SUPPLEMENTAL TABLES

Supplemental Table 1. Selection criteria and resettlement support for relevant refugee and immigration streams in Canada. Reference: Evaluation of the resettlement programs (GAR, PSR, BVOR and RAP): Immigration, Refugees and Citizenship Canada 2016

	Privately Sponsored Refugee (PSR)	**Government Assisted Refugee (GAR)**	**Blended Visa Office-Referred (BVOR)[1]**
Selection Source	UNHCR or similar agency, and matched to sponsors[2], or identified by Sponsorship Agreement Holders	UNHCR or similar agency based upon medical need, survivors of violence and trauma, vulnerability	UNHCR or similar agency
Resettlement Services (1 year)	Private Sponsor	Federal Government	Private Sponsor
Income Support (1 year)	Private Sponsor	Federal Government	6 months Private Sponsor and 6 months Federal Government
Medical Care Coverage	Provincial (Ontario) publicly funded health care insurance	Provincial (Ontario) publicly funded health care insurance	Provincial (Ontario) publicly funded health care insurance
Medication and Dental Care Coverage (1 year)	Federal Government	Federal Government	Federal Government

[1]Blended Visa Office Referred Refugees is a category introduced in 2013 by the Canadian government. Due to BVORs being privately sponsored, and only representing up to 2% of the recent refugee population, they were assigned to the PSR category.
[2]Private sponsors can be Sponsorship Agreement Holders (incorporated organization with a signed sponsorship agreement with Immigration Refugee Citizenship Canada (IRCC), groups of five Canadian citizens or permanent residents, or community sponsors who are organizations without formal agreements with the IRCC. Most PSRs are referred by friends or family.

Supplemental Table 2. List of linked administrative health and demographic databases, corresponding covariates used in current study. Reference: ICES data dictionary. Available at Datadictionary.ices.on.ca.

Database	Data elements	Variable	Time Period	Date Range
Canadian Institute for Health Information Discharge Abstract	Record of hospital admission data Diagnostic codes associated with hospitalizations Postal code	Age, parity, time in Canada	At delivery	2002-2020
Ontario Health Insurance Plan	Billing claims	Primary Care Affiliation, Major Aggregated Diagnosis Groups (ADG) and Resource Utilization Bands (RUB) (Johns Hopkins ACG ® System ADG case-mix adjustment system version 10) Prenatal care provider	One year prior to conception At delivery	2002-2020
Ontario Registered Persons	Patient sex, residential postal code, date of birth on all residents eligible for healthcare services	Postal code for neighbourhood income quintile	At delivery	2002-2020
ICES Physician Database	Physician specialty	Prenatal care provider	During pregnancy	2002-2020
Mother-Baby (MOMBABY)	Linked hospital admission records of mother and newborn	Outcome definition	During pregnancy	2002-2020
Statistics Canada's Postal Code Conversion File	Neighbourhood income quintiles using Canadian Census data on the year closest to the immigration year	Neighbourhood income quintile	At delivery	2002-2020
Immigration, Refugees, and Citizenship Canada's (IRCC) Permanent Resident Database	Immigration status, refugee resettlement sponsorship pathway, and characteristics upon immigration. Linkage of immigration data to the healthcare registry is done using	education (if age at arrival was >25 years), language ability (if age on arrival was >18 years), world region of origin, secondary migration.	Time of immigration	1985-2017

	demographic data (sex, postal code, dates of birth and first and surnames.			
Community Health Centres (CHC) database	Electronic health records of all encounters from 2008 onwards for patients registered to CHCs (which are not captured in the Ontario Health Insurance Plan billing database)	Captured during pregnancy: Prenatal care visits in CHCs		2008-2019

Supplemental Table 3. Inclusion and Exclusion criteria of non-refugee immigrant and long-term residents

