

# Refugee Health Guidelines: Domestic Guidelines

## *Guidelines for Evaluation of Refugees for Intestinal and Tissue-Invasive Parasitic Infections during Domestic Medical Examination*

These guidelines were developed by the Division of Global Migration and Quarantine (DGMQ), CDC and the Office of Refugee Resettlement (ORR) Health Work Group. Please see the [HHS Office of Refugee Resettlement page](#) for more information regarding the special health challenges of refugees. In order to address such needs, ORR provides guidance, resources and oversight for refugee medical assistance, initial refugee medical screening, and refugee health/mental health technical assistance and consultation. For technical questions regarding the guidelines, please contact DGMQ at 404-498-1600.

### **Background**

At least one-third of the world's population is infected with intestinal parasites, making infections with these organisms one of the most common infections of humans and one of the most common conditions detected in newly arrived refugees (Table 1). Although these infections are usually asymptomatic and often go unnoticed, some have the potential to become chronic infections and lead to serious health consequences.

Parasites discussed in this document may be classified as either single-celled protozoa or multicellular helminths. The helminths consist of two phyla: the hermaphroditic Platyhelminths (flatworms) and the Nematoda (nematodes or roundworms), each having separate male and female worms. The Platyhelminths are further subdivided into two classes: the trematodes (flukes) and cestodes (tapeworms). General categories of parasites are summarized below; for brief discussions of the most commonly encountered individual parasites, see <http://www.health.state.mn.us/divs/idepc/refugee/guide/parasites.pdf>

### **Classifications of commonly detected intestinal parasites**

The *pathogenic protozoa and coccidia* most likely to affect refugees include the amoeba *Entamoeba histolytica/dispar* and the flagellate *Giardia intestinalis* (also known as *G. lamblia* or *G. duodenalis*). Some evidence suggests that cryptosporidiosis is a common infection in newly arrived refugees (William Stauffer, unpublished data). Although many other protozoa, such as *Cyclospora cayetanensis* and *Balantidium coli*, are known to cause intestinal disease throughout the world, the importance of these organisms in refugee populations remains uncertain. Two protozoa which have the potential to cause illness but are more frequently associated with asymptomatic infection are *Blastocystis hominis* and *Dientamoeba fragilis*. *Blastocystis hominis*, found in 20%-40% of refugees, is the most commonly detected intestinal parasites in all refugee populations arriving to the United States.

Although *Entamoeba histolytica* (*E. histolytica*) is commonly reported in refugees, its true prevalence is unknown because it is generally not distinguished from the morphologically identical *Entamoeba dispar* (*E. dispar*). In most populations, *E. dispar*, which is considered nonpathogenic, accounts for 90% of infections reported as *E. histolytica* (William Stauffer, unpublished data). In addition, another morphologically indistinguishable protozoan, *Entamoeba moshkovskii*, also complicates diagnosis.

**Nematodes**, or **roundworms**, are common parasites infecting humans and are the organisms most frequently associated with the term “parasite” infection, due to their wormlike appearance. Intestinal nematodes are transmitted to humans by one of two routes: 1) ingestion of soil contaminated with infective eggs (e.g., *Ascaris lumbricoides*, *Trichuris trichiura*) or 2) penetration of skin with infective larvae (e.g., hookworm, *Strongyloides stercoralis*). Although *Ascaris*, *Trichuris*, and hookworm may be associated with eosinophilia and hookworm with anemia, these organisms are rarely associated with disease in refugees after migration. Most pathology associated with these organisms is related to parasite load, which decreases rapidly after migration. In addition, these nematodes have a relatively short lifespan and re-infection occurs only after a life-cycle stage outside the human host. However, *S. stercoralis* is a unique nematode that has an autoinfective cycle and frequently causes chronic infection. In immunosuppressed hosts, *S. stercoralis* may become invasive, causing serious morbidity and mortality. Several studies have demonstrated that refugee populations have very high prevalence rates, with more than 40% of certain populations having serologic evidence of strongyloides infection.<sup>1 2 3</sup>

Important nonintestinal nematodes that may cause disease and eosinophilia include the tissue-dwelling filariae and zoonotic nematodes (*Toxocara canis*, *Angiostrongylus* species, *Gnathostoma* species, and *Trichinella spiralis*). These parasites are rarely detected by routine stool testing and, with the exception of filariasis in certain sub-Saharan African populations, are relatively rare in refugees arriving in the United States.

**Trematodes**, or **flukes**, are a group of parasites with a life cycle that requires an intermediate snail host. They often cause chronic infections, with many important long-term consequences. Two groups may be distinguished by the manner in which the infective larvae enter their human host: the blood flukes and the foodborne flukes. The blood flukes infect humans by penetrating skin surfaces, while the foodborne flukes infect humans through the ingestion of specific foods. All trematodes tend to cause eosinophilia due to the tissue-invasive character of these infections.

