Postpartum self-harm, suicide, assault and homicide in relation to immigrant status: a population-based study

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Abstract (250 words)

Background: Intentional injuries such as suicide and assault are leading causes of maternal morbidity and mortality. Whether immigrant women have a different risk, warranting intervention, is unknown.

Methods: This cohort study used population-based administrative data in Ontario, Canada, 2002-2012. The risk of self-inflicted injury (self-harm or suicide), and injury inflicted by others (assault or homicide), were each analyzed within 1 year postpartum, comparing 327,279 immigrant vs. 942,502 non-immigrant mothers. Relative risks (RR) were adjusted for maternal age, parity, income, resource utilization and psychiatric history.

Results: Self-inflicted injury was lower among immigrants (0.73/1000 births) than non-immigrants (1.27/1000 births; RR 0.58 (95%CI 0.50-0.67) but the difference was attenuated after covariate adjustment, aRR 0.91 (95%CI 0.78-1.04). Risk of injury inflicted by others was lower among immigrants (aRR 0.57, 95%CI 0.51-0.64). Within immigrants, there were no differences in risk for self-injury by duration of residence or refugee status; injury inflicted by others was higher in refugees than non-refugees (aRR 1.79, 95%CI 1.33-2.41), and among long-term (aRR 2.27, 95%CI 1.76-2.91) and medium-term (aRR 1.58, 95%CI 1.19-2.11) vs. recent immigrants. Compared to immigrants from India, risk for self-injury was lower among women from China (0.61) and Jamaica (0.37). For injury inflicted by others, risk was higher for women from Somalia (2.92), Guyana (3.35), Trinidad & Tobago (3.84) and Jamaica (4.00).

Interpretation: Immigrant mothers are at overall lower risk of intentional injury than their Canadian-born counterparts. Variability in risk between immigrant groups highlights risk and resilience factors, and supports need for cultural competency in perinatal care provision.

Introduction

Intentional injury is a leading cause of morbidity and mortality for postpartum women, with potential for devastating consequences for women, children and families (1). Suicidal thoughts are common postnatally, affecting as many as 9% of women (2), and suicide accounts for a high proportion of maternal deaths globally (1, 3, 4). Assault, mainly by intimate partners, affects about 14% of women perinatally (5), and also influences maternal mortality (6-9).

Immigrant women contribute about one-quarter to one-third of births in high income countries (12), but their risk for intentional injury in the postnatal period is unknown. The selective nature of the immigration process can result in an over-representation of relatively young, healthy, educated and economically active persons – the so-called "healthy immigrant effect"(13-15). Yet, some immigrant women exhibit up to three times the rate of postpartum depression of their non-immigrant counterparts, a risk factor for suicidal thoughts and actions (16-18). Outside the perinatal period, women from certain immigrant groups are at higher risk for intimate partner violence and homicide, relative to non-immigrants (19, 20). Given the large number of births to immigrant women in many countries, specific knowledge about if, and how, immigration status is a risk factor for postpartum intentional injury may be important to the design and delivery of policies and interventions to prevent this serious outcome.

This study compared the risk of self-inflicted injury (self-harm or suicide) and injury inflicted by others (assault or homicide) between immigrant and non-immigrant women in a large population-based Canadian sample. Risk was also evaluated, among immigrants, by immigration characteristics of refugee status, duration of residence and country of origin.

Methods

Study Design. This population-based cohort study was completed in Ontario, Canada's most populous province of about 13.5 million people. Included were all Ontarian women who had a live birth between April 1st, 2002 and March 31st, 2012. Outcomes were assessed up to 1 year from the index birth. Research ethics board approval was from Sunnybrook Health Sciences Centre in Toronto, Ontario (# 2016 0904 337 000).

Data Sources. De-identified and linked sociodemographic and health administrative databases were accessed through the Institute for Clinical and Evaluative Sciences (ICES) in Toronto, Ontario (www.ices.on.ca). The MOMBABY dataset, derived from the Canadian Institutes for Health Information Discharge Abstract Database (CIHI-DAD), was used to identify all women with a hospital delivery, reflecting more than 98% of all births (21). The Ontario segment of the Immigration, Refugees and Citizenship Canada (IRCC) database contains detailed information for immigrants to the province from 1985 onward, including their refugee status, date of immigration and country of origin. Immigrants to Canada prior to 1985 are not classified as such, nor are those who immigrated to another Province before moving to Ontario. The National Ambulatory Care Reporting System (NACRS) contains diagnostic information for all emergency department visits, including for intentional injuries, and the Ontario Vital Statistics Database (OVSD) records cause of death. The Registered Persons Database (RPDB) includes information about sex, age and postal code for all Ontario residents. The Ontario Health Insurance Plan (OHIP) contains physician billings, including diagnostic and procedures codes. The Ontario Mental Health Reporting System (OMHRS) contains psychiatric hospitalization data. These linked datasets contain complete and reliable data, with excellent validity for primary diagnostic information in emergency and inpatient health encounters (22-24).