Inclusion/Exclusion	Non-refugee immigrants	Long-Term Residents
Dates of Conception	Conceived their first birth in Ontario between April 1, 2003 and May 31, 2019. Conceived at least 365 days from date of arrival in Canada.	Conceived their first birth in Ontario between April 1, 2003 and May 31, 2019.
Landing Dates	Landed in Canada between April 1 2002 and May 31, 2017.	Not applicable.
Immigration Definition	Immigrate to Canada under the immigration category of family class or economic class. Generally selected based on their high level of education, language fluency and work experience, or through sponsorship by a family member who is a Canadian citizen.	No record of immigration into Ontario since 1985, and includes those born in Ontario

Supplement Table 4. Adequate number of prenatal care visits based on minimum recommendations of the Society of Obstetricians and Gynaecologists of Canada. Reference: Schuurmans N, Blake J. Healthy beginnings: Guidelines for care during pregnancy and childbirth: Society of Obstetricians and Gynecologists of Canada 2017.

Gestational Age at Birth	Minimum Number of Visits (if initiated at 11 weeks)*
28 weeks	3
32 weeks	4
36 weeks	6
40 weeks	9

*The number of visits recommended by the Society of Obstetricians and Gynaecologists of Canada (SOGC) is every 4 – 6 weeks at the beginning of pregnancy, 2-3 weeks after 30 weeks gestation, and every 1-2 weeks after 36 weeks and until delivery.

Supplemental Table 5. Ontario Health Insurance Plan (OHIP) billing codes utilized to define prenatal visits and prenatal fetal anatomy ultrasonography. Reference: Schedule of benefits: Physician services under the health insurance act. Toronto, Ontario: Ministry of Health and Long-Term Care; 2015.

Billing Code	Specialty	Description
Prenatal Visit		
A007	Family Physician	Intermediate assessment

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A001	Family Physician	Minor assessment
A003	Family Physician	General Assessment
K013	Family Physician	Counselling/30min unit
P002	Obstetrician	High Risk Pregnancy
P003	Family Physician / Obstetrician	General assessment (Major prenatal visit)
P004	Family Physician / Obstetrician	Minor assessment (Minor prenatal visit)
P005	Family Physician / Obstetrician	Preventative Health Visit
A205	Obstetrician	Obstetrics Consult
A203	Obstetrician	Specific Assessment
A206	Obstetrician	Repeat Consultation
A204	Obstetrician	Partial Assessment
Prenatal fetal anatomy ultrasound		
J159	Radiology	On or after 16 weeks' gestation (maximum one per normal pregnancy)
J459	Radiology	On or after 16 weeks' gestation (maximum one per normal pregnancy)
J160	Radiology	For high risk pregnancy or complications of pregnancy
J460	Radiology	For high risk pregnancy or complications of pregnancy

Supplement Table 6: Covariates used in Propensity Score Definitions and Justification

	Definition	Justification
Age	Age of female at delivery.	Age is a factor influencing both timing and amount of prenatal care received. [1]
Parity	Parity was recorded at the time of conception (using data from hospital delivery records).	People in their first pregnancy, or who have had greater than 3 pregnancies have a higher risk of inadequate prenatal care. [2]
Time in Canada	Measured as time since arrival in Ontario, Canada, at the time of conception.	Knowledge of the healthcare system increases with time in Canada, and can change patterns of prenatal care utilization. [3]
Language	Ability to speak the official languages of Canada, was obtained for those who were > 18 years old upon arrival in Canada) through the IRCC database.	Language ability has been identified as a barrier to healthcare access as well as utilization. [4]

