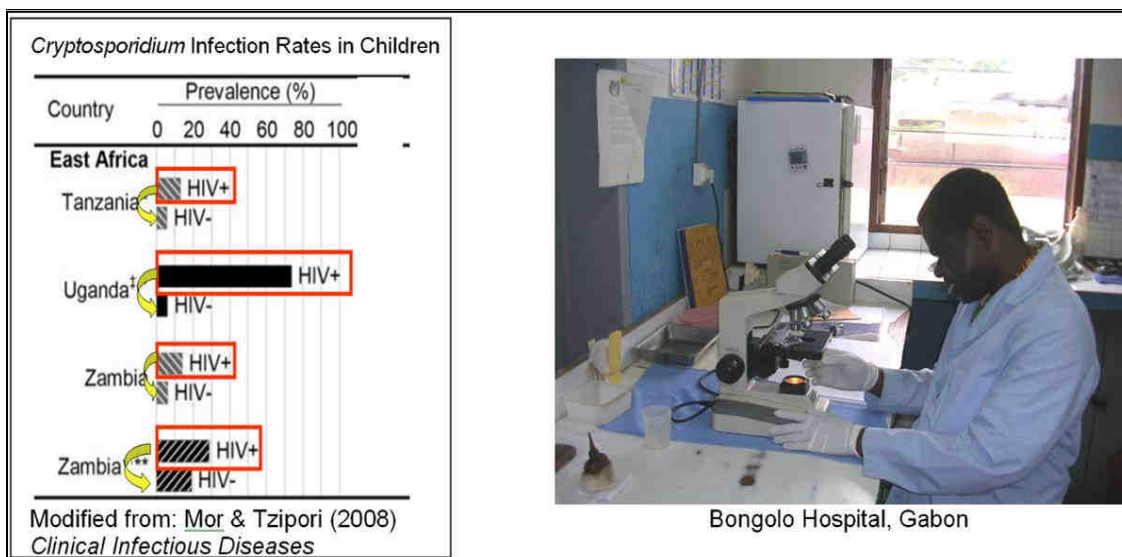


WATERBORNE PATHOGEN INFECTION RATES FOR PEOPLE LIVING WITH HIV/AIDS

A CAWST Literature Summary
November 2009 Edition

PART II – CARIBBEAN and LATIN AMERICA





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CAWST is a Canadian humanitarian organization focused on the principle that clean water changes lives. Safe water and basic sanitation are fundamentals necessary to empower the world's poorest people and break the cycle of poverty. CAWST believes that the place to start is to teach people the skills they need to have safe water in their homes. CAWST transfers knowledge and skills to organizations and individuals in developing countries through education, training and consulting services. This ever expanding network can motivate individual households to take action to meet their own water and sanitation needs.

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Acronyms

CAWST	Centre for Affordable Water and Sanitation Technology
HIV	Human Immunodeficiency Virus
AIDS	Acquired Immune Deficiency Syndrome
ART	antiretroviral treatment
PCR	polymerase chain reaction
CD4	cluster difference 4
CD	chronic diarrhea
UNICEF	United Nations International Children's Emergency Fund
WHO	World Health Organization
MIT	Massachusetts Institute of Technology

Authors

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Introduction

This document has been prepared for individuals working in either the fields of public health or water treatment, particularly those who work in resource-limited countries. There is increasing awareness that waterborne pathogens are an important cause of morbidity and mortality for people living with HIV/AIDS in resource-limited countries. This document focuses on pathogens that are commonly or sometimes waterborne. As noted in the journal *HIV Medicine*:

“Since the first reported case of HIV infection in 1981, many HIV-seropositive patients have died as a result of diarrhea induced by opportunistic protozoal infections: pathogens that would normally cause only a transient illness in immunocompetent individuals” (Miao and Gazzard).

The readers of this document are advised that the percent positive rates for different waterborne pathogens are likely higher than the infection rates summarized in this document as noted in the following from an article in *HIV Medicine*:

“Stool light microscopy and culture are highly specific but not particularly sensitive tests. Newer polymerase chain reaction (PCR) techniques are available, but these tests are costly and time-consuming and therefore not routinely available in hospital practice. The sensitivity of PCR techniques for both cryptosporidia and microsporidia may be much better than currently available techniques. Thus, some of the individuals formerly diagnosed with pathogen-negative diarrhoea may have been infected with these organisms” (Miao and Gazzard).

In a study conducted in the GHESKIO Centers in Haiti with the University of Virginia, Cornell University and the University of the Philippines, microscopy only detected *Cryptosporidium* oocysts in about 30% of the patients for which real-time PCR detected oocysts (Eyma et al.).

Besides the *Cryptosporidium* infection rates described in this document, the prolonged duration and severity of illness associated with Cryptosporidiosis and AIDS patients (Hunter and Nichols) is also important. In addition, higher waterborne pathogen infection rates in the community lead to increased quantities of pathogens that can potentially contaminate drinking water sources given the inadequate sanitation that exists in many resource-limited countries. In a study conducted by the University of Texas and Tufts University, total oocysts shed per person ranged from 5×10^6 to 1×10^{10} , the latter occurring in the volunteer with the longest episode of diarrhea and oocyst shedding (Chappell et al.). The same study found that the dose of *Cryptosporidium* oocysts high enough to infect 50% of the volunteers was estimated to be only 10 oocysts.

The reader should note the following relative to data contained in this document on relative to infection rates for *Entamoeba Histolytica*:

“Diagnosis of infection is complicated by the morphologically similar, but non-pathogenic, *E. dispar*. Microscopy is ineffective at distinguishing between the two species, and since the *E. dispar* infection-rate is 10-fold higher than that of *E. histolytica*, there is high incidence of misdiagnosis and treatment.” (Herbein et al.)

Because of the large volume of information provided in this document, colored lines have been added to make comparison of data in many of the tables easier.

References for Introduction Section

Chappell et al. “*Cryptosporidium Hominis*: Infectivity and Illness in Healthy Adults” Presented at ASTMH 2005 Annual Meeting

Eyma et al. “Improved diagnosis of Cryptosporidial and Microsporidial infections by PCR in patients with AIDS and diarrhea in Haiti” Presented at ASTHM Annual Meeting 2006

Herbein J, Buss S, Haque R., Ayeh-Kum³ P, Petri WA, Lyerly DM. “Evaluation of a rapid fecal diagnostic test for *Entamoeba histolytica* infection” *Am J Trop Med Hyg* 2004 Oct; 71(4 Suppl):12-30.

Hunter PR and Nichols G. “Epidemiology and Clinical Features of *Cryptosporidium* Infection in Immunocompromised Patients” *Clinical Microbiology Reviews*, 2002

Miao YM and Gazzard BG. “Management of protozoal diarrhoea in HIV disease” *HIV Medicine* 2000

CARIBBEAN

Haiti. DeHovitz JA, Pape JW, Boncy M, Johnson WD Jr . “Clinical manifestations and therapy of *Isospora belli* infection in patients with the acquired immunodeficiency syndrome” *N Engl J Med.* 1986 Jul 10; 315(2):87-90.

- *Isospora* infection in 15% of AIDS patients in Haiti in the study, which was associated with chronic watery diarrhea that was clinically indistinguishable from *Cryptosporidium*.
 - Neither *Isospora* nor *Cryptosporidium* were detected in stool samples from 170 healthy siblings, friends, and spouses of the patients with AIDS.
 - Recurrent symptomatic *Isospora* infection developed in 47% of the patients, but it also responded promptly to therapy with trimethoprim-sulfamethoxazole.
-

Haiti. Dillingham RA, Pinkerton R, Leger P, Severe P, Guerrant RL, Pape JW, Fitzgerald DW. “High early mortality in patients with chronic acquired immunodeficiency syndrome diarrhea initiating antiretroviral therapy in Haiti: a case-control study” *Am J Trop Med Hyg.* 2009 Jun; 80(6):1060-4.