Participants. We considered all Ontario women aged 10-50 with a liveborn infant during the study period. Women entered the cohort at each birth, unless a birth was within one year of a previous one. Excluded were women without a valid health card number.

For the main exposure status, women were classified as immigrant or non-immigrant, based on their inclusion in the Ontario segment of the IRCC dataset. For additional analyses, immigrant women were further classified as refugee or non-refugees, by duration of residence in Canada at the time of in the index birth (10+ years, 5-9 years or under 5 years), and by country of origin.

Outcomes. There were two main study outcomes assessed within 365 days after the index birth: The first was self-inflicted injury, a composite that included any form of self-harm or death by suicide. The second was injury inflicted by others, a composite that included maternal assault or death. The NACRS dataset was used to identify ICD-10 codes for self-harm with deliberate (X60-X84) and undetermined (Y10-Y19, Y28) intent. The latter codes were included because they are strongly associated with future deliberate self-harm (25). Injury inflicted by others used ICD-10 assault codes X92-Y09 and Y87.1. Deaths by suicide were identified in the OVSD; homicides were defined as a death from external injury in the OVSD where there was also a documented assault in the NACRS dataset (26).

Covariates. Covariates included maternal age, parity and neighbourhood income level – each at the index birth. In the two years prior to the index birth, we assessed for maternal psychiatric diagnoses (i.e. psychotic disorders, mood disorders, substance and alcohol use disorders) and maternal medical morbidity, summarized using health care Resource Utilization Bands, where categories 4 and 5 represent high and very high-care needs patients as per the Johns Hopkins Adjusted Clinical Groups Case-Mix System (27).

Statistical Analyses. We compared the risk for each of the two main study outcomes between immigrant vs. non-immigrant women, using modified Poisson regression with robust error variance, to account for potential clustering of more than one birth within an individual woman. Relative risks (RR) and 95% confidence intervals (CI) were generated. Models were adjusted for variables chosen, *a priori*, to be important potential confounders: maternal age, parity, residential income quintile, medical morbidity (defined by resource utilization band quintile), and prior maternal psychiatric diagnosis.

Further analyses were restricted to immigrant women. Therein, the risk for the two main study outcomes were assessed by refugee vs. non-refugee status, duration of residence in Canada at the time of in the index birth (10+ years, 5-9 years or under 5 years), and by country of origin. For maternal country of origin, the top-20 immigrant countries contributing the most births in Ontario were chosen, with women from India serving as the reference group, since they are the most numerous. In the immigrant analyses, RRs were adjusted for age, parity and other immigration characteristics.

Because of small sample sizes, modified Poisson regression models did not always converge. In that situation, Cox proportional hazard models were used, and generated hazard ratios were reported as HRs with 95% CIs. Due to counts less than six, the individual elements of the main study outcomes could not be presented.

All analyses were conducted using SAS 9.3 for Unix (SAS version 9.3, SAS Institute Inc., Cary, NC, USA). Cell sizes < 6 were not reportable due to Ontario privacy regulations.

Results

There were 1,269,781 births among 327,279 immigrants and 942,502 non-immigrants. Among the immigrant women, 41,500 (13%) were refugees, and close to half (N=147,286; 45.0%) had lived in Canada less than 5 years. Immigrant women were most frequently from India (N = 45,032), China (N = 31,157), Pakistan (N = 26,130) and the Philippines (N = 21,653) (Table S1). Immigrant women were similar in age to non-immigrants, but more likely to be multiparous and to reside in a low income neighbourhood (Table 1). Immigrant women had slightly higher rates of diabetes and general medical morbidity, but lower rates of maternal psychiatric diagnoses in the preceding 2 years. Clinically, perinatal outcomes appeared not to differ substantively by immigrant status.

