Parasitic stool testing in newly arrived refugees in Calgary, Alta

Giselle DeVetten MD CCFP DTM&H Meghan Dirksen MD CCFP Robert Weaver MSc
Tanvir Turin Chowdhury PhD MB BS Michael William Aucoin MD CCFP DTM&H

Abstract

Objective To determine the prevalence of intestinal parasites and rates of stool testing compliance, as well as associated patient characteristics, among newly arrived refugees at the Mosaic Refugee Health Clinic in Calgary, Alta.

Design Retrospective chart review.

Setting Primary care clinic for refugee patients.

Participants A total of 1390 new refugee patients at the clinic from May 1, 2011, to June 30, 2013.

Main outcome measures Stool ova and parasite test completion and proportion of positive test results.

Results Of 1390 patients, 74.1% (95% CI 71.7% to 76.4%) completed at least 1 stool ova and parasite test. Among those completing tests, 29.7% (95% CI 26.9% to 32.6%) had at least 1 positive result. Patients aged 6 to 18 years were more likely to have positive test results (38.5%, 95% CI 32.2% to 45.0%) than patients aged 19 to 39 were, as were those last residing in Asia (36.4%, 95% CI 30.4% to 42.8%) or sub-Saharan Africa (30.9%, 95% CI 26.8% to 35.1%), compared with those arriving from the Middle East. *Giardia lamblia, Blastocystis hominis, Dientamoeba fragilis,* and *Entamoeba histolytica* or *Entamoeba dispar* were the most prevalent parasites. If *B hominis* and *D fragilis* are excluded because of their lower potential to cause harm, the overall prevalence was 16.3%.

Conclusion Given the high compliance of patients submitting stool ova and parasite tests and a high prevalence of positive test results in some refugee groups, targeted screening should be considered in newly arrived refugees at greater risk of intestinal parasites.

EDITOR'S KEY POINTS

- This study aimed to determine the prevalence of intestinal parasites and rates of stool testing compliance among newly arrived refugees in a refugee health clinic in Calgary, Alta.
- More than 70% of patients completed their requested stool tests. There was an overall intestinal parasite prevalence rate of 29.7%.
- The highest parasite burden was found in school-aged children. This population has more to gain from both screening and treatment, as untreated intestinal parasites are associated with growth and development concerns.

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Recherche de parasites dans les selles chez les réfugiés récemment arrivés à Calgary, en Alberta

Giselle DeVetten MD CCFP DTM&H **Meghan Dirksen** MD CCFP **Robert Weaver** MSc
Tanvir Turin Chowdhury PhD MB BS **Michael William Aucoin** MD CCFP DTM&H

Résumé

Objectif Déterminer la fréquence de parasitose intestinale chez des réfugiés nouvellement arrivés à la Mosaic Refugee Health Clinic de Calgary, en Alberta, et établir le taux d'acceptation du dépistage qu'on offrait aux patients, en plus de vérifier les caractéristiques de ces patients.

Type d'étude Revue rétrospective de dossiers.

Contexte Une clinique de soins primaires pour réfugiés.

Participants Un total de 1390 nouveaux réfugiés ayant fréquenté la clinique entre le 1er mai 2011 et le 30 juin 2013.

Principaux paramètres à l'étude le nombre de recherches d'œufs et de parasites intestinaux effectuées, et la proportion de résultats positifs.

Résultats Sur 1390 patients, 74,1% (IC à 95% 71,7 à 76,4%) ont eu au moins une recherche d'œufs et de parasites. Parmi ces derniers patients, 29,7% (IC à 95% 26,9% à 32,6%) avaient au moins un résultat positif. Par rapport aux patients de 19 à 39 ans, ceux de 6 à 18 ans étaient plus susceptibles d'avoir des résultats positifs (38,5%, IC à 95% 32,2% à 45,0%), tout comme ceux dont le dernier lieu de résidence était l'Asie (36,4%, IC à 95% 30,4% à 42,8%) ou qui provenaient d'Afrique subsaharienne (30,9%, IC à 95% 26,8% à 35,1%) étaient plus susceptibles d'avoir des résultats positifs que ceux qui arrivaient du Moyen Orient. Les parasites les plus souvent rencontrés étaient *Giardia lamblia*, *Blastocystis hominis, Dientamoeba fragilis* et *Entamoeba histolytica* ou *Entamoeba dispar*. Si on excluait *B hominis* et *D fragilis* en raison de leur faible potentiel de nocivité, la fréquence globale était de 16,3%.