The five blood flukes of human importance are all *Schistosoma* species. *S. mansoni* and *S. haematobium* are the most important trematodes in newly arriving refugees because of their high prevalence rates in sub-Saharan Africa, their potential for chronic infection, and their ability to cause liver and urologic disease complications, including a high association with cancer. Close to 50% of some sub-Saharan refugee populations have ongoing infection after migration.<sup>3 4 5 6</sup>

Foodborne trematodes can be divided into the biliary liver flukes (*Opisthorchis* species, *Clonorchis sinensis* and *Fasciola* species), intestinal flukes (*Fasciolepis buski*, heterophyids and echinostomes), and lung flukes (*Paragonimus* spp.). These organisms tend to chronically infect specific populations, depending on dietary consumption of certain types of raw fish, crustaceans,

or aquatic plants contaminated with the infective stages. The biliary liver flukes, particularly *Opisthorchis* spp. and *C. sinensis*, are of special concern because of their association with the development of cholangiocarcinoma, an invasive cancer of the bile ducts.

The *cestodes*, or *tapeworms*, commonly infect humans and are distinguished by their physical characteristic during the adult phase, when the worms are divided into segments, or proglottids. Except for the human dwarf tapeworm, cestodes are transmitted to humans through consumption of undercooked meats. When humans eat undercooked beef, pork or fish with encysted larvae, they become infected with the adult form of *Taenia saginata*, *Taenia solium*, and *Diphyllobothrium latum*, respectively. The most common cause of serious morbidity and mortality is *T. solium*. If eggs, passed in the human feces of individuals harboring an adult *T. solium* worm, are subsequently ingested by another human, the developing larval stage may become ectopic and migrate to various organs, causing symptomatic disease termed cysticercosis. Although neurologic complications, particularly seizures, are the most common sequelae, many complications may occur, including hydrocephalus and ocular and musculoskeletal complications.

Infection with adult *Hymenolepis nana*, the dwarf tapeworm, is an exception, as it is not acquired by consumption of undercooked meat. Its simple fecal-oral transmission and its ability to persist in a cycle of autoinfection make it the most commonly detected human cestode in nearly all refugee populations.

**Nonpathogenic parasites.** Although all intestinal helminths are potentially pathogenic and should be treated, many protozoan parasites detected in screening stool ova and parasite (O&P) examination specimens are nonpathogenic (Table 2). These organisms are very common and should not be treated. When detected, their presence indicates time spent in areas where poor sanitation and past fecal-oral contamination are common.

## Epidemiology

All refugees, regardless of region of origin, are at risk for harboring intestinal parasites (Table 1). Prevalence data for parasitic infections in refugees groups in the United States come primarily from state refugee screening programs and published reports of convenience samples. Little data are available on the prevalence of tissue-invasive parasites, as there is no standard screening for these parasites and routine stool examination is not a sensitive method of detecting infection for most of these organisms.

The prevalence rates of pathogenic intestinal parasites among refugees in North America have been reported to range from 8% to 86%.<sup>5</sup> This large range can be explained by differences in geographic origin and ages of the populations studied, living conditions (including quality of drinking water, sanitation, and access to footwear), dietary habits, and previous countries of asylum. Data collected after 1999 have noted large decreases in prevalence.<sup>7</sup> Other determinants include educational level and past occupational exposures. In addition, methodologic differences likely account for some of the variability in reported prevalence. For example, intestinal parasitosis rates among a population of Cambodian refugees in New York varied from 31% to 86%, depending on the method of stool examination.<sup>8</sup>

Of particular concern are two parasitic infections that are commonly encountered in refugee populations, *Schistosoma* spp. (fluke) and *S. stercoralis* (roundworm) infections. *S. stercoralis* infection is found in virtually all groups of refugees but is particularly prevalent in Southeast Asia; *Schistosoma* spp. is encountered predominantly in sub-Saharan refugees. Infections with these two parasites carry the risk of chronicity and have been associated with both morbidity and mortality years after migration. Studies of parasite prevalence that used stool microscopy for O&P to determine the prevalence of these infections have underestimated the true prevalence due to the lack of sensitivity of this test for both strongyloides and schistosomiasis.<sup>1 2 8 9</sup>

As many as 100 million persons worldwide are estimated to be chronically infected with *S. stercoralis*.<sup>5</sup> A recent serosurvey by CDC found a 44% prevalence rate of strongyloides in Sudanese refugees after arrival in the United States.<sup>6</sup> In Australia, a recent study of newly arrived refugees found seroprevalence rates ranging from 11% in East Africans to 42% in Cambodian refugees.<sup>1</sup> If the condition is not detected promptly after arrival, screening data indicate that the average time to diagnosis of *S. stercoralis* in the United States is 61 months after migration.<sup>10</sup> In fact, one study found that 24% of Laotian refugees had continued *S. stercoralis* infection for an average of 12 years after migration.<sup>11</sup> Strongyloidiasis hyperinfection or dissemination may occur years after exposure, with reports of two cases occurring >50 years after last known host exposure in an endemic area.<sup>12 13</sup> The fatality rate of disseminated/hyperinfection strongyloidiasis exceeds 50%.<sup>12 14</sup> Although antecedent treatment with corticosteroids accounts for a majority of reported iatrogenic cases, numerous case reports have been published of strongyloidiasis hyperinfection that resulted from the immunosuppression associated with HIV, as well as with the use of chemotherapeutic agents.<sup>12 14</sup>