In the 1-year period after the index birth, there were 4424 births affected by intentional injury inflicted either by self or others -- a rate of 3.48 per 1000 births. There were 1,411 non-fatal self-inflicted injury events (1.11 per 1000 births), 3061 non-fatal injuries inflicted by others (2.41 per 1000), and 44 deaths due to injury following self-inflicted injury or an injury inflicted by others (0.03 per 1000 births).

Immigrants had a lower rate of fatal or non-fatal self-inflicted injury (0.73 per 1000) than non-immigrants (1.27 per 1000) -- a crude RR of 0.58 (95% CI 0.50 to 0.60) (Table 2). The relation was attenuated after adjusting for other covariates in the multivariable model (aRR 0.91, 95% CI 0.78-1.04), with the attenuation especially driven by the higher number of prior psychiatric disorder diagnoses among non-immigrant women (Table 2). Immigrants also had a lower associated risk of injury inflicted by others (1.10 per 1000 deliveries) than non-immigrants (2.28 per 1000) – a crude RR of 0.38 (95% CI 0.34 to 0.43) and an aRR of 0.57 (95% CI 0.51 to 0.64) (Table 2).

Upon restricting to immigrant women, the RRs for self-inflicted injury were similar by duration of residence in Canada and by refugee status (Figure 1). Self-inflicted injury was notably less common among immigrant women from China, Jamaica and the Former Republic of Yugoslavia, compared to immigrant women from India, the largest immigrant group by population size (Figure 2a, Table S1).

The risk for injury inflicted by others increased with longer duration of residence in Canada (Figure 1). For example, the corresponding rate among immigrant women living in Canada 10+ years was 1.67 per 1000 births, compared to a rate if 0.77 per 1000 in immigrant women living in Canada less than 5 years (Figure 1). Refugees (2.07 per 1000) also had a higher associated risk than non-refugee immigrants (0.96 per 1000) (Figure 1). Women from Trinidad and Tobago, Guyana, Jamaica and Somalia were specifically at the highest risk for injury inflicted by others (Figure 2b, Table S1).

Interpretation

Intentional injury in the first year after pregnancy was observed among almost 1 in every 250 births in Canada. Immigrants had a similar risk for self-inflicted injury compared to non-immigrants, after considering differences in pre-existing psychiatric morbidity, suggesting an absence of a healthy immigrant effect for this outcome. While injury inflicted by others was less likely to occur among immigrant women, certain subgroups were at higher risk than others, with rates closer to that of Canadian-born women.

Context

The self-inflicted injury rate for the overall cohort herein is similar to postpartum self-injury rates reported previously in Canada and other high-income countries such as the U.S. and the U.K. (4, 11, 28). Non-postpartum immigrant women are at lower risk for suicidality than non-immigrants (18). Yet, immigrant women are at overall higher risk for postpartum depression, itself a risk factor for suicidality, so the fact that our results do not align with data collected outside the perinatal period is not surprising (17, 29, 30). Aligned with the current study findings, prior Canadian population-level data showed the risk for postpartum psychiatric hospitalization to be similar between immigrants and non-immigrants (31).

The rate of injury inflicted by others in our overall cohort is lower than in reports mainly originating from the U.S., where homicide rates are higher than in Canada (9, 32)(33). Herein, the observed lower risk among immigrants vs. non-immigrants counters prior European data showing a higher homicide rate among female migrants (19, 20)(34). Prior studies were not restricted to events arising postpartum, however, and did not include non-fatal assault. The current findings are consistent with studies observing a higher risk of sexual assault among mothers who are refugees and asylum seekers, than non-refugee immigrant mothers (35).

Mechanisms

Immigrant women in our cohort were of lower income and more likely to be multiparous than non-immigrants, both of which conferred increased risk for suicidality. However, they were at lower risk for suicidality than non-immigrants, a difference nullified after considering that non-immigrant women were much more likely to have a prior maternal

psychiatric diagnosis, the strongest risk factor for postpartum mental illness (36, 37). This suggests that immigrant women may enter the postpartum period with a lower burden of diagnosed mental illness, but immigrant status is not protective against developing postpartum suicidality. Symptoms of mental illness may present differently in women from different cultures than for non-immigrants. For example, women from some Asian countries may present with somatic symptoms such as non-specific pain or discomfort as an initial sign (38), so mental illness can be missed. Awareness of cultural differences can help rapidly identify emerging mental illness, and ensure women are screened for any ensuing suicidality.