- This case-control study examined whether chronic diarrhea at initiation of antiretroviral therapy (ART) affects survival of HIV-positive patients. Cases (288) were non-pregnant adults with self-reporting of frequent loose stool for > 3 weeks at the time that ART was initiated.
 - One-third of patients had an enteric pathogen identified including *Cryptosporidium*, *Giardia*, *Isospora belli*, *Cyclospora cayetanensis*, and *Entamoeba histolytica*. Control patients (400) did not have diarrhea when initiating antiretroviral therapy.
 - At six weeks, mortality was 10% in the patients with diarrhea and 5% in the patients without diarrhea (P = 0.009).
 - Conclusion: “Chronic diarrhea in patients requesting ART in Haiti is associated with increased early mortality.”
-

Haiti. Eyma E, Dillingham R, Leger P, Beauharnais CA, Sevilleja JE, Amidou S, Barrett L, Fitzgerald DW, Guerrant RL, Pape JW. "Improved diagnosis of Cryptosporidial and Microsporidial infections by PCR in patients with AIDS and diarrhea in Haiti." Presented at 2006 ASTMH meeting

- 10 of 23 patients (43%) had stools positive for *Cryptosporidium* using PCR. The median number of *Cryptosporidium* oocysts for patients was 700 oocysts per ml of stool. In contrast, only 3/23 (13%) of samples were positive for *Cryptosporidium* by acid-fast staining. "At GHESKIO, standard practice for stool evaluation includes a wet mount for ova and parasites and a modified Kinyoun acid-fast stain for coccidial parasites. The sensitivity of the current practice for the identification of *Cryptosporidium* infection in Haitian AIDS patients with diarrhea is 30%."
- Microsporidia (*E. bienersi*) DNA was detected in 4/23 (17%) patients. No Microsporidia were identified by microscopy.

Haiti. Pape JW, Verdier RI, Boncy M, Boncy J, Johnson WD Jr. "Cyclospora infection in adults infected with HIV. Clinical manifestations, treatment, and prophylaxis." *Ann Intern Med.* 1994 Nov 1; 121(9):654-7.

Enteric protozoa identified included:

- *Cryptosporidium* (30%)
- *Isospora belli* (12%)
- *Cyclospora* species (11%)
- *Giardia lamblia* (3%)
- *Entamoeba histolytica* (1%)
- Patients with diarrhea and *Cyclospora* infection had symptoms that were indistinguishable from those seen in patients with Isosporiasis or Cryptosporidiosis.

Haiti. Raccurt CP, Fouché B, Agnamey P, Menotti J, Chouaki T, Totet A, Pape JW. "Presence of *Enterocytozoon bieneusi* associated with Intestinal Coccidia in Patients with Chronic Diarrhea Visiting an HIV Center in Haiti" *Am J Trop Med Hyg.* 2008 Oct; 79(4):579-80.

Investigated the presence of Microsporidia (*Enterocytozoon bieneus*) as a possible cause of chronic diarrhea in Haitian patients attending the GHESKIO AIDS clinic in Port-au-Prince, Haiti. In the stools of patients with chronic diarrhea the following agents were detected using PCR:

- *Cryptosporidium* spp (60%)
- *Cyclospora* – (34%)
- *Isospora belli* – 15%
- Microsporidia (*E. bieneus*) – 7%

Haiti. Verdier RI, Pape JW, Boncy M, Johnson WD Jr; "Alga-like organism associated with chronic diarrhea in HIV-infected/AIDS patients: importance and treatment." *Int Conf AIDS.* 1992 Jul 19-24; 8(2):B146 (abstract no. PoB 3357).

- From 1986 to 1992, 2,512 stool examinations were obtained for 1,800 HIV-positive patients and examined for parasites by wet mount and modified acid-fast-stain.
- *Cryptosporidium* - 30%, *Isospora Belli* - 12%, *Giardia Lamblia* - 5%, *E. Histolytica* - 2%, *S. Stercoralis* - 1%.

Jamaica. Barrett DM, Lindo JF, Nembhard A, Eldemire-Shearer D. "OPPORTUNISTIC PARASITIC INFECTIONS AMONG PERSONS LIVING WITH HIV/AIDS IN JAMAICA" Abstracts of the 53rd Annual meeting of the American Society of Tropical Medicine and Hygiene November 7-11, 2004.

- During a 7-month period (October 2003- May 2004), 130 stool samples were collected from 65 HIV-positive patients and examined for intestinal parasites at the University Hospital of the West Indies, Kingston.
 - Oocysts of *Cryptosporidium* were identified in 10.8% (7/65) of patients, 71.4% of *Cryptosporidium*-positive patients had diarrhea and 28.6% were asymptomatic.
 - None of the positive patients was on HAART and no other parasite was detected. *Cryptosporidium* was the only parasitic infection.
-

Jamaica. Lindo J. "The Epidemiology of Emerging Parasitic Infections among Persons Living with HIV/AIDS (PLWHA) in Jamaica" (posted on Internet)

- Stool specimens were received from 132 patients (28.8% children and 71.2% adults). A child was defined as an individual below 18 years of age. The patients were from: the Centre for HIV/AIDS Research and Education Services (CHARES), the Lord's Place Hospice, the medical wards at the University Hospital of the West Indies (UHWI), the Kingston Public Hospital (KPH), the Comprehensive Health Centre, the Dare to Care Children's Home, Matthew 25:40 Children's Home and the Bustamante Hospital for Children.
 - *Cryptosporidium* was identified in 9.8% (13/132) of patients.
 - Microsporidia (*Enterocytozoon bieneusi*) were identified in 1.5% (2 of 132) of patients.
 - *Giardia lamblia* was detected in 3.8% (5/132) of the study population. All cases of *Giardia lamblia* occurred in patients between the ages of two and 10 years of age.
 - *Strongyloides stercoralis* and *Ascaris lumbricoides* were each detected in only one (separately) out of 132 individuals.
 - 6/13 (46.1%) of the individuals diagnosed with *Cryptosporidium* were from the Hospice, five (38.5%) were admitted to hospital and two (15.4%) were attendees of the CHARES clinic.
 - Ten of the 39 patients (25.6%) who presented with diarrhea within four weeks of recruitment into the study were positive for *Cryptosporidium*.
 - "We did not detect any *Cyclospora* or *Isospora* infections and this may be related to the widespread use of co-trimoxazole by PLWHA in Jamaica as a prophylactic measure against *Pneumocystis carinii* pneumonia (PCP) which may be one contributing factor since both parasites are susceptible to this antibiotic. The use of this inexpensive antibiotic may therefore have additional beneficial effects as far as parasitic infections are concerned." 78.3% of participants were on antibiotics. Co-trimoxazole was the antibiotic most commonly used by the patients (59.4%).
 - 48.5% of the study patients were on antiretroviral therapy (ART). Of these patients 24 (27.3%) were on HAART. Of the total patients on ART only two were diagnosed with an opportunistic parasite.
-

LATIN AMERICA

Argentina. Barboni G, Candi M, Villace MI, Leonardelli A, Balbaryski J, Gaddi E. "Intestinal cryptosporidiosis in HIV infected children" *Medicina* [Buenos Aires] VOL. 68 N° 3 - 2008 68 No. 3

- *Cryptosporidium* incidence in pediatric HIV/AIDS patients during a 6 years period, was studied. Cryptosporidiosis incidence was 13.7%; 33 out of 240 children showed chronic diarrhea lasting 14 days at least.

