# NTDs in Global Health

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# Case: Malnutrition & Anemia

HPI: Jose is a 2 ½ yo Honduran boy brought in for a check up at a clinic in Honduras. Mom is concerned because Jose doesn't seem hungry. He was hospitalized once at the age of 6 months for pneumonia. He had two episodes of diarrhea last year.

SH: Mom is raising Jose, as well as his 3 older brothers and sister alone. Their father went to the US to work, but they haven't seen much money come back yet. There is sometimes not enough money to buy food.

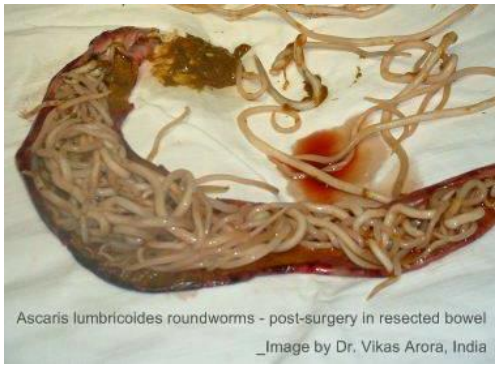
PE: VS: Height: 86 cm, Weight 10 kg (Wt for Age z-score: -2.0). Temp 99.1. He is sitting on mom's lap, alert; poor appearing, barefoot. His hair is thin but normal in color. His conjunctiva appear mild pale. His abdomen is distended, but nontender. Remainder of exam is unremarkable.

# Case: Malnutrition & Anemia

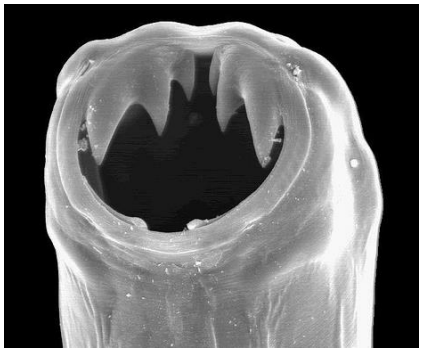
- What do you think is the cause of Jose's malnutrition and anemia?
- How would you treat Jose?

# STHs

- **Roundworm (Ascariasis) (1.2b infected)**
  - *Ascaris lumbricoides* (up to 40cm)
  - Fecal-oral (egg lasts up to 6 yrs in soil)
  - Abd pain, obstruction (likes jejunum), eosinophilic pneumonitis, CBD obstrxn
  - Dx pearl: Prepatent period of 2 months
  - Tx: Albendazole* (better GI absorption and tissue distribution than Mebendazole; Preg Cat C)




- **Hookworm (740m infected)**
  - *Necator americanus, Ancylostoma duodenale* (1cm)
  - Fecal-oral, Skin penetration (larvae "quest" on grass blades)
  - Clinical: Ground itch, pneumonitis, abd pain, anemia, impaired cognitive development (IQ decrease of 10 pts), low protein
  - Tx: Albendazole



- **Whipworm (795m infected)**
  - *Trichuris trichiura* (up to 3-5cm, shaped like whip)
  - Fecal-oral
  - 90% asymptomatic, Growth retardation, rectal prolapse (likes cecum)
  - Tx: Mebendazole (high dose) OR Albendazole 3 days OR Oxantel-Pamoate w/ Albendazole single dose

*__Benzimidazoles__ bind nematode beta-tubulin to prevent microtubule assembly to stop cell division in adults and eggs; also inhibit glucose uptake in worm

# The Helminths

- **Nematodes** **"Roundworms"**
  - Intestinal
    - Roundworm — Ascaris lumbricoides
    - Hookworm — Necator americanus, Ancylostoma duodenale
    - Whipworm — Trichuris trichiura
    - Pinworm — Enterobius vermicularis
    - Threadworm — Strongyloides stercolaris
  - Filarial — Examples: Wuchereria bancrofti, Loa loa, Onchocerca volvulus
  - Other Tissue — Examples: Dracunculus medinensis, Trichinella spp, Toxocara spp, Ancylostoma spp
- **Cestodes** **"Tapeworms"**

  Examples:

  Taenia solium (and other Taenia spp)

  Echinococcus
- **Trematodes** **"Flukes"**

  Examples:

  Schistosomiasis (hematobium)

  Intestinal Flukes: Fasciolopsis

  Liver Flukes: Opisthorchis, Clonorchis

  Lung Fluke: Paragonimus

Red = NTDs

# Helminths - Treatment

**"Roundworms" → <u>Benzmidazoles (Albendazole)</u>**

Examples:

Ascaris lumbricoides

Necator americanus, Ancylostoma duodenale

Trichuris trichiura (Albendazole + Oxantel Pamoate OR high-dose/longer course Benzmidazoles)

Enterobius vermicularis

Strongyloides stercolaris (Ivermectin)

Examples: Wuchereria bancrofti, Loa loa, Onchocerca volvulus

Examples: Dracunculus medinensis, Trichinella spp, Toxocara spp, Ancylostoma spp

**"Tapeworms" → <u>Benzmidazoles (Albendazole)</u>**

Examples:

Taenia solium (and other spp)

Echinococcus

**"Flukes" → <u>Praziquantel</u>**

Examples:

Schistosomiasis

Intestinal Flukes: Fasciolopsis (Triclabendazole)

Liver Flukes: Opisthorchis, Clonorchis

Lung Fluke: Paragonimus

Red = exceptions to typical treatment of genus

# Case: Leg wound

- A 38y man presents to you with a painful leg wound that started as a blister then ulcerated (pictured)
- What's your DDX for ulcers in the tropics?
- What prevention interventions may be especially important in this region?

# Dracunculiasis (Guinea Worm Disease)

- 16,000 infections (2007), now 126 (2014)
- Cause: *Dracunculiasis medinensis*
- SSA: Sudan, Mali, Ethiopia, Chad
- CLINICAL: Painful cutaneous blisters that ulcerate w/ emergence of worm as white filament
- GOAL: Targeted for Eradication. GWEP (Carter Center 1986): Community Health approach, keeping water sources clean, using boiled/filtered water

