



Seroprevalence of Strongyloidiasis and Schistosomiasis among Immigrants and Refugees in Montreal, Canada

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Background

- Foreign-born immigrants account for over 10% of the populations of major immigrant receiving countries, many of who are at risk for strongyloides and schistosomiasis¹.
- Strongyloidiasis can remain asymptomatic for years and once the host is immunosuppressed can cause disseminated disease with a mortality rate of >80%.
- Undetected and untreated schistosomiasis may lead to liver cirrhosis and liver failure. Chronic infections increases the risk of colon and bladder cancer.
- Current US and Canadian guidelines recommend screening for these parasitic infections only among refugees however this population likely only represents a small proportion of the at-risk migrant population^{2,3}.
- Justification to extend screening to immigrants is limited by lack of prevalence data of these diseases in this. Most studies have been done in restricted geographic regions or HIV positive persons.
- Furthermore older studies often used stool microscopy to detect strongyloides rather than serologic tests which are much more sensitive.^{4,5}

Objective

The objective of this study was to measure and compare the serologic prevalence of Strongyloides and Schistosoma infection among refugees and immigrants from all world regions in Montreal.

Methods

- 1297 Foreign born adults (≥18 years) who had been living in Canada for ≤ 5 years were recruited from October 2002 to December 2004 from 2 hospitals and 3 clinics in Montreal, Quebec.
- Banked sera from a study to measure vaccine preventable diseases was used⁶.
- Demographic information was collected via questionnaire.
- Antibodies to recombinant *Strongyloides stercoralis* NIE antigen [Optical density (OD) <0.30=negative, ≥0.30=positive] and *Schistosoma mansoni* [OD <0.40=negative, ≥0.40=positive] were detected by ELISA on stored, banked sera.

Analyses

- The prevalence with 95% confidence intervals (CI) of the presence of strongyloides or schistosomiasis antibodies was calculated.
- Age group, sex, region of origin, refugee status, time since arrival in Canada and socio-economic and sanitary conditions were thought to be important predictors for exposure.
- Univariate and multivariable logistic regression models were used to test for associations with these variables and seropositivity.
- All analyses were conducted with SAS version 9.0 (SAS Institute)
- Maps of seroprevalence by region of origin for strongyloides and schistosomiasis were generated with Arc GIS-9 software (ESRI data and Maps 9-3).

References

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Table 1. Demographic Characteristics

Characteristic	N (%)	Immigration Category	N (%)
Age	1297		
Mean ± SD	32.4 ± 8.8	Refugee Claimant	493 (38.0)
		Refugee	82 (6.3)
Sex		Immigrant	635 (49.0)
Female	852 (65.7)	Other (students, visitors or Canadian citizens)	87 (6.7)
Male	445 (34.3)		
Time since arrival (years)		Income Level	
Mean ± SD	1.7 ± 1.3	Lower third	84 (6.5)
< 1 year	531 (40.9)	Middle third	1086 (83.7)
1-2	301 (23.2)	Upper third	126 (9.7)
2-3	203 (15.7)	Years of education	
3-4	153 (11.8)	Mean ± SD	13.9 ± 4.1
4-5	107 (8.2)	University Education	607 (46.8)
		Region of origin	
Latin America/Caribbean	333 (25.7)	Sub-Saharan Africa	190 (14.6)
South Asia	293 (22.6)	Eastern Europe/Central Asia	149 (11.5)
East Asia/Pacific	192 (14.8)	Middle East/North Africa	140 (10.8)

Included migrants from 86 different countries. The top 10 countries were China (n = 114), India (n = 111), Mexico (n = 79), Romania (n = 74), Pakistan (n = 69), Peru (n = 63), Bangladesh (n = 58), Sri Lanka (n = 46), Algeria (n = 39) and the Congo (n = 39) and they accounted for 57% of the participants.

Seroprevalence by Region of Origin (World Bank Regions)

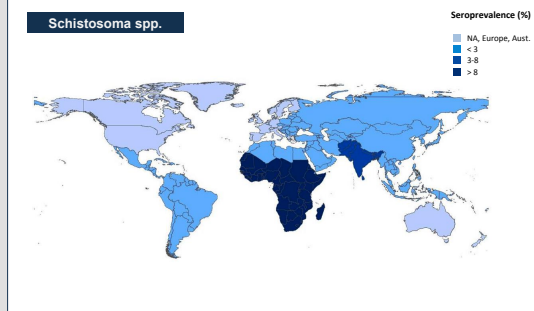
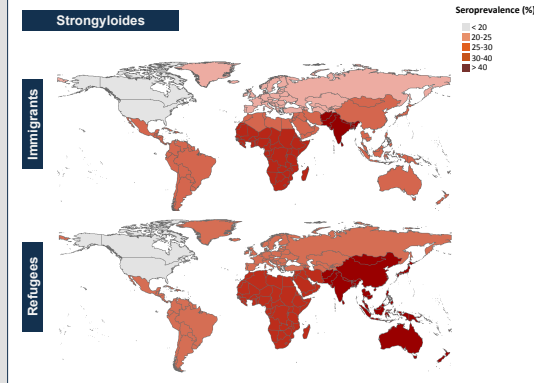