Conclusion Étant donné le haut taux d'acceptation des patients pour la recherche d'œufs et de parasites intestinaux, et considérant la haute fréquence de résultats positifs chez certains groupes de réfugiés, il y aurait lieu d'envisager un dépistage visant les réfugiés nouvellement arrivés qui sont plus à risque de parasitose intestinale.

POINTS DE REPÈRE DU RÉDACTEUR

- Cette étude voulait vérifier la fréquence de parasitose intestinale chez des réfugiés nouvellement arrivés dans une clinique pour réfugiés à Calgary, en Alberta, ainsi que le taux d'acceptation par les patients du dépistage qu'on leur suggérait.
- Plus de 70% des patients se sont soumis à l'examen des selles qu'on leur suggérait. Globalement, la fréquence de parasitose intestinale était de 29,7%.
- C'est chez les enfants d'âge scolaire que les cas positifs étaient les plus nombreux. C'est aussi ce groupe qui bénéficierait le plus d'un dépistage et d'un traitement, puisque qu'une parasitose intestinale non traitée peut compromettre la croissance et le développement.

Cet article a fait l'objet d'une révision par des pairs.
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Canada welcomes more than 20 000 refugees per year.[1] Refugees often come from regions with higher infectious disease burdens that are often associated with overcrowded living conditions and poor sanitation. Further, many refugees have limited or inequitable access to health care. The World Health Organization (WHO) estimates approximately 1.5 billion people worldwide are infected with soil-transmitted helminths, which can lead to considerable morbidity and nutritional deficiencies.[2] The WHO is currently rolling out a strategy to periodically treat soil-transmitted helminths.[2] Previous studies have demonstrated prevalences of stool tests positive for ova and parasites of 13% to 57% in newly arrived refugee populations in Western countries, as well as a higher burden of disease in children.[3-7]

The Canadian guidelines for the delivery of refugee preventive and primary health care recommend screening serology for both strongyloidiasis and schistosomiasis but do not suggest screening stool for other intestinal parasites.[8] This differs from the most recent American and Australian guidelines that suggest presumptive pretreatment of intestinal parasites and an arrival screening algorithm.[9,10]

The purpose of this study was to determine the prevalence of intestinal parasites and rates of stool testing compliance, as well as associated patient characteristics, in newly arrived refugees at the Mosaic Refugee Health Clinic (MRHC) in Calgary, Alta.

METHODS

Study design and setting

We conducted an exploratory retrospective review leveraging data from the MRHC electronic medical record (EMR). The institutional review board of the University of Calgary granted ethics approval for the project.

The MRHC formed in response to the growing need for streamlined medical care for refugees arriving in Calgary.[11] Government-assisted refugees are automatically referred to the clinic through a local resettlement agency. Other refugees self-refer to the clinic for care. Refugees are encouraged to attend a medical intake visit to complete various screening tests similar to those recommended in the recent Canadian clinical guidelines.[8]

Patient population

The study population included all refugee patients with an intake visit between May 1, 2011, and June 30, 2013, at the MRHC. Among the 1400 patients who had intake appointments at the MRHC during the study period, we excluded 8 who were born in Canada or the United States and 2 owing to a lack of information in the EMR.

Stool ova and parasite tests

The MRHC previously screened all newcomers with 2 stool ova and parasite tests. Stool specimens were collected both fresh and in sodium acetate–acetic acid–formalin preservative and sent to Calgary Laboratory Services for microbiologic analysis. All specimens were first screened for *Giardia lamblia* and *Cryptosporidium* using an enzyme immunoassay[12]; positive results were confirmed by direct fluorescent antibody testing. Microscopic examination of all specimens was performed on a wet mount, after concentration with ethyl acetate, and a permanent slide, using a modified iron hematoxylin stain with a carbol fuchsin and acid decolourization step.[13]

Patient characteristics

We identified patients' sex, date of birth, country of birth, country of last residence, refugee camp history, number of stool ova and parasite tests completed, and test results. Two reviewers (G.D., M.D.) recorded the outcomes of the first 2 stool ova and parasite tests, including types of parasites identified. Only tests completed within 1 month of each other were included, as we considered tests beyond this time period not to be screening tests.