Schistosomiasis may persist in humans for more than 30 years and has been associated with many chronic illnesses, depending on the species, the parasite load, and the host response. A CDC serosurvey of Sudanese refugees found seroprevalence rates of 46%, while the recent study from Australia found a seroprevalence rate of 15% in East African refugees.<sup>1</sup> Current data from CDC indicate rates exceeding 40% in several refugee groups, including Somali and Liberian refugees (personal communication, Marianna Wilson, CDC). Schistosomiasis is associated with liver cirrhosis and resulting clinical complications (*S. mansoni*, *S. japonicum*), squamous cell carcinoma of the bladder (*S. haematobium*), and urinary tract obstruction and renal failure (*S. haematobium*). Potentially devastating clinical manifestations occasionally occur when an egg enters the systemic circulation and travels to a normally sterile site within the body, causing severe inflammation. Eggs may travel to virtually any part of the body, including the brain and spinal cord where, when deposited in the nerve plexus, they may cause paralysis or myelitis (inflammation of the spinal cord).

### ***Pre-departure albendazole therapy***

In 1997, CDC and the International Organization for Migration (IOM) detected a 38% prevalence of potentially pathogenic intestinal parasite infections in a group of Somali refugees living in refugee camps in Kenya. In response, CDC recommended presumptive treatment for all nonpregnant refugees over the age of 2 years with a single 600-mg dose of albendazole 3 days prior to departure to the United States. In May 1999, CDC extended this recommendation to

refugees from throughout sub-Saharan Africa. Subsequently, some populations migrating from Southeast Asia also began receiving this presumptive therapy.

Pre-departure albendazole treatment has dramatically decreased the prevalence of parasitic infections detected in stool samples in newly arrived refugees. A reduction from 24% to 4% in the prevalence of intestinal helminth infections has been documented in African refugees arriving in Massachusetts before and after May 1999, respectively (odds ratio [OR]=0.15, 95% confidence interval [CI] 0.09-0.24). In this study, those who arrived after the widespread initiation of pre-departure treatment (n=636) were over 90% less likely to have *Ascaris* (OR=0.07, 95% CI 0.01-0.58), hookworm (OR=0.03, 95% CI 0.00-0.29), or *Trichuris* (OR=0.05, 95% CI 0.02-0.13) infections than were those who arrived before 1999 (n=618). Surprisingly, a less dramatic but still significant decrease in *Entamoeba histolytica/dispar* infections was also detected (OR=0.47, 95% CI 0.26-0.86).<sup>7</sup> This is an interesting finding, since albendazole is an antihelminthic treatment that is not used to treat this protozoal infection.

A recent study of refugee arrivals to northern California from Africa, South Central Asia, Eastern Europe and the Middle East found a relatively low intestinal helminth prevalence of 6% during 2001–2004, after implementation of universal predeparture treatment.<sup>15</sup> This regimen, however, is not adequate treatment for either *S. stercoralis* or *Schistosoma* spp.

### ***Future overseas management of intestinal parasitic infections***

Despite decreased overall prevalence of intestinal parasitic infection as detected by stool O&P examination, a single dose of albendazole may not treat the parasites of most concern for chronic infection and associated serious morbidity and mortality. The parasites of particular concern are *Strongyloides stercoralis*, *Schistosoma* spp., and other flukes and trematodes. [New overseas treatment recommendations](#) that have been issued with these domestic guidelines recommend expanded presumptive treatment to address these concerns. However, institution of any guidelines may be variable and dependent on funding and population. Therefore, domestic guidelines are individualized and dependent on the overseas presumptive therapy received.

## **Guidelines for Screening**

### **General Guidelines for Adults and Children**

Overseas recommendations and implementation of presumptive therapy will vary over time, depending on cost, availability of medications, implementation of administration strategies, and evolving epidemiology. Some refugees will receive no overseas treatment, others a single dose of albendazole, and still others, a more comprehensive treatment for all nonprotozoal parasitic infections with ivermectin or albendazole in combination with or without praziquantel. Thus, screening guidelines must be implemented based on the individual refugee's point of departure for the United States (Table 1) and whether the refugee received pre-departure presumptive therapy.

### **Screening for parasitic infection in asymptomatic refugees who had no pre-departure treatment**

A refugee who received no overseas predeparture antiparasitic treatment should receive post-arrival intestinal parasite screening tests (Figure 1). This evaluation should include two O&P examinations performed on separate morning stools by the concentration method. All potentially pathogenic parasites detected should be treated (Table 2).

