HIV and NTDs

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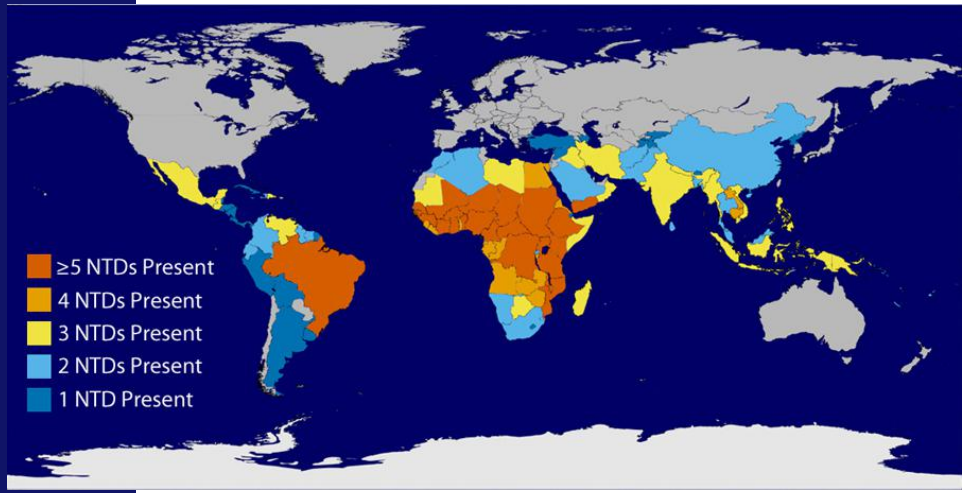
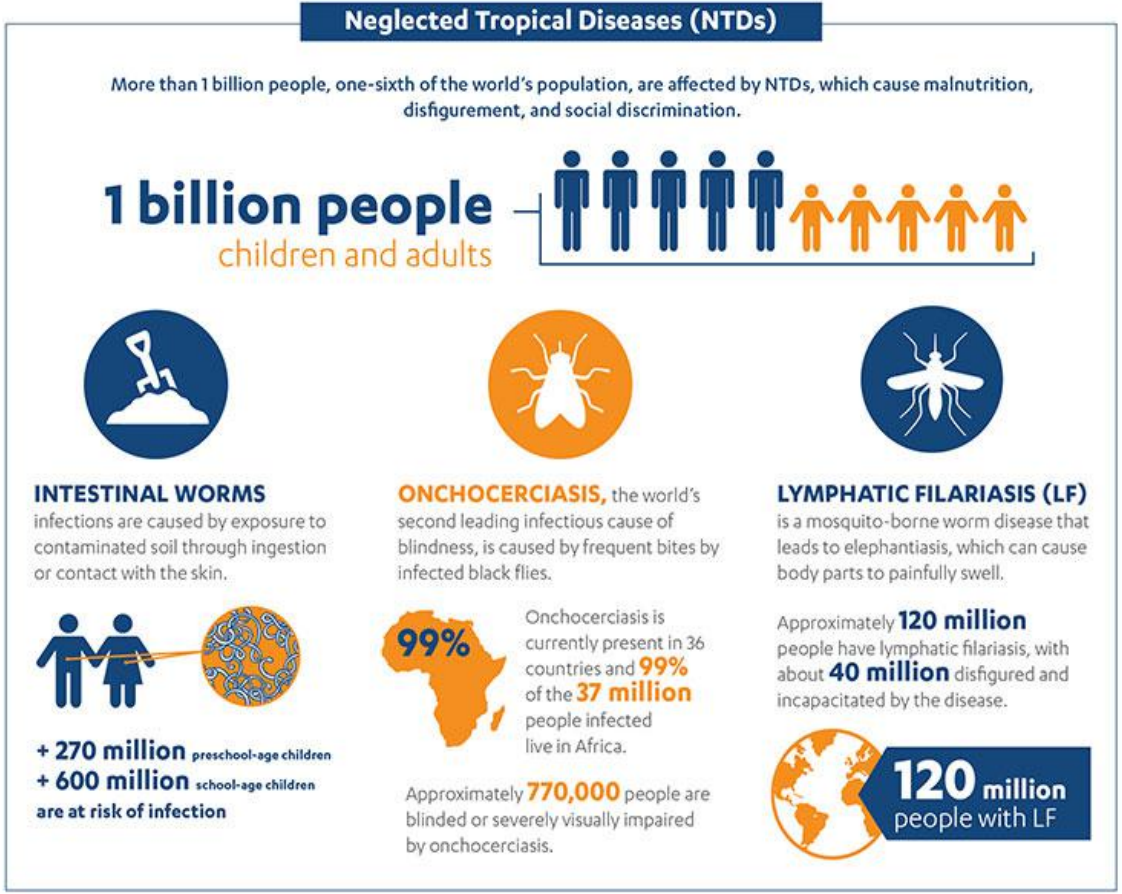
Neglected tropical diseases (NTDs)

- “a diverse group of communicable diseases that prevail in tropical and subtropical conditions in 149 countries – affect more than one billion people and cost developing economies billions of dollars every year.
- Populations living in poverty, without adequate sanitation and in close contact with infectious vectors and domestic animals and livestock are those worst affected.”



NTDs

- ***Buruli ulcer***
- ***Chagas disease***
- Dengue and Chikungunya
- Dracunculiasis (guinea-worm disease)
- Echinococcosis
- ***Foodborne trematodiases***
- Human African trypanosomiasis (sleeping sickness)
- ***Leishmaniasis***
- ***Leprosy***
- ***Lymphatic filariasis***
- Mycetoma, chromoblastomycosis and other deep mycoses
- Onchocerciasis (river blindness)
- Rabies
- Scabies and other ectoparasites
- ***Schistosomiasis***
- ***Soil-transmitted helminthiases***
- Snakebite envenoming
- Taeniasis/Cysticercosis
- Trachoma
- Yaws (Endemic treponematoses)



The neglected tropical diseases (NTDs) share a high degree of geographic overlap with malaria and HIV.

- Research suggests that NTDs can impact HIV, tuberculosis, and malaria disease progression and transmission.
- Immunological, epidemiological, and social cofactors contribute to disease impact.
- Evidence is variable but poverty and stigma are shared

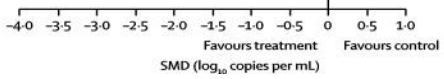
THE LANCET
Infectious Diseases
Volume 10, Issue 7, July 2010, Pages 455-463

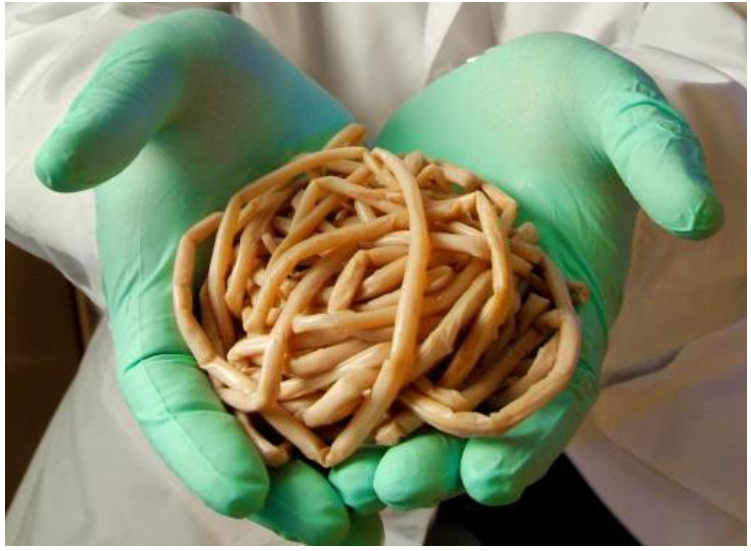
Review

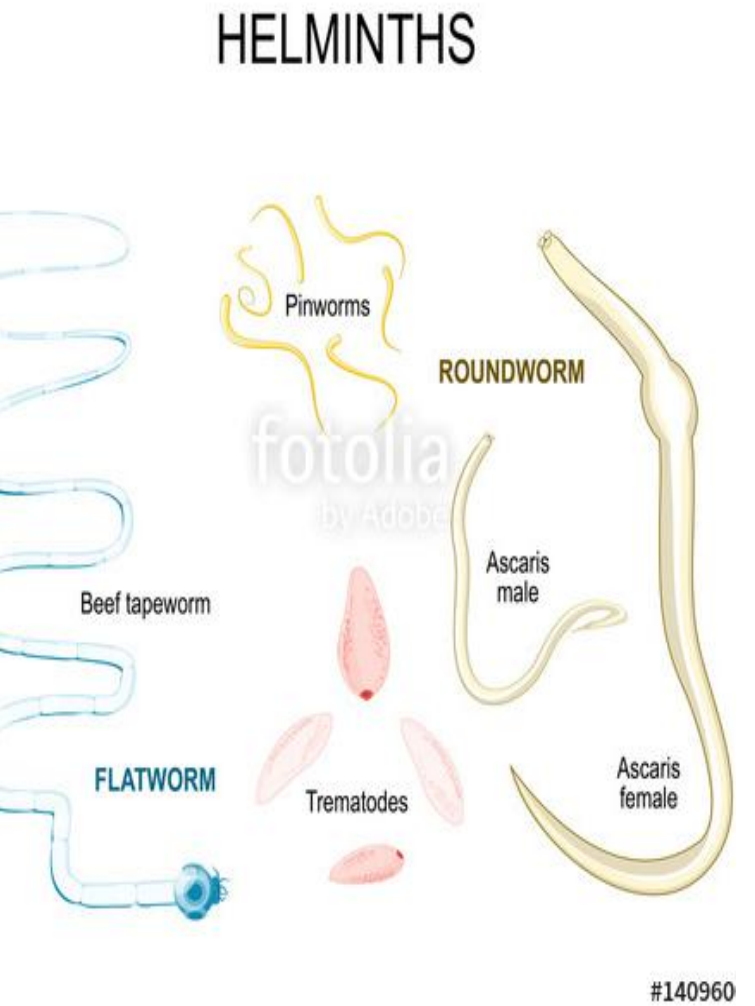
Effect of treating co-infections on HIV-1 viral load: a systematic review

Dr Kayvon Modjarrad MD [a, c] ✉, Sten H Vermund MD [b, c]

	Treatment n	Treatment Mean	Control n	Control Mean	SMD (95% CI)
Tuberculosis					
Goletti (1996)[6]	3	−1·22 (0·25)	7	0·24 (0·42)	−3·47 (−3·78 to −3·16)
Kizza (2005)[24]	27	−0·50 (0·11)	13	0·00 (0·11)	−0·50 (−0·72 to −0·28)*
Malaria					
Hoffman (1999)[11]	47	−0·25 (0·11)	42	0·04 (0·11)	−0·29 (−0·51 to −0·07)*
Kublin (2005)[12]	77	−0·10 (0·60)	23	0·05 (0·50)	−0·30 (−0·50 to −0·10)
Geohelminthiasis					
Wolday (2002)[32]	13	−0·36 (0·83)	9	0·14 (0·24)	−2·10 (−2·26 to −1·94)
Brown (2003)[29]	163	−0·08 (0·63)	140	0·06 (0·56)	−0·25 (−0·34 to −0·16)
Modjarrad (2005)[30]	54	0·06 (0·15)	57	0·13 (0·49)	−0·22 (−0·28 to −0·16)
Walson (2008)[25]	108	−0·15 (0·95)	100	−0·02 (1·00)	−0·17 (−0·37 to 0·03)
Schistosomiasis					
Kallestrup (2005)[7]	64	0·00 (0·57)	66	0·21 (0·54)	−0·39 (−0·52 to −0·26)
Filariasis					
Nielsen (2007)[31]	11	−0·34 (0·50)	15	0·36 (0·91)	−0·77 (−1·23 to −0·31)
Herpes simplex virus					
Schacker (2002)[10]	12	−0·15 (0·11)	27	−0·01 (0·11)	−0·14 (−0·36 to 0·08)*
Ouedraogo (2006)[35]	30	−0·13 (2·24)	30	0·17 (1·51)	−0·59 (−1·13 to −0·05)
Nagot (2007)[26]	68	−0·40 (1·35)	68	0·11 (0·72)	−0·71 (−0·88 to −0·54)
Zuckerman (2007)[27]	20	−0·33 (0·72)	20	0·00 (0·71)	−0·46 (−0·77 to −0·15)
Baeten (2008)[33]	20	−0·26 (0·22)	20	0·00 (0·22)	−1·18 (−1·28 to −1·08)
Celum (2010)[36]	606	−0·25 (0·11)	590	0·00 (0·11)	−0·25 (−0·47 to −0·03)*
Gonorrhoea					
Anzala (2000)[28]	14	−0·16 (0·14)	3	−0·06 (0·14)	−0·71 (−0·78 to −0·64)
Syphilis					
Sadiq (2005)[34]	13	0·10 (0·33)	20	0·12 (0·46)	−0·04 (−0·24 to 0·16)