Given that some immigrant mothers experience greater poverty (16), we might also have expected to observed a heightened risk for assault or homicide. However, consistent with results from a Canadian self-report survey where intimate partner violence rates were half that among immigrant vs. non-immigrant mothers (39), this was not the case. Among women from countries most highly represented herein, including India and Pakistan, the risk for injury inflicted by others was relatively low, driving the overall lower risk. Women from these countries have established social support structures, and practice traditional postpartum rituals that include high levels of woman-to-woman support (40). These factors have been shown to decrease risk for mental health problems (41), so that may also be protective against escalating violence in the home or elsewhere. Some immigrant women were at higher risk than others, however, with rates that approached those of non-immigrant women. The higher risk with longer duration of residence in Canada would align with the “healthy immigrant effect”, wherein individuals are most healthy nearer to the time of their arrival, and then take on the tendencies of their host country over time, partly in response to the stress of acculturation and

norms of the new country (14). The higher risk for refugee women and for those from various countries of origin may be multifactorial. Refugees often face additional pre- and post-migratory stressors, including gender-based violence, post-traumatic stress disorder, forced migration and separation from their children (29, 42). Many refugees originate from world regions with high rates of perinatal intimate partner violence, including areas of Africa and the Caribbean (43-45). Also, qualitative research suggests that Caribbean women, in particular, report negative experiences with the healthcare system, which may result in their reluctance to access and engage with treatment and support services intimate partner violence (46, 47).

Strengths and limitations

Strengths of this study include its use of population-level data, within a universal healthcare system, and the capture of serious health outcomes at the individual level. However, administrative health data can only capture those injuries severe enough to warrant declaration, such as an emergency department encounter. Intentional injury may have been selectively under-identified in immigrant women: social stigma, language barriers, fear of deportation or reprisal, or the presence of a male at a health visit might discourage an immigrant woman from disclosing that a specific injury was intentional (48, 49). Health care providers with minimal knowledge of a woman's cultural norms may under-identify intentional injury, in some cases (50).

This study expands knowledge about postpartum risk factors for self-harm, and harm perpetrated by others, among immigrant women. The apparent protective effect among some immigrant groups might highlight how their traditional postpartum structures might be generalized to others, including non-immigrant women. The vulnerability of refugee immigrant

women and those from specific countries to harm perpetrated by others supports the rationale for intervention to improve outcomes, including by enhancing the cultural competence of health care providers who care for women in pregnancy and in the months thereafter.

Table 1. Baseline characteristics of immigrant and non-immigrant women who gave birth in Ontario during thr study period. Data are presented as a number (%) unless otherwise indicated.

Characteristic	Immigrants (N = 327,279)	Non-immigrants (N = 942,502)
Demographic		
Mean (SD) age, years	30.5 (5.2)	29.7 (5.6)
Primiparous	141,131 (43.1)	435,940 (46.3)
Lowest neighbourhood income quintile	112,624 (34.4)	175,588 (18.6)
Maternal morbidity within 2 years prior to the index birth		
Diabetes mellitus prior to or in pregnancy	6,445 (2.0)	16,057 (1.7)
Hypertension prior to or in pregnancy	6,276 (1.9)	26,657 (2.8)
Health Utilizations Bands 4 and 5 (highest)	233,840 (71.4)	638,345 (67.7)
Psychiatric morbidity within 2 years prior to the index birth		
Mood disorder	7,372 (2.3)	46,849 (5.0)
Psychotic disorder	680 (0.2)	2,929 (0.3)
Substance or alcohol use disorder	1,613 (0.5)	24,966 (2.6)
Primary care physician visit	75,978 (23.2)	271,515 (28.8)
Psychiatrist visit	5,518 (1.7)	34,413 (3.7)
Psychiatric hospitalization	532 (0.2)	4,358 (0.5)
Deliberate self-harm	2,588 (0.8)	20,396 (2.2)
Obstetrical and perinatal indicators at the index birth		
Preterm birth < 37 weeks' gestation	21,594 (6.6)	68,637 (7.3)
Mean (SD) birthweight, grams	3,282 (557)	3,410 (584)
Cesarean delivery	92,094 (28.1)	258,841 (27.5)
Neonatal morbidity:		
Respiratory distress syndrome	3,724 (1.1)	14,216 (1.5)
Seizure	949 (0.3)	3,583 (0.4)
Sepsis	4,144 (1.3)	14,094 (1.5)
Intraventricular hemorrhage	1,745 (0.5)	5,490 (0.6)
Persistent fetal circulation	893 (0.3)	3,172 (0.3)
Congenital/neonatal infection	1,219 (0.4)	1,219 (0.4)
Neonatal intensive care unit admission	45,976 (14.0)	121,434 (12.9)
Infant mortality < 365 days of the index birth	1,227 (3.8 per 1000)	3,276 (3.5 per 1000)