An eosinophil count should be routinely performed as part of the domestic medical screening examination. An absolute eosinophil count of  $>400$  cells/ $\mu$ L is considered elevated. Follow-up should be arranged for all refugees with a high eosinophil count. If the refugee has a parasite infection that is known to cause eosinophilia (Table 3) identified in the stool O&P examination, appropriate therapy should be provided (for treatment recommendations, see The 2004 Medical Letter on Drugs and Therapeutics, at <http://medicalletter.org/hidden/parasitic2004.pdf>. The updated 2007 Medical Letter on Drugs and Therapeutics can be purchased at [www.themedicalletter.org](http://www.themedicalletter.org)). Two additional O&P examinations and a repeat eosinophil count should be performed 3-6 months following treatment. A refugee who has persistent eosinophilia and no identified pathogen commonly associated with an increased eosinophil count should undergo serologic testing for *S. stercoralis* (all refugees) and *Schistosoma* spp. (sub-Saharan African refugees) (Figure 2a; Figure 2b). If results are positive for either of these infections, the refugee should be treated and another follow-up eosinophil count performed at 3-6 months. Persistent eosinophilia requires further evaluation.

### **Screening for parasitic infection in asymptomatic refugees who received single dose pre-departure albendazole**

Refugees who received one dose of presumptive albendazole overseas should have an absolute eosinophil count as part of their hematologic profile during domestic routine screening (Figure 3). An absolute eosinophil count  $>400$  cells/ $\mu$ L is most likely a residual eosinophilia due to an already-treated parasitic infection (e.g., hookworm) or due to ongoing infection with *S. stercoralis* (all refugees) and *Schistosoma* spp. (sub-Saharan African refugees).<sup>16</sup> These patients should undergo serologic evaluation for strongyloidiasis (all refugees) and schistosomiasis (African refugees) with appropriate treatment when indicated. An acceptable alternative is to presumptively treat these refugees if serologic testing is difficult to obtain or loss to follow-up is likely (see precautions below). Guidelines for presumptive therapy would be the same [as recommendations for overseas treatment](#). Presumptive treatment is not 100% effective for any parasite, and other uncommon parasites are not treated with this presumptive regimen. Therefore, a follow-up eosinophil count is recommended 3-months later to assure resolution. If the follow-up eosinophil count exceeds  $>400$  cells/ $\mu$ L, further diagnostic evaluation is recommended.

, and further diagnostic evaluation is recommended if elevated.

### **Screening for parasitic infection in asymptomatic refugees who received single dose pre-departure albendazole and single dose praziquantel**

Currently, sub-Saharan African refugees are receiving a single dose of presumptive albendazole. Starting on January 1, 2009 most populations are also receiving a single dose of praziquantel presumptive therapy. Following arrival, these refugees should have an absolute eosinophil count as part of their hematologic profile during domestic routine screening (Figure 3). An absolute eosinophil count  $>400$  cells/ $\mu$ L is most likely a residual eosinophilia due to an already-treated parasitic infection (e.g., hookworm) or due to ongoing infection with *S. stercoralis* (all refugees) or successfully treated *Schistosoma* spp. (sub-Saharan African refugees).<sup>16</sup> These patients should undergo serologic evaluation for strongyloidiasis with appropriate treatment when indicated. An acceptable alternative is to presumptively treat for strongyloides if serologic testing is difficult to obtain or loss to follow-up is likely (see precautions below). Guidelines for presumptive therapy would be the same [as recommendations for overseas treatment](#). A single dose of praziquantel is not 100% effective for schistosomiasis, and other less common untreated parasites may cause eosinophilia. Therefore a follow-up eosinophil count in 3-6 months is suggested to assure resolution. If the follow-up eosinophil count exceeds  $>400$  cells/ $\mu$ L, further diagnostic evaluation is recommended.

***Screening for parasitic infection in asymptomatic refugees who received high-dose pre-departure albendazole (7 days) OR ivermectin +/- praziquantel***

Refugees who receive high-dose presumptive pre-departure albendazole or ivermectin with or without praziquantel treatment (sub-Saharan African refugees) should have an absolute eosinophil count as part of their routine domestic hematologic profile (Figure 4). An absolute eosinophil count  $>400$  cells/ $\mu$ L at the new refugee screening is most likely a residual eosinophilia due to an already-treated parasitic infection. Routine stool O&P examination in this population is not cost effective. However, presumptive treatment is not 100% effective for any parasite, and other uncommon parasites are not treated with this presumptive regimen. Therefore, a follow-up eosinophil count should be performed 3-6 months later to assure resolution. If the follow-up eosinophil count exceeds  $>400$  cells/ $\mu$ L further diagnostic evaluation is recommended.(Table 3).

## **Considerations in Special Populations**

***Pregnant women and young children and treatment for parasitic infection:***

When deciding to initiate therapy for any asymptomatic infection, the risk of consequences of the infection compared with the cost and risk of the medication must be considered. This is particularly true when a medication has not been shown to be safe during pregnancy or in young children. Each medication has a lower age or weight limit for approved use. For example, albendazole and ivermectin are not FDA-approved for use in children less than 1 year of age, ivermectin should also not be used in children weighing less than 15 kg, and praziquantel has not been approved in children less than 4 years of age. Although these medications should not generally be used as presumptive therapy, when a pathogenic organism is detected, depending on the organism identified and the clinical scenario, it may be necessary to use these medications off-label in these special populations; however, expert consultation should be sought before doing so.