Education	Educational attainment was measured upon arrival for those who were > 25 years old through the IRCC database.	Lower level of education is associated with lower preventative care utilization. [5]
Neighbourhood Income Quintile	Approximated using the postal code from the delivery record of each patient, linked to the income quintile within a dissemination area which is adjusted for household and community size. Dissemination areas, which consist of small populations (400-700 people), are relatively homogenous but not a perfect proxy for individual level income.	Socioeconomic status has been associated with prenatal care utilization. [6]
Secondary Migration	Secondary migration was defined as having citizenship different from the country of last permanent residence) as a proxy variable for being in a refugee camp.	Refugees displaced to a refugee camps face higher risks of migration-related health care issues.[7]
Primary Care Affiliation	Primary care affiliation was assigned based upon visits during the one year prior to conception. Those individuals that were seen at a CHC were categorized as 'CHC'; Those rostered in a primary care model were identified as affiliated with a 'comprehensive model'; Individuals not rostered in a primary care model (ie patients seeing solo-practitioner physicians or using walk-in clinics) were categorized as 'fee for service or no model'; Those with no primary care use were defined as such ('none').	Primary care affiliation is associated with utilization of healthcare services. [8]
Major Aggregated Diagnosis Groups	The Johns Hopkins ACG ® System Aggregated Diagnosis Groups (ADGs) case-mix adjustment system (version 10) was used to assign individuals to a single, mutually exclusive ACG value, using this classification as a relative measure of the individual's excepted or actual consumption of healthcare services. The ACG system allocates	Comorbidity burden can increase the need for additional or earlier prenatal care.[1] GARs are known to be selected based on health needs and so may have a higher comorbidity burden. [9]

	International Classification of Disease (ICD) codes to clusters known as Aggregated Diagnosis Groups (ADG). An individual may have diagnoses that belong between zero to 32 ADGs; these 32 ADGs can be collapsed into 12 collapsed ADGs. Any major morbidity was characterized as time-limited major; chronic medical, unstable; psychosocial, unstable; progressive or likely to recur; or a malignancy.	
Resource Utilization bands	Resource Utilization Bands (RUBS) are a ranking system of overall morbidity level based upon expected use of healthcare. They are also part of the Johns Hopkins ACG case-mix system. They are a simplified ranking system of overall morbidity level whereby individuals who are expected to use the same level of resources are grouped together regardless of illness or epidemiological patterns. There are six classes: 0 - No or only invalid diagnosis; 1 - Healthy users; 2- Low 3; 3- moderate; 4- High; 5- Very High.	Higher users of health care are likely to require more prenatal care (higher number of prenatal visits or ultrasounds). [10]

Supplemental Table 7. Characteristics of resettled refugee women, non-refugee immigrant women, and long-term residents who gave birth in Ontario, Canada from 2002 to 2020. All data are shown as a number (%) unless otherwise indicated.

Characteristic	Resettled Refugees (ResR) (N = 5149)	Non-refugee Immigrants (Imm) (N = 105,099)	Long-Term Residents (LTR) (N = 557,950)	Standardized difference[1]		
				Imm vs. ResR	LTR vs. ResR	Imm vs. LTR
Age at conception, y						
Mean (SD) age, y	28.7 (6.0)	30.4 (4.9)	28.0 (5.6)	0.30	0.12	0.45
<18	87 (1.7)	261 (0.25)	19335 (3.5)			
18-22	698 (13.5)	5255 (5.0)	81822 (14.7)			
23-27	1515 (29.4)	24544 (23.4)	140558 (25.2)			
28-32	1435 (27.8)	39937 (38.0)	198572 (35.6)			
33-37	999 (19.4)	26484 (25.2)	93666 (16.8)			
38-49	426 (8.3)	8618 (8.2)	23997 (4.3)			
Parity						
Mean (SD)	1.1 (1.0)	0.8 (1.2)	0.5 (0.4)	0.38	0.89	0.58
0	2989 (57.9)	74830 (71.2)	517579 (92.8)			
1	679 (13.2)	22808 (21.9)	28908 (5.2)			
2	659 (12.8)	5570 (5.3)	7917 (1.4)			
3	396 (7.7)	1471 (1.4)	2364 (0.42)			
4+	434 (8.4)	420 (0.4)	1182 (0.21)			
Duration of residence in Canada, y						
Mean (SD)	4.1 (3.2)	4.1 (3.0)	..	0.2	..	..
1 to < 3	2148 (41.6)	49396 (47.0)	..	0.11	..	..
3 to < 5	1107 (21.5)	26274 (25.0)	..	0.08	..	..
5 to < 10	1367 (26.5)	2913 (21.8)	..	0.11	..	..
10+	538 (10.4)	6516 (6.2)	..	0.15	..	..
Year of index delivery						
2003-2008	352 (6.8)	14714 (14.0)	146740 (26.3)	0.24	0.54	0.30
2009-2014	1485 (28.8)	42565 (40.5)	198082 (35.5)	0.24	0.14	0.10
2015-2020	3312 (34.3)	47820 (45.5)	213128 (38.1)	0.39	0.54	0.15
Education level at landing						
None	296 (5.8)	3783 (3.6)	..	0.10	..	..
No postsecondary education	1362 (26.4)	7882 (7.5)	..	0.52	..	..
Postsecondary education below bachelor's degree	232 (4.5)	9354 (8.9)	..	0.17	..	..