Table 2. Risk of self-inflicted injury (self-harm or suicide), and injury inflicted by others (assault or homicide), comparing 327,279 immigrant women vs. 942,502 non-immigrant women who gave birth in Ontario Canada, 2002-2012. Relative risks are adjusted for maternal age, parity, income quintile, resource utilization band and prior maternal psychiatric diagnosis.

	Self-inflicted injury				*Injury inflicted by others*		
Variable modeled	**No. with the outcome (rate per 1000 births)**	**Crude relative risk (95% CI)**	**Adjusted relative risk (95% CI)**		**No. with the outcome (rate per 1000 births)**	**Crude relative risk (95% CI)**	**Adjusted relative risk (95% CI)**
Non-immigrant status	1199 (1.27)	1.00 (referent)	1.00 (referent)		2710 (2.88)	1.00 (referent)	1.00 (referent)
Immigrant status	240 (0.73)	0.58 (0.50-0.67)	0.91 (0.78-1.04)		360 (1.10)	0.38 (0.34-0.43)	0.57 (0.51-0.64)
Maternal age, years			0.86 (0.85-0.87)				0.81 (0.80-0.81)
Number of previous births			1.44 (1.39-1.51)				1.64 (1.59-1.68)
Maternal income quintile (Q)							
Q1, 2 or 3 (lower)			1.00 (referent)				1.00 (referent)
Q4 or 5 (higher)			0.86 (0.76-0.98)				0.61 (0.56-0.68)
Resource Utilization Band (RUB)							
RUB 1, 2 or 3 (lower)			1.00 (referent)				1.00 (referent)
RUB 4 or 5 (higher)			0.88 (0.79-0.98)				1.04 (0.96-1.12)
Prior maternal psychiatric diagnosis							
No			1.00 (referent)				1.00 (referent)
Yes			7.01 (6.25-7.86)				3.55 (3.26-3.86)

Figure 1. Risk of self-inflicted injury (self-harm or suicide) and injury inflicted by others (assault or homicide), by duration of residence and by refugee status, restricted to immigrants to Canada. Relative risks are adjusted for maternal age and parity.