### ***Immunocompromised hosts:***

In addition, immunocompromised hosts with *S. stercoralis* infection should have close follow-up with documentation of successful eradication of the infection, which may necessitate referral to an infectious disease or tropical medicine specialist. Increased risk associated with *Strongyloides* infection should be considered in refugees with AIDS/HIV infection (regardless of CD4 count), or cancer; chronic steroid users or those who may require future steroid use; and persons who have had or may receive an organ transplant.

### ***Precautions and contraindications to presumptive treatment***

Exceptions to presumptive treatment are as follows:

1. Children

Children under 1 year of age should not receive presumptive treatment with ivermectin or albendazole. Children older than 1 year of age can receive albendazole therapy. Children weighing less than 15 kg should not receive ivermectin. However, there has been extensive overseas use of these medications during World Health Organization (WHO) helminth control activities. For overseas situations in which therapy for children may otherwise be indicated, CDC's Division of Global Migration and Quarantine (DGMQ) should be contacted at [RefGuidelines@cdc.gov](mailto:RefGuidelines@cdc.gov). For questions regarding treatment of children within the United States, the CDC Division of Parasitic Diseases (DPD) should be contacted.

2. Pregnant women

In general, presumptive treatment for pregnant women should be deferred until after delivery. However, an exception to this rule is that presumptive therapy with a single dose of albendazole for pregnant women during the second and third trimesters from areas with high rates of hookworm, trichuris and ascaris (exceeding 20% prevalence) is recommended during the pre-departure visit and is in accordance with current WHO guidelines. [See overseas pre-departure guidelines for details](#). Treatment for pregnant women who were immunocompromised prior to pregnancy or have clinical signs and/or symptoms of disease should be discussed with clinicians in CDC-DPD.

3. Women who are breastfeeding

Albendazole therapy may be administered to women who are breastfeeding. Ivermectin is excreted in human milk in low concentrations. Women who are breastfeeding should not use ivermectin during the first week after birth. Praziquantel can be administered to women who are breastfeeding per WHO. The manufacturer suggests discarding milk for 72 hours following the administration of the dose.

4. Refugees who are immunocompromised <sup>A</sup>



Refugees who are immunocompromised, including refugees with AIDS, HIV infection, or cancer; chronic steroid users; and persons who have had or may receive an organ transplant should have documented negative serologic tests or should receive presumptive treatment for strongyloidiasis, especially before planned immunosuppressive therapy. Immunocompromised refugees should have documented successful treatment of this infection by follow-up laboratory examination (i.e., repeat serologic tests).

#### 5. Refugees with cysticercosis infection

Persons who have neurocysticercosis infection may have seizures following treatment with albendazole or praziquantel. This reaction may occur when these medications kill *T. solium* cysticerci in the brain parenchyma, causing inflammation and provoking seizure activity. Although the disease is clearly more prevalent in some populations (e.g., Latin America), the true prevalence of cysticercosis in refugee populations is not well documented. Refugees with a history of seizures should be evaluated for cysticercosis prior to receiving these anti-parasitics. Refugees with known neurocysticercosis, an unexplained seizure disorder or subcutaneous nodules consistent with cysticercosis should not receive presumptive treatment with either albendazole or praziquantel. Physicians with questions regarding cysticercosis infection and its evaluation can consult clinicians from DGMQ at [RefGuidelines@cdc.gov](mailto:RefGuidelines@cdc.gov).

Physicians should consult the package inserts for additional information about ivermectin, albendazole and praziquantel prior to use.

A. Except women who are pregnant or breastfeeding. See previous discussion regarding pregnant and lactating women.

## Post-Treatment Guidelines And Follow-Up

Persons who are immunocompromised or may become immunocompromised in the near future, including persons with AIDS, HIV infection, or cancer; chronic steroid users or those who may need future steroid use (e.g., persons with asthma); and persons who have had a transplant or who may receive a transplant are at high risk for *Strongyloides* hyperinfection syndrome. All refugees who have been treated should be counseled about this risk, and refugees who are immunocompromised will need follow-up as described above. Persons who have symptoms that suggest failure of cure or morbidity from these diseases should have appropriate follow-up evaluation, which may necessitate referral to an infectious disease or tropical medicine specialist.

Physicians should consult the package inserts for additional information about ivermectin, albendazole and praziquantel prior to use.

For questions regarding these guidelines, please contact in CDC-DPD.