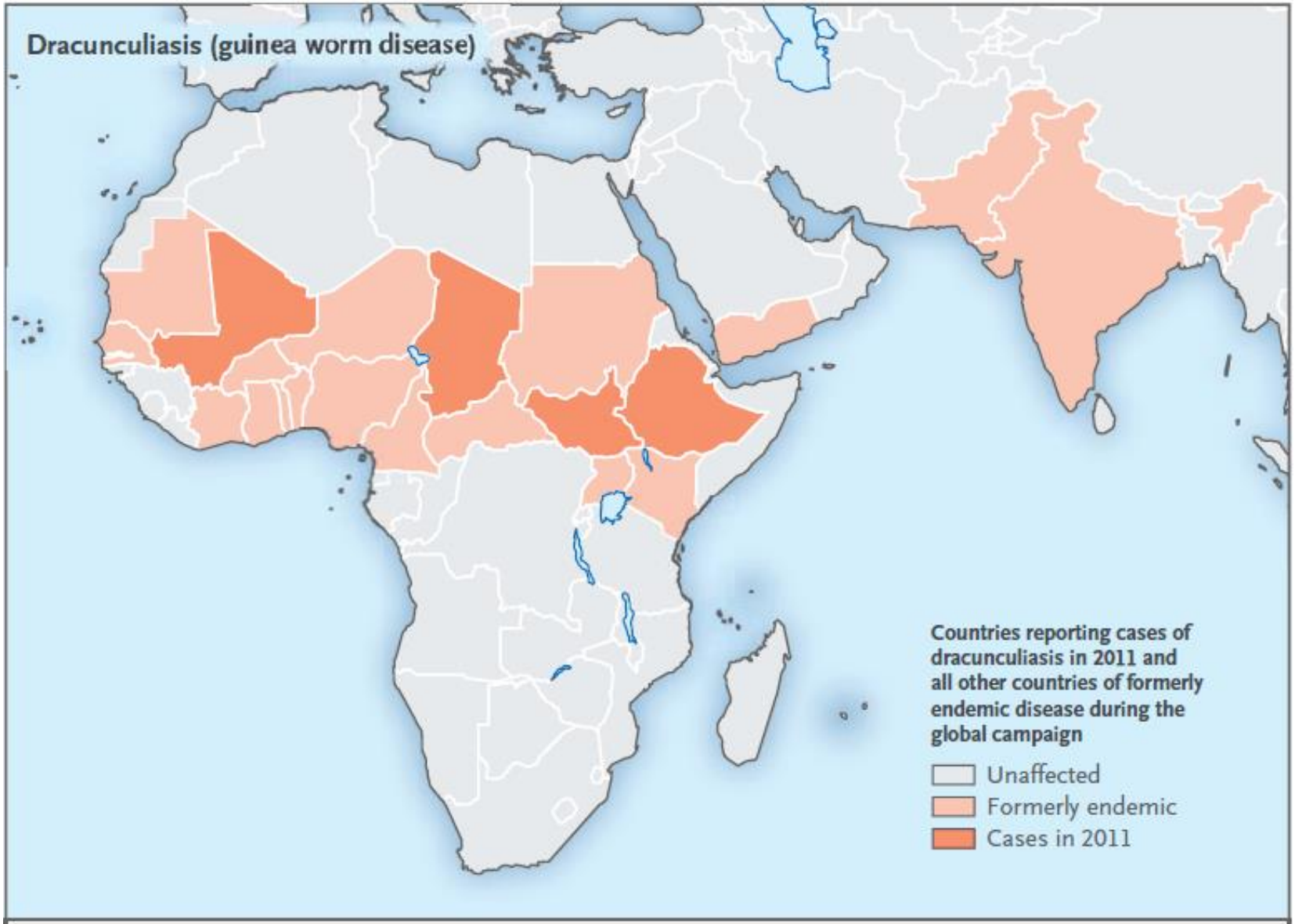
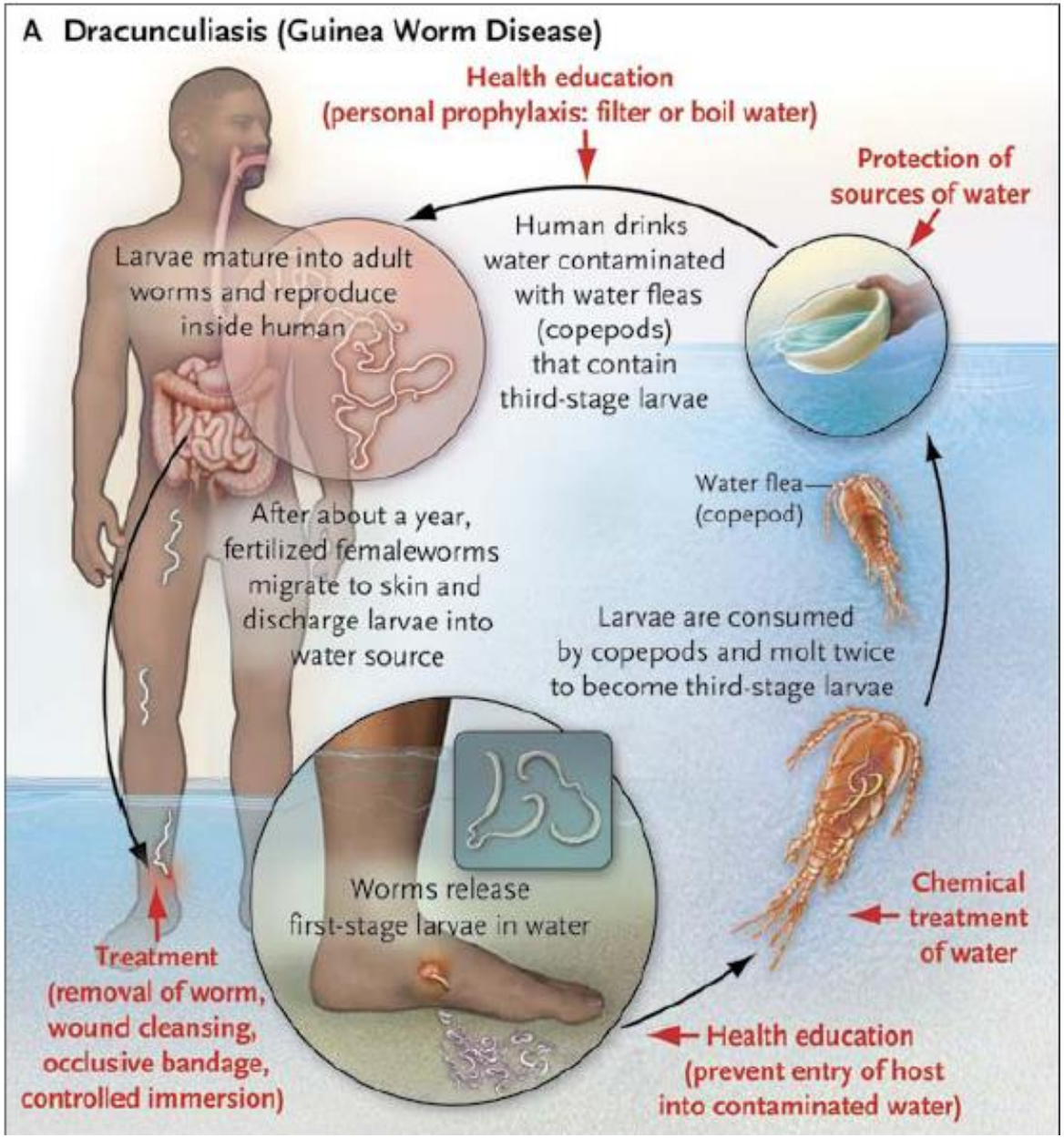
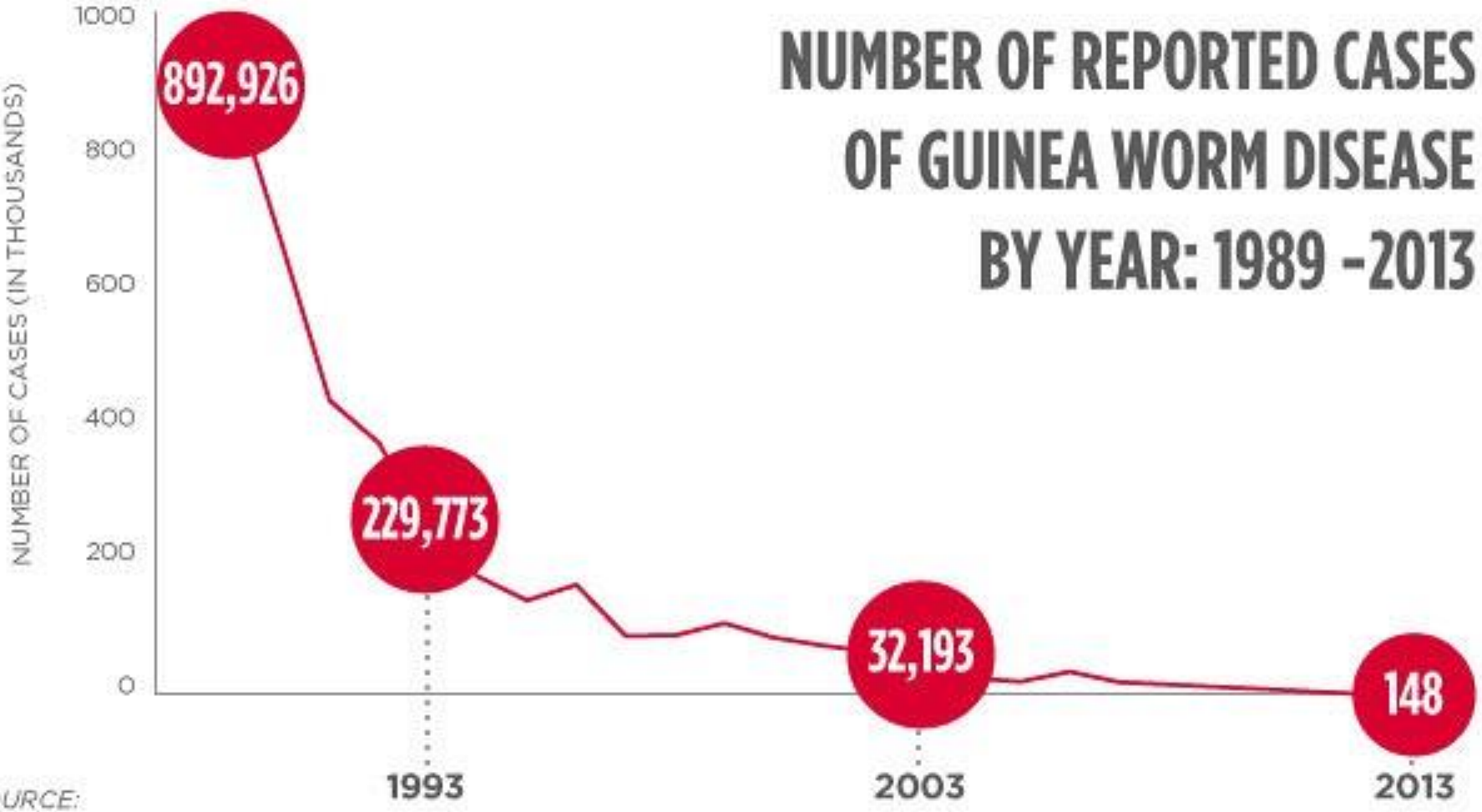



**Figure 2. Countries Reporting Cases of Dracunculiasis in 2011 and Countries in Which the Disease Was Endemic in 1980.**


A Dracunculiasis (Guinea Worm Disease)
Health education
(personal prophylaxis: filter or boil water)
Protection of
sources of water
Human drinks
water contaminated
with water fleas
(copepods)
that contain
third-stage larvae
Larvae mature into adult
worms and reproduce
inside human
Water flea
(copepod)
After about a year,
fertilized femaleworms
migrate to skin and
discharge larvae into
water source
Larvae are consumed
by copepods and molt twice
to become third-stage larvae
Worms release
first-stage larvae in water
Chemical
treatment
of water
Treatment
(removal of worm,
wound cleansing,
occlusive bandage,
controlled immersion)
Health education
(prevent entry of host
into contaminated water)