Characteristic	Resettled Refugees (ResR) (N = 5149)	Non-refugee Immigrants (Imm) (N = 105,099)	Long-Term Residents (LTR) (N = 557,950)	Standardized difference[1]		
				Imm vs. ResR	LTR vs. ResR	Imm vs. LTR
Bachelors or higher	290 (5.6)	40672 (38.4)	..	0.86	..	..
College diploma or trade certificate	73 (1.4)	2627 (2.5)	..	0.08	..	..
Not applicable (age was < 25 y at landing, or was missing)	2907 (56.4)	41409(39.4)	..	0.35	..	..
Official language ability[1]						
English or French	1780 (34.4)	77353 (73.6)	..	0.85	..	..
Neither	3380 (65.5)	27746 (26.4)	..	0.85	..	..
Secondary migration[2]	3172 (61.5)	95534 (90.9)	..	0.73	..	..
Neighbourhood income quintile						
1 (lowest)	3125 (60.6)	32896 (31.3)	113018 (20.3)	0.03	0.91	0.26
2	894 (17.3)	24908 (23.7)	114276 (20.5)	0.61	0.08	0.08
3	561 (10.9)	20706 (19.7)	116906 (21.0)	0.16	0.28	0.03
4	400 (7.8)	16500 (15.7)	118579 (21.3)	0.24	0.39	0.14
5 (highest)	178 (3.4)	10089 (9.6)	95185 (17.1)	0.25	0.46	0.22
Primary care affiliation[3]						
Community health center	249 (4.8)	841 (0.80)	4071 (0.8)	0.22	0.24	0.02
Comprehensive model	3283 (63.6)	69156 (65.8)	371409 (66.6)	0.04	0.06	0.02
Fee for Service or no model	1415 (27.4)	28271 (26.9)	147261 (26.4)	0.01	0.02	0.02
None	213 (4.1)	6831 (6.5)	35209 (6.3)	0.11	0.10	0.03
Resource utilization band[4]						
Non-user	453 (8.8)	11140 (10.6)	60816 (10.9)	0.06	0.07	0.01
Healthy user	293 (5.7)	7882 (7.5)	58026 (10.4)	0.07	0.18	0.1
Low morbidity	1131 (21.9)	28061 (26.7)	152878 (27.4)	0.11	0.13	0.02
Moderate morbidity	2452 (47.5)	45199 (43.0)	222396 (39.9)	0.09	0.15	0.06
High Morbidity	809 (15.7)	12716 (12.1)	62490 (11.2)	0.10	0.13	0.03
Very High morbidity	22 (0.43)	115 (0.11)	892 (0.16)	0.06	0.05	0.01
Any major morbidity[5]	1266 (24.5)	19863(18.9)	109916 (19.7)	0.14	0.12	0.02
World region of origin[6]						