Table 1: Predominant geographic distribution of intestinal parasites found in refugee populations

Global	Africa*	Asia*	Latin America*	Middle East*	Eastern Europe*
<i>Ascaris lumbricoides</i>	<i>Schistosoma mansoni</i> <i>haematobium</i> <i>intercalatum</i>	<i>Fasciolopsis buski</i>	<i>Taenia solium</i>  <i>Schistosoma mansoni</i>	<i>Echino-coccus</i>  <i>Giardia</i>	<i>Diphyllobothrium latum</i>  <i>Opisthorchis felineus</i>
<i>Trichuris trichiura</i>	<i>Taenia saginata</i> (especially Ethiopia and Eritrea)	Southeast Asia: <i>Opisthorchis viverrini</i>	<i>Opisthorchis guayaquilensis</i> (Ecuador)		
Hookworm		<i>Clonorchis sinensis</i>			
<i>Strongyloides stercoralis</i>		<i>Schistosoma japonicum</i> <i>mekongi</i>			
<i>Enterobius vermicularis</i>					
<i>Fasciola</i>		South Asia: <i>Taenia solium</i>			
<i>Hymenolepis</i>					
Most protozoa, especially <i>Giardia intestinalis</i> ( <i>lamblia</i> )					

\*Organisms either unique to the location or particularly common or over-represented.

Table 2. Common organisms detected on stool examination and potential pathogenesis

Potentially pathogenic					Controversial	Nonpathogenic
Nematodes	Trematodes	Cestodes	Protozoa	Other	Protozoa	Protozoa
<i>Ascaris lumbricoides</i>	<i>Ophisthorchis</i> spp.	Tapeworm ( <i>Taenia solium</i> and <i>T. saginatum</i> )	<i>Entamoeba histolytica</i>	<i>Toxocara</i>	<i>Blastocystis hominis</i> (diarrhea)	<i>Entamoeba dispar</i>
Hookworm ( <i>Necator americanus</i> & <i>Ancylostoma braziliense</i> )	<i>Fasciola</i>  <i>Paragonimus westermani</i>				<i>Dientamoeba fragilis</i> (diarrhea)	<i>Entamoeba moshkowskii</i>  <i>Entamoeba coli</i>
<i>Trichuris</i>	<i>Schistosoma</i> ( <i>S. mansoni</i> , <i>S.</i>				<i>Entamoeba polecki</i>	<i>Entamoeba</i>

<i>trichiura</i>	<i>haematobium, S. japonicum)</i>				(diarrhea)	<i>hartmanii</i>
<i>Strongyloides stercoralis</i>						<i>Endolimax nana</i>
						<i>Iodamoeba butschlii</i>
						<i>Chilomastix mesnili</i>
						<i>Trichomonas hominis</i>