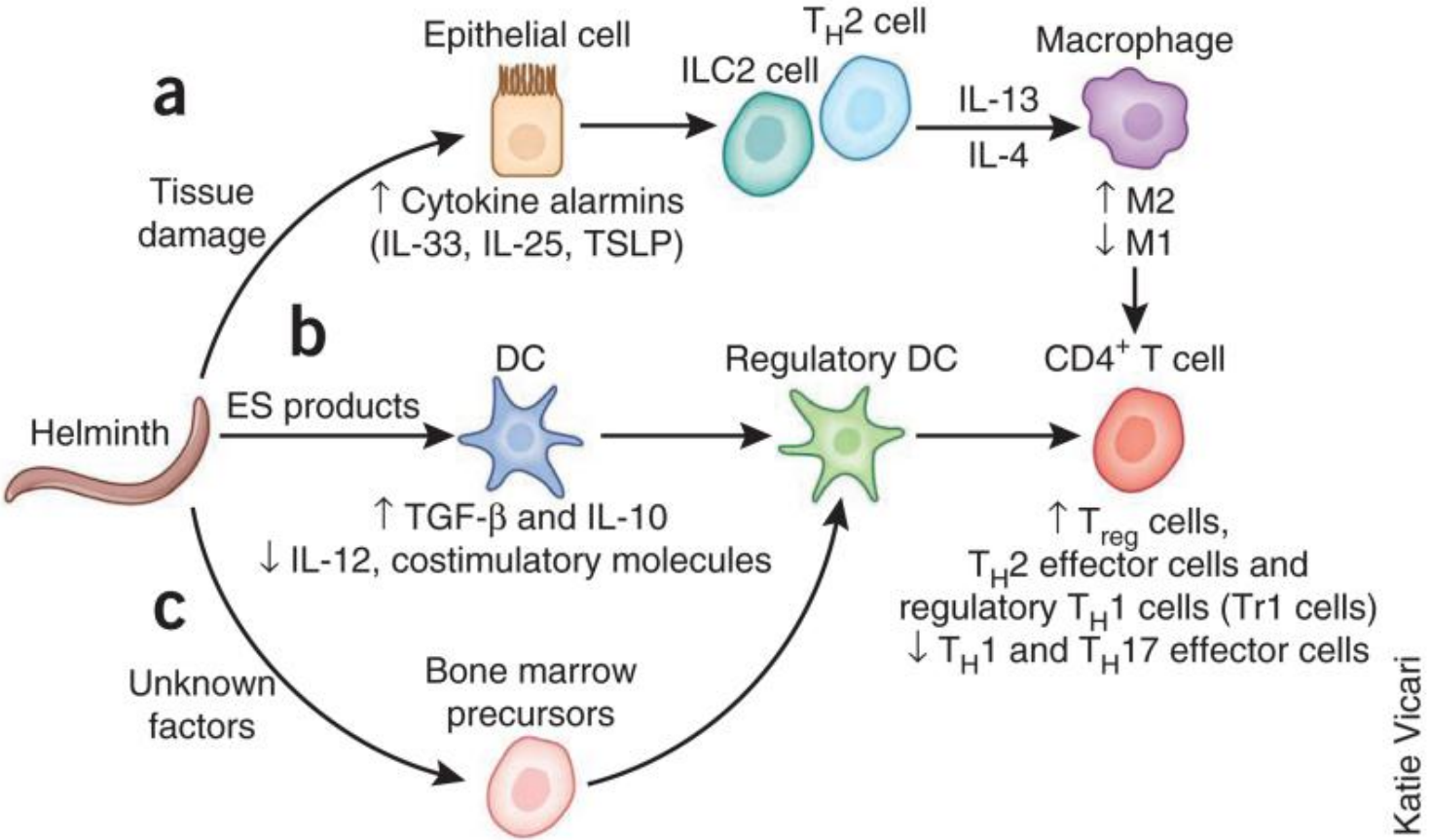






Helminths

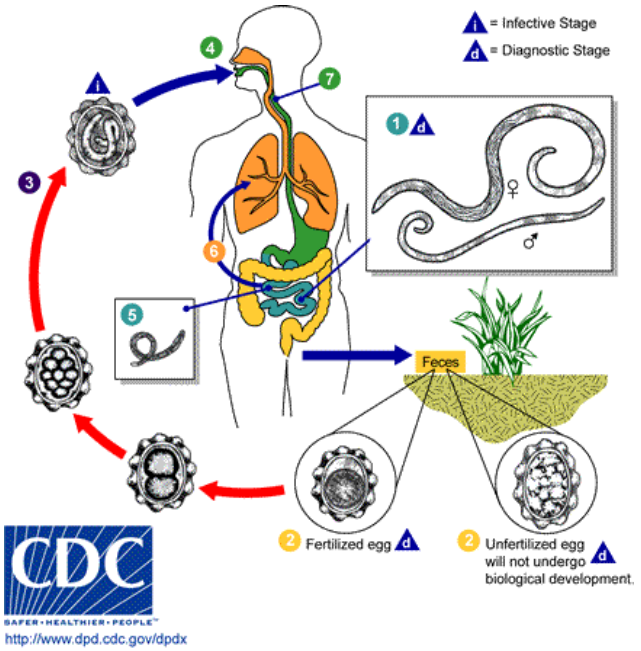
- Helminths are a group of organisms which share a similar form but are not necessarily related.
- Helminths include members of the following taxa:
- cestodes (tapeworms *eg* pork tapeworm T. solium and the beef tapeworm T. saginata)
- nematodes (roundworms *eg* Ascaris)
- trematodes (flukes – *eg* Schistosomiasis, foodborne - Clonorchis, Opisthorchis, Fasciola and Paragonimus)



Salgame P, Yap GS, Gause WC. Effect of helminth-induced immunity on infections with microbial pathogens. *Nature immunology*. 2013;14(11):1118-1126.

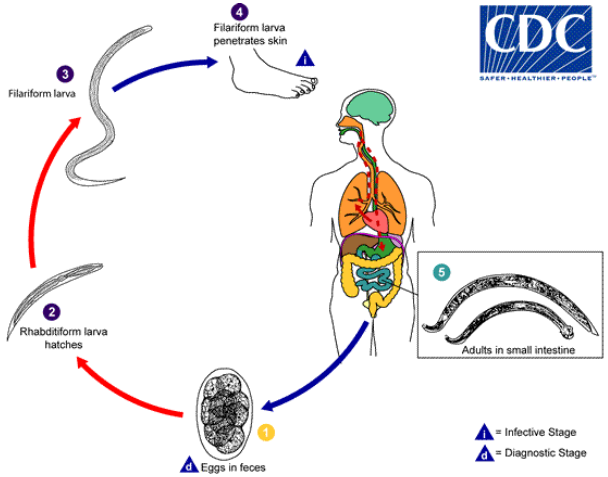
Soil-transmitted helminth infections are caused by different species of parasitic worms.

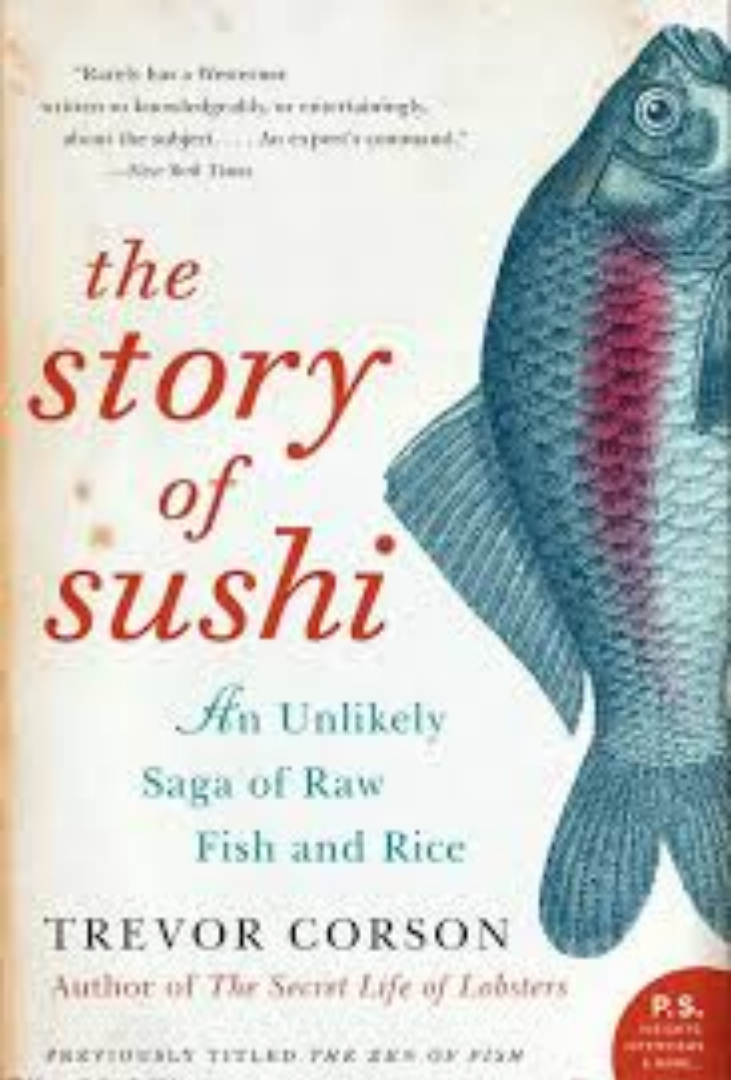
- the roundworm (*Ascaris lumbricoides*)
- the whipworm (*Trichuris trichiura*)
- hookworms (*Necator americanus* and *Ancylostoma duodenale*)
- They are transmitted by eggs present in human faeces, which contaminate the soil in areas where sanitation is poor.
- Approximately 1.5 billion people are infected worldwide.
- Infected children are nutritionally and physically impaired.
- Control is based on:
  - periodical deworming to eliminate infecting worms
  - health education to prevent re-infection
  - improved sanitation to reduce soil contamination with infective eggs.
- Safe and effective medicines are available to control infection – albendazole, mebendazole or ivermectin.



24% of the world's population, are infected with soil-transmitted helminth infections worldwide.

- Adult worms live in the intestine where they produce thousands of eggs each day. In areas that lack adequate sanitation, these eggs contaminate the soil. This can happen in several ways:
- eggs that are attached to vegetables are ingested when the vegetables are not carefully cooked, washed or peeled;
- eggs are ingested from contaminated water sources;
- eggs are ingested by children who play in the contaminated soil and then put their hands in their mouths without washing them.
- In addition, hookworm eggs hatch in the soil, releasing larvae that mature into a form that can actively penetrate the skin. People become infected with hookworm primarily by walking barefoot on the contaminated soil.
- There is no direct person-to-person transmission, or infection from fresh faeces, because eggs passed in faeces need about 3 weeks to mature in the soil before they become infective.
- Since these worms do not multiply in the human host, re-infection occurs only as a result of contact with infective stages in the environment.

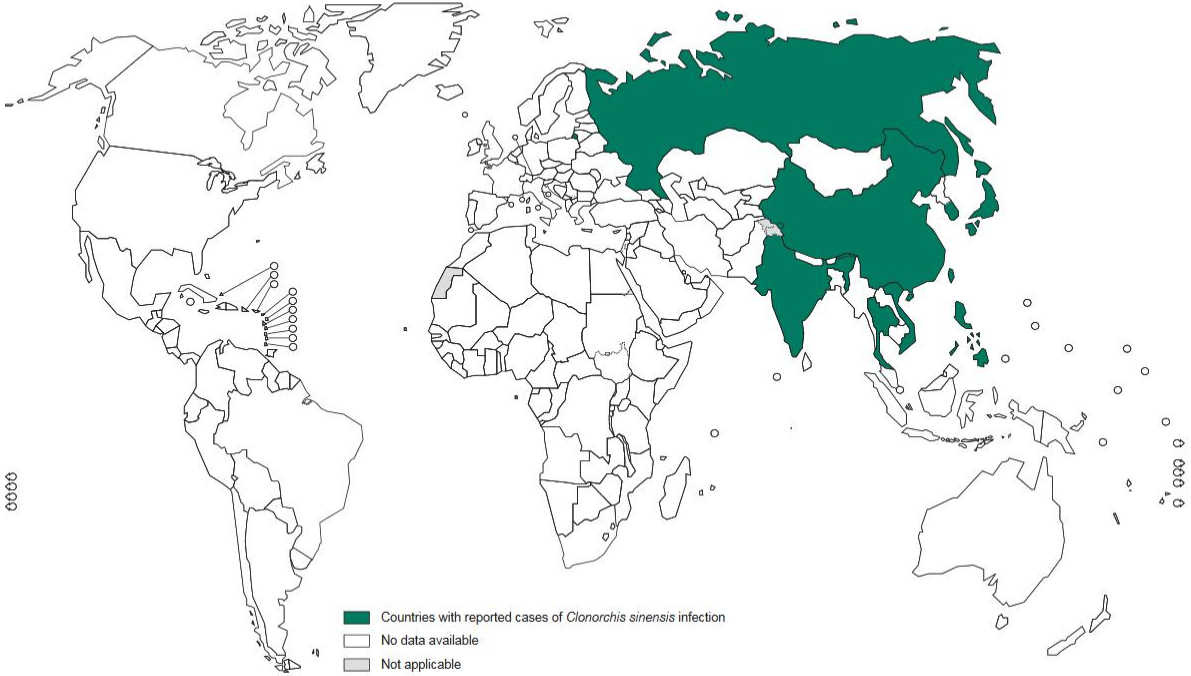




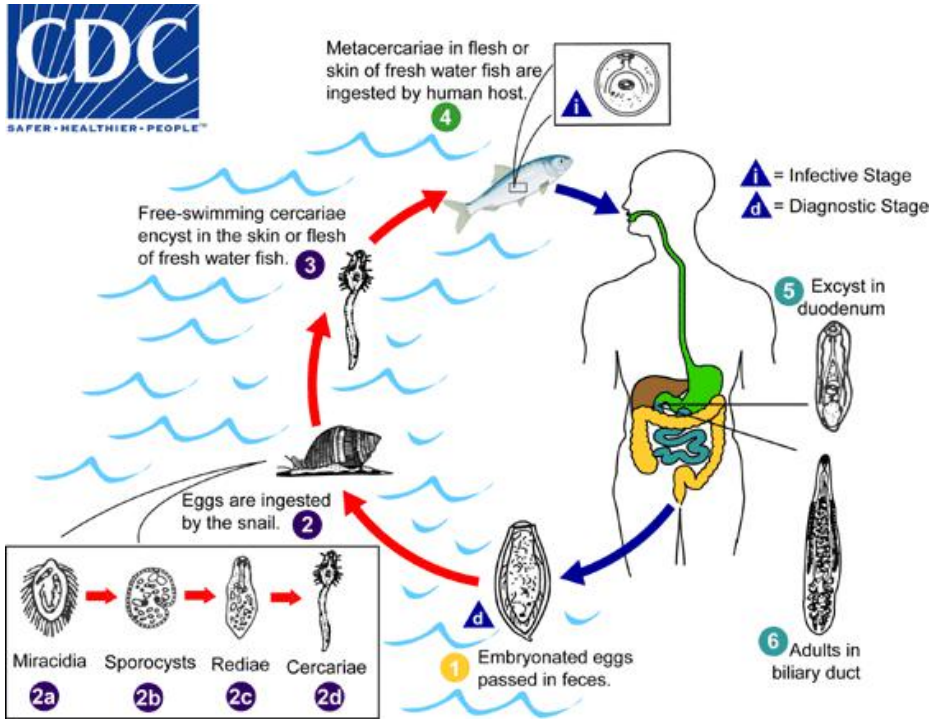
Foodborne trematodiases

- Foodborne trematodiases are caused by trematode worms ("flukes")
- ***Clonorchis***
- ***Opisthorchis***
- ***Fasciola***
- ***Paragonimus***
- People become infected by eating raw fish, crustaceans or vegetables that harbour the parasite larvae.
- Foodborne trematodiases are most prevalent in East Asia and South America.
- Can cause severe liver and lung disease.
- Safe and efficacious medicines are available to prevent and treat foodborne trematodiases.
- People become infected through the consumption of raw or undercooked food: fish, crustaceans and vegetables that harbour the minute larval stages of the parasites