# NUMBER OF REPORTED CASES OF GUINEA WORM DISEASE BY YEAR: 1989 -2013




SOURCE:
*The Carter Center*

# Skin Ulcer DDX (in tropics)

- **Buruli Ulcer** (pictured)
  - *M. ulcerans* (Toxin: Mycolactone)
  - Usually <15yo
  - Painless, undermined border, legs/arms
  - Can erode bone, deform
  - Tx: Rifampin+Streptomycin (or Clarithromycin or FQ)
- **Tropical Phagedenic Ulcer** (TPU)
  - Bacterial/treponemal
  - Painful, enlarging; smelly; usually on leg
  - Hot & humid climate
- **Others**:
  - Anthrax
  - Leprosy
  - Tick Bite Eschar
  - Dracunculiasis (rare)


http://www.who.int/buruli/en/

# Case: Swollen Leg

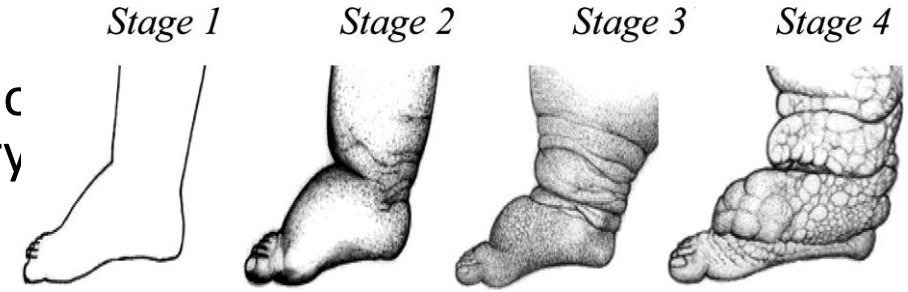
HPI/PE: A 52 year old Rwandan man presents to the FMC for resettlement screening and is noted to have non-pitting edema of the right leg on physical exam. The remainder of your exam is normal. The patient states the problem has been present for >20 years with gradual worsening and is bothersome but not painful. He recalls an episode of acute swelling and pain in the leg as a teenager.

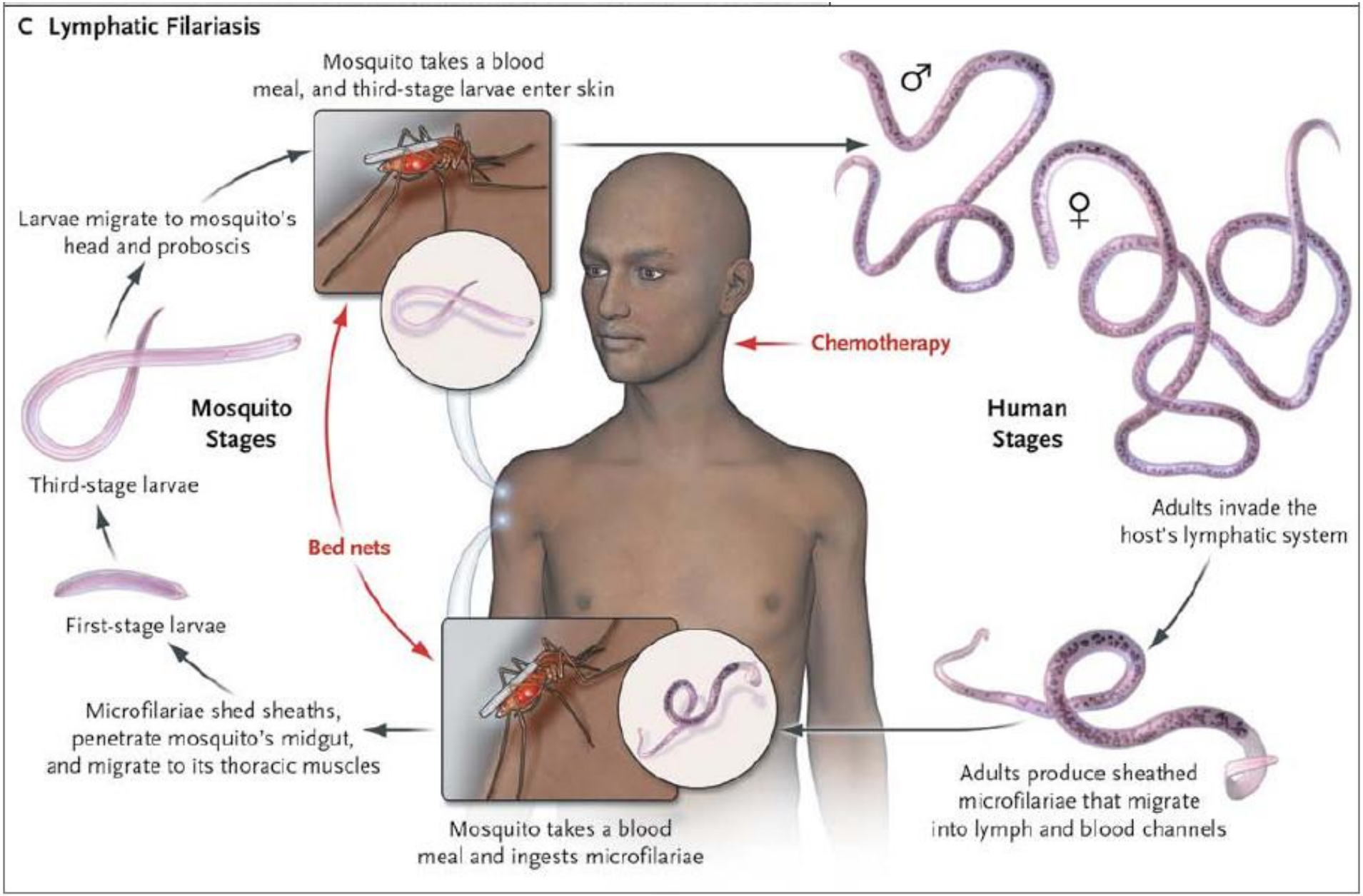
What is the likely diagnosis?

What would you do?

# Lymphatic Filariasis (LF)

- Cause: W bancrofti (90%), B malayi, B timori
- Vector: Culex (Asia), Anopheles (Africa)
- Epid: 120m infected, SSA/Asia
- Clinical: (1/3rd of infected)
  - Acute: local swelling 3-12m post-exp (AFL), ADLA/cellulitis, TPE
  - Chronic: lymphedema, hydrocele, elephantiasis
- Dx: Midnight blood smear (Giemsa), Trop Bio Og4C3 Ag, ICT card, IgG, U/S (Filarial Dance Sign)
- Tx: DEC, Ivermectin, Albendazole, Doxycycline (Wolbachia endosymbic lymphedema mgmt; limit secondary bacterial infections
- Program: GPELF




C Lymphatic Filariasis
Mosquito takes a blood meal, and third-stage larvae enter skin
Larvae migrate to mosquito's head and proboscis
Third-stage larvae
Mosquito Stages
First-stage larvae
Microfilariae shed sheaths, penetrate mosquito's midgut, and migrate to its thoracic muscles
Bed nets
Chemotherapy
Human Stages
Adults invade the host's lymphatic system
Adults produce sheathed microfilariae that migrate into lymph and blood channels
Mosquito takes a blood meal and ingests microfilariae