Argentina. Giordano MO, Martinez LC, Rinaldi D, Espul C, Martinez N, Isa MB, Depetris AR, Medeot SI, Nates SV. "Diarrhea and enteric emerging viruses in HIV-infected patients." *AIDS Res Hum Retroviruses*. 1999 Nov 1; 15(16):1427-32.

- Enteric viruses were found significantly more often in specimens from HIV-positive patients (20%) than in specimens from HIV-negative patients (0%) ($P < 0.05$).
- Picobirnavirus was detected in 14.63% of 82 HIV-infected patients with diarrhea, but it was detected neither in those without diarrhea (0%) ($p < 0.05$) nor in the groups of HIV-negative subjects (0%) ($p < 0.05$).
- Rotaviruses were not detected in any of the clinical subgroups studied.
- Enteric viruses were detected in 16.1% of the HIV-positive patients with CD4+ T cell count $<200/uL$ and 15.8% of HIV-positive individuals with a CD4+ T cell count 200-499/uL, showing no significant difference at the different CD4 levels ($p > 0.05$).
- "...only picobirnaviruses could be significantly associated with diarrhea in these patients."

Argentina. Olmos M, Molina C, Piskorz E, Tawil J, Magnanini F, Casiró A, Cahn P, Concetti H, Janeiro M, Guelfand L, Kaufman S. "Diarrhea and AIDS: more complex diagnostic techniques; better therapeutic results" *Acta Gastroenterol Latinoam*. 1996; 26(2):91-100.

During 17 months, 73 HIV-positive patients with diarrhea lasting at least for 14 days were studied. The main pathogens found were:

- *Cryptosporidium* (24%)
- *Giardia lamblia* (12%)
- *Isospora belli* (5%)
- *Shigella* (5%)
- *Salmonella* (5%)
- *Entamoeba histolytica* (3%)

Brazil. Bachur TP, Vale JM, Coêlho IC, Queiroz TR, Chaves CS. "Enteric parasitic infections in HIV/AIDS patients before and after the highly active Antiretroviral therapy" *Braz J Infect Dis* 2008, vol.12, n.2, pp. 115-122.

- The prevalence of enteric parasites in patients with HIV/AIDS seen at two hospitals in Ceara, Brazil, was compared in the pre-HAART (Group 1; n = 482) and HAART eras (Group 2; n = 100).
- *Cryptosporidium* sp. - 8.1% pre-HAART and 0 - HAART ($p = 0.0007$)
- *Entamoeba histolytica/dispar* - 3.3% pre-HAART and 1% - HAART ($p = 0.3301$),
- *Isospora belli* - 4.8% pre-HAART and 1% - HAART ($p = 0.0993$),
- *Strongyloides stercoralis* - 30.1% pre-HAART and 11% - HAART ($p < 0.0001$),
- *Ascaris lumbricoides* - 15.6% pre-HAART and 2% - HAART ($p < 0.0001$),
- Hookworms - 13.7% pre-HAART and 2% - HAART ($p < 0.0001$)

Brazil. Bonfim de Lima D, Jurado da Silva E, Favoreto CA, Gomes VR, Silva OF; "Diarrhea in AIDS patients" *Int Conf AIDS*. 1990 Jun 20-23; 6(2):358 (abstract no. 2017).

- *Giardia lamblia* (18%),
 - *Isospora belli* (16%),
 - *Cryptosporidium* sp (16%),
 - *Shigella* sp (8%),
 - *Entamoeba histolytica* (5%).
-

Brazil. Costa-Cruz JM, Ferreira MS, Rossin IR. "Intestinal Parasites in AIDS and +HIV Patients in Uberlândia, Minas Gerais, Brazil" *Mem Inst Oswaldo Cruz*, Rio de Janeiro, Vol. 91(6): 685-686, Nov. /Dec. 1996.

- *Cryptosporidium* most common parasite in AIDS patients (13%) but not tested for HIV-positive patients that hadn't progressed to AIDS nor for HIV-negative patients (control group).

Intestinal parasites in AIDS, +HIV patients and control group in Uberlândia, MG, Brazil

Parasites	AIDS		+HIV		Control group	
	Frequencies	no. positive/ no. tested	Frequencies	no. positive/ no. tested	Frequencies	no. positive/ no. tested
<i>Cryptosporidium</i> sp.	13.0%	(15/108)	—	—	—	—
<i>Strongyloides stercoralis</i>	3.8%	(09/238)	3.8%	(02/53)	1.2%	(11/897)
<i>Giardia intestinalis</i>	3.4%	(08/238)	1.9%	(01/53)	3.8%	(34/897)
<i>Isospora belli</i>	2.8%	(03/108)	—	—	—	—
<i>Entamoeba histolytica</i>	2.1%	(05/238)	1.9%	(01/53)	0.9%	(08/897)
Hookworm	2.1%	(05/238)	1.9%	(01/53)	1.3%	(12/897)
<i>Ascaris lumbricoides</i>	0.8%	(02/238)	0	(00/53)	0.5%	(05/897)
<i>Hymenolepis nana</i>	0.4%	(01/238)	0	(00/53)	0.4%	(04/897)
<i>Schistosoma mansoni</i>	0.4%	(01/238)	0	(00/53)	0.2%	(02/897)
<i>Trichuris trichiura</i>	0.4%	(01/238)	0	(00/53)	0.5%	(05/897)
<i>Enterobius vermicularis</i>	0	(00/238)	0	(00/53)	0.2%	(02/897)

— = not tested

Brazil. De Paula MD, Queiroz W, Janini M, Soraggi C, Hughes V, Rodriguez C; “*Cryptosporidium* SP and *Isospora belli* infections in pediatric patients” *Int Conf AIDS*. 1989 Jun 4-9; 5:319 (abstract no. T.B.P.196).

- From January 1987 to November 1988, 25 children varying from 10 months to 10 years were analyzed. All of them fulfilled the pediatric AIDS criteria (CDC-1987) and had fecal samples collected for *Cryptosporidium* sp and *Isospora belli* screen (one daily sample for 3 consecutive days).
- *Cryptosporidium* were recovered from 40% of patients.
- *Isospora* isolates from 8% of patients.
- The recovery of *Isospora belli* was always associated with diarrheal illness at the moment of the diagnosis, whereas only one of the patients with *Cryptosporidium* sp presented diarrhea. All the other children with *Cryptosporidium* infection reported constipation.

Brazil. Garlipp CR, Bottini PV, Teixeira AT. “The relevance of laboratory diagnosis of human cryptosporidiosis and other coccidia” *Rev Inst Med Trop Sao Paulo*. 1995 Sep-Oct; 37(5):467-9.

- Studied 188 stool samples from 111 patients (84 men and 27 women) with diarrhoea.
- *Cryptosporidium* in 18% (n = 20) of the patients, 90% (n = 18) of whom were HIV-positive.
- *Isospora belli* was recorded only from HIV-positive patients (6.5% of those who were HIV-positive).

Brazil. Gutierrez MC, Mattos H, Moura H. “Intestinal microsporidiosis in HIV-positive patients with chronic unexplained diarrhea in Rio de Janeiro, Brazil: diagnosis, clinical presentation and follow-up” *Rev Inst Med Trop Sao Paulo* 1996 Mar-Apr; 38(2):97-102.

- Study of 13 HIV-infected patients from Hospital Evandro Chagas with chronic unexplained diarrhea.
 - Spores of Microsporidia were found in the stools of 6/13 (46.1%) of patients studied.
 - The Microsporidia-infected patients presented chronic diarrhea with about 6 loose to watery bowel movements a day.
 - ‘Intestinal Microsporidiosis seems to be a marker of advanced stages of AIDS, since 5 of our 6 infected patients were dead after a 6 month period of follow-up.’
-

Brazil. Lainson R and da Silva BAM, "Intestinal Parasites of Some Diarrhoeic HIV-Seropositive Individuals in North Brazil, with Particular Reference to *Isospora belli* Wenyon, 1923 and *Dientamoeba fragilis* Jepps & Dobell, 1918" *Mem Inst Oswaldo Cruz*, Rio de Janeiro, 1999 Vol. 94(5): 611-613.