Fig. 4.7.1 Distribution of clonorchiasis, worldwide, latest year available



Clonorchis



- **What is *Clonorchis*?**
- Clonorchis is a liver fluke that can infect the liver, gallbladder and bile duct. Found across parts of Asia, it is also known as the Chinese or oriental liver fluke.
- **How does one become infected with *Clonorchis*?**
- The eggs of *Clonorchis sinensis* are ingested by snails in fresh water. After the eggs hatch, infected snails will release microscopic larvae that will enter freshwater fish. People become infected when eating the parasite containing cysts within infected raw or undercooked fish. Once ingested, cysts travel to the small intestine and liver where they feed upon the bile created by the liver and mature. The life cycle takes 3 months to complete in humans. Infected people will then pass eggs in their feces or may cough them up.
- **Where is *Clonorchis* found?**
- *Chlonorchis* is found in Asia including Korea, China, Taiwan, Vietnam, Japan, and Asian Russia. When clonorchiasis has been reported in non-endemic areas, the infection was found in Asian immigrants. Some cases were found in people who had ingested imported, undercooked or, pickled freshwater fish containing parasitic cysts.
- **How is it diagnosed?**
- The detection of eggs in stool is the most common way to diagnose the infection. Sometimes an endoscopy is done to examine the small intestine for eggs. Additionally, ultrasound, CT, and MRI scanning may be used to discover parasite-containing cysts that contribute to a diagnosis.
- **What are the signs and symptoms?**
- Most signs and symptoms are related to inflammation and intermittent obstruction of the biliary ducts. In severe cases, abdominal pain, nausea, and diarrhea can occur. In long-standing, untreated infections, inflammation of the biliary system can lead to cancer, which can be fatal.
- **How can I prevent clonorchiasis?**
- Do not eat raw or undercooked freshwater fish.
- The FDA recommends the following for fish preparation or storage to kill parasites.
- **Cooking**
  - Cook fish adequately (to an internal temperature of at least 145° F [~63° C]).
- **Freezing**
  - At -4°F (-20°C) or below for 7 days (total time), or
  - At -31°F (-35°C) or below until solid, and storing at -31°F (-35°C) or below for 15 hours, or
  - At -31°F (-35°C) or below until solid and storing at -4°F (-20°C) or below for 24 hours.
- **What is the treatment?**
- Praziquantel or albendazole are the drugs of choice to eliminate the infection

Fig. 4.7.3 Distribution of fascioliasis, worldwide, latest year available

fascioliasis

- The adult (mature) flukes are found in the bile ducts and liver of infected people and animals, such as sheep and cattle.
- Infected by eating raw watercress, by drinking contaminated water or by eating vegetables that were washed or irrigated with contaminated water.
- The infection typically is diagnosed by examining stool (fecal) specimens under a microscope
- Triclabendazole is the drug of choice

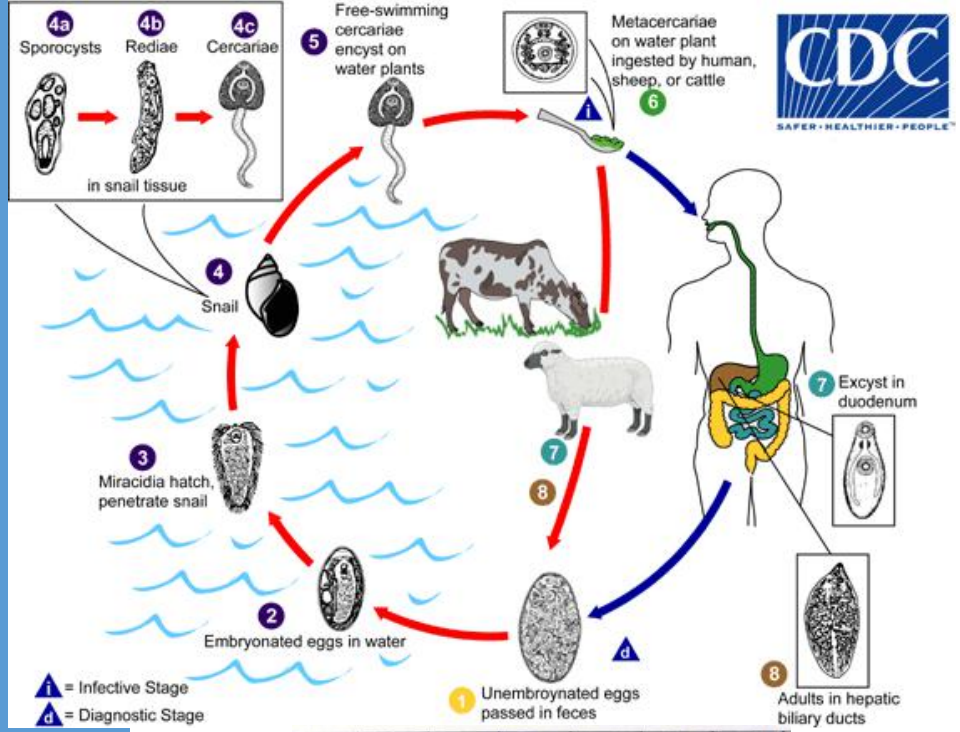
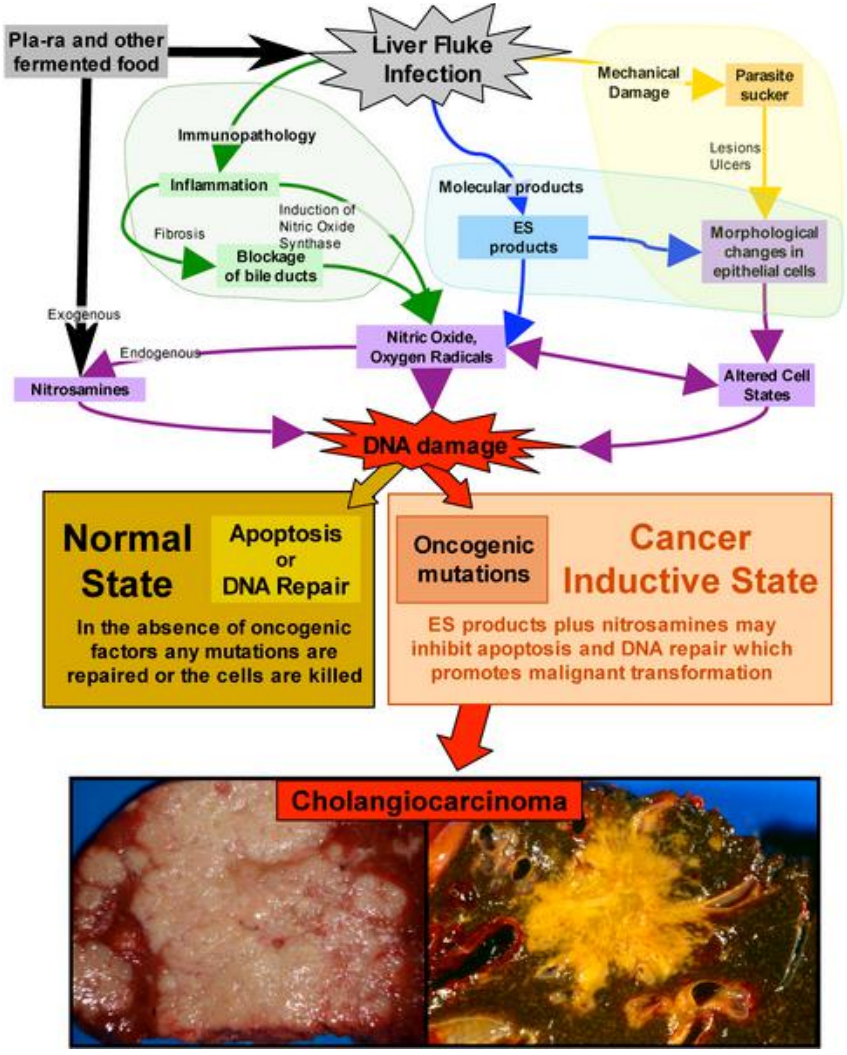


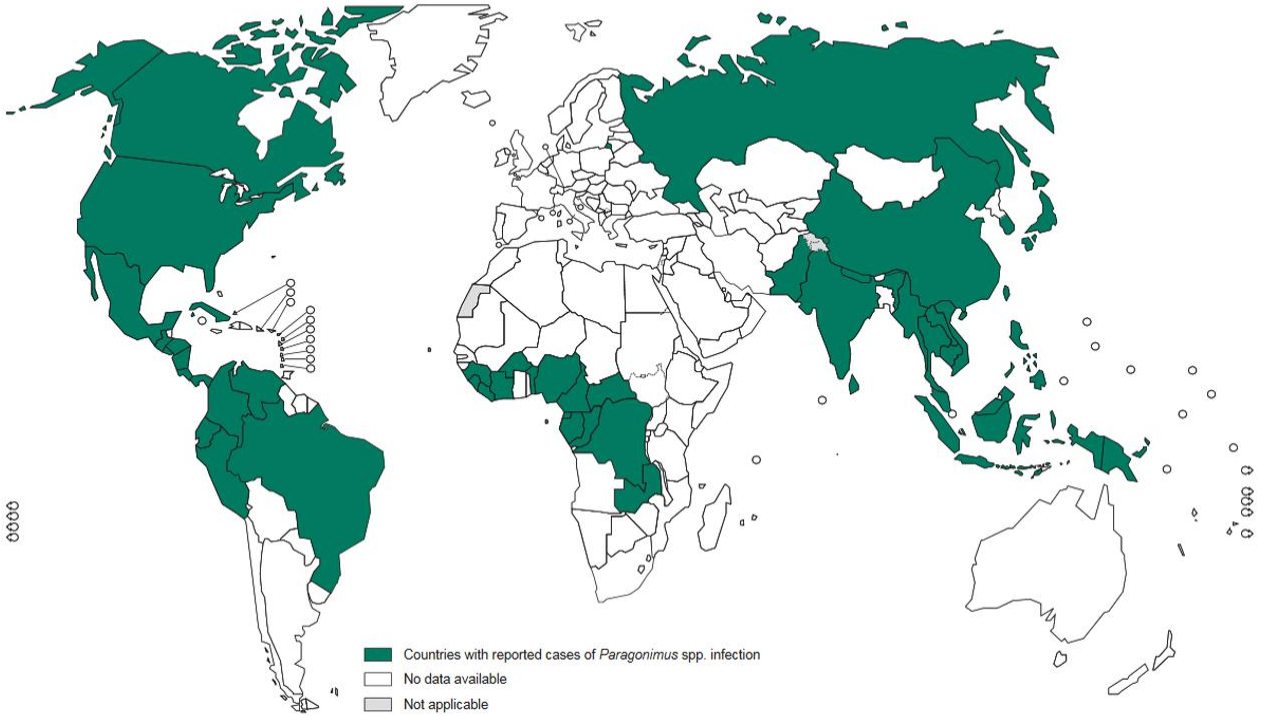
Figure 5. Proposed Mechanisms of Opisthorchis-Derived CCA Initiation

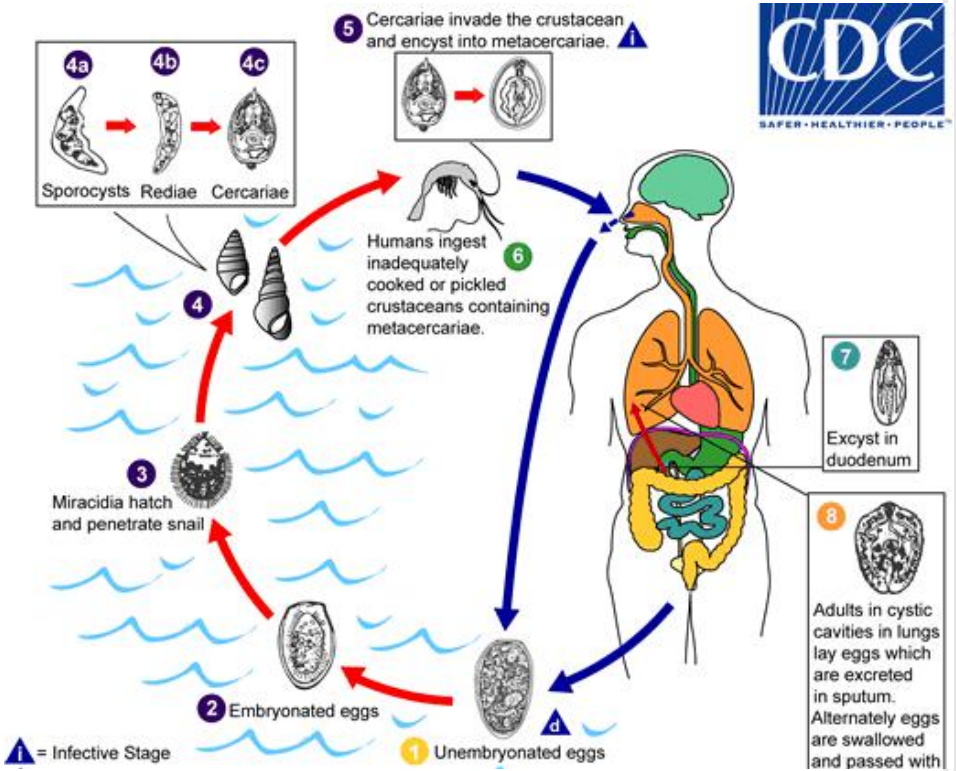


Sripa B, Kaewkes S, Sithithaworn P, Mairiang E, Laha T, et al. (2007) Liver Fluke Induces Cholangiocarcinoma. PLOS Medicine 4(7): e201. https://doi.org/10.1371/journal.pmed.0040201
http://journals.plos.org/plosmedicine/article?id=10.1371/journal.pmed.0040201

PLOS | MEDICINE

Fig. 4.7.4 Distribution of paragonimiasis, worldwide, latest year available

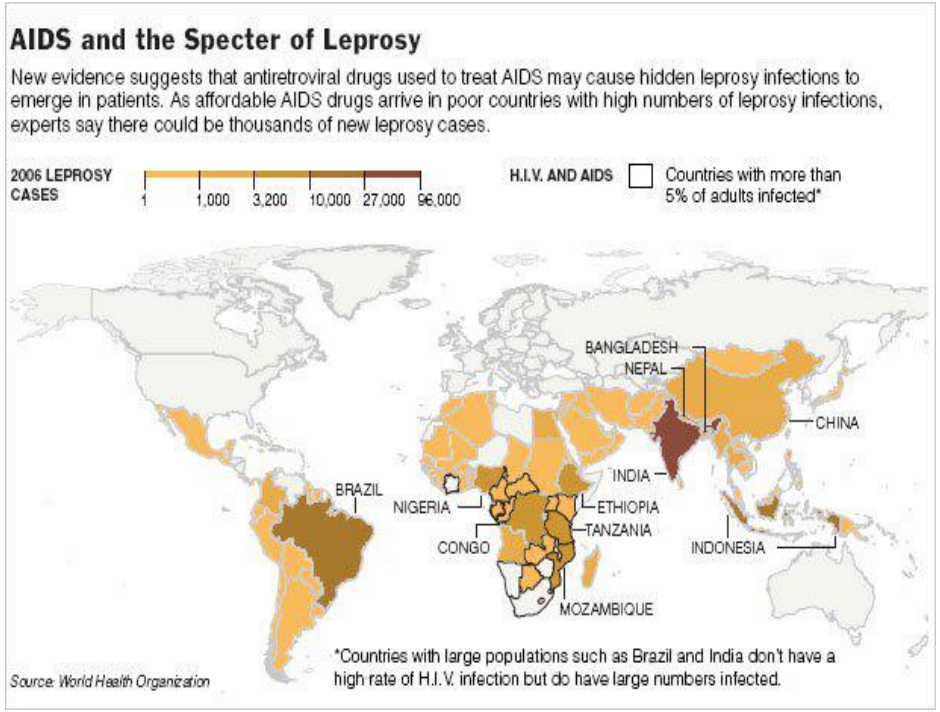




paragonimiasis

- *Paragonimus westermani* and several other species are found throughout eastern, southwestern, and southeast Asia; (including China, the Philippines, Japan, Vietnam, South Korea, Taiwan, and Thailand). *P. africanus* is found in Africa, and *P. mexicanus* in Central and South America.
- The infection is transmitted by eating infected crab or crawfish that is either, raw, partially cooked, pickled, or salted.
- Adult flukes living in the lung cause lung disease. After 2-15 days, the initial signs and symptoms may be diarrhea and abdominal pain. This may be followed several days later by fever, chest pain, and fatigue. The symptoms may also include a dry cough initially, which later often becomes productive with rusty-colored or blood-tinged sputum on exertion. Mistaken for tuberculosis.
- The diagnosis is usually made by identifying *Paragonimus* eggs in the sputum or sometimes in the stool.