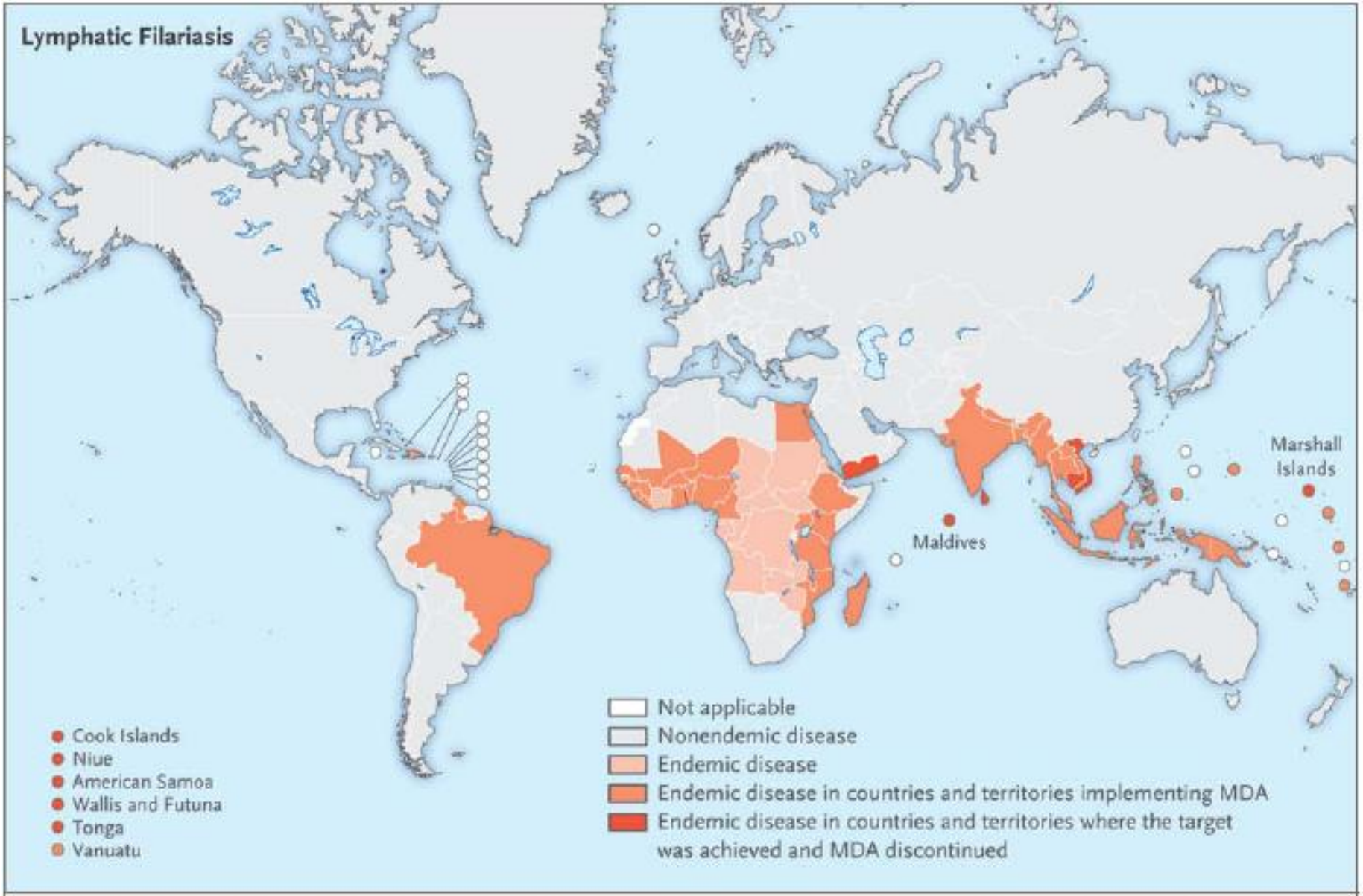



**Figure 4. Countries Where Lymphatic Filariasis Is Endemic and Status of Mass Drug Administration (MDA) in Those Countries, 2010.**
Adapted from the World Health Organization.[26]

# Case: Hematuria & Hepatomegaly

HPI: A 10 year old boy from Yemen presents complaining of pain w/ urination for 6 months. He also noted some blood at the end of voiding. He described a “piece of meat” following the blood associated w/ lower abdominal pain.

PE: Normal VS. POS suprapubic tenderness. O/w negative exam.

What is the likely Diagnosis?

How would you diagnose and treat this?

# Schistosomiasis

- Cause: *Schistosoma haematobium* (Fluke)
- Vector: Snails (warm shallow fresh water)
- Epidemiology: 207m people infected, most in SSA
- Clinical:
  - Acute: dermatitis, pneumonitis, fever (+/- diarrhea) 4-6wks after infection (Katayama Fever)
  - Chronic: GU tract disease including hematuria, SCC Bladder CA
- Dx:
  - Active: Ova on urine or rectal mucosa scrapes/snips (Kato-Katz Smear)
  - Old: ELISA
- Tx:
  - Praziquantel (1d = 80-85% cure); re-treat 8 wks; f/u testing 3-6mo


Harries, JR, et al. Case 23, *Clinical Problems in Tropical Medicine*, WB Saunders, 1998.

# Case: Blindness

- A 30y woman is brought to your clinic in Nigeria with decreased visual acuity and h/o of recurrent eye problems
- PE: bilateral conjunctival scarring, eyelash entropion, and slight corneal scarring (pictured)
- What's your DDX?
- How would you manage this case at a community health level?

# Trachoma

- Cause: *Chlamydia trachomatis*
- 21m actively infected (2010)
- Cause of 3% of blindness worldwide
- Multiple re-infections in childhood results in conjunctival scarring, then trichiasis
- Tx: <u>Azithromycin</u>

www.trachomacoalition.org

| Stage | Description |
|---|---|
|  **N:** Normal Tarsal Conjunctiva | For examination, the upper eyelid is turned over (everted).<br><br>Notice the large deep-lying blood vessels that mainly run vertically. |
|  **TF:** Trachomatous inflammation – Follicular | Presence of 5 or more follicles in the upper tarsal conjunctiva, each at least 0.5 mm in size. |
|  **TI:** Trachomatous inflammation – Intense | Pronounced inflammatory thickening of the upper tarsal conjunctiva, which obscures more than one half of the normal tarsal vessels. |
|  **TS:** Trachomatous Scarring | The presence of easily visible white lines, bands, or sheets in the tarsal conjunctiva. Scarring may obscure the tarsal vessels. |
|  **TT:** Trachomatous Trichiasis | At least 1 eyelash that rubs the globe or evidence of recently removed in-turned lash (*epilation*). |
|  **CO:** Corneal Opacity | The presence of an easily visible corneal opacity that obscures at least part of the pupillary margin |

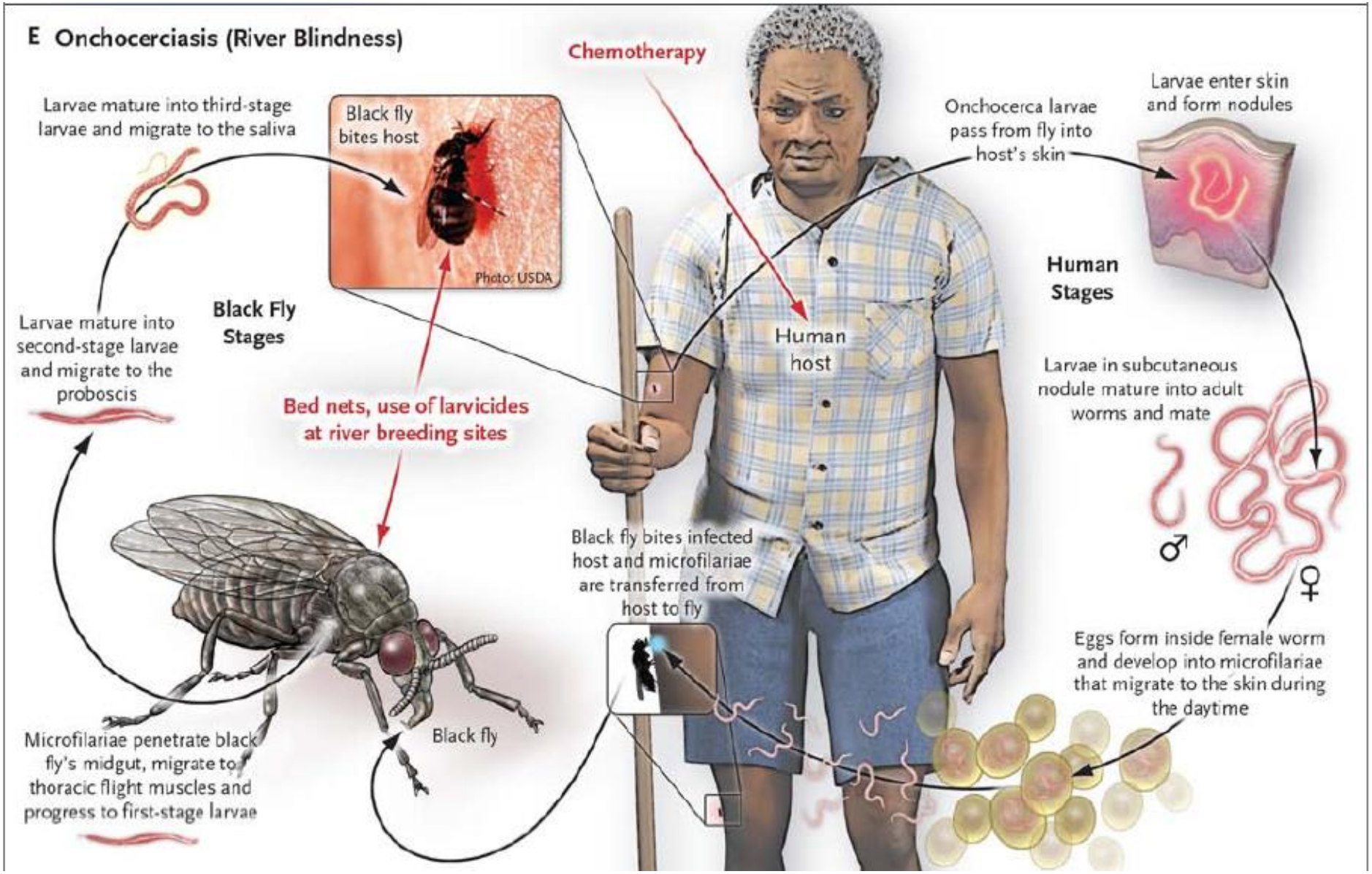
# Key Strategy for Elimination: SAFE

# DDX for Blindness in Global Health

- Cataracts (46%)
- Glaucoma (12.3%)
- AMD (8.7%)
- Corneal Opacities (5.1%)
- Diabetic Retinopathy (4.8%)
- Childhood Blindness/VAD (3.9%)
- **Trachoma** (3.6%)
- **Onchocerciasis** (0.8%)
  - 37m infected (99% in Africa)
  - Cause: *Onchocerca volvulus*
  - Vector: *Simulium damnosum*
  - Migrate in skin/eye
  - Tx: Ivermectin
  - Programs:
    - OEPA 1992 (L Am) → Eliminated
    - OCP (Afr) → Almost eliminated in 11 countries
    - APOC (Afr) → Expanded OCP in 1995 (reduced from 46.5% 1995 to 28.5% in 2008)