- Samples were examined from 34 adult HIV-positive individuals suffering from persistent diarrhoea in Belém, Pará, Brazil.
- *Isospora belli* was detected in eleven individuals (32.3%), and *Cryptosporidium parvum*, *Entamoeba histolytica*, and *Giardia lamblia* each on single occasions (3%).

Brazil. Langoni-Júnior G and Souza LR. "Cryptosporidium SP in HIV-infected individuals attending a Brazilian University Hospital" *Journal of Venomous Animals and Toxins including Tropical Diseases* 2007 V.13, n.4, p.737-747.

- 10 of 77 (13%) patients on antiretroviral treatment were positive for *Cryptosporidium*.
- "In the current study, *Cryptosporidium* sp was found at a lower proportion in patients with CD4⁺ T cells <200/mm³; however, 75% of these presented diarrhea, whereas only 28.6% of those with counts >200 cells/mm³ presented diarrhea. This could be explained by findings from literature in which the infection was self-limited in patients with low immunosuppression."

Brazil. Morillo SG, Luchs A, Cilli A, Carmona RC, Neme SN, Timenetsky MC "Rotavirus genotype G4P[8] and enteric adenovirus in HIV-positive patients with and without diarrhoea in São Paulo State, Brazil" *Trans R Soc Trop Med Hyg*. 2009 Article in Press.

- Study was carried out in order to identify rotavirus and enteric adenovirus in HIV-positive patients with and without diarrhoea, collected in a pre- and early highly active antiretroviral therapy era.
 - Rotavirus was identified in 1.5% (2 of 133) of HIV-positive patients with diarrhea and 2.5% (3/118) without diarrhea.
 - Adenovirus was detected in 7.5% (10 of 133) of patients without diarrhea and 14.4% (17 of 118) of the patients without diarrhea.
 - "These findings suggest no increased frequency of virus excretion in HIV-infected patients with diarrhoea."
-

Brazil. Moura H, Fernandes O, Viola JP, Silva SP, Passos RH, Lima DB. "Enteric parasites and HIV infection: occurrence in AIDS patients in Rio de Janeiro, Brazil" *Mem. Inst. Oswaldo Cruz* 1989, vol.84, n.4, pp. 527-533.

Study evaluated the occurrence of intestinal parasites in AIDS treated at "Hospital Universitário Pedro Ernesto" between 1986 and 1988. Results included:

- *Cryptosporidium* sp. (18%)
- *Strongyloides stercoralis* (15%)
- *Giardia lamblia* (15%)
- *E. histolytica* (13%)
- *Ascaris lumbricoides* (11%)
- *Isospora belli* (10%)

Brazil. Ribeiro PC, Pile E, Maria de Carvalho Queiroz M, Neres Norberg A, Ricardo de Oliveira Tenório J. "Cryptosporidiosis occurrence in HIV-positive patients attended in a hospital, Brazil" *Rev Saúde Pública* 2004;38(3):469-70.

- HIV-positive patients treated in the Clinic of Infect-parasitic Diseases in a hospital of Rio de Janeiro, Brazil.
- Overall *Cryptosporidium* prevalence for patients with diarrhea or without was 9.3%.

Brazil. ROSSIT AR, DE ALMEIDA MT, NOGUEIRA, CA. "Bacterial, yeast, parasitic, and viral enteropathogens in HIV-infected children from São Paulo State, Southeastern Brazil" *Diag. Microbiol. Infect. Dis.*, 200757: 59-66.

- 100 stool samples from 55 HIV-positive Brazilian children.
- *Cryptosporidium parvum* was the commonest enteropathogen, followed by *Candida albicans*, Enteropathogenic *Escherichia coli*, and astrovirus.
- "The number of potential pathogenic agents identified in fecal specimens in asymptomatic HIV-positive infants is high..."

Brazil. Sauda FC, Zamarioli LA, Ebner Filho W, Mello LB. "Prevalence of *Cryptosporidium* sp. and *Isospora belli* among AIDS patients attending Santos Reference Center for AIDS, São Paulo, Brazil" *Journal Parasitology* 199379: 454-456.

- *Cryptosporidium* prevalence - 19.1%
- *Isospora* - 9.9%

Brazil. Silva CV, Ferreira MS, Borges AS, Costa-Cruz JM. "Intestinal parasitic infections in HIV/AIDS patients: experience at a teaching hospital in central Brazil" *Scand J Infect Dis.* 2005; 37(3):211-5.

- 100 HIV/AIDS patients: *Isospora belli* - 7%; *Cryptosporidium* sp. - 4%; with one asymptomatic case. 6 of 27 infected patients from "Group 1" were on highly antiretroviral therapy (HAART).
- For 85 clinically healthy individuals *Giardia lamblia* - 3.5%.

Brazil. Wuhib T; Silva TM; Newman RD; Garcia LS; Pereira ML; Chaves CS; Wahlquist SP; Bryan RT; Guerrant RL; Sousa AD. "Cryptosporidial and microsporidial infections in human immunodeficiency virus-infected patients in northeastern Brazil." *J Infect Dis.* 1994 Aug; 170(2):494-7.

- 295 stool specimens were examined from 166 HIV-positive patients (49% with AIDS) at São José Hospital, Fortaleza, Brazil, from September 1990 to March 1992.
- "Of the potential parasitic causes of diarrhea, only *Cryptosporidium parvum* and Microsporidia were significantly associated with diarrheal disease."
- Infections with *Cryptosporidium parvum*, but not microsporidia, were associated with the rainy season (P < .005).

Chile. Weitz JC, Botelho R, Bryan R. "Microsporidiosis in patients with chronic diarrhea and AIDS, in HIV asymptomatic patients and in patients with acute diarrhea" *Rev Med Chil.* 1995 Jul; 123(7):849-56.

- 33% of patients with AIDS, 16.3% of HIV-positive patients and none of the individuals with acute diarrhea had Microsporidia in their stools (p < 0.05).
- In 15 patients with AIDS they detected intermittent stool Microsporidia shedding; noting that this finding should encourage repetitive examinations in negative cases.

Columbia. Botero JH, Montoya MN, Vanegas AL, Díaz A, Navarro-i-Martínez L, Bornay FJ, Izquierdo F, del Aguila C, Agudelo Sdel P. "Frequency of intestinal microsporidian infections in HIV-positive patients, as diagnosis by quick hot Gram chromotrope staining and PCR" *Biomedica.* 2004 Dec; 24(4):375-84.

- 103 HIV-positive patients of Medellín between August 2001 and September 2002.
- The overall frequency of intestinal microsporidiosis was 3.9%.
- 3 of 4 patients positive for Microsporidium were infected with *Enterocytozoon bieneusi* and one with *Encephalitozoon intestinalis*.

Cuba. Escobedo AA, Núñez FA. "Prevalence of intestinal parasites in Cuban acquired immunodeficiency syndrome (AIDS) patients" *Acta Trop.* 1999 Jan 15; 72(1):125-30.