Statistical analysis

Two stages of analyses were performed. The first comparison was between the patients who completed stool tests and those who did not complete the tests. The second comparison was between those patients who had test results positive for parasites and those whose results were negative.

We first conducted descriptive analyses using χ^2 tests to compare categorical variables with the outcomes of interest. We used univariate modified Poisson regression models with robust standard errors to analyze the relationship between selected variables and the likelihood of completing the tests.[14] The variables of interest were age at intake, sex, region of last residence, and a personal history of residing in a refugee camp. We used region of last residence rather than region of birth, as we thought it more relevant; some refugees spend many years in another country before coming to Canada. Subsequently, a multivariate Poisson model was fit using the variables with *P* values less than .2 from the univariate analyses and using backward elimination, retaining covariates with *P* values less than .05. A similar approach was used for positive stool test results. All statistical analyses were performed with Stata, version 12.1.

RESULTS

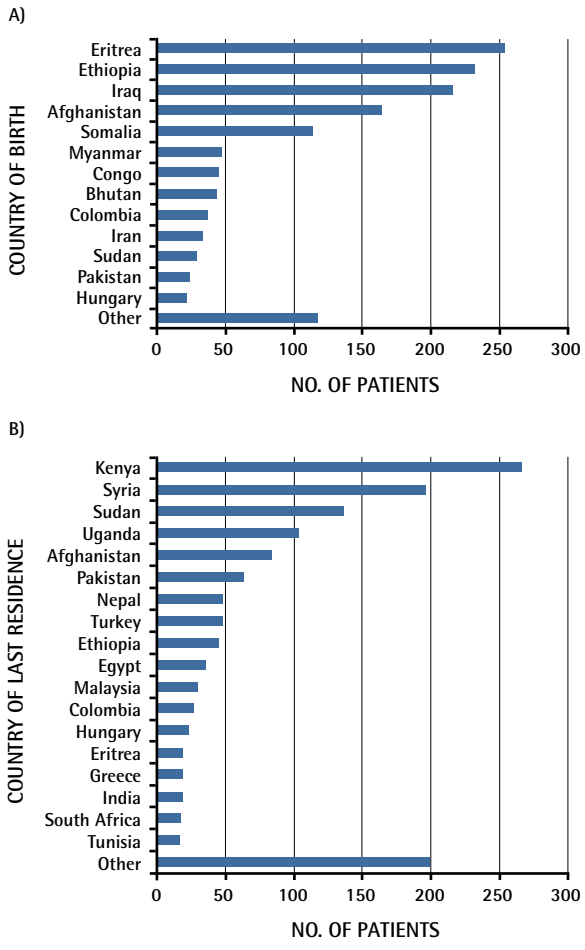
Characteristics of the study population (N=1390) are shown in **Table 1**.[15] The population was evenly divided between male and female patients; almost half (46.5%) were between

Table 1. Baseline characteristics of clinic patients: *N = 1390.*

CHARACTERISTIC	N (%)
Age at intake, y	
• < 6	177 (12.7)
• 6-18	328 (23.6)
• 19-39	647 (46.5)
• ≥ 40	238 (17.1)
Sex	
• Male	695 (50.0)
• Female	695 (50.0)
Region of last residence*	
• Sub-Saharan Africa	645 (46.4)
• North Africa	53 (3.8)
• Middle East	271 (19.5)
• Asia	285 (20.5)
• Latin America	57 (4.1)
• Europe or North America	79 (5.7)
Region of birth*	
• Sub-Saharan Africa	726 (52.2)
• North Africa	1 (0.1)
• Middle East	225 (16.2)
• Asia	332 (23.9)
• Latin America	65 (4.7)
• Europe or North America	41 (2.9)
Refugee camp history	
• Yes	258 (18.6)
• No	74 (5.3)
• Unknown	1058 (76.1)

*Regions adapted from United Nations Millennium Development Goals Indicators regional groupings.[15]

Figure 1. Patients' origins (N = 1390): *A) Country of birth and B) country of last residence.*



the ages of 19 and 39 years, and almost half (46.4%) had most recently resided in sub-Saharan Africa. **Figure 1** shows countries of last residence and countries of birth.