% based on WHO 2002 data

# Onchocerciasis control programmes


E Onchocerciasis (River Blindness)
Chemotherapy
Larvae mature into third-stage larvae and migrate to the saliva
Black fly bites host
Photo: USDA
Onchocerca larvae pass from fly into host's skin
Larvae enter skin and form nodules
Human Stages
Black Fly Stages
Larvae mature into second-stage larvae and migrate to the proboscis
Human host
Larvae in subcutaneous nodule mature into adult worms and mate
♂
♀
Bed nets, use of larvicides at river breeding sites
Black fly bites infected host and microfilariae are transferred from host to fly
Eggs form inside female worm and develop into microfilariae that migrate to the skin during the daytime
Black fly
Microfilariae penetrate black fly's midgut, migrate to thoracic flight muscles and progress to first-stage larvae

# Case: Syncope

HPI: 27y male admitted to hospital for syncope. Had been in excellent health, until day of admission, when he experienced palpitations and dizziness while playing soccer and then passed out. LOC x2-3min.

ROS: intermittent palpitations w/ CP over last 2 yrs

PMH: o/w neg

Soc: Occas ETOH and MJ; POS h/o prostitute exp

PE: HR 56, o/w nl VS; athletic appearing; CV occas premature beats, “forceful left ventricular lift”, S3; nl neuro exam

Scully, RE, et al. Case Records of the MGH, New Eng J Med, 8/12/1993; 329(7).

# Case:  Syncope

- What's on your DDX?
- What more would you like to know?
- What further testing would you like to order?

# Case: Syncope

- Pt is Latin-American born in El Salvador
- DDX:
  - Syncope: Cardiovascular vs Neurologic vs Other
  - Cardiac:
    - Arrythmias (Long QT, WPW, PSVT, etc)
    - Valvular disease (AI from Syphilis)
    - CMP (HCOM, other)
    - Myocarditis (Viral, Syphilitic, Protozoal)
- Tests:
  - EKG: RBBB, LAD; Monitor: PVCs, 8b VT
  - CXR: LVH
  - Echo: Nl AV, Nl EF, POS LV dilation, hypokinesis of apex/septum
  - Cardiac Bx: multifocal fibrosis (neg stains for fungi, toxo, trypanosomes, treponema, and mycobacterium)

# Chagas Disease (American Trypanosomiasis)

- Epidemiology: >20m LAs infected; >300k USA, no txf screening before 2007, 50k deaths/yr, #1 cause of HF in LA
- Cause: *Trypanosoma cruzi*
- Vector: Reduviid Bug (Triatomine)
- Reservoir: Rodents, Armadillos, Opossums
- Pathophysiology: Infection of autonomic ganglia, striated and cardiac mm
- Clinical:
  - Acute: Rare (1%), Chagoma, Romana's Sign, Giemsa Stain
  - Chronic: 30%, >20yrs after infection, Mega-esophagus, Mega-colon, Cardiac disease (arrythmias, HF)
- Treatment:
  - Acute: Nifurtimox or Benznidazole
  - Chronic: Symptomatic (eg, anti-arrythmics)

# Case: Fever & Headache

HPI: 30y Australian returned home after 4 wk trip to E Africa (Zambia) and 1 day later developed fever, severe headache, and rigors. Initial w/u was negative and pt worsened, developing nausea, vomiting and myalgia.

ROS/PMH o/w noncontributory

PE: T 39.5, HR>100, postural hypotn; enlarged spleen (1cm bcm), 5x6cm macular erythematous lesion on inner right thigh, no LA

Maddocks, S, O'Brien, R, New Eng J Med, 4/27/2000

# Case:  Fever & Headache

- What's on your DDX?
- What more would you like to know?
- What further testing would you like to order?

# Case: Fever & Headache

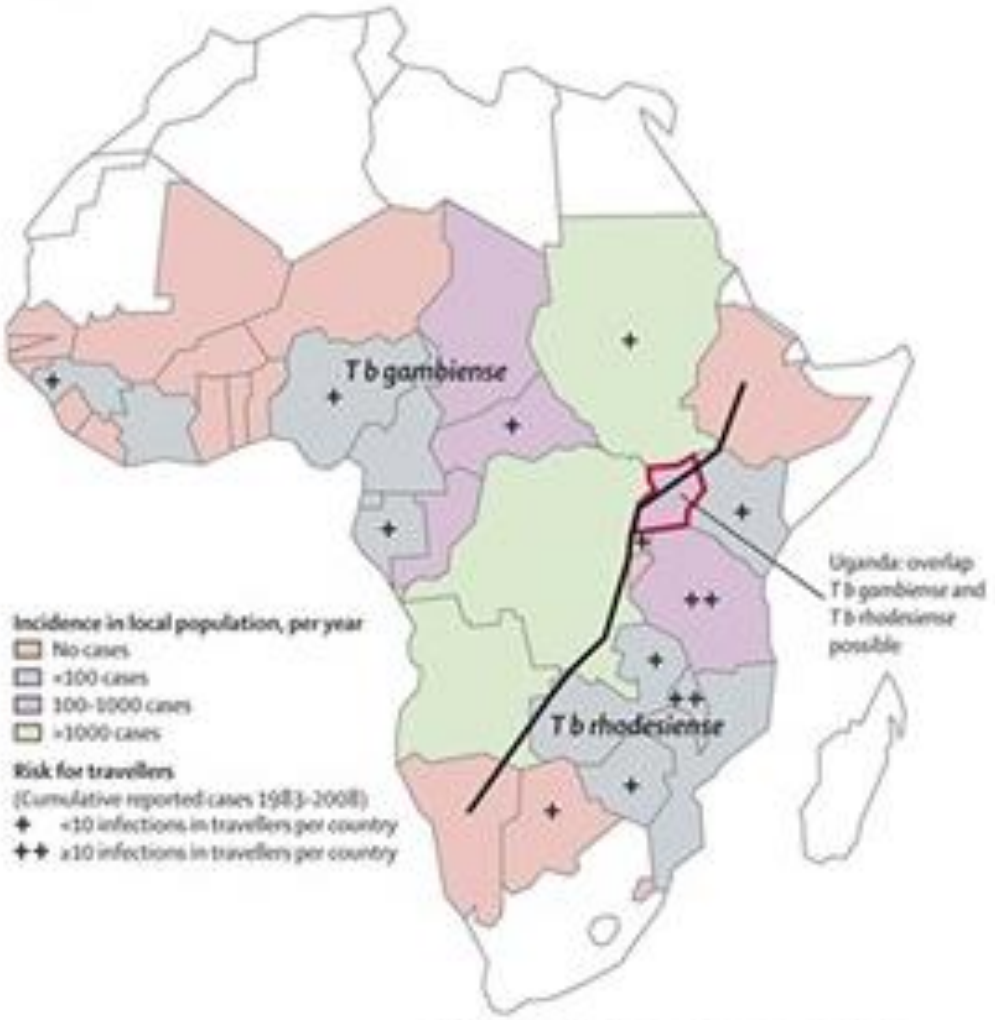
- DDX: (Fever+HA+Splenomegaly)
  - Malaria
  - Acute Schistosomiasis (Katayama Fever)
  - African Trypansomiasis
  - VL (Kala Azar, “Black Fever”)
  - ATBF
- Hx: Multiple insect bites while in Africa, none recalled as painful and did not recall being bitten at lesion site
- Tests:
  - CBC, CMP, Urine Cx normal/neg
  - Multiple malaria smears NEG, but POS for…