- A study was carried out on 67 AIDS patients admitted at the Institute of Tropical Medicine. The results were compared with 136 HIV-negative patients (control group) who were also hospitalized in the same period.
 - In both groups monoparasitism was more prevalent than polyparasitism and intestinal protozoa were more prevalent than helminths.
 - Intestinal coccidia were only detected in AIDS patients;
 - *Cryptosporidium* spp. was the most prevalent with eight cases (11.9%),
 - Followed by *Cyclospora cayetanensis* with two cases (3.0%)
 - *Isospora belli* in one case (1.5%).
 - Microsporidia weren't detected.
-

El Salvador. Sorvillo FJ, Lieb LE, Seidel J, Kerndt P, Turner J, Ash LR. "Epidemiology of isosporiasis among persons with acquired immunodeficiency syndrome in Los Angeles County." *Am J Trop Med Hyg.* 1995 Dec; 53(6):656-9.

- Analysis of AIDS surveillance registry data from Los Angeles for 1985-1992 indicated *Isospora* rates were highest for foreign-born residents from El Salvador (7.4%).
-

Guatemala. Estrada y Martín RM, Samayoa B, Arathoon E, Mayorga R, Hernández JE. "Atypical Infection Due to *Vibrio cholerae* in Patients Infected with Human Immunodeficiency Virus" *Clinical Infectious Diseases* 1995;21:1516-7.

- Outpatient clinic of the Guatemalan Association for the Prevention and Control of AIDS at the Hospital General San Juan de Dios in Guatemala City.
 - 9 of 77 (11%) patients had cryptosporidiosis
 - Five patients (6%) had cholera
-

Honduras. Lindo JF, Dubon JM, Ager AL, de Gourville EM, Solo-Gabriele H, Klaskala WI, Baum MK, Palmer CJ. "Honduras Intestinal parasitic infections in human immunodeficiency virus (HIV)-positive and HIV-negative individuals in San Pedro Sula, Honduras" *Am J Trop Med Hyg.* 1998 Apr; 58(4):431-5.

- *Cryptosporidium parvum* and *S. stercoralis* (and a single case of *Cyclospora cayetanensis*) were reported exclusively in HIV-infected individuals. Found lower prevalence of *Ascaris* infections in HIV-positive individuals.

Distribution of intestinal parasites in human immunodeficiency virus (HIV)-positive and HIV-negative patients in San Pedro Sula, Honduras*

	HIV-positive (n = 52)	HIV-negative (n = 48)	Total (n = 100)
Helminths			
<i>Trichuris trichiura</i>	11 (21.2)	19 (39.6)	30
Hookworm	9 (17.3)	4 (8.3)	13
<i>Strongyloides stercoralis</i>	4 (7.7)	0	4
<i>Ascaris lumbricoides</i>	1 (1.9)	10 (20.8)	11
<i>Taenia</i> sp.	1 (1.9)	0	1
<i>Hymenolepis nana</i>	1 (1.9)	0	1
Protozoans			
<i>Entamoeba histolytica</i>	3 (5.8)	7 (14.6)	10
<i>Giardia lamblia</i>	1 (1.9)	6 (12.5)	7
<i>Cryptosporidium parvum</i>	4 (7.7)	0	4
<i>Cyclospora cayetanensis</i>	1 (1.9)	0	1
<i>Entamoeba coli</i>	4 (7.7)	2 (4.2)	6
<i>Chilomastix mesnili</i>	1 (1.9)	1 (2.1)	2
<i>Blastocystis hominis</i>	1 (1.9)	0	1
<i>Iodamoeba butschlii</i>	0	1 (2.1)	1
<i>Balantidium coli</i>	0	1 (2.1)	1
<i>Dientamoeba fragilis</i>	0	1 (2.1)	1

* Values are the no. (%).

Mexico. Moran P, Ramos F, Ramiro, M, Curiel O, González E, Valadez A, Gómez A., García G, Melendro, EL, Ximénez, C. “*Entamoeba histolytica* and/or *Entamoeba dispar*: infection frequency in HIV-positive/AIDS patients in Mexico City” *Experimental Parasitology* 2005 Volume 110, Issue 3, July 2005, Pages 331-334.

- By microscopic analysis *E. histolytica*/*E. dispar* complex was present in 5.9% of the HIV-positive/AIDS group, while in the HIV-negative group was 2.9%.
- By PCR, *E. histolytica* prevalence was 25.3% in HIV-positive/AIDS group and 18.5% in the HIV-negative group.
- “Besides, we found patients who were infected with *E. histolytica* in both groups were asymptomatic cyst passers. Our results suggest that *E. histolytica* strains prevalent in the studied community appear to be of low pathogenic potential.”

Mexico. MORAN P, RAMOS F, RAMIRO M, CURIEL O, GONZALEZ E, VALADEZ A, GÓMEZ A, GARCÍA G, MELENDRO EI, XIMÉNEZ C. “INFECTION BY HUMAN IMMUNODEFICIENCY VIRUS-1 IS NOT A RISK FACTOR FOR AMEBIASIS” *Am. J. Trop. Med. Hyg.*, 73(2), 2005, pp. 296–300.

- “The purpose of this study was to determine whether HIV-1 infected patients in our community were more susceptible to *Entamoeba histolytica* and *Entamoeba dispar* infection than non-HIV-infected individuals. The prevalence and frequency of invasive amebiasis was determined in 203 HIV-positive/AIDS subjects and 140 close relatives or sexual partners, all of whom were HIV–.”
 - Anti-*E. histolytica* antibodies (IgG, IgA) were assessed as indicators of *E. histolytica* invasive infection. PCR was used for the characterization of the *Entamoeba* species.
 - By PCR data showed that *E. histolytica* infection was more common in the HIV-positive/AIDS group (25.32%), than in HIV–negative individuals (18.46%).
 - *E. histolytica* and/or *E. dispar* infection were highly prevalent in HIV-positive/AIDS patients (34.1%) without evidence of recent or current invasive disease.
 - “The current study describes two closely related populations, HIV-positive/AIDS patients and their HIV-negative contacts, and show that both groups were equally likely to have intestinal parasitic infections.”
 - “These data confirm the high prevalence of *E. histolytica* strains in Mexico, particularly in Mexico City. However, during the 12 months of the study, no one developed a clinical event attributable to *E. histolytica* infection. This suggests that the study populations were colonized with *E. histolytica* strains of low pathogenic potential. Our results suggest that *E. histolytica* strains prevalent in the studied community appear to be of low pathogenic potential.”
-

Mexico. Morán P, Gómez A, Valadez A, García G, Ramos F, González E, Limón A, Riebeling C, Valenzuela O, Rojas L, Melendro EI, Ximénez C. "Periodicity and patterns of *Entamoeba histolytica* and *E. dispar* infection in HIV (+)/AIDS patients in Mexico" *Ann Trop Med Parasitol*. 2009 Jun; 103(4):307-15.

- In a 12-month study, Mexican HIV-positive/AIDS patients checked several times for *Entamoeba* infection, with the parasites identified, as *E. histolytica* or *E. dispar*, using PCR.
- "As seen in a previous study in Mexico, none of the *E. histolytica*-infected patients developed any clinical symptoms of invasive amoebiasis during the follow-up period."

Mexico. Pavia-Ruz NM, Jarillo D, Munoz MR, Rdenas C, Ramirez ML, Ortega M, Santos JI; "Opportunistic enteric parasites in AIDS Mexican children" *Int Conf AIDS*. 2002 Jul 7-12; 14: abstract no. ThPeB7299

- For children with AIDS, 55.3% had chronic diarrhea
- For HIV-negative children, 38 of 131 children were positive for Microsporidia by IFA

Mexico. Vivas-Rosel M, Flores-Abuxapqui J, Puc-Franco M, Heredia-Navarrete R, Castro-Sansores C, Franco-Monsreal J, Rodriguez-Sanchez R; "Prevalence of *Cryptosporidium* spp. in patients infected by HIV with diarrhoea from Yuctan, Mexico" *Int Conf AIDS*. 2002 Jul 7-12; 14: abstract no. C10965.