Leprosy (Mycobacterium leprae) – "the course of leprosy in coinfected patients has not been greatly altered by HIV. "



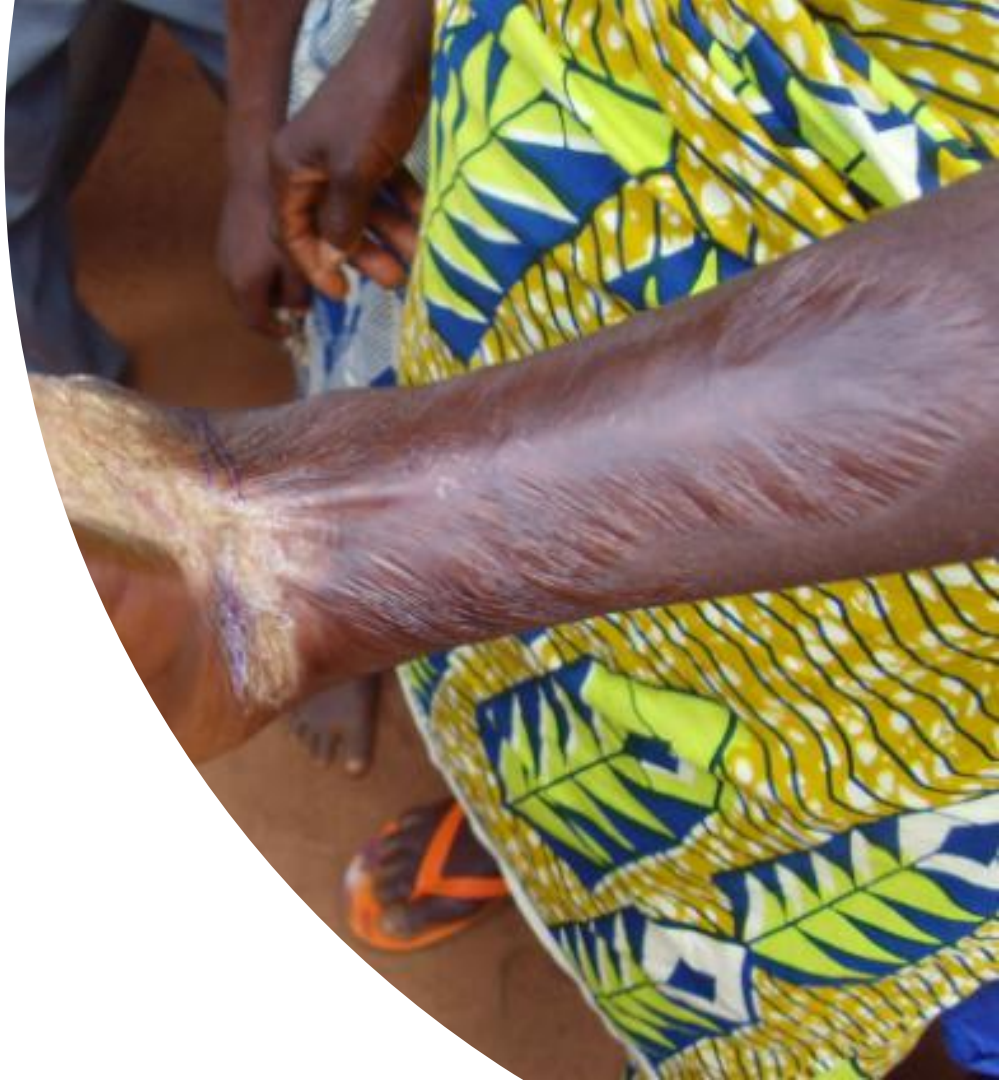
- Two East African studies reporting an increase multibacillary (MB) cases.
- Since the introduction of HAART borderline tuberculoid leprosy is the predominant form in Brazilian studies.
- Coinfected patients treated with standard length WHO-multi-drug therapy (MDT), have responded although possibly an increased relapse rate.
- A Ugandan study demonstrated an increased risk of developing type 1 reactions in an MB leprosy patient with HIV, and increased recurrence rates of type 1 reactions were seen in an Ethiopian study.
- In general, however, neuritis was not found to be more severe in HIV-positive cases.

Dermatologic Clinics Volume 29, Issue 1, January 2011, Pages 125-128

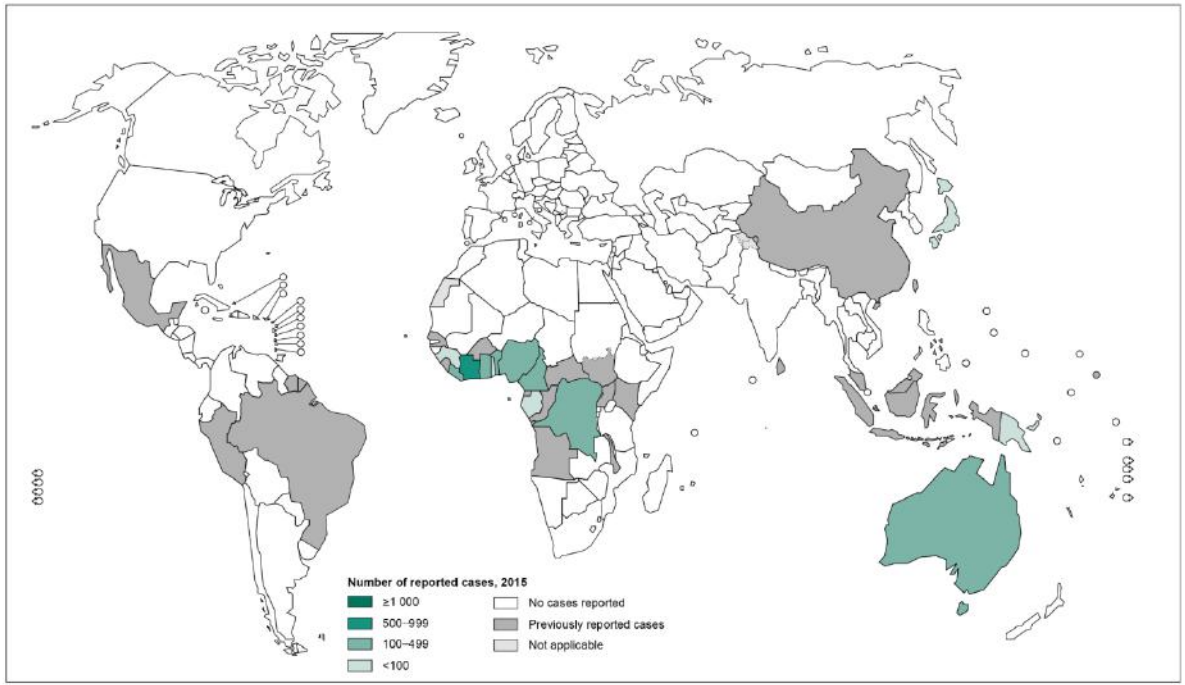
The New York Times October 23, 2006

Buruli ulcer: early detection and antibiotic treatment can cure this debilitating skin condition

- Buruli ulcer is an ulcerative skin disease caused by the bacterium *Mycobacterium ulcerans*.
- It often starts as painless nodules, usually on the arms and legs. These then develop into large ulcers with a whitish-yellow base.
- Buruli ulcer can be cured with early detection and a combination of antibiotics.
- But, if diagnosed late, the condition can lead to permanent disfigurement and disability.
- M. ulcerans produces a toxin – mycolactone – which destroys tissue, infection leads to destruction of skin and soft tissue with large ulcers.
- Lesions frequently occur in the limbs: 35% on the upper limbs, 55% on the lower limbs, and 10% on the other parts of the body



Distribution of Buruli ulcer, worldwide, 2015

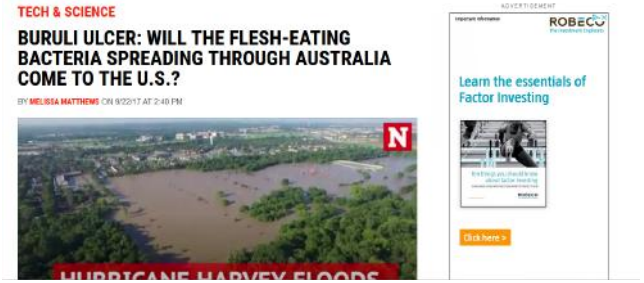


Data Source: World Health Organization
Map Production: Control of Neglected Tropical Diseases (NTD)
World Health Organization

World Health Organization

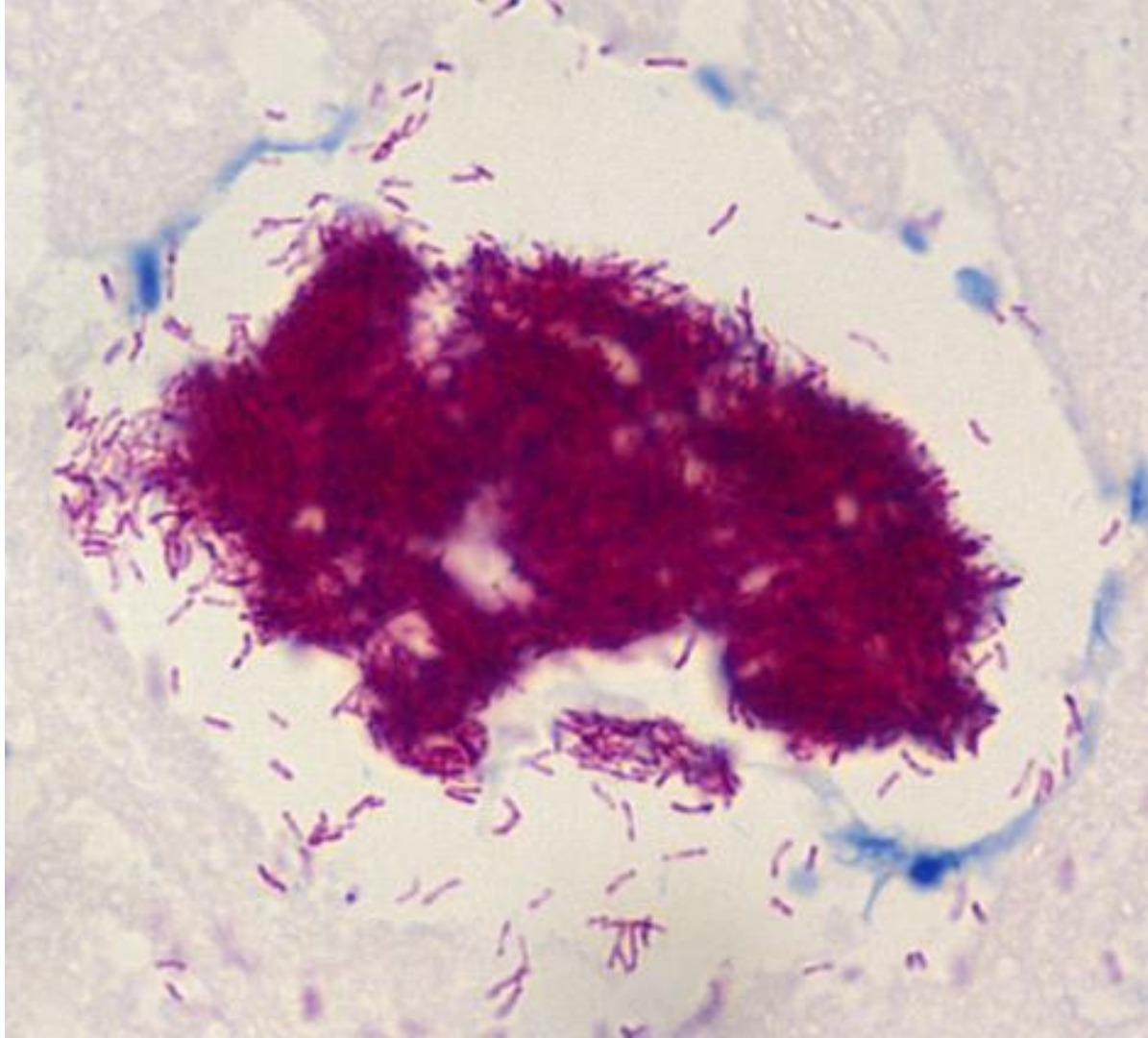
Epidemiology

- Mainly in humid, rural, tropical regions with limited access to medical care.
- It has been reported in about 33 (mostly tropical) countries, with the greatest frequency in Africa, particularly in the West African countries of Côte d'Ivoire, Ghana, and Bénin (20 to 158 cases per 100,000)
- Cases have also been described in Mexico, South America, Papua New Guinea, and Australia (Bairnsdale ulcer)
- In Victoria, Australia, and in Japan transmission has been observed in moderate, nontropical climates.
- The peak age group in West Africa studies is 5 to 15 years, although Buruli ulcer can affect any age group
- In Japan, the median age is 40 to 57 years, and, in Australia, the median age is 50 to 66 years .
- The mode of transmission is not fully understood, although the disease is known to be linked to contaminated water probably through skin breaks.
- The disease has a low mortality rate, but its disabling sequelae have an enormous physical and socioeconomic impact on affected individuals.