Of the 1390 patients, 1030 (74.1%, 95% CI 71.7% to 76.4%) completed at least 1 stool and ova parasite test (343 completed 1 test and 687 completed 2). The median time from intake to completion of the first test was 9 days (interquartile range 6 to 27). **Table 2** describes the characteristics associated with the completion of a stool test.[15] Both the univariate and multivariate regression models showed that patients arriving from sub-Saharan Africa, North Africa, and Asia were more likely to complete their tests, and patients from Europe or North America were less likely to complete their tests, compared with patients arriving from the Middle East. Further, patients were also more likely to complete stool testing if they did not reside in refugee camps before arriving in Canada when compared with those who did reside in refugee camps.

Among patients who completed at least 1 test, 306 (29.7%, 95% CI 26.9% to 32.6%) had at least 1 positive stool ova and parasite result. Significantly more patients who completed 2 tests had positive results compared with those who completed only 1 test (32.3% vs 24.5%; *P* = .01). **Table 3** describes the association of other characteristics with having a positive test result.[15] Univariate and multivariate regression models both showed that those aged 6 to 18 years were more likely to have a positive stool test result compared with those aged 19 to 39 years; those who had most recently lived in an Asian region were more likely to have a positive stool test result compared with those who had most recently lived in the Middle East.

Of the 306 patients with positive stool test results, 219 (71.6%) had 1 parasite present, while 64 (20.9%) had 2 parasites, 17 (5.6%) had 3 parasites, and 6 (2.0%) had 4 parasites.

Fourteen parasites were identified, the most prevalent of which were *G lamblia, Blastocystis hominis, Dientamoeba fragilis*, and *Entamoeba histolytica* or *Entamoeba dispar* (**Table 4**).

If *B hominis* and *D fragilis* are excluded because of their lower potential to cause harm, the overall intestinal

Table 2. Characteristics associated with the completion of at least 1 ova and parasite stool test

CHARACTERISTICS	NO. COMPLETING A TEST (NO. REFERRED)	PROPORTION COMPLETING A TEST (95% CI)	*P* VALUE*	UNIVARIATE RR (95% CI)	MULTIVARIATE RR† (95% CI)
Overall	1030 (1390)	74.1 (71.7 to 76.4)	NA	NA	NA
Age at intake, y			.20		
• < 6	125 (177)	70.6 (63.3 to 77.2)		0.92 (0.83 to 1.02)	0.90 (0.82 to 1.00)
• 6-18	234 (328)	71.3 (66.1 to 76.2)		0.93 (0.86 to 1.01)	0.93 (0.86 to 1.01)
• 19-39 (reference)	496 (647)	76.7 (73.2 to 79.9)		1.00	1.00
• ≥ 40	175 (238)	73.5 (67.4 to 79.0)		0.96 (0.88 to 1.05)	1.00 (0.92 to 1.09)
Sex			.39		
• Male	522 (695)	75.1 (71.7 to 78.3)		1.03 (0.97 to 1.09)	NA
• Female (reference)	508 (695)	73.1 (69.6 to 76.4)		1.00	NA
Region of last residence§			< .001		
• Sub-Saharan Africa	499 (645)	77.4 (74.0 to 80.5)		1.23 (1.11 to 1.36)	1.23 (1.11 to 1.36)
• North Africa	41 (53)	77.4 (73.8 to 87.7)		1.23 (1.03 to 1.46)	1.22 (1.03 to 1.46)
• Middle East (reference)	171 (271)	63.1 (57.1 to 68.9)		1.00	1.00
• Asia	247 (285)	86.7 (82.2 to 90.4)		1.37 (1.24 to 1.52)	1.39 (1.25 to 1.55)
• Latin America	40 (57)	70.2 (56.6 to 81.6)		1.11 (0.92 to 1.35)	1.13 (0.93 to 1.37)
• Europe or North America	32 (79)	40.5 (29.6 to 52.1)		0.64 (0.48 to 0.85)	0.64 (0.49 to 0.85)
Refugee camp history			.003		
• Yes (reference)	199 (258)	77.1 (71.5 to 82.1)		1.00	1.00
• No	66 (74)	89.2 (79.8 to 95.2)		1.16 (1.04 to 1.28)	1.22 (1.10 to 1.36)
• Unknown	765 (1058)	72.3 (69.5 to 75.0)		0.94 (0.87 to 1.01)	1.01 (0.94 to 1.09)