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Characteristic	Resettled Refugees (ResR) (N = 5149)	Non-refugee Immigrants (Imm) (N = 105,099)	Long-Term Residents (LTR) (N = 557,950)	Standardized difference[1]		
				Imm vs. ResR	LTR vs. ResR	Imm vs. LTR
Africa & Middle East	3327 (64.5)	12219 (11.6)	..	1.3	..	..
Americas	129 (2.5)	11771 (11.2)	..	0.49	..	..
Asia & Pacific	1534 (29.7)	68945 (65.6)	..	0.77	..	..
Europe	100 (1.9)	12008 (11.4)	..	0.39	..	..
Stateless	70 (1.3)	210 (0.2)	..	0.13	..	..
Prenatal care provider[7]						
Family physician	730 (14.2)	9669 (9.2)	94629 (17.0)	0.14	0.08	0.22
Community health centre	25 (0.48)	53 (0.05)	268 (0.05)	0.09	0.08	0.0
Obstetrician	1727 (33.5)	48367 (46.0)	251314 (45.0)	0.26	0.24	0.02
Obstetrician and community health centre	115 (2.2)	494 (0.47)	2539 (0.45)	0.15	0.16	0.0
Family physician/obstetrician mix	2558 (49.7)	46558 (44.3)	209256 (37.5)	0.11	0.25	0.0

[1]Standardized differences (SD) with a value > 0.10 considered potentially important.
[2]Self reported for Canada's official languages of French and English.
[3] Secondary migration indicates country of citizenship was different from their country of last permanent residence
[4]'Community Health Clinics' are unique primary health care delivery models which prioritize immigrant and refugee populations, 'Comprehensive' refers to enrollment in any primary care model, 'Fee-for-service' refers to physicians who are not part of primary care models such as solo practicing or walk-in clinic physicians, and 'None' refers to having no primary care visits in the previous year.
[5]Resource utilization bands are a ranking system of overall morbidity level based upon expected use of the healthcare system.
[6]Any major morbidity is based on the Johns Hopkins ACG ® System Aggregated Diagnosis Groups case-mix adjustment system. Any major morbidity was characterized as time-limited major; chronic medical, unstable; psychosocial, unstable; progressive or likely to recur; or a malignancy.
[7]Regions of origin were assigned based on country of citizenship
[8] Prenatal care provider is the physician who provided >70% of visits for prenatal care provided by this specialty, or if less a mix is indicated.

Supplement Table 8. Relative risks of adequate prenatal care by the Adequacy of Perinatal Care Utilization (APCU) Index among Privately Sponsored Refugees vs Government Assisted Refugees.

Adequate prenatal care by APCU Index[1]	Relative Risk (95% Confidence Interval)
Privately Sponsored Refugee	Referent
Government Sponsored Refugee	Unweighted 0.95 (0.92-0.96)
	Weighted 0.95 (0.89-1.0)[2]

[1] Adequacy of Prenatal Care Use Index utilizes the month prenatal care began, and proportion of visits received, as recommended by the Society of Obstetrics and Gynaecology of Canada. Prenatal care is deemed to be not adequate if initiated after 16 weeks' gestation.
[2] Weighted results are based on the inverse probability treatment weighted analysis using a propensity score that included maternal age, parity, year of delivery, education, language ability, neighbourhood income quintile, primary care affiliation, resource utilization band and the presence of a major maternal comorbidity.

Supplemental Table 9. Adequate prenatal care by the Adequacy of Perinatal Care Utilization (APCU) Index results among Government Assisted Refugees, Privately Sponsored Refugees, and the secondary cohorts of non-refugee immigrant and long-term residents in Ontario.

Prenatal care outcome	Number with outcome/ number eligible (%)	Relative risk (95% CI)
Adequate prenatal care by APCU Index[1]		
Long-term residents of Ontario	482369/557950 (86.5)	1.00 (Referent)
Non-refugee immigrants	92487/105099 (88.4)	1.02 (1.02-1.03)
Privately Sponsored Refugees	2081/2374 (87.7)	1.01 (1.00-1.03)
Government Assisted Refugees	2267/2775 (81.7)	0.94 (0.93-0.96)

[1] Adequacy of Prenatal Care Use Index utilizes the month prenatal care began, and proportion of visits received, as recommended by the Society of Obstetrics and Gynaecology of Canada. Prenatal care is deemed to be not adequate if initiated after 16 weeks' gestation.

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