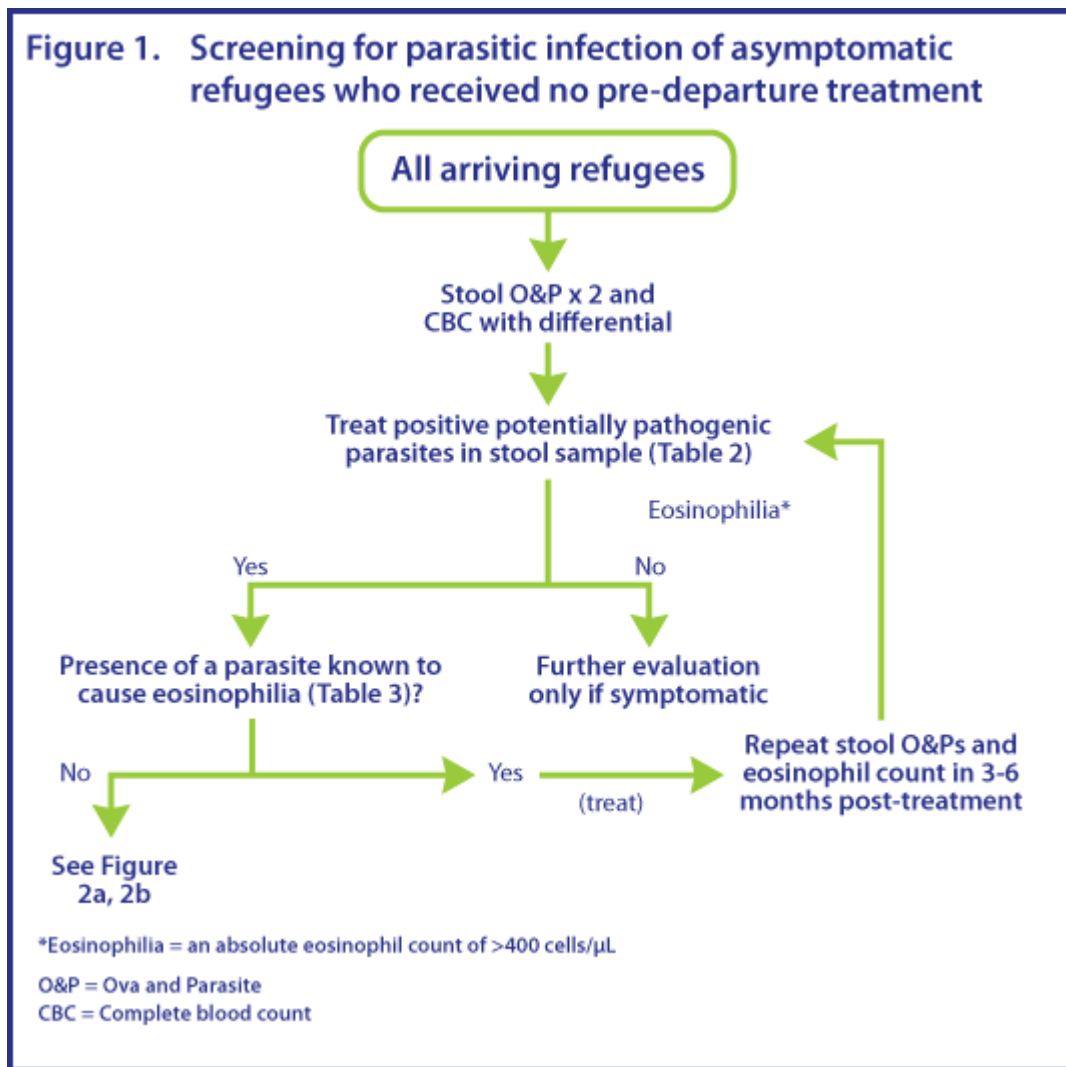
Table 3. Causes of eosinophilia

Associated stool parasitic infections with eosinophilia	Stool parasitic infections NOT typically associated with eosinophilia	Common non-parasitic causes of eosinophilia	Tropical infections NOT associated with eosinophilia	Other tropical infections commonly associated but not typically found in stool
<i>Ascaris lumbricoides</i>	Amebiasis	Asthma	Arboviral infections	Angiostrongylus
Hookworm	Cryptosporidiosis	Atopy	Brucellosis	Anasaciasis
<i>Trichuris trichiura</i>	<i>Giardia intestinalis (lamblia)</i>	Drug allergy	Enteric fever	Capillariasis
<i>Strongyloides stercoralis</i> *		Eosinophilic leukemia	Leishmaniasis	Cysticercosis
Tapeworm ( <i>Taenia solium</i> and <i>T. saginatum</i> )		Hodgkin's lymphoma	Leprosy	Echinococcus
Filariasis		Hyper-eosinophilic syndrome	Malaria	Fascioliasis
<i>Ophisthorchis</i>		Pemphigoid	Trypanosomiasis	Filariasis (e.g., loiasis)
<i>Fasciola</i>		Pemphigus	Tuberculosis	Gnathostomiasis
<i>Paragonimus westermani</i>		Polyarteritis nodosa		Paragonimiasis
				Schistosomiasis*
				Strongyloidiasis*

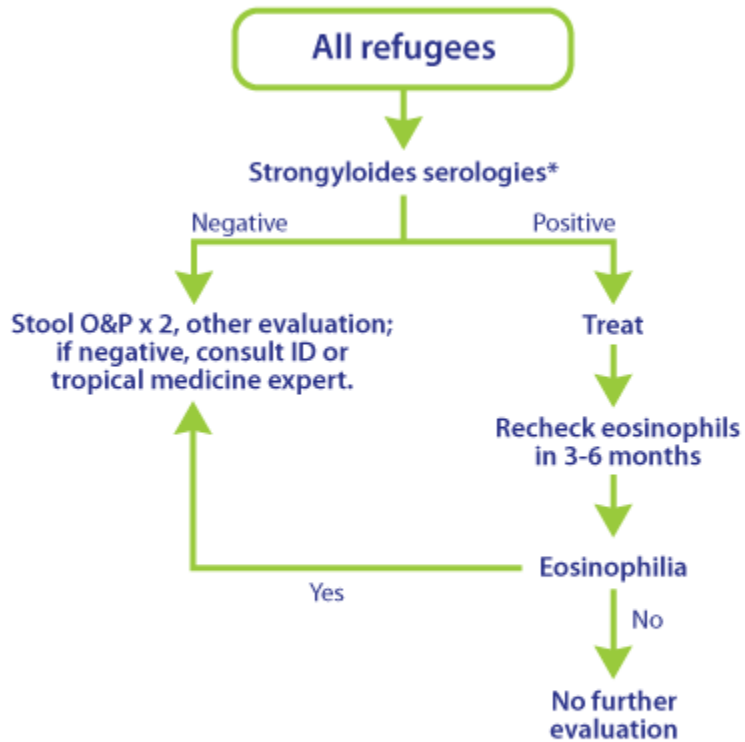
<i>Schistosoma</i> ( <i>S. mansoni</i> *, <i>S. haematobium</i> *, <i>S. japonicum</i> )  <i>Toxocara</i>				<i>Toxocariasis</i>  <i>Trichinosis</i>
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\*Particularly common causes of eosinophilia with negative stool O&P examination or persistent eosinophilia in refugees.