NA—not applicable, RR—relative risk.
*P values are from χ^2 tests.
†The multivariate model included age group, region of last residence, and refugee camp history. Sex was dropped from the model because it was non-significant.
§Regions adapted from the United Nations Millennium Development Goals Indicators regional groupings.[15]

parasite prevalence was 16.3%. With this exclusion, the prevalence was 24.7% for refugees arriving from Asia and 25.2% for children aged 6 to 18 years.

DISCUSSION

The MRHC is the predominant primary health care provider for refugees in Calgary, making it a unique care model seeing patients of all ages and refugee statuses. This allows a concentrated and optimal research population with consistent screening methods.

Our study results reinforce that the refugee population arriving in Calgary has a high prevalence of intestinal parasitic infection. This study demonstrated high compliance for patients completing at least 1 stool test (74.1%). Among those completing tests, the prevalence of intestinal parasites was 29.7%. The highest prevalence of positive tests was found in school-aged children and in those whose last region of residence was in Asia or sub-Saharan Africa.

Other Canadian studies have reported the prevalence of intestinal parasites via stool ova and parasite testing in refugee populations.[6,16-19] A recent study of primarily refugee claimants (N = 1063) in Toronto, Ont, found a 16% prevalence of parasites from the 391 stool tests completed.[19] This lower prevalence might be related to refugees coming from countries with lower intestinal parasite burden. A large study from almost 30 years ago found a prevalence of 29.3% (N = 1967),[18] while 2 more recent, smaller studies found prevalence rates of 10.5% (N = 289)[17] and 13.6% (N = 112).[6]

Our study demonstrated a significantly higher prevalence of parasites in school-aged children when compared with adults and children younger than 6 years old. This finding is similar to data on refugees arriving in other Western countries.[3,4] The American Academy of Pediatrics recommends screening all refugee children with 3 stool ova and parasite tests if the children did not receive presumptive treatment of soil-transmitted helminths.[20] The WHO states that children with intestinal parasites, including those who are asymptomatic, can

Table 3. Characteristics associated with having at least 1 positive ova and parasite stool test result

CHARACTERISTICS	NO. WITH A POSITIVE RESULT (NO. OF TESTS AVAILABLE)	PREVALENCE, % (95% CI)	*P* VALUE*	UNIVARIATE RR (95% CI)	MULTIVARIATE RR† (95% CI)
Overall	306 (1030)	29.7 (26.9 to 32.6)	NA	NA	NA
Age at intake, y			.007		
• < 6	37 (125)	29.6 (21.8 to 38.4)		1.08 (0.79 to 1.47)	1.01 (0.75 to 1.38)
• 6-18	90 (234)	38.5 (32.2 to 45.0)		1.40 (1.13 to 1.74)	1.38 (1.12 to 1.71)
• 19-39 (reference)	136 (496)	27.4 (23.5 to 31.6)		1.00	1.00
• ≥ 40	43 (175)	24.6 (18.4 to 31.6)		0.90 (0.67 to 1.21)	0.93 (0.69 to 1.26)
Sex			.50		
• Male	160 (522)	30.7 (26.7 to 34.8)		1.07 (0.88 to 1.29)	NA
• Female (reference)	146 (508)	28.7 (24.8 to 32.9)		1.00	NA
Region of last residence§			.005		
• Sub-Saharan Africa	154 (499)	30.9 (26.8 to 35.1)		1.29 (0.95 to 1.73)	1.28 (0.94 to 1.74)
• North Africa	9 (41)	22.0 (10.6 to 37.6)		0.92 (0.48 to 1.73)	0.94 (0.50 to 1.79)
• Middle East (reference)	41 (171)	24.0 (17.8 to 31.1)		1.00	1.00
• Asia	90 (247)	36.4 (30.4 to 42.8)		1.52 (1.11 to 2.08)	1.48 (1.08 to 2.05)
• Latin America	9 (40)	22.5 (10.8 to 38.5)		0.94 (0.50 to 1.77)	0.91 (0.48 to 1.72)
• Europe or North America	3 (32)	9.4 (2.0 to 25.0)		0.39 (0.13 to 1.19)	0.40 (0.13 to 1.21)
Refugee camp history			.26		
• Yes (reference)	68 (199)	34.2 (27.6 to 41.2)		1.00	NA
• No	21 (66)	31.8 (20.9 to 44.4)		0.93 (0.62 to 1.39)	NA
• Unknown	217 (765)	28.4 (25.2 to 31.7)		0.83 (0.66 to 1.04)	NA