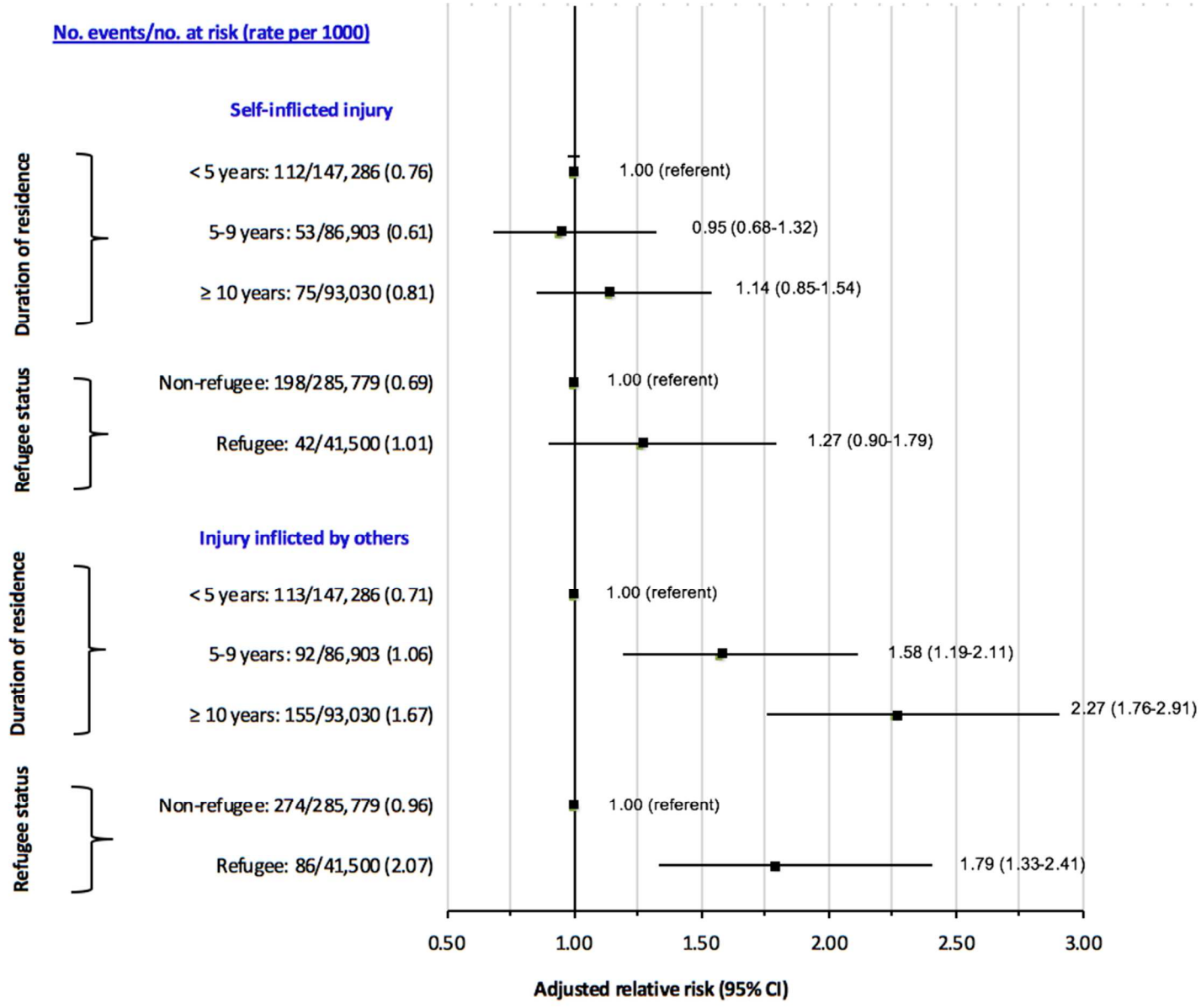

Figure 2a. Risk of self-inflicted injury (self-harm or suicide) among immigrant women, comparing those from 19 different countries to women from India. Hazard ratios are adjusted for maternal age, parity, duration of residence and refugee status.