- 50 patients were studied, in 25 patients (50%) the diarrhoea was intermittent, in 21 (42%) was chronic and in 4 (8%) was acute; 27 (54%) patients were having antiretroviral therapy.
- *Cryptosporidium* spp. were found in nine patients for a prevalence of 18%.
Cryptosporidium spp. were found frequently in patients with AIDS stage (21% vs. 8%, $p=0.4$) and less frequently in patients with antiretroviral therapy (15% vs. 22%, $p=0.7$).
- *Cryptosporidium* spp. were found in patients with chronic and intermittent diarrhoea, but not in those with acute diarrhoea (20% vs. 0%, $p=0.4$).
- CONCLUSIONS. - "The *Cryptosporidium* spp. prevalence was associated with advanced stage of HIV infection and with antiretroviral therapy absence. This confirms the opportunistic role of the *Cryptosporidium* spp. and the fact that the antiretroviral therapy can to improve the diarrhoea and in some cases to disappear *Cryptosporidium*."

Peru. Bern C, Kawai V, Vargas D, Rabke-Verani J, Williamson J, Chavez-Valdez R, Xiao L, Sulaiman I, Vivar A, Ticona E, N´avincopa M, Cama V, Moura H, Secor WE, Visvesvara G, Gilman RH. "The Epidemiology of Intestinal Microsporidiosis in Patients with HIV/AIDS in Lima, Peru" *Journal of Infectious Disease* 2005:191 (15 May)

- 2,652 patients in 2 Lima hospitals, only 6% received antiretroviral therapy (ART), and the median CD4 count was 131 cells/uL.
- 3% of patients had microsporidiosis; mostly *Enterocytozoon bieneusi* of 10 different genotypes. The 2 most common genotypes, Peru-1 and Peru-2, were not associated with significant increases in chronic diarrhea; other genotypes were associated with a 4-fold increase.
- Shortened survival was associated with cryptosporidiosis (odds ratio 1.6 and $p = 0.04$) but not with microsporidiosis (odds ratio = 1.1 and $p = 0.48$)

Peru. Cama VA, Bern C, Sulaiman IM, Gilman RH, Ticona E, Vivar A, Kawai V, Vargas D, Zhou L, Xiao L. "Cryptosporidium species and genotypes in HIV-positive patients in Lima, Peru" *J Eukaryot Microbiol.* 2003; 50 Suppl: 531-3.

- 2,672 patients participated in this study and provided 13,937 specimens for this study conducted in two national hospitals in Lima, Peru.
 - *Cryptosporidium* parasites from a cross-sectional study were genetically characterized to determine the diversity of *Cryptosporidium* spp. in HIV-positive people.
 - *Cryptosporidium* oocysts were detected by microscopy in 13.3% of the patients.
 - Analysis of specimens from 300 patients using a small subunit rRNA-based PCR-RFLP tool identified 6 genotypes; *Cryptosporidium hominis* was the species most frequently detected (67.5%), followed by *C. meleagridis* (12.6%) and *C. parvum* (11.3%). *Cryptosporidium canis* (4.0%), *C. felis* (3.3%), and *Cryptosporidium* pig genotype (0.5%) were also found.
 - Results indicate that *Cryptosporidium hominis* is the predominant species in Peruvian HIV-positive persons, and that zoonotic *Cryptosporidium* spp. account for about 30% of cryptosporidiosis in these patients.
-

Peru. Carcamo C, Hooton T, Wener MH, Weiss NS, Gilman R, Arevalo J, Carrasco J, Seas C, Caballero M, Holmes KK. "Etiologies and Manifestations of Persistent Diarrhea in Adults with HIV-1 Infection: A Case-Control Study in Lima, Peru" *The Journal of Infectious Diseases* 2005; 191:11–19.

Table 1. Enteric microbial pathogens identified in HIV-1-infected case subjects with persistent diarrhea and HIV-1-infected control subjects without diarrhea.

Agent	Control subjects, no. (%)	Case subjects, no. (%)	Odds ratio	
			Crude	Adjusted (95% CI) ^a
Parasite				
<i>Cryptosporidium</i> species	10 (7)	29 (20)	3.37	2.65 (1.2–5.9)
<i>Giardia lamblia</i>	4 (3)	18 (12)	4.99	5.69 (1.7–18.8)
<i>Microsporidium</i> species	3 (2)	7 (5)	2.40	2.52 (0.6–10.8)
Other parasites ^b	4 (4)	14 (10)	2.47	2.00 (0.7–5.5)
Bacterium				
<i>Shigella</i> species ^c	7 (5)	12 (8)	1.83	1.84 (0.7–5.2)
<i>Aeromonas</i> species ^d	0	7 (5)	... ^e	... ^e
<i>Campylobacter</i> species ^f	0	5 (4)	... ^e	... ^e
ETEC ^g	3 (2)	5 (4)	1.72	1.43 (0.3–6.2)
<i>Salmonella</i> species ^h	0	3 (2)	... ^e	... ^e
<i>Vibrio alginolyticus</i>	0	1 (1)	... ^e	... ^e
Any bacterial pathogen isolated ⁱ	10 (7)	32 (22)	3.92	3.52 (1.6–7.7)
<i>Clostridium difficile</i> toxin A	3 (2)	3 (2)	1.00	0.90 (0.2–4.7)
Rotavirus	0	12 (8)	... ^e	... ^e
Any pathogen	31 (21)	79 (55)	4.51	3.83 (2.2–6.5)