NA—not applicable, RR—relative risk.
**P* values are from χ^2 tests.
†The multivariate model included age group and region of last residence. Sex and refugee camp history were dropped from the model because they were non-significant.
§Regions adapted from United Nations Millennium Development Goals Indicators regional groupings.[15]

develop nutritional, developmental, and physical complications and suggests that treatment is safe, effective, and inexpensive.[2] If untreated, there is concern for ongoing local disease exchange. A Canadian study specifically demonstrated a lack of self-clearance and ongoing local transmission when refugees were tested at 6 months after arrival in Canada without screening or treatment of intestinal parasites.[16]

In our study, patients whose last region of residence was Asia had the highest prevalence of intestinal parasites (36.4%). The second highest prevalence was among patients from sub-Saharan Africa (30.9%). Other studies have also noted a difference in intestinal parasite prevalence by region of origin in refugee populations. A Swedish study indicated that originating from India or Southeast Asia was the greatest predictor of intestinal parasites in refugees.[21] American studies report both Asia and Africa as regions of note for intestinal parasite infections in refugees.[7,22] The United States has a predeparture treatment program for intestinal parasites, unlike Canada, which might have affected the prevalence rates found.

The parasites with the greatest prevalence in our study were *G lamblia, B hominis, D fragilis*, and *E histolytica* or *E dispar*. Other studies have found high prevalence rates of these parasites as well.[3,5,7,21,23,24] *Giardia lamblia* infections have several clinical presentations ranging from asymptomatic presentations to growth and development concerns in children.[25-28] In children and their families, treatment of *G lamblia* is important to ensure the health and development of the children and to reduce ongoing transmission. *Blastocystis hominis* and *D fragilis* tend to be benign and are commonly not treated.[29,30] At the time of the study, *E histolytica* and *E dispar* were not differentiated by Calgary Laboratory Services. *Entamoeba histolytica* commonly causes adverse health effects and needs treatment whereas *E dispar* does not.[31] Therefore, patients with results positive for *E histolytica* or *E dispar* were treated.

Our findings suggest that refugees are likely to complete stool testing (74.1%) and that testing identifies a high prevalence of intestinal parasites (29.7%). When the relatively benign parasites *B hominis* and *D fragilis* are excluded, the overall prevalence remains high (16.3%) and is even higher in school-aged children (25.2%) and refugees from Asia (24.7%).

Limitations

Study limitations were related to its retrospective nature and to EMR data extraction from a database with

Table 4. Prevalence of stool ova and parasites by region of last residence: *N = 1030 refugees who completed at least 1 stool test.*