# Human African Trypanosomiasis (HAT)("African Sleeping Sickness")

- Epidemiology: Affects 50m in Africa plus economic damage due to cattle disease (Nagana)
- Cause: *Trypanosoma brucei gambiae* (90%) & *Trypanosoma brucei rhodesiense* (10%)
- Vector: *Glossina* (Tsetse Fly)
- Reservoir: Cattle
- Clinical:
  - Tbg: West/Central SSA, bite lesion, fever 1-3 wks later, lymph node involvement (Winterbottom sign), later CNS involvement (mos-yrs)
  - Tbr: East SSA, bite lesion/chancre (70-80%), fever 1-3wks later, early CNS involvement (wks-mos)
- Treatment: (Fatal if untreated)
  - Pre-CNS: Suramin (Tbr), Pentamadine (Tbg)
  - CNS: Melarsoprol (Tbr), Eflornithine (Tbg)

http://publichealth.yale.edu/news/slideshows/hat.aspx

# Disease Foci




Sub-Saharan Africa

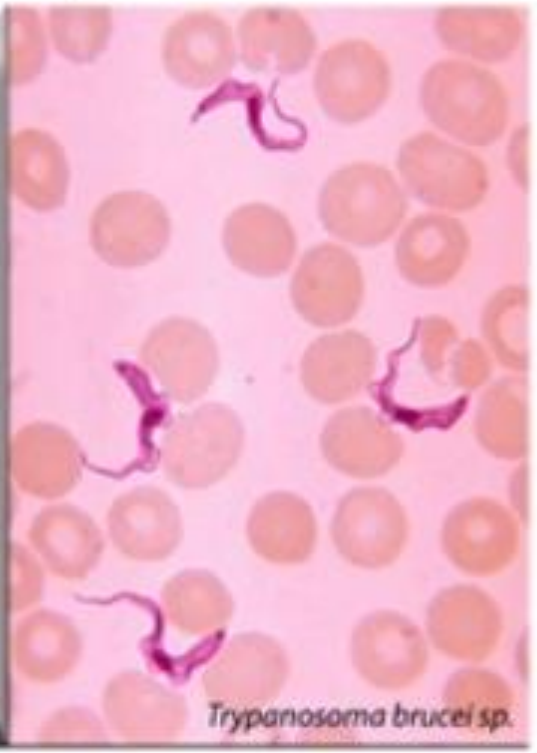
http://publichealth.yale.edu/news/slideshows/hat.aspx

Disease Foci

Sub-Saharan Africa

Vector


Pathogen




Vector control is primarily achieved by population control through trapping and insectide treatment of livestock.
Image from the Food and Agriculture Organization of the United Nations http://www.fao.org/

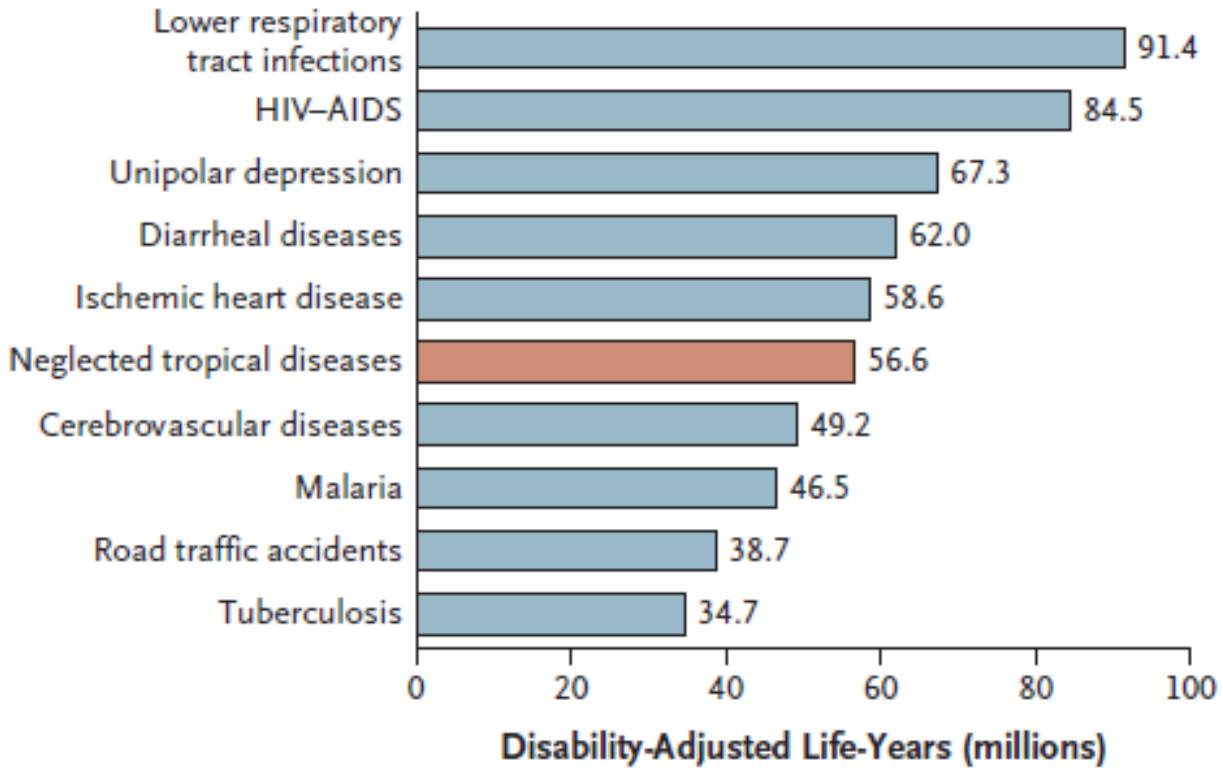



**Figure 1. The 10 Leading Causes of Life-Years Lost to Disability and Premature Death.**

The number of years lost to disability and premature death (disability-adjusted life-years) for the 13 major neglected tropical diseases were calculated according to a method we described previously.[4] The disability-adjusted life-years for the other conditions are based on data from the World Health Organization.[23] The ranking of disease burdens is based on data in Hotez.[5]

Hotez, PJ, et al, Control of NTDs, NEJM, 2007

# NTD Geographical Overlap

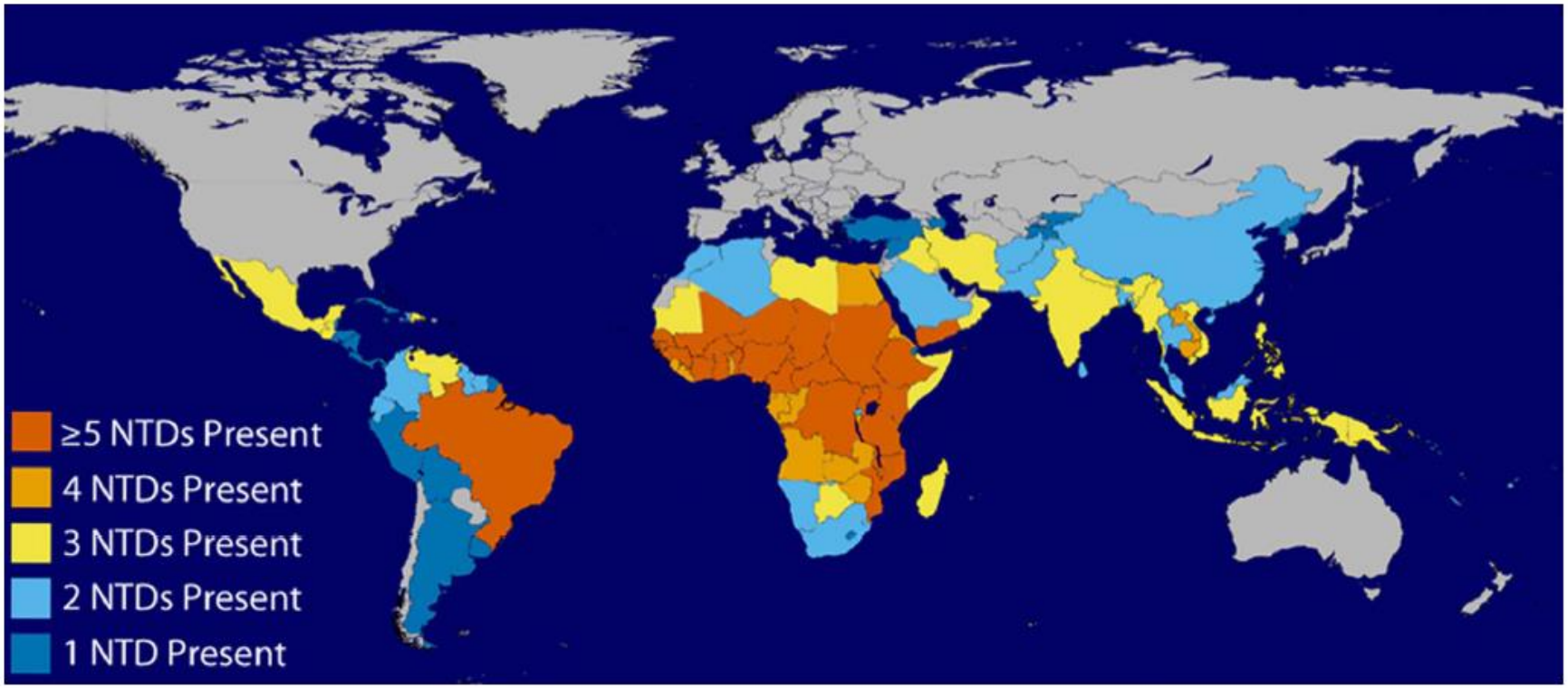



**Figure 1** Map showing the significant geographical overlap and global burden of six neglected tropical diseases (specifically guinea worm, lymphatic filariasis, onchocerciasis, schistosomiasis, trachoma and the three major soil transmitted helminth infections). Image courtesy of the Centers for Disease Control and Prevention.

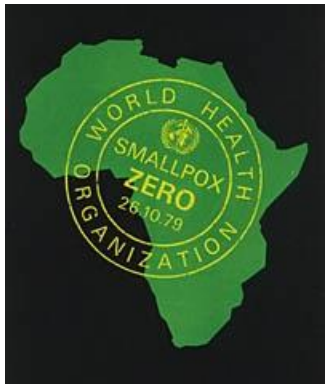
Barry MA, et al. Arch Dis Child 2013;98:635–641.