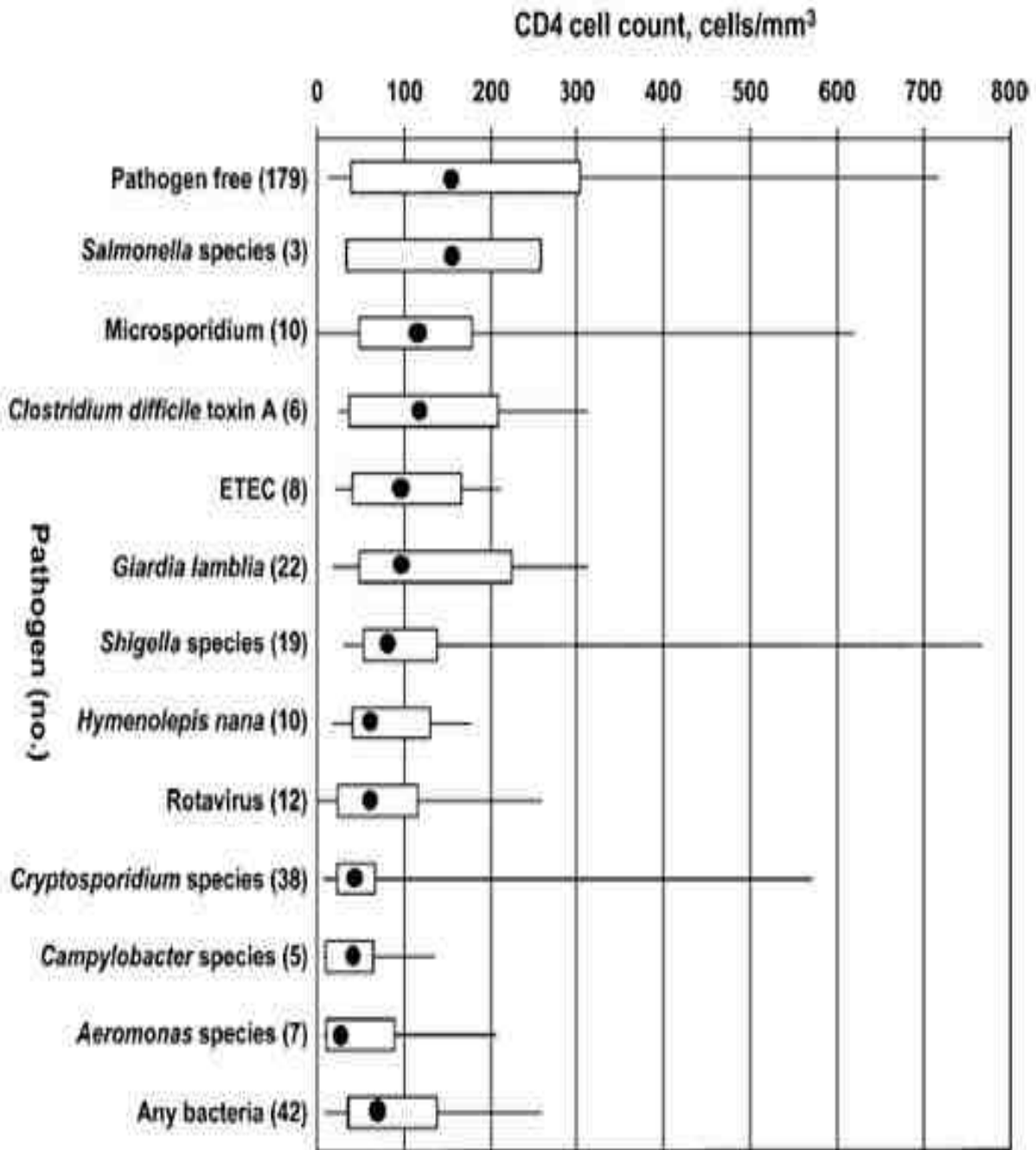


Figure 1. Box plots of CD4 lymphocyte count, by the pathogen identified. The circles inside the boxes represent the median, the boxes represent the 25%–75% (interquartile) range, and the vertical lines (whiskers) represent the 5%–95% percentile range of CD4 lymphocyte counts for each category. ETEC, enterotoxigenic *Escherichia coli*.

Peru. García C, Rodríguez E, Do N, López de Castilla D, Terashima A, Gotuzzo E. "Intestinal parasitosis in patients with HIV-AIDS" *Rev Gastroenterol Peru*. 2006 Jan-Mar; 26(1):21-4.

- Study included 217 HIV-AIDS patients who reported diarrhea between May 2002 and September 2005 at the Cayetano Heredia National Hospital (Lima, Peru). Analyzed 1-3 stool samples per patient using six methods.
- *Cryptosporidium* spp. was the most frequent parasite detected. It was more prevalent in the group of patients who had diarrhea for two or more weeks than those who had diarrhea for less than two weeks (22.82% vs. 10.29%, $p = 0.029$).
- *Isospora* - 10.6%
- *Giardia* - 8.3%
- *Strongyloidiasis* - 6.9%

Peru. Gotuzzo E, Frisancho O, Sanchez J, Liendo G, Carrillo C, Black RE, Morris JG "Association Between the Acquired Immunodeficiency Syndrome and Infection With *Salmonella typhi* or *Salmonella paratyphi* in an Endemic Typhoid Area" *Arch Intern Med*. 1991;151(2):381-382.

- Eight cases of typhoid and paratyphoid fever were identified during a 4-year period in a study of 117 patients who were positive for human immunodeficiency virus in Lima, Peru.
- "In our cohort there were 0.06 cases of typhoid or paratyphoid per patient year of observation; this rate is approximately 60 times that in the general population in Lima, and 25 times that in the 15- to 35-year-old age group. Our data indicate that patients who are positive for human immunodeficiency virus are at significantly increased risk for infection with *S typhi* and *S paratyphi*, and suggest that the clinical presentation of these diseases in patients with the acquired immunodeficiency syndrome differs from that seen in immunocompetent hosts."

Peru. Uribe MR, Valdivia RM, Carrasco EJ. "GASTROINTESTINAL SYMPTOMS IN ACQUIRED IMMUNODEFICIENCY SYNDROME (AIDS): A REVIEW OF ONE HUNDRED CASES AT ARZOBISPO LOAYZA HOSPITAL" *Rev Gastroenterol Peru*. 1997 Sep-Dec;17(3):214-221.

- In 1996, 100 health histories of HIV-positive patients were reviewed at the Arzobisp
- o Loayza National Hospital. Chronic diarrhea was the main symptom,
- *Giardia lamblia* was isolated in 32% of the cases
- *Isospora Belli* in 16% of cases
- *Cryptosporidium* in 12.5% of cases

Peru. Willingham FF, Chavez ET, Taylor DN, Bowen AB, Crane AR, Gottlieb AL, Gayles MK, Grahn KF, Chavez Perez VM, Apolinario IS, Gilman RH. "Diarrhea and *Clostridium difficile* Infection in Latin American Patients with AIDS" *Clinical Infectious Diseases* 1998;27:487–93.

Table 2. Pathogens identified in the stool of Peruvian AIDS patients with and without acute diarrhea.

Diarrheal agent identified	No. (%) of patients with diarrheal agent	
	With diarrhea	Without diarrhea
Pathogens	<i>n</i> = 93	<i>n</i> = 33
<i>Clostridium difficile</i> *	22 (29)	5 (15)
<i>Cryptosporidium parvum</i>	21 (23)	3 (9)
Microsporidia	15 (16)	5 (15)
<i>Giardia lamblia</i>	12 (13)	3 (9)
Rotavirus	10 (11)	5 (15)
<i>Isospora belli</i>	8 (9)	1 (3)
<i>Cyclospora cayentanensis</i>	3 (3)	0
<i>Strongyloides stercoralis</i>	1 (1)	0
<i>Mycobacterium avium</i>	1 (1)	0
Bacterial enteropathogens	<i>n</i> = 63	<i>n</i> = 25
<i>Shigella</i> species [†]	7 (10)	0
ETEC [‡]	3 (5)	0
<i>Salmonella</i> species [§]	2 (3)	0
<i>Campylobacter jejuni</i>	2 (3)	0
Multiple agents	30 (32)	5 (15)
No agent	31 (33)	16 (49)

Conclusions

- *Clostridium difficile* highest but commonly due to antibiotic use.
- *Cryptosporidium* next highest prevalence and significantly higher in AIDS patients with diarrhea.

Venezuela. Arenas-Pinto A, Certad G, Ferrara G, Castro J, Bello MA, Núñez LT. "Association between parasitic intestinal infections and acute or chronic diarrhoea on HIV-infected patients in Caracas, Venezuela" *International Journal of STD & AIDS*. Jul 2003. Vol. 14, Iss. 7; pg. 487.

Table 2. Prevalence of intestinal parasitic infections (%)

Agent	Acute diarrhoea (n=104)	Chronic diarrhoea (n=113)	Control group (n=87)	Total population (n=304)
<i>Blastocystis hominis</i>	25	26	31	27
<i>C. parvum</i>	16	19	7	15
<i>E. histolytica/E. dispar</i>	16	15	5	13
<i>I. belli</i>	12	17	1	11
<i>S. stercoralis</i>	10	17	3	11
<i>G. intestinalis</i> (<i>lamblia</i>)	2	4	2	3

- Study found that *Cryptosporidium*, *Entamoeba*, *Isospora*, and *S. stercoralis* (but not *Giardia*) had a much higher prevalence in HIV-positive patients than in control group.
- "According to our data, *S. stercoralis* must be considered as a potential cause of chronic diarrhoea in HIV-infected patients living in tropical areas, even among urban populations. Previously chronic, asymptomatic *S. stercoralis* infection in HIV-positive patients can become symptomatic during the progression of the HIV-induced immunosuppression. In this context, it is possible that most of our patients had caught this parasitic infection several years before their infection."