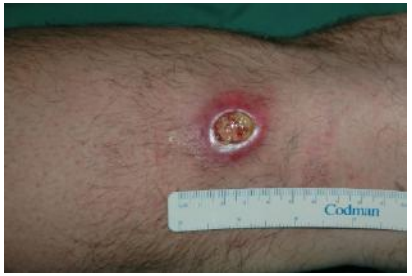
Diagnosis

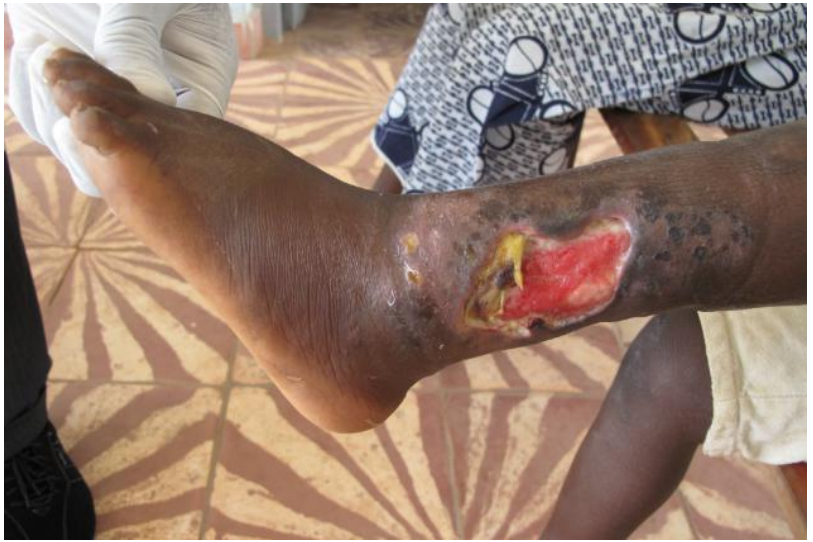
- Acid-fast staining
- Culture *M. ulcerans* is a slow-growing mycobacterium that can be cultured in vitro at 29 to 33°C
- Histology – Histology has good sensitivity up to 82 percent
- PCR – PCR for *M. ulcerans* utilizes the insertion sequence 2404 as research tool



Treatment

- Surgical for small lesions
- Rifampin and streptomycin currently for 8 weeks
- Combined surgery and antibiotics
- Trials ongoing of oral regimen rifampicin plus moxifloxacin or clarithromycin
- Treatment of *Mycobacterium ulcerans* disease (Buruli ulcer): guidance for health workers, World Health Organization, Geneva (2012)





HIV infection is not a risk factor but . . .

- Possibly slightly higher incidence of HIV in BU patients vs population
- 2.6% versus 0.3% in Benin
- But only 8.2% versus 4.8% in Ghana

- However clinicians tend to treat for longer
- More relapses
- More need for surgical intervention
- Drug interactions with rifampicin and ARVs
- ?IRIS or paradoxical reaction to antibiotics

AIDS 22:901–903

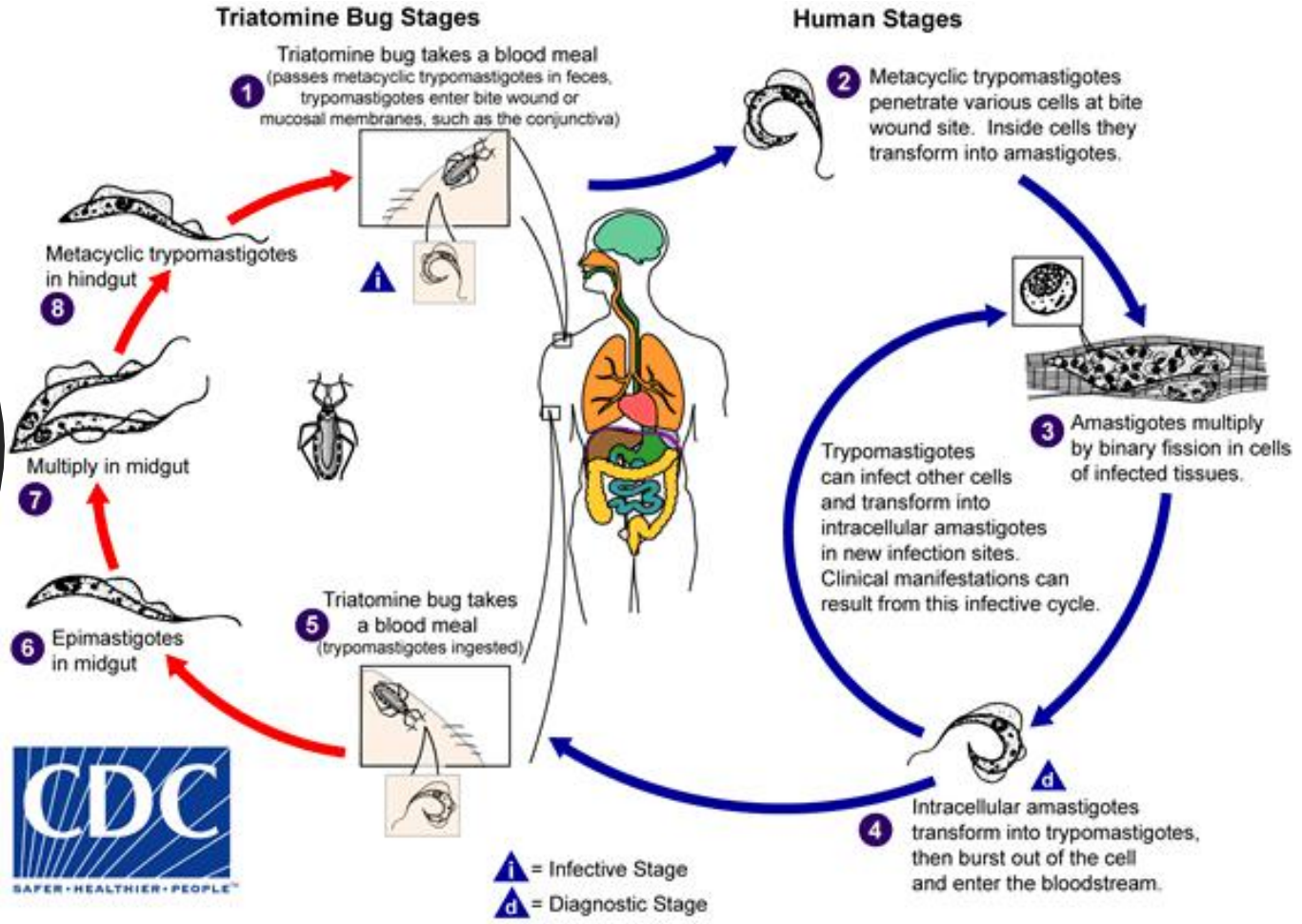
Am. J. Trop. Med. Hyg.,93(2), 2015, pp. 216–223

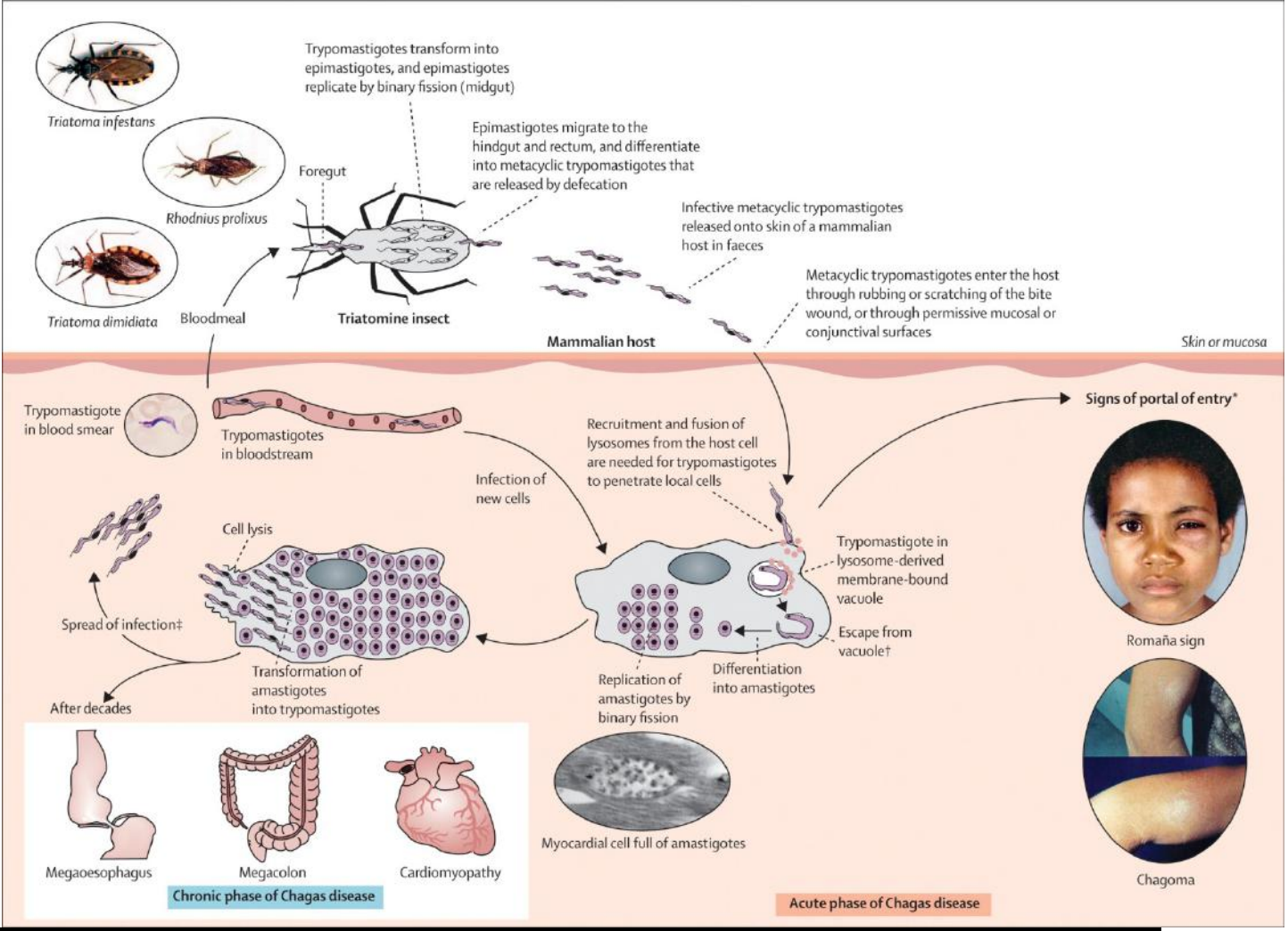
Rev Med Suisse, 8 (2012), pp. 1792-1793

Review in The Lancet Infectious Diseases 14: (5) 2014, P435-440

And 14:(9) 2014, P796-797

American trypanosomiasis





The Lancet 2010 375, 1388-1402DOI: (10.1016/S0140-6736(10)60061-X)

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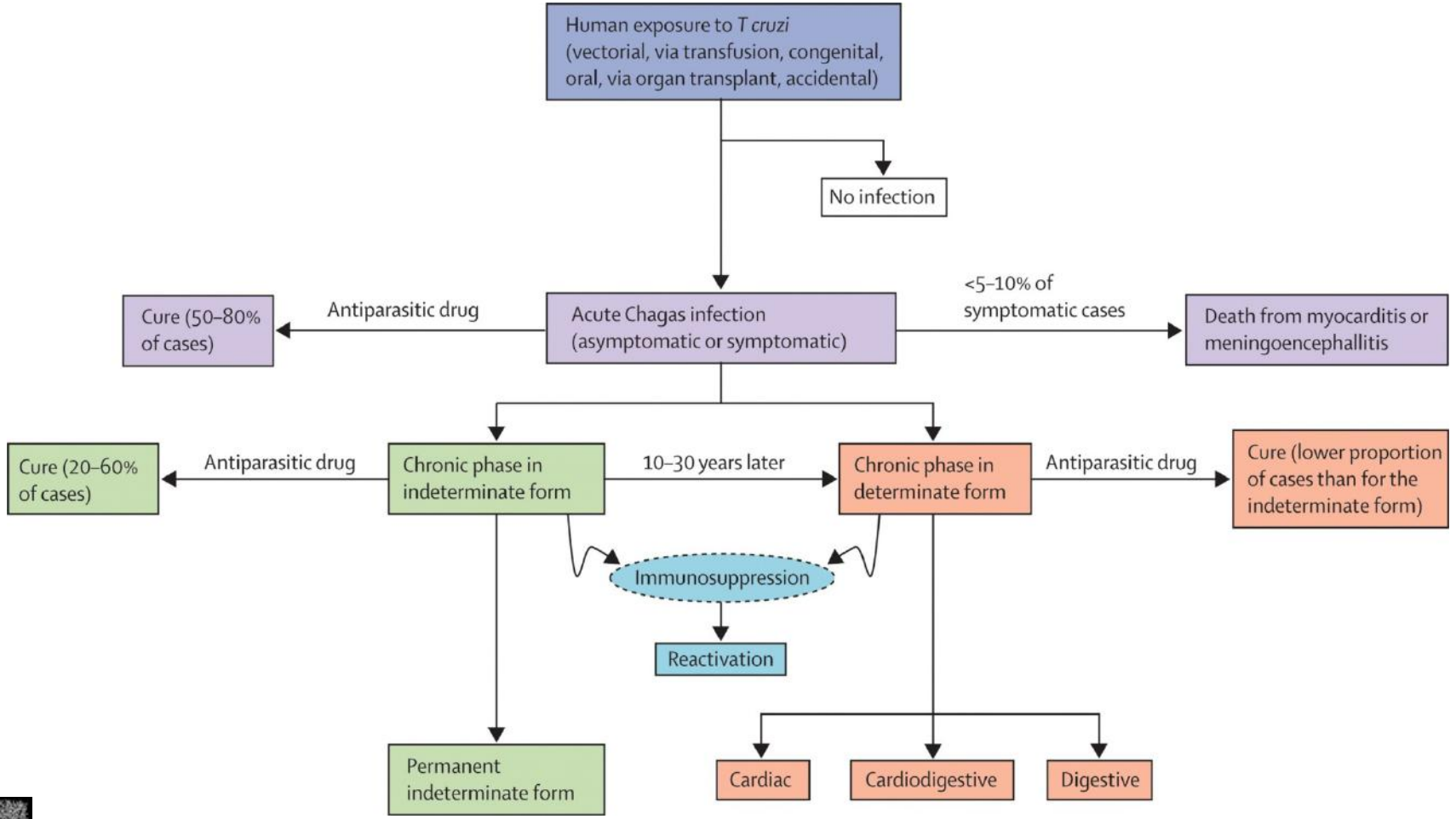