Table 2. Risk factors in Univariate and Multivariate Regression

Variable	Strongyloides				Schistosoma			
	Total	Positive (95% CI)	Crude OR (95% CI)	Adjusted OR* (95% CI)	Total	Positive (95% CI)	Crude OR (95% CI)	Adjusted OR** (95% CI)
Overall	404/1290	31.3 (28.8 - 33.8)			96/1296	7.4 (6.0 - 8.8)		
Age								
< 25	67/216	31.0 (24.8 - 37.2)	1.0	1.0	15/216	6.9 (3.6 - 10.3)	1.0	1.0
25 - 29	88/308	28.6 (23.5 - 33.6)	0.9 (0.6 - 1.3)	1.0 (0.7 - 1.5)	16/313	5.1 (2.7 - 7.6)	0.7 (0.3 - 1.5)	0.8 (0.4 - 1.7)
30 - 34	107/358	29.9 (25.1 - 34.6)	0.9 (0.7 - 1.4)	1.1 (0.7 - 1.6)	23/359	6.4 (3.9 - 8.9)	0.9 (0.5 - 1.8)	1.2 (0.6 - 2.4)
35 - 39	64/197	32.5 (25.9 - 39.0)	1.1 (0.7 - 1.6)	1.1 (0.7 - 1.7)	16/197	8.1 (4.3 - 11.9)	1.2 (0.6 - 2.5)	1.3 (0.6 - 2.9)
≥ 40	78/211	37.0 (30.5 - 43.5)	1.3 (0.9 - 1.9)	1.0 (0.7 - 1.6)	26/211	12.3 (7.9 - 16.8)	1.9 (1.0 - 3.7)	1.9 (0.9 - 4.0)
Sex								
Female	230/846	27.2 (24.2 - 30.2)	1.0	1.0	51/852	6.0 (4.4 - 7.6)	1.0	1.0
Male	147/444	39.2 (34.6 - 43.7)	1.7 (1.4 - 2.2)	1.4 (1.1 - 1.8)	45/444	10.1 (7.3 - 12.9)	1.8 (1.2 - 2.7)	1.2 (0.8 - 2.0)
Region of origin								
Sub-Saharan Africa	60/189	31.7 (25.1 - 38.4)	1.7 (1.0 - 2.8)	1.2 (0.7 - 2.2)	37/190	19.5 (13.8 - 25.1)	6.5 (3.3 - 12.8)	6.1 (2.9 - 12.7)
Middle East/North Africa	39/139	28.1 (20.6 - 35.5)	1.4 (0.8 - 2.4)	1.5 (0.9 - 2.6)	6/140	4.3 (0.9 - 7.6)	1.2 (0.4 - 3.3)	1.4 (0.5 - 3.9)
Eastern Europe/Central Asia	32/149	21.5 (14.9 - 28.1)	1.0	1.0	9/149	6.0 (2.2 - 9.9)	1.7 (0.7 - 4.2)	2.0 (0.8 - 5.2)
South Asia	133/293	45.4 (39.7 - 51.1)	3.0 (1.9 - 4.8)	2.3 (1.4 - 3.8)	23/292	7.9 (4.8 - 11.0)	2.3 (1.1 - 4.7)	1.9 (0.9 - 4.1)
East Asia/Pacific	54/189	28.6 (22.1 - 35.0)	1.5 (0.9 - 2.4)	1.5 (0.9 - 2.5)	9/192	4.7 (1.7 - 7.7)	1.3 (0.5 - 3.2)	1.5 (0.6 - 3.9)
Latin America/Caribbean	86/331	26.0 (21.3 - 30.7)	1.3 (0.8 - 2.0)	1.1 (0.6 - 1.7)	12/333	3.6 (1.6 - 6.6)	1.0	1.0
Time since arrival								
< 1 year	185/530	34.9 (30.8 - 39.0)	1.0	1.0	43/531	8.1 (5.8 - 10.4)	1.0	1.0
1-3 years	147/499	29.5 (25.5 - 33.5)	0.8 (0.6 - 1.0)	0.9 (0.7 - 1.1)	36/503	7.2 (4.9 - 9.4)	0.9 (0.6 - 1.4)	-
3-5 years	71/259	27.4 (22.0 - 32.8)	0.7 (0.5 - 1.0)	0.8 (0.6 - 1.2)	16/260	6.2 (3.2 - 9.1)	0.7 (0.4 - 1.3)	-
Refugee status								
No	170/652	26.1 (22.7 - 29.4)	1.0	1.0	34/656	5.2 (3.5 - 6.9)	1.0	1.0
Yes	234/638	36.7 (32.9 - 40.4)	1.6 (1.3 - 2.1)	1.4 (1.0 - 2.0)	62/640	9.7 (7.4 - 12.0)	2.0 (1.3 - 3.0)	1.1 (0.6 - 2.0)
University Education								
Yes	167/602	27.7 (24.2 - 31.3)	1.0	1.0	38/607	6.3 (4.3 - 8.2)	1.0	1.0
No	237/688	34.4 (30.9 - 38.0)	1.4 (1.1 - 1.7)	1.1 (0.8 - 1.4)	58/689	8.4 (6.3 - 10.5)	1.4 (0.9 - 2.1)	-