# A Summary of the 5 “tool ready” NTDs

| Disease | Cause | Prevalence worldwide | Importance | Key Strategy | Goal |
|---|---|---|---|---|---|
| **Lymphatic Filariasis** (Elephantiasis) | *Wuchereria bancrofti* | 120m in 81 countries | Disfigurement, permanent disability | MDA (DEC, Ivermectin + Albendazole) | Elimination by 2020 (GPELF) |
| **Onchocerciasis** (River Blindness) | *Onchocerca volvulus* | 37m (99% in Africa) | Eye lesions, blindness, skin disease | MDA (Ivermectin) | Elimination in Americas by 2016 |
| **Schistosomiasis** (Snail Fever, Bilharzia) | *Schistosoma hematobium* | 200m | Anemia, bladder/ renal/liver/spleen disease | MDA (Praziquantel) | Control |
| **STHs** (Roundworm, Whipworm, Hookworm) | *Ascaris, Necator, Ancylostoma, Trichuria* | 1.5-2b | Impaired growth & cognition, malnutrition, anemia | MDA (Albendazole) | Control |
| **Trachoma** | *Chlamydia trachomatis* | 80m | Blindness | MDA /“SAFE” (Azithromycin) | Elimination by 2020 (GET) |

# Disease Eradication

- Definitions (Dahlem Workshop, 1997)
  - **Control** – reduction to locally acceptable level w/ continued intervention
  - **Elimination** – reduction of incidence to zero in defined area w/ continued intervention
  - **Eradication** – permanent reduction of worldwide incidence to zero w/ continued intervention no longer needed
- History of Eradication
  - Success: *Smallpox* (1977)
  - Failure: *Malaria, YF, Yaws*
- Current Targets
  - *Polio*, *Guinea Worm* (Eradication)
  - *LF, Oncho, Trachoma* (Elimination)
  - *STHs, Schistosomiasis* (Control)





Ali Maow Maalin (World Health Organization)

# Mass Drug Administration (MDA)

**Table 2. Drugs, dosages, implementation thresholds and regimens in preventive chemotherapy interventions**

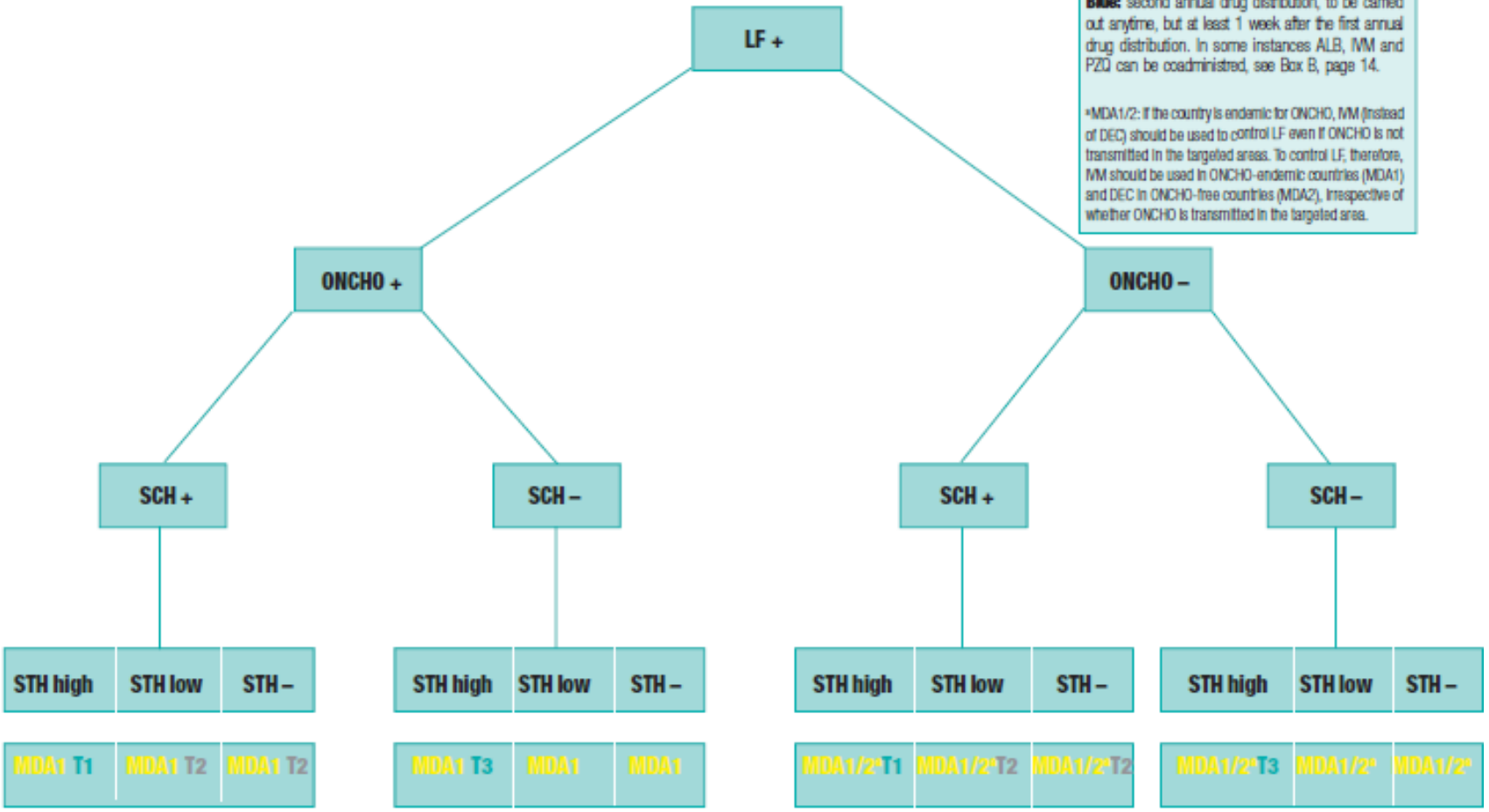
Note: Drug names are given in full in the list of abbreviations at the front of the manual.

| Disease | Drugs and dosages | Threshold for implementation of preventive chemotherapy interventions[b] | Frequency of intervention |
|---|---|---|---|
| Lymphatic filariasis (in countries where onchocerciasis is co-endemic) | IVM according to height (using IVM tablet-pole) **plus** ALB 400 mg | Prevalence of infection ≥1% | Once a year |
| Lymphatic filariasis (in countries where onchocerciasis is not co-endemic) | DEC 6 mg/kg (using age as criterion for dose) **plus** ALB 400 mg | Prevalence of infection ≥1% | Once a year |
| Onchocerciasis | IVM according to height (using IVM tablet-pole) | Prevalence of infection ≥ 40% or prevalence of palpable nodules ≥ 20% | Once a year |
| Schistosomiasis | PZQ 40 mg/kg (using PZQ tablet-pole) | Presence of infection | According to prevalence of infection (see Annex 2) |
| Soil-transmitted helminthiasis (ascariasis, trichuriasis, hookworm disease) | ALB 400 mg **or** MBD 500 mg[a] | Presence of infection | According to prevalence of infection (see Annex 2) |
| Trachoma | Azilthromycin 20mg/kg (using tablet-pole) max 1g in adults | Active trachoma (TF) prevalence > 5 % in 1–9 years old at district level[c] | Once a year |

[a] LEV 2.5 mg/kg or PYR 10 mg/kg is useful where trichuriasis does not pose a significant problem.
[b] For details, see Annex 6.
[c] TF >10% at district level: dictrict-wide mass treatment. If TF <5% at district level, some communities might still require community wide treatment.