**Figure 1. Screening for parasitic infection of asymptomatic refugees who received no pre-departure treatment**



**Figure 2a. Evaluation of eosinophilia (>400 cells/ $\mu$ L) in all asymptomatic refugees**

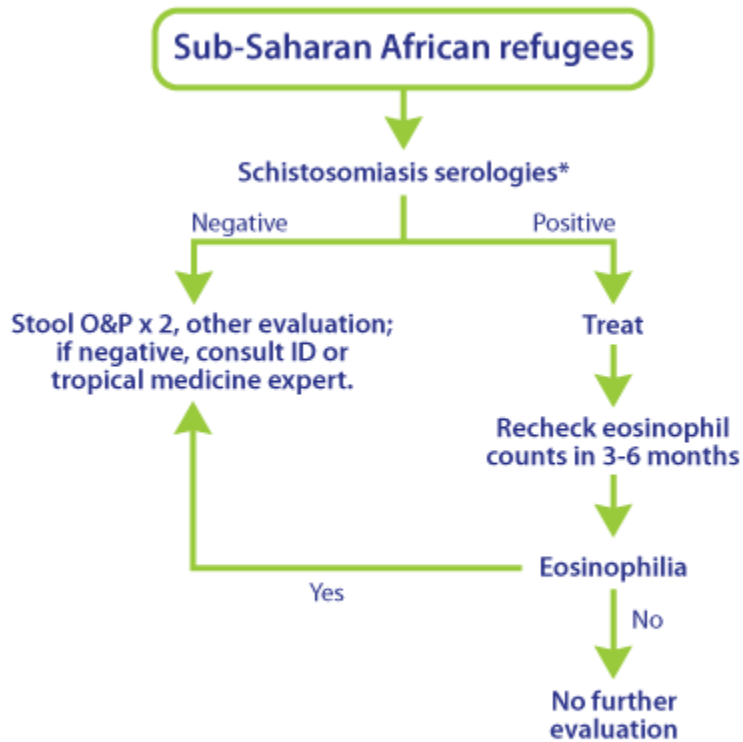


\*It is acceptable to presumptively treat for strongyloides and schistosomiasis rather than test by serologies. Refer to overseas guidelines for appropriate protocols.

O&P = Ova and Parasite

ID = Infectious Diseases

Figure 2b. Additional evaluation of eosinophilia (>400 cells/ $\mu$ L) in asymptomatic sub-Saharan African refugees

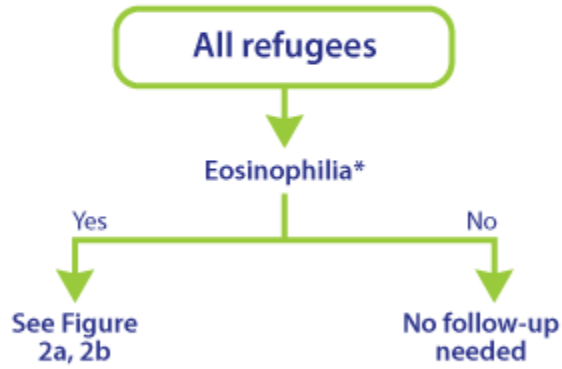


\*It is acceptable to presumptively treat for strongyloides and schistosomiasis rather than test by serologies. Refer to overseas guidelines for appropriate protocols.

O&P = Ova and Parasite

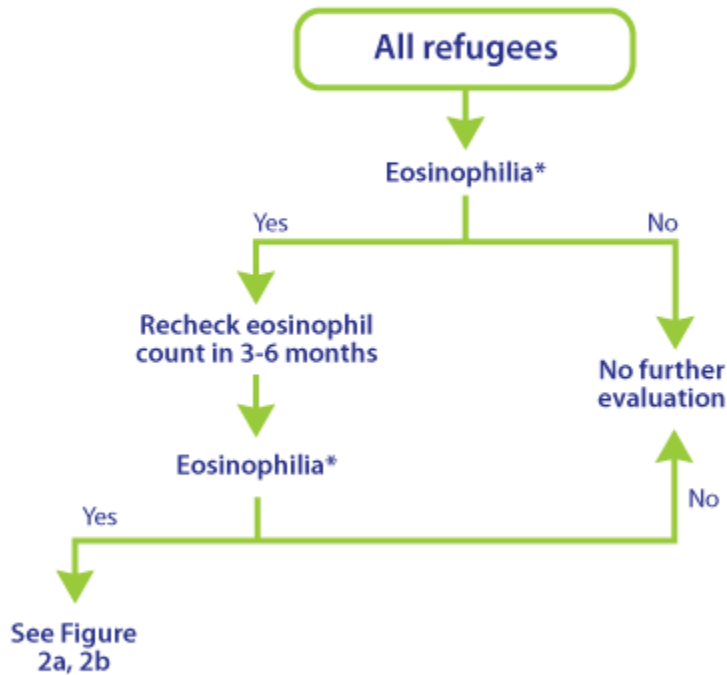
ID = Infectious Diseases

**Figure 3. Screening for parasitic infection of asymptomatic refugees who received pre-departure single-dose albendazole therapy**



\*Eosinophilia = an absolute eosinophil count of >400 cells/ $\mu$ L

**Figure 4. Screening for parasitic infection of asymptomatic refugees who received new pre-departure recommendations for albendazole (7 days) OR ivermectin +/- praziquantel**



\*Eosinophilia = an absolute eosinophil count of >400 cells/ $\mu$ L

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