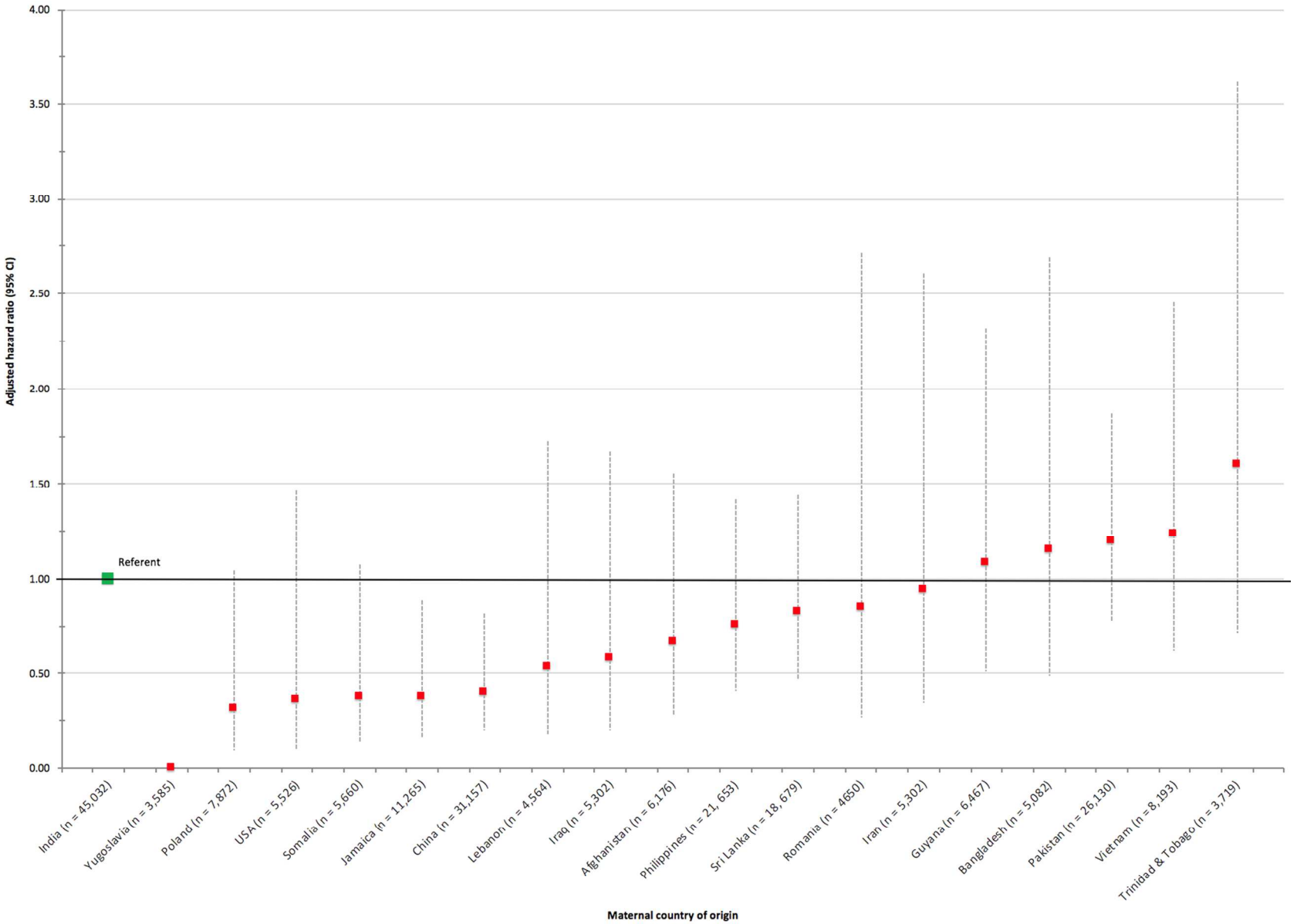

Figure 2b. Risk of injury inflicted by others (assault or homicide) among immigrant women, comparing those from 19 different countries to women from India. Hazard ratios are adjusted for maternal age, parity, duration of residence and refugee status.