Venezuela.. CERTAD G, ARENAS-PINTO A, POCATERRA L, FERRARA G, CASTRO J, BELLO A, AND NÚÑEZ L. "Isosporiasis in Venezuela Adults Infected with Human Immunodeficiency IV: Clinical Characterization" *Am. J. Trop. Med. Hyg.*, 69(2), 2003, pp. 217-222.

- *Cryptosporidium* – 15%
- *Isospora belli* – 14%
- *S. stercoralis* – 11%
- *Entamoeba histolytica* – 10%

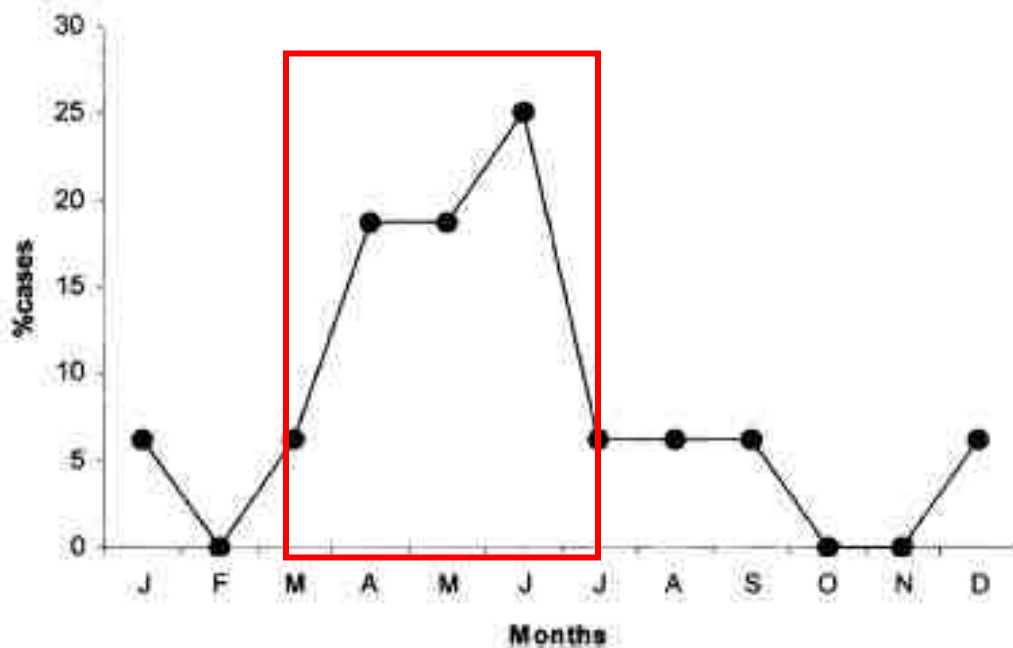


FIGURE 1. Seasonal distribution by month of *Isospora belli*-positive stools in patients with severe diarrhea.

Conclusion

- For patients with severe diarrhea, there was a significant difference in *Isospora* for the rainy season (April-June) vs. driest months of year (December and January).

Venezuela. CHACIN-BONILLA L, PANUNZIO AP, MONSALVE-CASTILLO FM, PARRA-CEPEDA IE, AND MARTINEZ R. "MICROSPORIDIOSIS IN VENEZUELA: PREVALENCE OF INTESTINAL MICROSPORIDIOSIS AND ITS CONTRIBUTION TO DIARRHEA IN A GROUP OF HUMAN IMMUNODEFICIENCY VIRUS–INFECTED PATIENTS FROM ZULIA STATE" *Am. J. Trop. Med. Hyg.*, 74(3), 2006, pp. 482-486 .

Prevalence of intestinal microsporidia and other parasitic pathogens in 103 HIV-infected patients from Venezuela*

Pathogenic Parasite	Cases in % (n=74)	Controls in % (n=29)
Microsporidia	17.6	3.4
<i>Cryptosporidium</i> spp.	29.7	13.8
<i>Isospora belli</i>	8.1	6.9175
<i>Cyclospora cayetanensis</i>	6.8	3.4
<i>Giardia lamblia</i>	13.5	10.3
<i>Entamoeba histolytica</i> / <i>E. dispar</i>	6.8	6.9
<i>Ascaris lumbricoides</i>	6.8	6.9
<i>Strongyloides stercoralis</i>	8.1	3.4

- "Cases included patients with diarrhea defined as the presence of three or more stools per day that were looser than usual for a period of three or more days before examination. Control patients were those who had no current or history of diarrheal disease during the preceding month."

Venezuela. González GG, Pujol FH, Liprandi F, Deibis L, Ludert JE. "Prevalence of enteric viruses in human immunodeficiency virus seropositive patients in Venezuela." *J Med Virol.* 1998 Aug; 55(4):288-92.

- Enteric viruses were detected in 6.4% (8 of 125) of the stools collected: five (4.0%) samples positive for adenoviruses and three (2.3%) samples positive for picobirnaviruses were detected. No rotavirus, astrovirus, or Norwalk virus was observed.
- Only one of the viruses identified (adenovirus) was found in a sample from a patient with diarrhea. "These results do not support a major role for enteric viruses in the diarrhea suffered by HIV-infected patients."

Venezuela. LISTE M B, NATERA I, SUAREZ J A, PUJOL F H, LIPRANDI F, LUDERT J E. "Enteric Virus Infections and Diarrhea in Healthy and Human Immunodeficiency Virus-Infected Children" *JOURNAL OF CLINICAL MICROBIOLOGY*, Aug. 2000, Vol. 38, No. 8 p. 2873–2877.

- Samples from 27 HIV-positive children and 38 HIV-negative children, collected during a 15-month period, were examined for enteric viruses.
- Specimens from HIV-positive children were more likely than those of HIV-negative children to be positive for enterovirus (56 versus 21%; $P < 0.0002$) and astrovirus (12 versus 0%; $P < 0.02$), but not rotavirus (5 versus 8%; $P > 0.5$).
- No adenoviruses, picobirnaviruses, or Norwalk viruses were found.
- The rates of virus-associated diarrhea were similar among HIV-positive and HIV-negative children.
- "These results suggest that although infection with enterovirus and astrovirus may be frequent in HIV-infected children, enteric viruses are not associated with the diarrhea frequently suffered by these children."

TABLE 1. Viral agents detected in stool samples from HIV-positive and HIV-negative children with and without acute diarrhea

Virus	Specimens					
	HIV positive no. [%] with virus)		P value ^a	HIV negative no. [%] with virus)		P value ^a
	Diarrhea ($n = 18$)	No diarrhea ($n = 25$)		Diarrhea ($n = 17$)	No diarrhea ($n = 21$)	
Rotavirus	2 (11)	0	0.1694	3 (18)	0	0.0806
Astrovirus	3 (17)	2 (8)	0.6344	0	0	
Adenovirus	0	0		0	0	
Norwalk virus	0	0		0	0	
Picobirnavirus	0	0		0	0	
Enterovirus	12 (67)	12 (48)	0.1320	6 (35)	2 (10)	0.1066

^a Fisher's exact test.

Venezuela. Rodríguez-Guillén L, Vizzi E, Alcalá AC, Pujol FH, Liprandi F, Ludert JE. "Calicivirus infection in human immunodeficiency virus seropositive children and adults" *J Clin Virol*. 2005 Jun; 33(2):104-9.

- "Human caliciviruses have emerged as a leading cause of acute diarrhea worldwide. The importance of enteric viral infections in HIV-related diarrhea is uncertain."
- Adults: Viruses were detected with equal frequencies in HIV-positive and HIV-negative adults (12%) but HIV-positive children were more likely than those of HIV-negative children to be positive for caliciviruses (51% versus 24%, $P < 0.05$). Samples were analyzed by RT-PCR.