Parasite	Consequence if left untreated / Clinical	Diagnosis	Treatment
Ascaris	The majority of infections with A. lumbricoides are asymptomatic, and symptoms are largely restricted to individuals with a high worm load Adult worms do not multiply in the human host, so the number of adult worms per infected person relates to the degree of continued exposure to infectious eggs over time. Untreated intestinal obstruction (IO) may lead to bowel necrosis, peritonitis, sepsis, and death. In younger children and in those with a heavy worm burden, symptoms may be caused by either partial or total IO. Migrating worms have also been reported to cause intestinal perforation. Migration of a single adult worm may obstruct the biliary tree, leading to biliary colic, cholangitis, or gallstone formation.	Peripheral eosinophilia can be found, particularly during the phase of larval migration through the lungs but also sometimes at other stages of Ascaris infection . Eosinophil levels are usually in the range of 5 to 12 % but can be as high as 30 to 50 %.	Albendazole — A single dose of albendazole (400 mg) is effective in almost 100 % of cases. Mebendazole (100 mg BID for 3 days or 500 mg as a single dose) is an alternative. The three-day regimen is approximately 95 % effective, and the single dose seems to have similar results. Pyrantel pamoate (11 mg/kg up to a maximum of 1 g) is administered as a single dose. Efficacy varies with worm load, but single dose therapy is approximately 90 % effective in eradicating adult worms.
Giardia	The spectrum of clinical disease includes asymptomatic infection, self-limited acute giardiasis, and chronic infection. The virulence of the giardial isolate, the parasite load, the host immune response, and perhaps other host determinants probably all contribute the manifestations in an individual patient. Giardia can be asymptomatic, but acute infection may symptomatic (loose, watery stools, with a certain foul-smelling greasy, floaty quality, flatulence, cramps, bloating, and malaise). Chronic giardiasis may follow the acute phase of illness or may develop without an antecedent acute illness. In one study, 84 % of experimentally infected people self-cured by a mean of 18.4 days after inoculation, whereas the remainder became chronically infected. A chronic syndrome that can develop in as many as 30 to 50 % of symptomatic patients. Chronic giardia may be associated with significant weight loss and failure-to-thrive. It also can cause secondary lactase deficiency - interfering with the intestine's ability to digest lactose. Acute giardiasis occurs in less than half of people infected with Giardia. Occasionally, hypersensitivity phenomena such as rash, urticaria, aphthous ulceration, and reactive arthritis or synovitis are seen in giardiasis, although these manifestations are rare. G. lamblia also can spread uncommonly from the duodenum to the biliary and pancreatic ducts. Cases of cholecystitis, cholangitis, and granulomatous hepatitis caused by this pathogen have been reported. Impaired exocrine pancreatic function with diminished secretion of trypsin and lipase has been noted.	A loose watery stool is more likely to be positive for trophozoites, whereas a semiformed or formed stool probably will contain only cysts. Because Giardia is excreted intermittently, it will be detected in 50 to 70 % of cases with a single specimen and in 90 % after three specimens. Sensitivity of 90 to 99 % and a specificity of 95 to 100 % when compared to stool microscopy. Antigen assays have a cost similar to that of O&P examinations. Although it is more sensitive than conventional microscopy for the diagnosis of Giardia, antigen testing should not replace the stool O&P for most patients with diarrhea. The stool O&P examination also can reveal other pathogens and multiple parasites, which is particularly important for returning travelers.	Metronidazole (30 to 40 mg/kg per day divided into three doses for five to seven days) has an efficacy of 80 to 95 %. The drug, frequently used outside the United States, was approved by the FDA in May, 2004 for giardiasis in children three years of age or older and in adults. A single 2 g dose (or 50 mg/kg for children) of tinidazole has an efficacy of more than 90 % with few associated side effects]. Tinidazole has been found to be safe in several pediatric studies but currently is only available in tablet form. Preliminary in vitro data suggest that newer nitroimidazole antibiotics in development may have even greater benefit . Furazolidone, which is available as a suspension, is 72 to 100 % effective when given for 7 to 10 days and is well-tolerated in children. Albendazole (400 mg or 22.5 mg/kg PO daily for five days) had an efficacy of 97 % in children two years of age or older in Bangladesh]. It also was as effective as was metronidazole, with fewer side effects, in two other pediatric studies of giardiasis, and can be formulated as a suspension. However, there have been conflicting reports about its benefit in adults.
Enterobiasis	Most infections with E. vermicularis are asymptomatic. Symptoms can be attributed to mechanical stimulation and irritation, allergic manifestations, or transportation of organisms to sites where they become pathogenic		A single 100 mg dose of mebendazole results in a mean cure rate of 95 %, but a second dose is often given after one to two weeks to help prevent recurrences due to reinfection. Albendazole is given at a dose of 100 mg if the patient is less than two years old or 400 mg if older. A single dose albendazole repeated at two weeks achieves a cure rate close to 100 %.
Trichuriasis	Most infections with T. trichiura are asymptomatic. Clinical symptoms are more frequent	Infected individuals may have a peripheral	The guidelines in the United States recommend mebendazole (500 mg as a single dose) or albendazole (400 mg as