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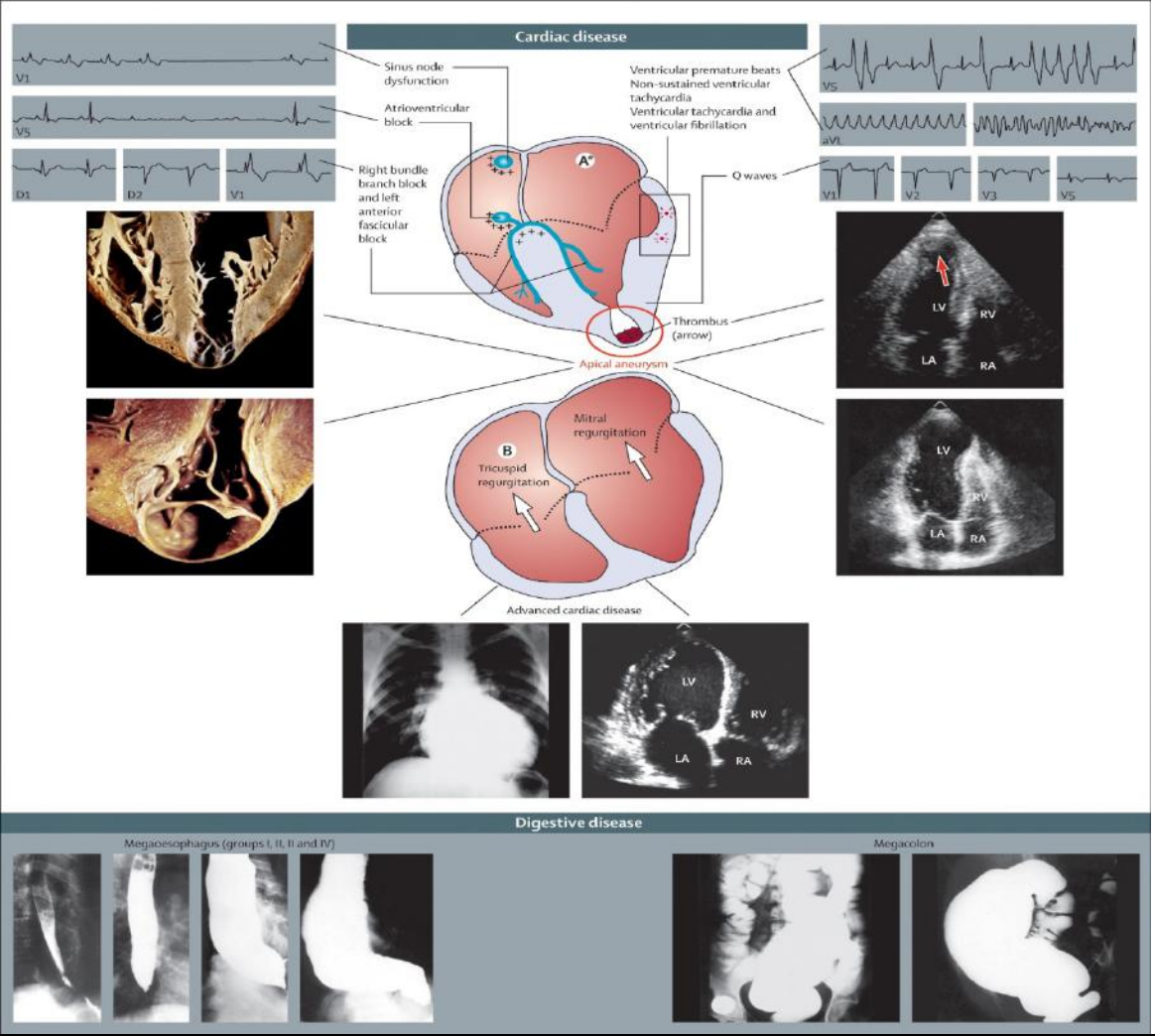

The Lancet 2010 375, 1388-1402DOI: (10.1016/S0140-6736(10)60061-X)

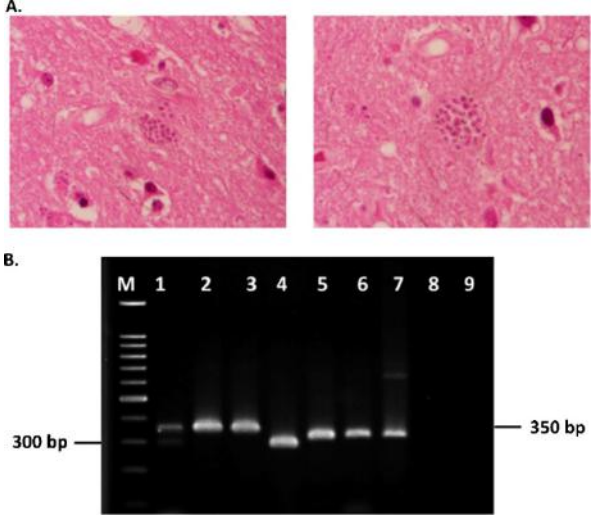

Figure 1. Detection and characterization of *Trypanosoma cruzi* in post-mortem biopsies from heart and brain tissues. (A) Hematoxylin and eosin stained sections from brain tissues; a *T. cruzi* amastigote nest is present in the brain tissue (original magnification ×100). (B) PCR amplification of DNA and characterization from *T. cruzi* present in tissues. Lanes 1–4 are amplification products of the intergenic region of the mini-exon: lane 1, heart tissue; lane 2, brain tissue; lane 3, TcI control (350 bp); lane 4, TcII control (300 bp). Lanes 5–7 are amplification products of kDNA: lane 5, heart tissue; lane 6, brain tissue; lane 7, TcI control (330 bp). Lanes 8 and 9 are negative controls. Electrophoresis on a 2% agarose gel visualized by staining with Gel Red 100-bp weight marker.

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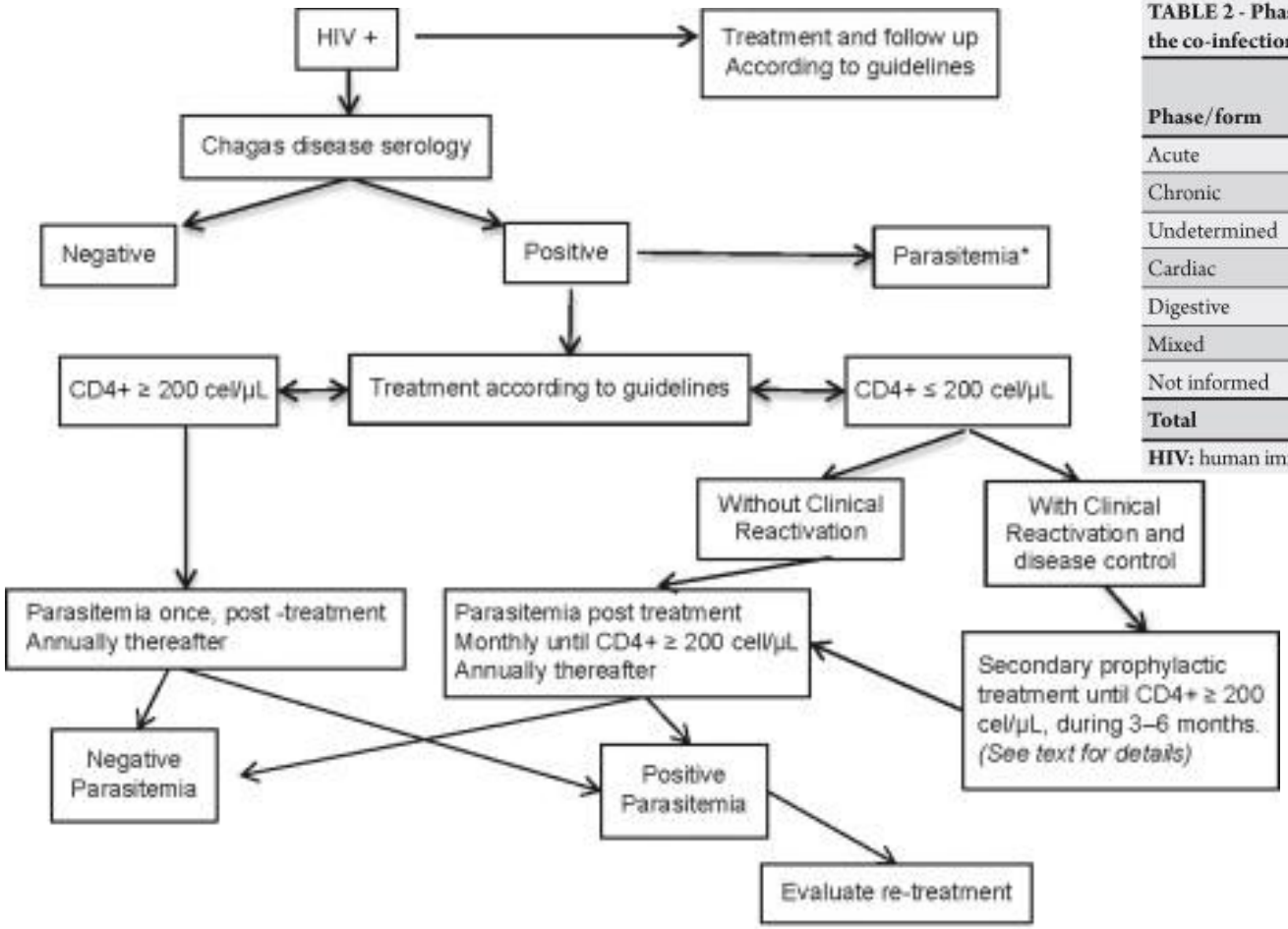


*Parasitemia: Identification of parasites in blood; qPCR: significant values yet to be determined

TABLE 2 - Phase and clinical forms of the Chagas disease in individuals with the co-infection *T. cruzi*/HIV and published in the period from 1980 to 2010.

	Cases	
Phase/form	**n**	**%**
Acute	6	2.0
Chronic	285	97.9
Undetermined	60	50.8
Cardiac	44	37.3
Digestive	6	5.1
Mixed	8	6.8
Not informed	173	59.5
Total	**291**	

HIV: human immunodeficiency virus.

Management of Trypanosoma cruzi coinfection in HIV-positive individuals outside endemic areas.
Perez-Molina, Jose

Current Opinion in Infectious Diseases. 27(1)9-15, February 2014.
DOI: 10.1097/QCO.0000000000000023

KEY POINTS

- Chronic *T. cruzi* infection in HIV-infected patients can behave as an opportunistic disease, mainly affecting the central nervous system and heart; morbidity and mortality are high.
- Screening for *T. cruzi* should be performed in all HIV-infected individuals from endemic areas, potentially exposed individuals from nonendemic countries and in the children of infected mothers.
- Diagnosis of chronic infection is based on serology; in reactivations, it is confirmed using direct parasitological methods and/or histopathology.
- Benznidazole and nifurtimox are indicated for parasiticidal treatment, although the ideal duration of therapy remains unknown, as does the need for and duration and dosing of secondary prophylaxis.
- Early diagnosis of HIV-infection and cART play a key role in preventing reactivations and relapses and improving prognosis.

TABLE 4 - Number of CD4+ T Cells in individuals with the co-infection *T. cruzi*/HIV and published in the period from 1980 to 2010.

Number	CD4+ T cells	CD4+ T cells – non reactivation	CD4+ T cells – reactivation
Minimum	1 cell/mm³	44 cells/mm³	1 cell/mm³
Maximum	1949 cells/mm³	1949 cells/mm³	551 cells/mm³
Average	339,5 cells/mm³	561,5 cells/mm³	98,4 cells/mm³

HIV: human immunodeficiency virus; **CD4:** cluster of differentiation 4.

TABLE 5 - Survival in individuals with the co-infection *T. cruzi*/HIV and published in the period from 1980 to 2010.

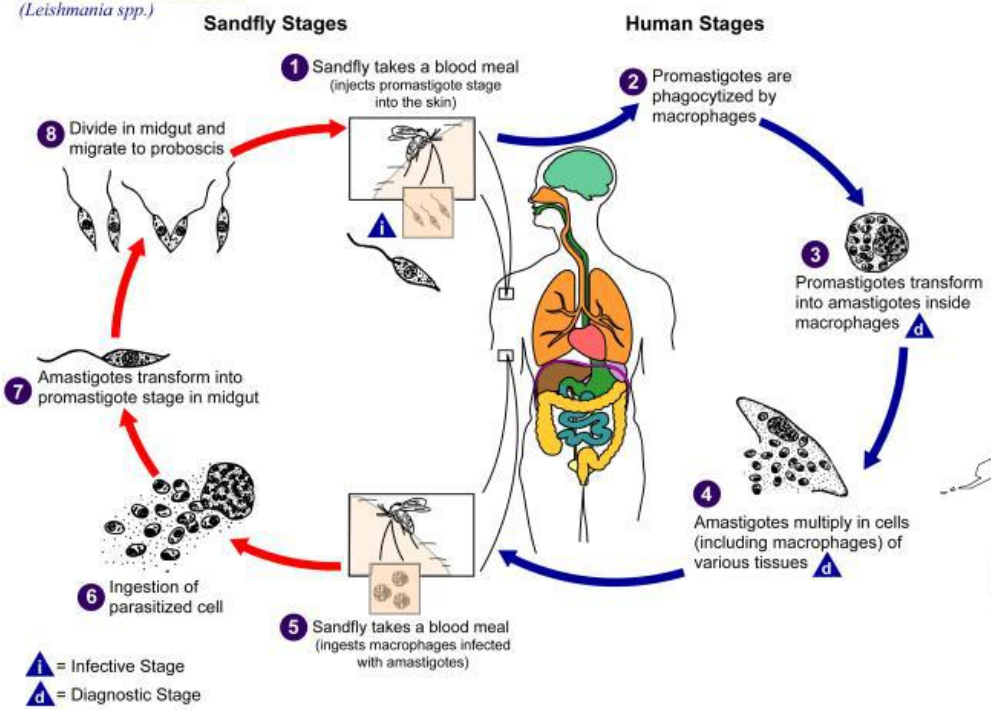
Survival	General	Non-reactivation	Reactivation
Minimum	1 day	2 months	1 day
Maximum	11 years	11 years	5 years
Média	1,7 years	2,8 years	10,6 months

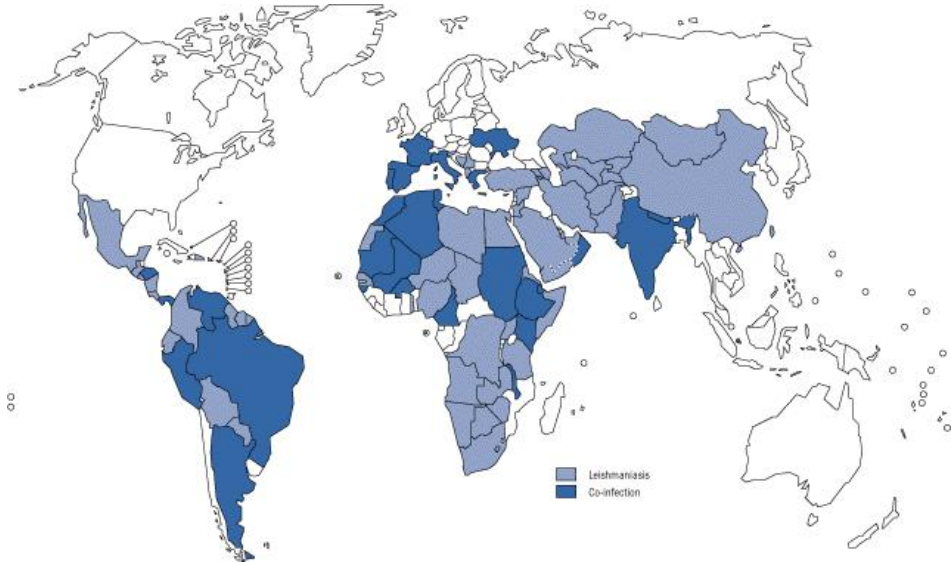
HIV: human immunodeficiency virus.