	PREVALENCE BY REGION OF LAST RESIDENCE, N (%)						
PARASITE	OVERALL PREVALENCE, N (%) (N = 1030)	SUB-SAHARAN AFRICA (N = 499)	NORTH AFRICA (N = 41)	MIDDLE EAST (N = 171)	ASIA (N = 247)	LATIN AMERICA (N = 40)	EUROPE OR NORTH AMERICA (N = 32)
Giardia lamblia	110 (10.7)	62 (12.4)	1 (2.4)	3 (1.8)	43 (17.4)	0 (0.0)	1 (3.1)
Blastocystis hominis	109 (10.6)	48 (9.6)	4 (9.8)	26 (15.2)	26 (10.5)	3 (7.5)	2 (6.3)
Dientamoeba fragilis	88 (8.5)	27 (5.4)	4 (9.8)	17 (9.9)	34 (13.8)	5 (12.5)	1 (3.1)
Entamoeba histolytica or *Entamoeba dispar*	72 (7.0)	45 (9.0)	0 (0.0)	13 (7.6)	13 (5.3)	1 (2.5)	0 (0.0)
Hymenolepis nana	13 (1.3)	10 (2.0)	0 (0.0)	0 (0.0)	3 (1.2)	0 (0.0)	0 (0.0)
Ascaris lumbricoides	6 (0.6)	0 (0.0)	0 (0.0)	0 (0.0)	6 (2.4)	0 (0.0)	0 (0.0)
Hookworm	6 (0.6)	1 (0.2)	1 (2.4)	0 (0.0)	4 (1.6)	0 (0.0)	0 (0.0)
Trichuris trichiura	5 (0.5)	3 (0.6)	0 (0.0)	0 (0.0)	1 (0.4)	1 (2.5)	0 (0.0)
Schistosoma mansoni	4 (0.4)	4 (0.8)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Cryptosporidium	3 (0.3)	2 (0.4)	0 (0.0)	0 (0.0)	1 (0.4)	0 (0.0)	0 (0.0)
Taenia species	3 (0.3)	2 (0.4)	1 (2.4)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Strongyloides stercoralis	1 (0.1)	1 (0.2)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Entamoeba polecki	1 (0.1)	0 (0.0)	0 (0.0)	0 (0.0)	1 (0.4)	0 (0.0ç)	0 (0.0)
Enterobius vermicularis	1 (0.1)	0 (0.0)	0 (0.0)	0 (0.0)	1 (0.4)	0 (0.0)	0 (0.0)

multiple users. For example, refugee camp history and refugee classes were not routinely recorded. However, the clinic data from 2012 (the only complete calendar year in our study) demonstrated that most refugees were government (47%) or privately sponsored (41%) and only 12% were refugee claimants.

Conclusion

This study demonstrates that refugees arriving in Calgary have a high prevalence of intestinal parasitic infections; this finding can likely be generalized to other large Canadian urban centres receiving high volumes of new refugees. Unlike the United States, Canada does not provide predeparture empiric treatment of refugees. Therefore, although treatment is not warranted in all clinical scenarios, targeted screening of stool for ova and parasites should be considered in newly arrived refugees at greater risk of intestinal parasites. Specifically, screening should be considered for refugee children, especially those arriving from Asia or sub-Saharan Africa. Further consideration should be given to those exhibiting gastrointestinal symptoms. As this is the largest Canadian study of its kind in the past 30 years, it will add to the limited data available to clinicians working in this area to help them make informed clinical decisions.

Dr DeVetten is a physician with the Mosaic Refugee Health Program and Clinical Lecturer in the Department of Family Medicine at the University of Calgary in Alberta, and was a family medicine resident at the University of Calgary at the time of the study. **Dr Dirksen** is a family physician working in hospital and community medicine in Calgary and was a family medicine resident at the University of Calgary at the time of the study. **Mr Weaver** is Statistical Associate in the Department of Medicine at the University of Calgary. **Dr Chowdhury** is Research Director and Assistant Professor in the Department of Family Medicine at the University of Calgary. **Dr Aucoin** is a physician with the Mosaic Refugee Health Program and Clinical Lecturer in the Department of Family Medicine at the University of Calgary.

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Contributors

Drs DeVetten and **Dirksen** were responsible for planning and carrying out the research including designing the research approach, completing a literature review, acquiring the data, and writing most of the article. **Mr Weaver** analyzed the data and was substantially involved in revising the manuscript. **Dr Chowdhury** provided important direction for the data analysis and presentation of the manuscript. As the principal investigator, **Dr Aucoin** was responsible for the study concept and contributed to manuscript revisions.

Competing interests

None declared

Correspondence
Dr Michael William Aucoin; e-mail **mwaucoin@ucalgary.ca**

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