Income								
Lower third	31/83	37.3 (26.9 - 47.8)	1.0 (0.6 - 1.8)	-	7/84	8.3 (2.4 - 14.2)	1.2 (0.4 - 3.3)	-
Middle third	328/1081	30.2 (27.4 - 32.9)	0.7 (0.5 - 1.1)	-	80/1085	7.4 (5.8 - 8.9)	1.0 (0.5 - 2.1)	-
Upper third	47/125	37.6 (29.1 - 46.1)	1.0	-	9/126	7.1 (2.6 - 11.6)	1.0	-
Father's occupation								
Farmer	77/198	38.9 (32.1 - 45.7)	1.5 (1.1 - 2.0)	1.0 (0.7 - 1.4)	23/198	11.6 (7.2 - 16.1)	1.9 (1.1 - 3.1)	1.6 (0.9 - 2.9)
Other	323/1081	29.9 (27.2 - 32.6)	1.0	1.0	71/1086	6.5 (5.1 - 8.0)	1.0	1.0
Participant's occupation								
Farmer	30/60	50.0 (37.3 - 62.7)	2.3 (1.4 - 3.8)	0.9 (0.5 - 1.8)	4/60	6.7 (0.4 - 13.0)	0.9 (0.3 - 2.5)	-
Other	374/1228	30.5 (27.9 - 33.0)	1.0	1.0	92/1234	7.5 (6.0 - 8.9)	1.0	-
Household conditions								
Electricity								
No	33/84	39.3 (28.8 - 49.7)	1.5 (0.9 - 2.3)	-	8/85	9.4 (3.2 - 15.6)	1.3 (0.6 - 2.9)	-
Yes	370/1202	30.8 (28.2 - 33.4)	1.0	-	87/1207	7.2 (5.7 - 8.7)	1.0	-
Outdoor Toilet only								
No	288/971	29.7 (26.8 - 32.5)	1.0	1.0	61/975	6.3 (4.7 - 7.8)	1.0	1.0
Yes	115/316	36.4 (31.1 - 41.7)	1.4 (1.0 - 1.8)	0.9 (0.6 - 1.3)	34/318	10.7 (7.3 - 14.1)	1.8 (1.2 - 2.8)	0.9 (0.5 - 1.5)
Outdoor Water only								
No	286/985	29.0 (26.2 - 31.9)	1.0	1.0	68/989	6.9 (5.3 - 8.5)	1.0	1.0
Yes	118/305	38.7 (33.2 - 44.2)	1.5 (1.2 - 2.0)	1.2 (0.9 - 1.7)	28/307	9.1 (5.9 - 12.3)	1.4 (0.9 - 2.2)	-

*Multivariable model adjusted for 10 variables: Sex, Age, Region of origin, Time since arrival, Refugee status, University Education, Outdoor Toilet, Outdoor Water, Father's occupation, Participant's occupation
 **Multivariable model adjusted for 6 variables: Sex, Age, Region of origin, Refugee status, Outdoor toilet, Father's occupation.

Conclusions

- One third of foreign-born individuals screened in this study were seropositive for Strongyloides and ranged from 21%-45% in different world regions.
- Male gender, refugee status and South Asia origin were the most significant demographic factors correlated with strongyloides seropositivity.
- One quarter of immigrants were also seropositive for Strongyloides demonstrating they are an important group at risk.
- The seroprevalence of schistosomiasis was highest in those from sub-Saharan region (19.5%) and consistent with known epidemiology of this infection.
- These data suggest that a large proportion of immigrants and refugees are at risk for strongyloides and all may benefit from screening.
- Migrants from Sub-Saharan Africa were at the highest risk for schistosomiasis and would benefit the most from screening