Preventive Chemotherapy in Human Helminthiasis, WHO 2006 Guidelines

**Algorithm 1 – Coordinated implementation of preventive chemotherapy interventions**




**Legend**

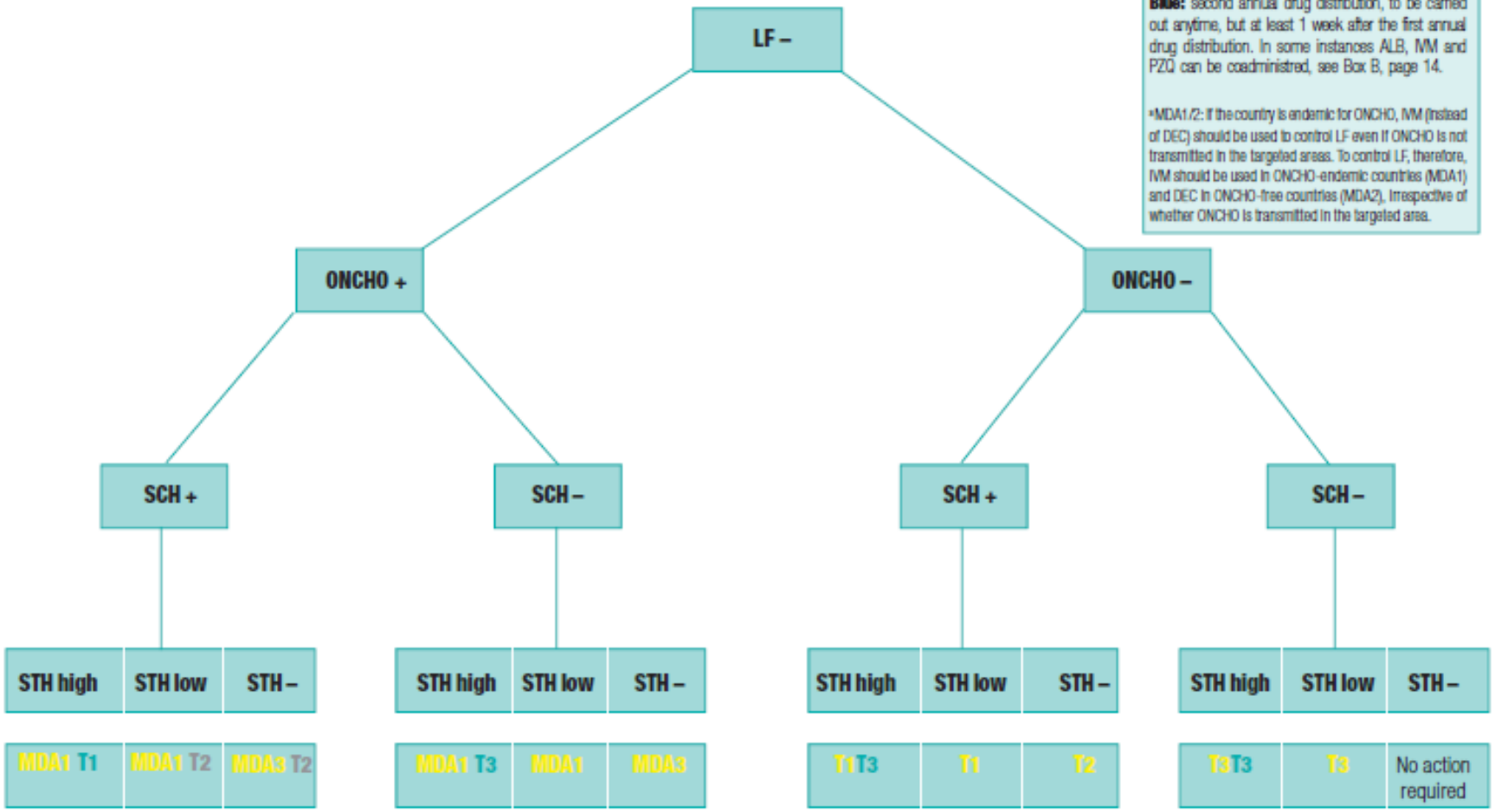
**Mass drug administration**
- **MDA1[a]** IVM+ALB
- **MDA2[a]** DEC+ALB
- **MDA3** IVM

**Targeted treatment**
- **T1** ALB+PZQ or MBD+PZQ
- **T2** PZQ
- **T3** ALB or MBD

**Colour coding**
**Yellow:** first annual drug distribution
**Green:** second annual drug distribution, to be carried out 6 months after the first annual drug distribution
**Blue:** second annual drug distribution, to be carried out anytime, but at least 1 week after the first annual drug distribution. In some instances ALB, IVM and PZQ can be coadministred, see Box B, page 14.

[a]MDA1/2: If the country is endemic for ONCHO, IVM (instead of DEC) should be used to control LF even if ONCHO is not transmitted in the targeted areas. To control LF, therefore, IVM should be used in ONCHO-endemic countries (MDA1) and DEC in ONCHO-free countries (MDA2), irrespective of whether ONCHO is transmitted in the targeted area.

**Algorithm 2– Coordinated implementation of preventive chemotherapy interventions**




**Legend**

**Mass drug administration**
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# Does MDA work? In Theory…

- ALB+DEC:
  - LF ↓ from 16.7 to 5.3%
  - Hookworm ↓ from 10.3 to 1.9%
  - Roundworm ↓ from 34.5 to 2.3%
  - Whipworm ↓ from 55.5 to 40.3%
- ALB+IVM
  - LF ↓ from 12.6 to 4.6%
  - Hookworm ↓ from 7.8 to 0.0%
  - Roundworm ↓ from 33.5 to 6.1%
  - Whipworm ↓ from 42.7 to 8.9%
- ALB alone similar to above, except for LF
- AZITHRO for trachoma (TF) – no RCTs in MDA

Reddy, M et al, *Oral Drug Therapy for Multiple NTDs*, JAMA, October 24/31, 2007, 298(16):1911-1924.

# Does MDA Work? In Reality…

Parker and Allen *Health Research Policy and Systems* 2011, **9**:3
http://www.health-policy-systems.com/content/9/1/3

HEALTH RESEARCH POLICY AND SYSTEMS

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## Does mass drug administration for the integrated treatment of neglected tropical diseases really work? Assessing evidence for the control of schistosomiasis and soil-transmitted helminths in Uganda

Melissa Parker[1*], Tim Allen[2]

**Background:** Less is known about mass drug administration [MDA] for neglected tropical diseases [NTDs] than is suggested by those so vigorously promoting expansion of the approach. This paper fills an important gap: it draws upon local level research to examine the roll out of treatment for two NTDs, schistosomiasis and soil-transmitted helminths, in Uganda.

**Table 2 Self-reported drug uptake as a percentage at selected villages in Moyo District, 2005-2008**

| | Olia West | Pakaa West | Pakonira East | Panjala | Paubu | Dufile | Laropi |
|---|---|---|---|---|---|---|---|
| 2008 | 90 | 50 | 92 | 5 | 100 | 15 | 33 |
| 2007 | 0* | 17 | 38 | 95 | 17 | 88 | 33 |
| 2006 | 50 | 8 | 38 | 32 | 17 | 54 | 76 |
| 2005 | 30 | 8 | 38 | 26 | 50 | 46 | 29 |

* No reported distribution.

# NTDs, MDA, & Child Health



**Table 1** Number of people requiring preventative chemotherapy and number of people receiving preventative chemotherapy for the seven most common NTDs, 2011

| | Number of people requiring preventative chemotherapy | Number of people receiving preventative chemotherapy | % at risk reached |
|---|---|---|---|
| STH infections (hookworm, ascariasis, trichuriasis) | 266 million pre-SAC<br>609 million SAC | 100 million pre-SAC<br>210 million SAC | 38% pre-SAC<br>34% SAC |
| Trachoma | 325 million people (in 2010) | 38 million people treated (in 2010) | 12% people |
| Lymphatic filariasis | 1.41 billion people | 557 million people | 40% people |
| Schistosomiasis | 112 million SAC | 16 million SAC | 14% SAC |
| All seven NTDs targeted by preventive chemotherapy | 1.9 billion people | 710 million people | 37% people |

Data reported for preschool age children (pre-SAC) and school age children (SAC) if available. If no data are available for these groups, the total population is reported. Onchocerciasis, the seventh NTD that is targeted for preventative chemotherapy, is not included in this table as it primarily affects adults. Numbers were calculated using data obtained from the Preventive Chemotherapy Databank, which is maintained by WHO (http://www.who.int/neglected_diseases/preventive_chemotherapy/databank/en/index.html). Additional figures obtained from the Weekly Epidemiological Record: Global WHO Alliance for the Elimination of Blinding Trachoma by 2020, published in 2012 by WHO; Sustaining the drive to overcome the global impact of neglected tropical diseases: Second WHO report on neglected tropical diseases, published by WHO in 2013; and From Promises to Progress: The First Annual Report on the London Declaration on NTDs, published in 2013.
NTD, neglected tropical disease; STH, soil transmitted helminth.

Thank you!

# Disease Eradication

| Definitions |
| --- |
| **Eradication** |
| Zero disease globally as a result of deliberate efforts |
| Control measures no longer needed |
| **Elimination** |
| Zero disease in a defined geographic area as a result of deliberate efforts |
| Control measures needed to prevent reestablishment of transmission |

| Criteria for Assessing the Eradicability of a Disease |
| --- |
| **Scientific feasibility** |
| Epidemiologic susceptibility (e.g., no nonhuman reservoir, ease of spread, naturally induced immunity, ease of diagnosis) |
| Effective, practical intervention available (e.g., vaccine, curative treatment) |
| Demonstrated feasibility of elimination (e.g., documented elimination from island or other geographic unit) |
| **Political will and popular support** |
| Perceived burden of the disease (e.g., extent, deaths, other effects; relevance to rich and poor countries) |
| Expected cost of eradication |
| Synergy of eradication efforts with other interventions (e.g., potential for added benefits or savings) |
| Need for eradication rather than control |

# History of Eradication, Elimination

- Eradication:
  - Smallpox has now been eradicated and programmes are currently under way to eradicate poliomyelitis and guinea-worm disease.
  - 1993: International Task Force for Disease Eradication evaluated over 80 potential infectious disease candidates and concluded that six were eradicable.
- Elimination:
  - 1997: World Health Assembly passed a res to eliminate LF
  - 1997: WHO listed leprosy, onchocerciasis, and Chagas disease as being candidates for elimination
- With this background, the **Dahlem Workshop** on the Eradication of Infectious Diseases was held in March 1997

MMWR, December 31, 1999 / Vol. 48 / Supplement