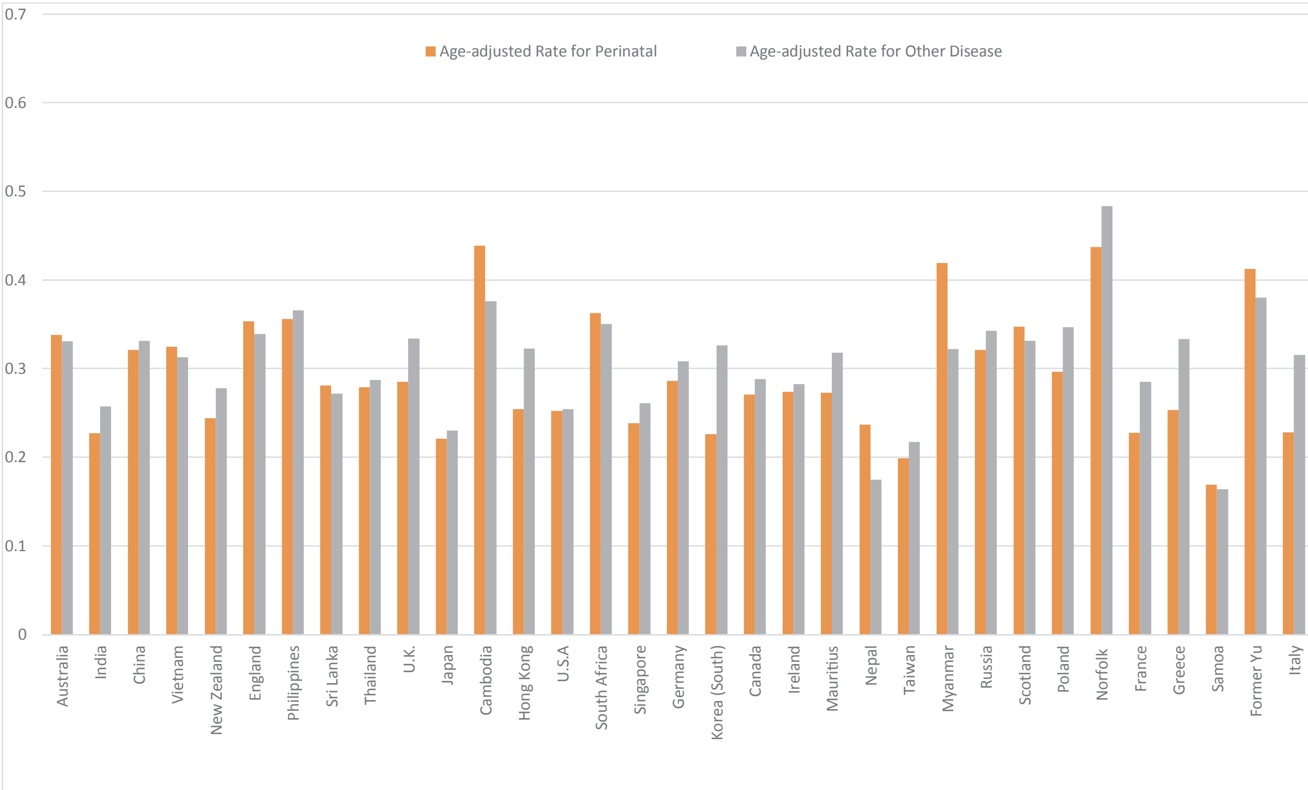

Fig. 4. Apparent screening rates (ASR) grouped by principal diagnosis of admission (perinatal vs other) for women born in Australia and Non-Muslim countries (Countries have been sorted by number of women in descending order).