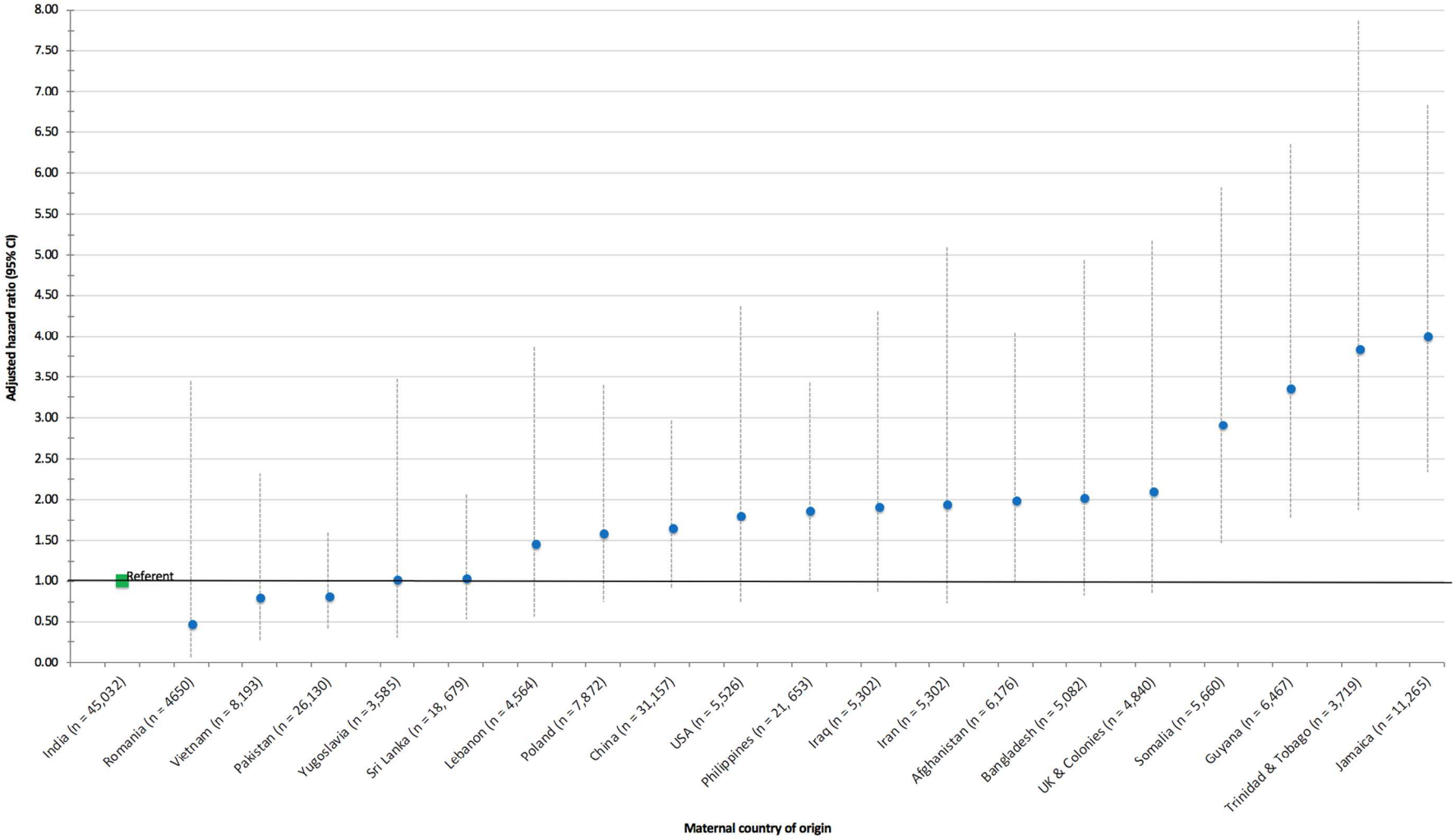

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Table S1. Risk of self-inflicted injury and injury inflicted by others by maternal country of origin for the 20 countries contributing the most births to the cohort. Shown are crude relative risks (RR), comparing women from each country to non-immigrant women.

	Self-inflicted injury			Injury inflicted by others		
Materal Country of Origin	No. with outcome	Rate per 1000 deliveries	Crude RR (95% CI)	No. with outcome	Rate per 1000 deliveries	Crude RR (95% CI)
Non-immigrant (N = 942,502)	240	0.73	1.00 (referent)	360	1.10	1.00 (referent)
India (N = 45,032)	45	1.00	0.79 (0.58-1.06)	26	0.58	0.20 (0.13-0.30)
China (N = 31,157)	9	0.29	0.23 (0.12-0.44)	21	0.67	0.23 (0.15-0.36)
Pakistan (N = 26,130)	36	1.38	1.08 (0.78-1.51)	14	0.54	0.19 (0.11-0.31)
Philippines (N = 21,653)	13	0.60	0.27 (0.47-0.82)	20	0.92	0.32 (0.21-0.50)
Sri Lanka (N = 18,679)	17	0.91	0.72 (0.44-1.15)	13	0.70	0.24 (0.14-0.42)
Jamaica (N = 11,265)	6	0.53	0.42 (0.19-0.93)	43	3.82	1.33 (0.98-1.79)
Vietnam (N = 8,193)	10	1.22	0.96 (0.52-1.79)	NR	-	-
Poland (N = 7,872)	NR	-	-	10	1.27	0.44 (0.24-0.82)
Guyana (N = 6,467)	8	1.24	0.97 (0.49-1.95)	16	2.47	0.86 (0.53-1.41)
Afghanistan (N = 6,176)	7	1.13	0.89 (0.42-1.87)	13	2.10	0.73 (0.42-1.26)
Somalia (N = 5,660)	NR	-	-	20	3.53	1.23 (0.78-1.95)
United States (N = 5,526)	NR	-	-	6	1.09	0.38 (0.17-0.84)
Iran (N = 5,302)	NR	-	-	NR		-
Iraq (N = 5,227)	NR	-	-	8	1.53	0.53 (0.27-1.07)
Bangladesh (N = 5,082)	6	1.18	0.93 (0.42-2.07)	6	1.18	0.41 (0.18-0.91)
UK and Colonies (N = 4,840)	9	1.86	1.46 (0.76-2.82)	14	2.89	0.43 (0.19-0.96)
Romania (N = 4650)	NR	-	-	NR	-	-
Lebanon (N = 4,564)	NR	-	-	NR	-	-
Trinidad & Tobago (N = 3,719)	7	1.88	1.48 (0.70-3.11)	11	2.96	1.03 (0.57-1.86)
Yugoslavia (N = 3,585)	0	0	0	NR	-	-
Other (N = 96,500)	44	0.46	0.36 (0.27-0.48)	109	1.13	0.39 (0.32-0.48)

NR (Not reportable) due to cell sizes under 6.