ALMEIDA, Eros Antonio de; RAMOS JUNIOR, Alberto Novaes; CORREIA, Dalmo and SHIKANAI-YASUDA, Maria Aparecida. Co-infection Trypanosoma cruzi/HIV: systematic review (1980 - 2010). *Rev. Soc. Bras. Med. Trop.* [online]. 2011, vol.44, n.6 [cited 2017-11-10], pp.762-770

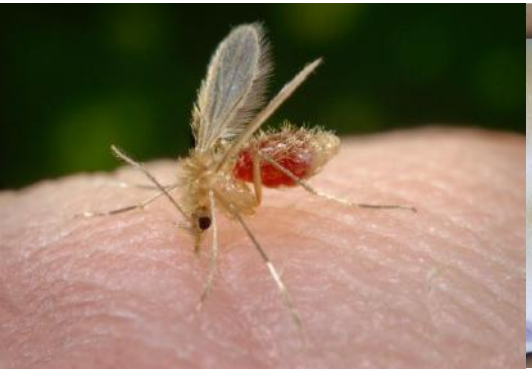
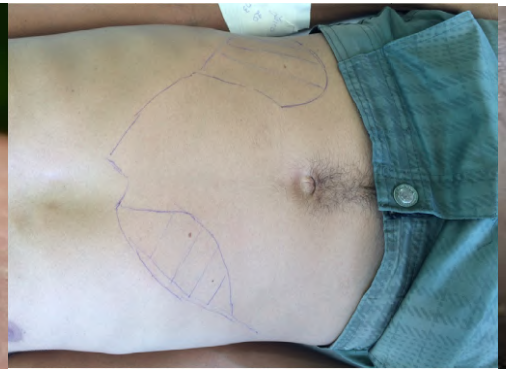
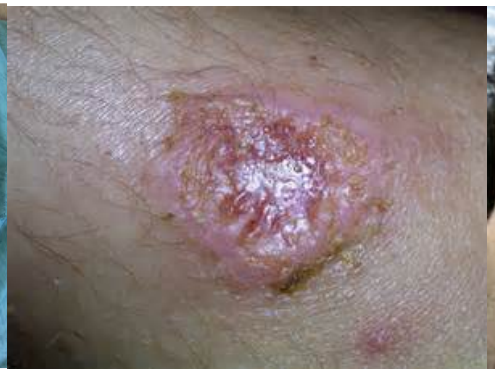
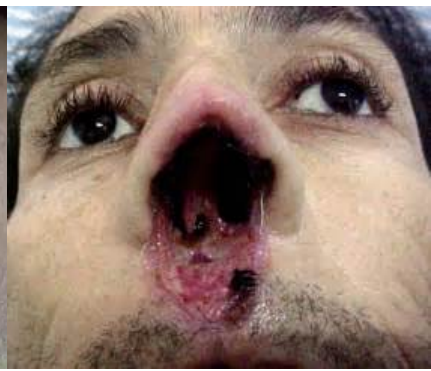
Leishmaniasis

(Leishmania spp.)





“Human immunodeficiency virus (HIV) coinfection of VL has been identified as an emerging challenge for VL control.”

HIV infection increases the risk of visceral leishmaniasis and, conversely, VL accelerates HIV disease progression. The problem is severe in parts of eastern Africa, particularly Ethiopia, where the prevalence of HIV infection in VL patients was reported to be as high as 40 percent in earlier studies and 18 percent in subsequent publication

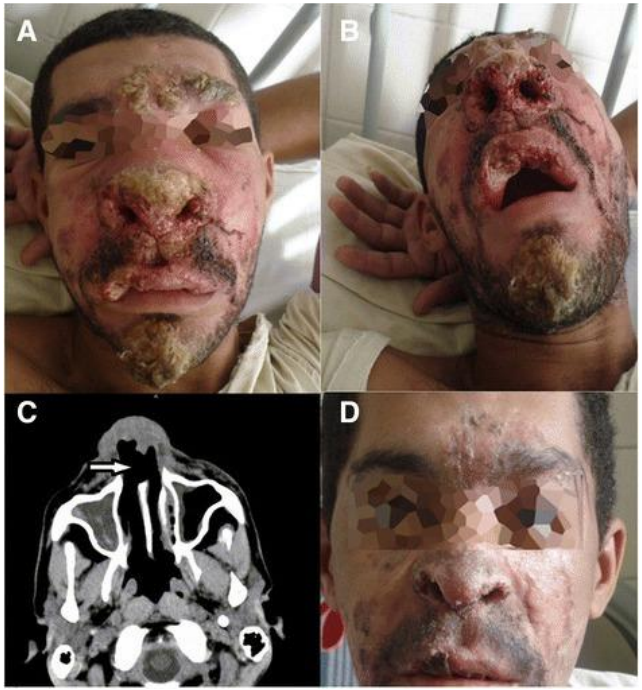
Visceral leishmaniasis and HIV coinfection: time for concerted action. van Griensven J, Zijlstra EE, Hailu A PLoS Negl Trop Dis. 2014;8(8):e3023.

In Brazil in 2011, the ministry of health noted a coinfection rate of 6 percent of VL cases.

Another study among 2077 patients with VL in Bihar, India, noted 2.4 percent with newly diagnosed HIV infection. HIV and visceral leishmaniasis coinfection in Bihar, India: an underrecognized and underdiagnosed threat against elimination. Burza S, Mahajan R, Sanz MG, Sunyoto T, Kumar R, Mitra G, Lima MA Clin Infect Dis. 2014;59(4):552.

Clinical manifestations

- Splenomegaly was observed less frequently observed in the setting of HIV-coinfection (80 versus 97 percent in one series)
- Patients with profound immunosuppression CD4 <50, may present with infection in atypical sites eg. gastrointestinal tract, peritoneum, lung, pleura, and skin.
- Oesophageal involvement can lead to dysphagia and odynophagia.
- Mucocutaneous manifestations include nonulcerative cutaneous lesions that may mimic Kaposi's sarcoma, nodular diffuse leishmaniasis, mucosal lesions, and Post-kala-azar dermal leishmaniasis (PKDL) .
- IRIS can occur.

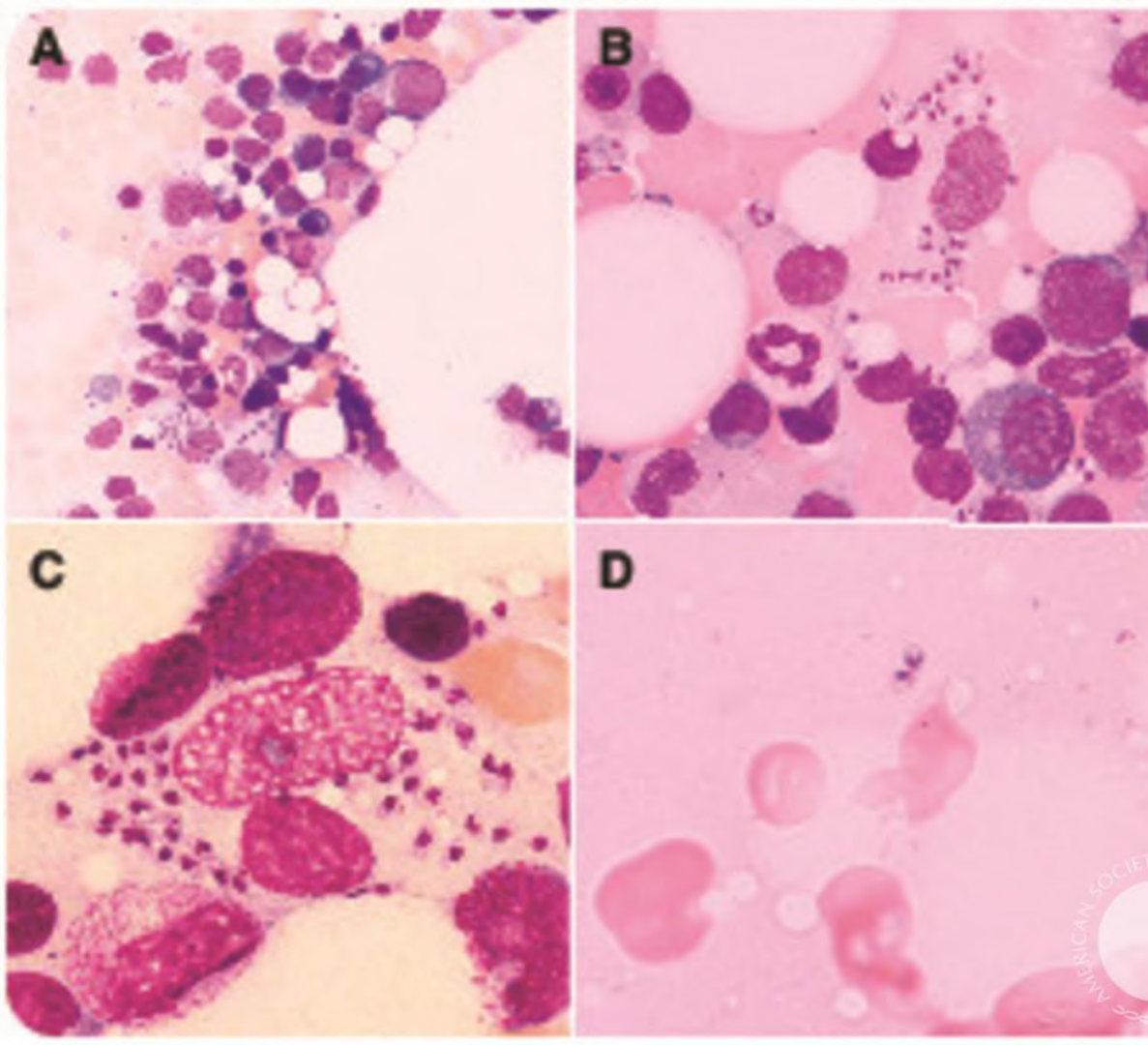


Immune response to Leishmania antigens in an AIDS patient with mucocutaneous leishmaniasis as a manifestation of immune reconstitution inflammatory syndrome (IRIS): a case report. Gois L, Badaró R, Schooley R, Grassi MF - BMC Infect. Dis. (2015)

Visceral leishmaniasis in human immunodeficiency virus (HIV)-infected and non-HIV-infected patients. A comparative study. Pintado V, Martín-Rabadán P, Rivera ML, Moreno S, Bouza E Medicine (Baltimore). 2001;80(1):54.

Diagnosis

- HIV-VL coinfected patients tend to have relatively low antibody titers.
- In one study, the sensitivity of serological tests ranged from 25 to 50 percent
- Histopathologic or molecular confirmation is best for definitive diagnosis especially as the parasite load in peripheral blood specimens is generally high in HIV
- Bone marrow or splenic aspirate most commonly used.
- The parasite load tends to be inversely proportional to the CD4 count;
- in patients with very low CD4 counts, PCR and blood culture have high sensitivity, and amastigotes may be visualized in buffy coat smears.

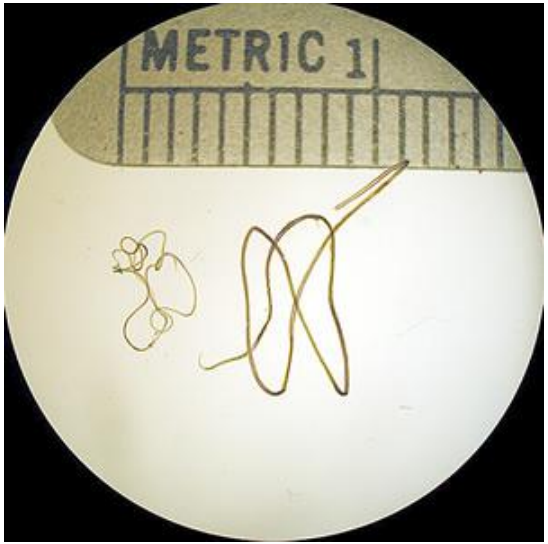


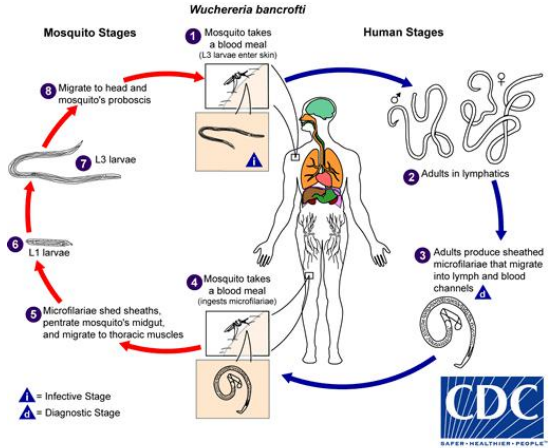
Treatment

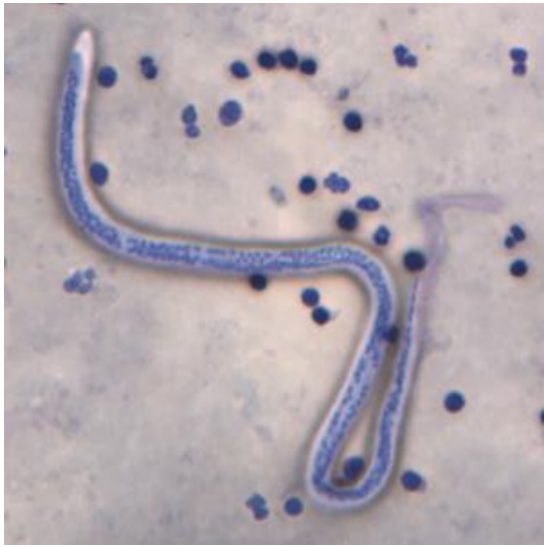
- Liposomal amphotericin B is the treatment of choice for patients with HIV and VL coinfection.
- Liposomal and lipid complex preparations are significantly better tolerated than conventional amphotericin B or pentavalent antimony, although these agents have comparable efficacy.
- Antiretroviral therapy should be initiated or optimized as soon as the patient is sufficiently able to tolerate it (eg, either during or soon after the initial course of therapy for VL).