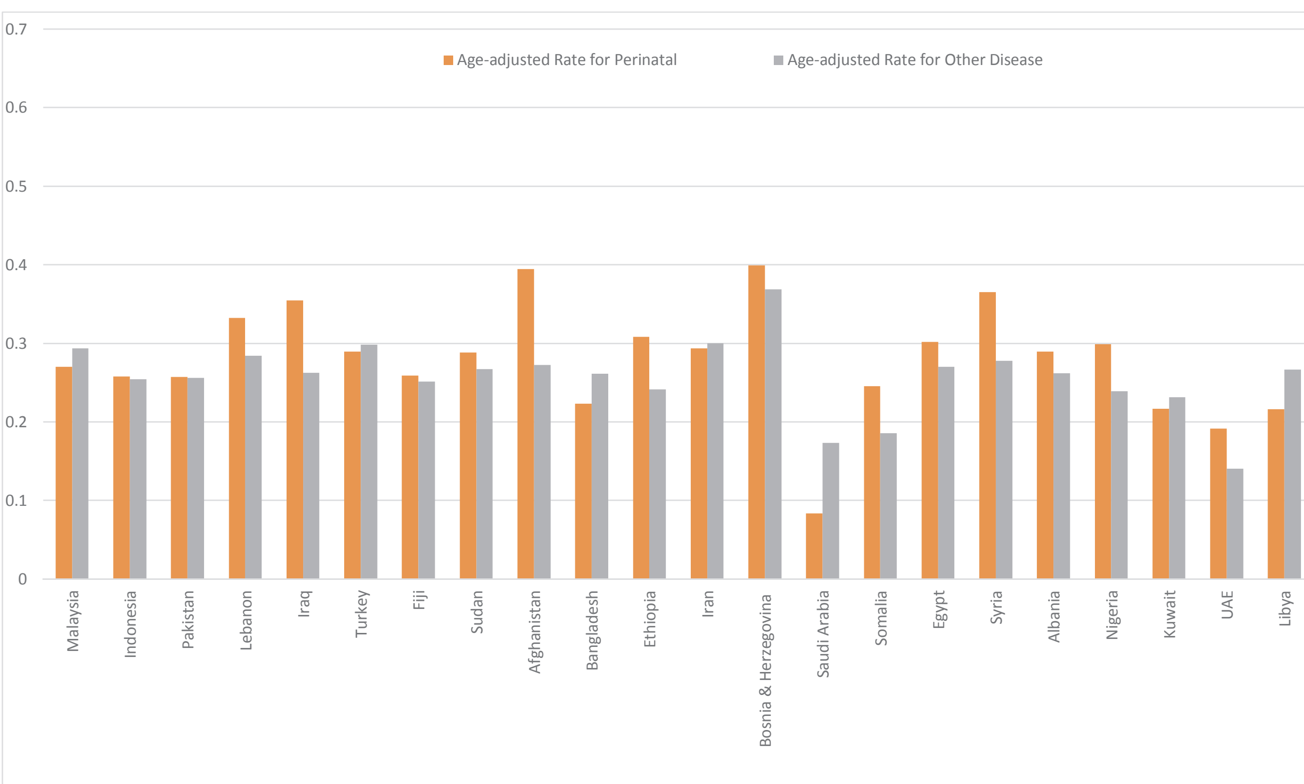

Fig. 5. Apparent screening rates (ASR) grouped by principal diagnosis of admission (perinatal vs other) for women born in Muslim countries (Countries have been sorted by number of women in descending order).

age adjusted rate.

Table 4 shows the results of the interaction tests run for logistic regression models. Interaction variables for country of birth and principal diagnosis were added separately in the logistic regression models. Women born in Muslim countries who were admitted for perinatal reasons have lower odds of apparent participation in screening than Australian born women.

4. Discussion

In this study, we investigated relative apparent cervical screening participation rates among women born in Muslim countries residing in Victoria obtained through probabilistic data linkage. We identified that women born in Muslim countries have lower apparent screening rates (ASR) than any other population groups particularly, lower than the Australian born women across all age groups (Fig. 1). Our research supports other Australian, US [10,22] and UK studies [23] that have found lower rates of cervical screening. Previous research has focused on the role of cultural and religious beliefs in contributing to lower levels of screening. Studies conducted in several Middle-eastern, Asian and African countries found factors including lack of knowledge and awareness, religious, cultural and sexual behaviour that influenced the perspectives of cervical cancer screening of Muslim women [10,11,24–29]. Muslim women have also been found to be less likely to participate in screening due to fear, pain and embarrassment, along with cultural influences [11,26,29].