	with moderate to heavy infections. Can lead to diarrhea, and rectal prolapse. Those who are heavily infected may also often have impaired growth and impaired cognition	eosinophilia of up to 15 %.	a single dose) [. However, in heavy infections, a three-day regimen of mebendazole (100 mg BID) or albendazole (400 mg QD) should be considered instead.
Strongyloides	Most infected patients do not experience prominent symptoms. The most common manifestations are mild waxing and waning gastrointestinal, cutaneous, or pulmonary symptoms that persist for years; others simply have eosinophilia in the absence of symptoms. Immune suppression (high dose exogenous steroid administration) may lead to hyperinfection that has a high case-fatality rate.	Approximately 25 % of infected patients have negative stool examinations. Specialized tests on stool specimens, including the Baerman concentration technique and a modified agar plate method, can increase the yield, but even three or more stool examinations can fail to detect Strongyloides. Highly sensitive and specific ELISA serology has proven valuable in detecting both symptomatic and asymptomatic strongyloides.	Albendazole — Albendazole (400 mg PO twice daily for two to three days) also has activity against Strongyloides although clinical experience is limited. The treatment of choice for strongyloidiasis at present is ivermectin with albendazole as an alternative. two single 200 mcg/kg doses of ivermectin administered two weeks apart.
Hookworm Ancylostoma duodenale ; Necator americanus.	Cutaneous manifestations; Transpulmonary passage (cough during the time larvae are migrating in the airways, eosinophilic pulmonary infiltrates typical of Ascaris pulmonary involvement are rare; Acute gastrointestinal symptoms (nausea, diarrhea, vomiting, abdominal pain) Chronic nutritional impact — The major impact of hookworm infection is on the nutritional status of the patient, especially of marginally nourished children and pregnant women. The daily losses of blood, iron, and albumin, especially in patients with heavy infections, can lead to hookworm anemia and contribute to impaired nutrition - effecting growth, exercise, and cognitive function.	Stool examinations for the eggs of N. americanus or A. duodenale, the diagnostic test for mature intestinal hookworm infections, are not helpful during early infections. Fecal egg excretion does not become detectable until about two months after dermal acquisition of N. americanus infection and up to 38 weeks for A. duodenale Stool examinations are insensitive for detecting hookworm infections [27] and, in such patients, eosinophilia may be the only clue that the patient harbors a parasitic infection. The degree of eosinophilia with hookworm infection is usually mild and varies during the course of the disease.	mebendazole (100 mg orally BID for three days or 500 mg once) . Alternative agents include pyrantel pamoate (11 mg/kg per day for three days, not to exceed 1 g/day) or albendazole (400 mg once) .

The anti-parasite drug line-up

Pyrantel pamoate (11 mg/kg up to a maximum of 1 g) is administered as a single dose. Adverse effects include gastrointestinal (GI) disturbances, headaches, rash, and fever. It can lead to adverse reactions including anorexia, nausea, vomiting, abdominal cramps, and diarrhea, and is also associated with neurotoxic effects and transient increases in hepatic enzymes. Usually reserved for treatment of strongyloides hyperinfection.

Mebendazole (100 mg BID for 3 days or 500 mg as a single dose) is an alternative. Adverse effects include transient GI discomfort, headache, and rarely leukopenia. The three-day regimen is approximately 95 % effective, and the single dose seems to have similar results.

Albendazole — A single dose of albendazole (400 mg) Similar side effects as mebendazole.

Metronidazole (30 to 40 mg/kg per day divided into three doses for five to seven days) has an efficacy of 80 to 95 %. Side effects include nausea, headache, and a metallic taste in the mouth; less commonly, dark urine, paresthesias, and dizziness occur.

Overmectin – 200 mcg/kg as a single dose. May cause cutaneous and/or systemic reactions (Mazzoti reaction) of varying severity including ophthalmological reactions in patients with onchocerciasis. Pretreatment assessment for Loa loa infection is recommended in any patient with significant exposure to endemic areas (West and Central Africa); serious and/or fatal encephalopathy has been reported during treatment in patients with loiasis. Safety and efficacy in children <15 kg have not be established.

Review of Studies on Parasite Infections among Immigrant / Refugee Children

Year of study	Location	n	Immigrant countries of origin	Prevalence of parasite infection	Giardia	Trichuriasis	Strongyloides	Other
95-98	Massachusetts	1,642	Africa, S America, Fomer Soviet Union	21%	esp former Soviet Union			< 1 yrs 1%, 1-5 yrs 84%, 6-9 yrs 24%, >9 yrs 21% 16% nonpathogenic
	Massachusetts		Latin America	35%				
1999	Massachusetts	1,254	Africa	62% 35% among <2 years	25%	11%	<1%	16% helminthes total in children 58% protozoa total 3% kids w multiple helminths 2% ascaris 334% Blastocystis hominis 1% hookworm 9% Entamoeba coli 56% in adults
98-02	Massachusetts	265 30% were < 10 yrs age	Africa, E Europe, SE Asia, L America, M East	29%	56%			37 subjects w no pathogen on initial stool: of these 6 had positive O&P w 2nd specimen. No association between eosiophilia severity and presence of Strongyloides or Schistosoma.
94-95	Maine	87		43.6%	50%	42%	0	
	Buffalo			22%				
	Sweden			21%				
1999	Minnesota	1,166 children 2,545 total	Africa, SE Asia, E Europe	30%	7% (from total pop)	8%	1%	15% in adults 3% schisto 3% hookworm 2% amebiasis 1% ascariasis Highest in Sudan, Liberia, Somalia, Vietnam, Ethiopia