Diagnosis and Treatment of Leishmaniasis: Clinical Practice Guidelines by the Infectious Diseases Society of America (IDSA) and the American Society of Tropical Medicine and Hygiene (ASTMH) (2016).

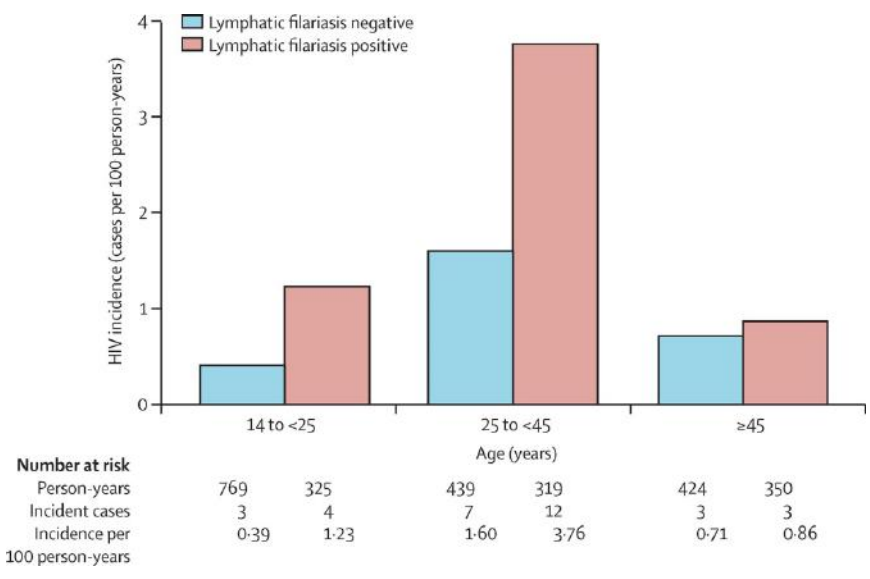
- The optimal regimen for secondary prophylaxis is uncertain.
- One controlled trial demonstrated lower relapse rates at one year with intermittent administration of amphotericin B lipid complex (3 mg/kg every 21 days) compared with no prophylaxis (50 versus 78 percent, respectively).
- Decreased relapse rates have also been observed in retrospective studies of prophylaxis with monthly sodium stibogluconate (SSG; 850 mg) or liposomal amphotericin B (200 to 350 mg)
- In addition, pentamidine may be an effective agent for secondary prophylaxis in HIV-VL–coinfected patients in Africa

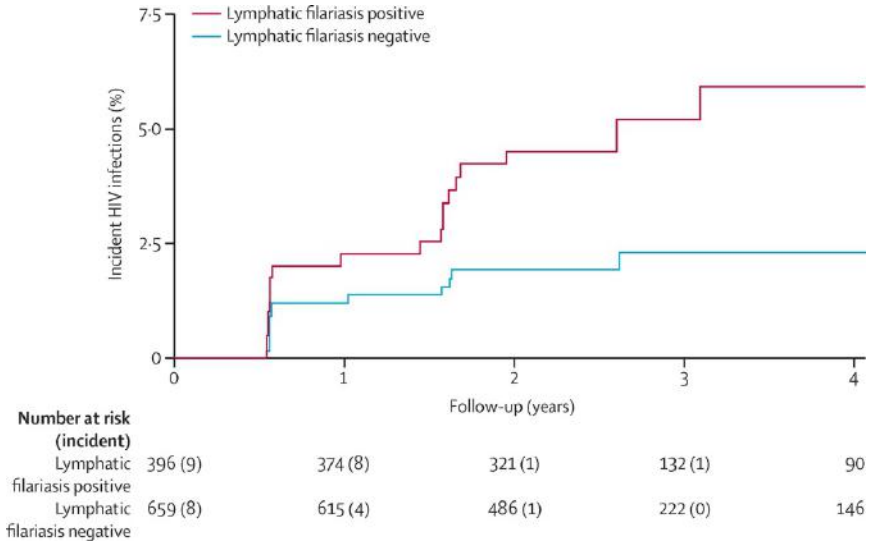






Lymphatic filiariasis



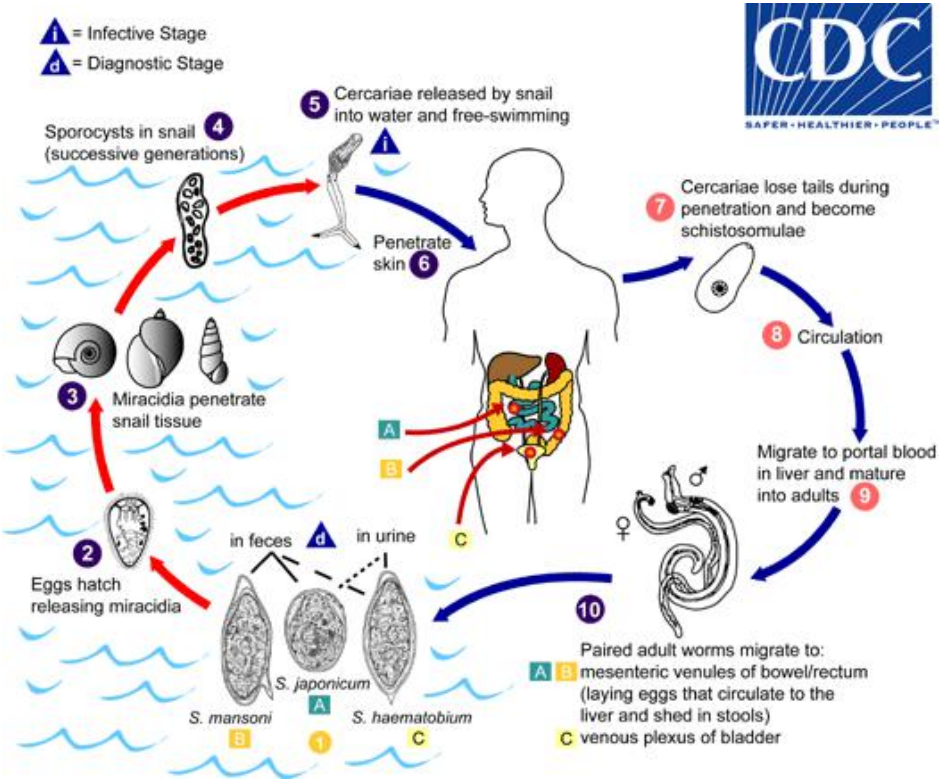


Lymphatic filariasis status is an independent and significantly relevant risk factor for HIV infection. The age-adjusted and sex-adjusted incidence rate ratio was 2·17 (95% CI 1·08–4·37, p=0·0300). Kroidi et al The Lancet Volume 388, Issue 10054, 15–21 October 2016, Pages 1912-1920

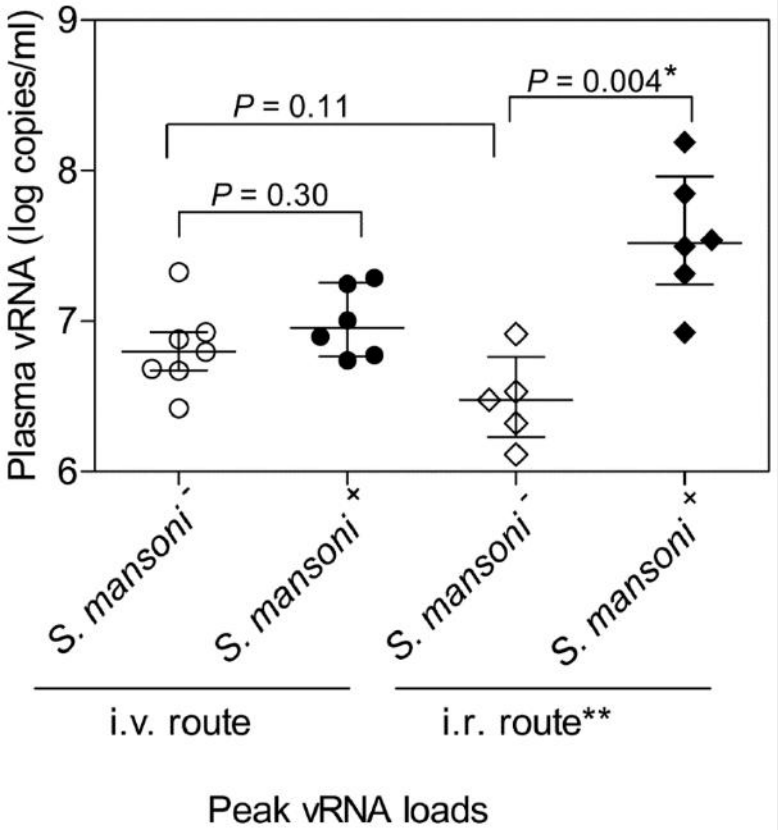
The adult worm of *W bancrofti* lives for 10–12 years in the lymphatic system and is not killed by single-dose treatment.

- Ivermectin or Diethylcarbamazine plus doxycycline
- Prior to DEC onchocerciasis should be excluded in all patients with a consistent exposure history due to the possibility of severe exacerbations of skin and eye involvement (Mazzotti reaction).
- DEC should be used with extreme caution in patients with circulating Loa loa microfilarial levels > 2,500/mm3 due to the potential for life-threatening side effects, including encephalopathy and renal failure.
- Ivermectin and DEC kills only the microfilariae, but not the adult worm; the adult worm is responsible for the pathology of lymphedema and hydrocele.
- Adult worm killing with treatment with doxycycline (200mg/day for 4–6 weeks).

Schistosomiasis



Having *S. haematobium* or living in a highly endemic area appeared to increase the risk of HIV infection approximately 3-fold

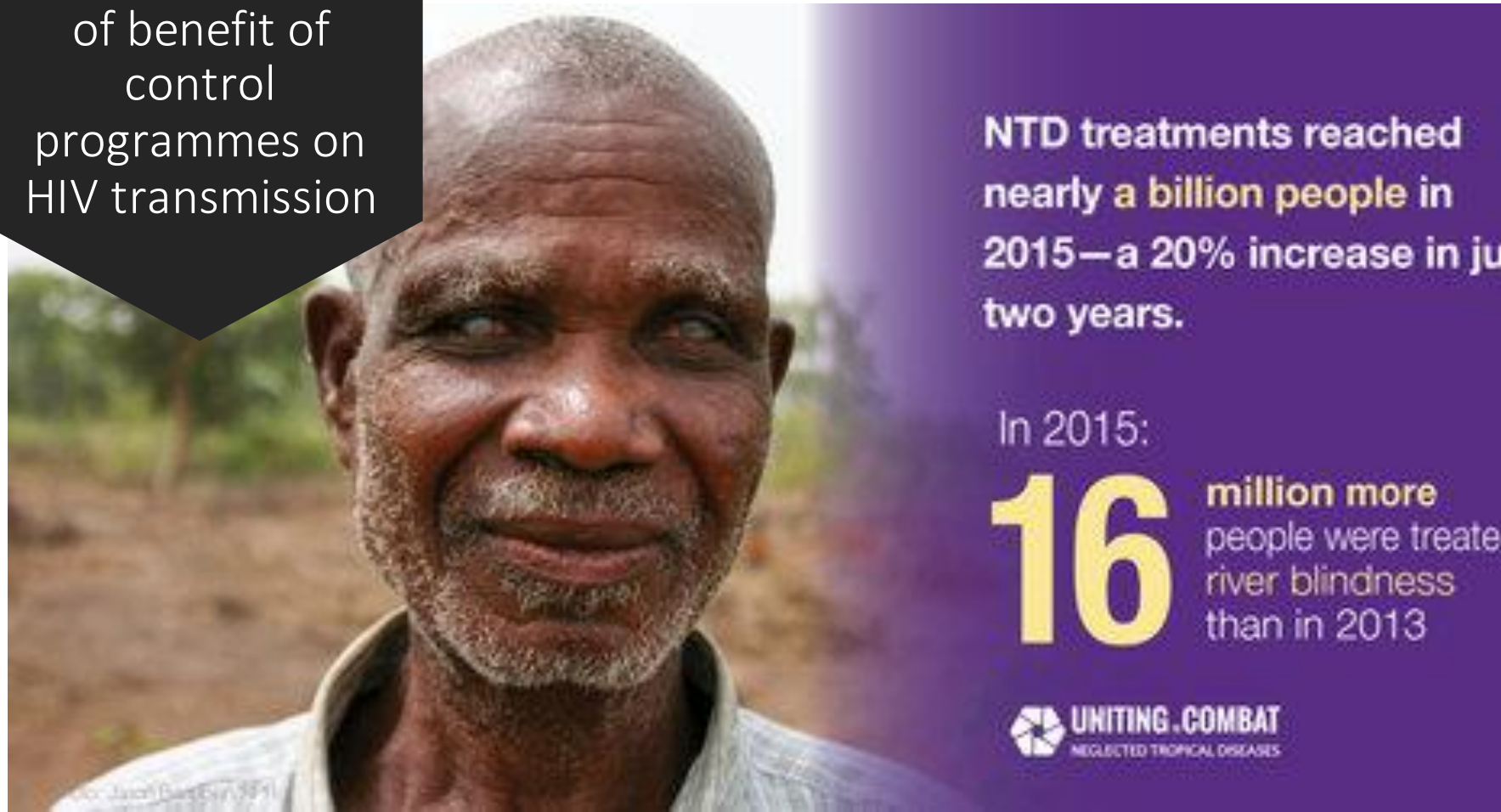


- Siddappa NB, Hemashettar G, Shanmuganathan V, Semenya AA, Sweeney ED, Paul KS, et al. (2011) *Schistosoma mansoni* Enhances Host Susceptibility to Mucosal but Not Intravenous Challenge by R5 Clade C SHIV. PLoS Negl Trop Dis5(8): e1270.

Treatment

Schistosoma species infection	Praziquantel dose and Duration
Schistosoma mansoni, S. haematobium, S. intercalatum	40 mg/kg per day orally in two divided doses for one day
S. japonicum, S. mekongi	60 mg/kg per day orally in three divided doses for one day

No real evidence of benefit of control programmes on HIV transmission



THE ROYAL SOCIETY

doi 10.1098/rstb.2000.0739

The omnivorous Tyrolean Iceman: colon contents (meat, cereals, pollen, moss and whipworm) and stable isotope analyses

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The contents of the colon of the Tyrolean Iceman who lived *ca.* 5300 years ago include muscle fibres,


END THE NEGLECT
They're called NTDs