The current study has several limitations. One limitation of the datasets is the apparent under linkage between the VAED and VCCR data. The VAED did not have names and addresses to match with VCCR which limits our ability to accurately match records between the two datasets. Another limitation is that only women who were admitted to the hospital are included for analysis; as such the calculated rates may not be representative of the general population. We obtained lower screening participation rates than the published Victorian population based rates for the same time period (e.g. In 2012–2013 period the two year participation rate for women aged 25–29 years was 52.0 % compared to our estimated rates for the same age group for women born in Australia, Muslim and Non-Muslim countries of 33.5 %, 27.5 %, and 25.8 %, respectively) [30]. However, since we are comparing across population groups we do not believe that this under linkage will bias our conclusions about relative participation as long as the likelihood of under matching of records is equal between the groups. We have excluded these cases of incorrect or multiple matching from our analysis.

In addition, it may seem that our results are affected by self-selection biases caused by hospital admission. In other words, healthy persons are more likely to attend screening compared to those who suffer poor health. However, there is little evidence that apparent screening rates (ASR) were biased according to hospital admission (Figs. 4 & Fig. 5). To confirm, we estimate separate logistic regression models for women who were admitted for perinatal reasons (Table B1) (see Appendix B) and women who were admitted due to other reasons (Table B2) (see Appendix B). One point to note that we have considered the hospital admission dates during the entire data collection period (2000–2013), not in the time period of estimating apparent screening rates (ASR) (2012–2013). Thus, the ages in Table B1 and Table B2 reflect that at the time of our analysis (2012–2013) not at the time of hospital admission. Comparing the odds ratios between Table B1 and Table B2, we find that Muslim women participate less in screening in both groups compared to the Australian born women. The effect is larger for Muslim women who were admitted for childbirth only, i.e. they participate less compared the those who were admitted for other reasons. Recent literature [31] suggests that comparison of odds ratios across groups can accurately describe the difference in effects across the groups.

Another limitation of our analysis is that we identified women born in Muslim countries through their country of birth. For countries with significant proportion of women from other religions, our conclusion for Muslim women from these countries may not hold. Finally, the linked data provide little information about specific reasons for the apparently lower screening rate among women born in Muslim countries. Further qualitative research is required to better understand these trends.

In contrast to cultural and religious factors, the contribution of health system factors to lower cervical screening among Muslim women has been relatively unexplored. In Australia cervical screening is provided by general practitioners and greater contact with general practitioners is generally associated with higher rates of screening [32]. This study shows that, for majority of the Muslim countries, women born in those countries admitted to hospital for perinatal reasons have higher rates of screening than women admitted for other reasons (Fig. 5). Nevertheless, in comparison to Australian born women, those born in Muslim countries who were ever admitted to hospital for perinatal reasons were still less likely to participate in screening. Further research is needed to investigate the underlying causes of the lower screening participation among this group.

The study also highlighted diversity among groups of women born in Muslim countries in terms of cervical screening. This may reflect differences in the length of settlement and networks of different Muslim countries in Australia [33]. It may also reflect differences in fertility between countries.

This study has provided valuable insights to understand the participation of cervical screening among women born in Muslim countries residing in Victoria. Unlike previous studies based on small scale survey data, this study has used Victorian cervical screening participation data which has a large sample size giving relative estimates of apparent cancer screening participation rates among immigrants from various countries. This population level study contributes to the broader knowledge of screening participation of women born in Muslim countries, an understudied population group in Australia and in the world. The study suggests that the reproductive years may be a key time to encourage regular screening participation for women born in Muslim countries. It also suggests that health care professionals need to have a greater focus on recommending older Muslim women participate in regular screening. Future cervical screening programs should consider the ethnic diversity of the population, particularly Muslim immigrant community.

Declaration of Competing Interest

None.

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Appendix A. Supplementary data

Supplementary material related to this article can be found, in the online version, at doi:https://doi.org/10.1016/j.jcpo.2019.100201.

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