



**Brigham and Women's Hospital**

Founding Member, Mass General Brigham

# **Tropical Medicine and Parasitology**

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Professor of Medicine

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**CONTINUING MEDICAL EDUCATION  
DEPARTMENT OF MEDICINE**



**HARVARD MEDICAL SCHOOL  
TEACHING HOSPITAL**

# James H. Maguire, MD



- Harvard Medical School
- Internal Medicine Residency and Infectious Disease Fellowship, Peter Bent Brigham Hospital
- Professor of Medicine, Harvard Medical School; Senior Physician, Brigham and Women's Hospital
  - Focus: parasitic disease, musculoskeletal infections

# Disclosures

- I have no financial disclosures

# Objectives

- Update approach to diagnosis, management and prevention of infectious diseases of travelers and immigrants, focusing on febrile illnesses, diarrhea, and diseases of skin
- Emphasize importance of identifying latent infections of immigrants to prevent complications later in life

# 40-year-old man with fever and mental status changes

- 3 week stay in Nigeria 10 days earlier
- x1 week: malaise, feverishness
- Unusual behavior at home after work
- ER next morning:
  - Temp 102° F
  - Agitated, unable to follow commands
- Hct 32, WBC 6000, platelets 110,000, creatinine 2.2

Differential diagnosis?

# Fever in returned travelers

- US travelers; Geosentinel clinics
- 9624 visits 2000-2012
- 18.2% with fever
- European multicenter study
- 765 febrile patients 2017-19
- 60%: undifferentiated fever

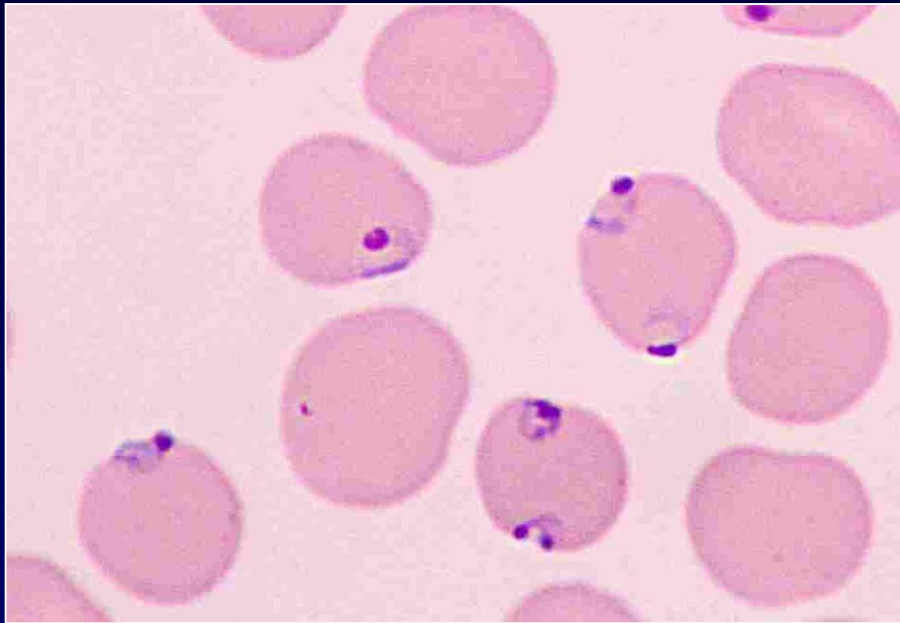
Malaria (27.4%)  
Viral syndrome (18.5%)  
Dengue (12%)  
Mononucleosis syndrome (9%)  
Rickettsial disease (4.7%)  
Enteric fever (6.1%)

Malaria (21.1%)  
Viral syndrome (29%)  
Arboviruses (23.7%)  
HIV/CMV/EBV (3%)  
Rickettsial disease (10.1%)  
Enteric fever (1.3%)

Also: fever with diarrhea or respiratory infection, acute hepatitis, acute HIV, brucellosis, leptospirosis, acute schistosomiasis.  
Undiagnosed 30%. Consider COVID-19, monkeypox

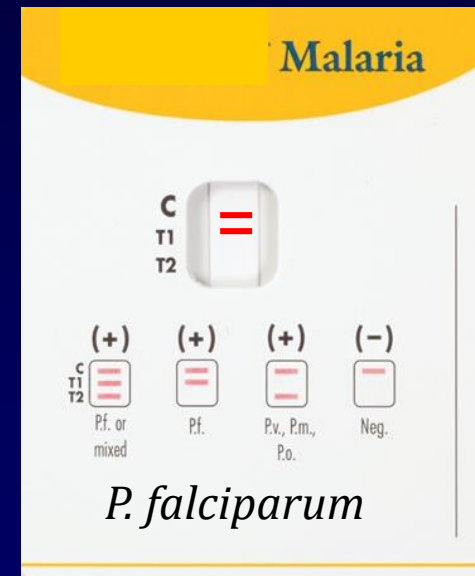
## Further history:

- Immigrated from Nigeria 6 years earlier
- Prior to travel: no pretravel vaccinations, no antimalarial chemoprophylaxis
- Visited family



*Plasmodium falciparum*  
(8% of RBCs infected)

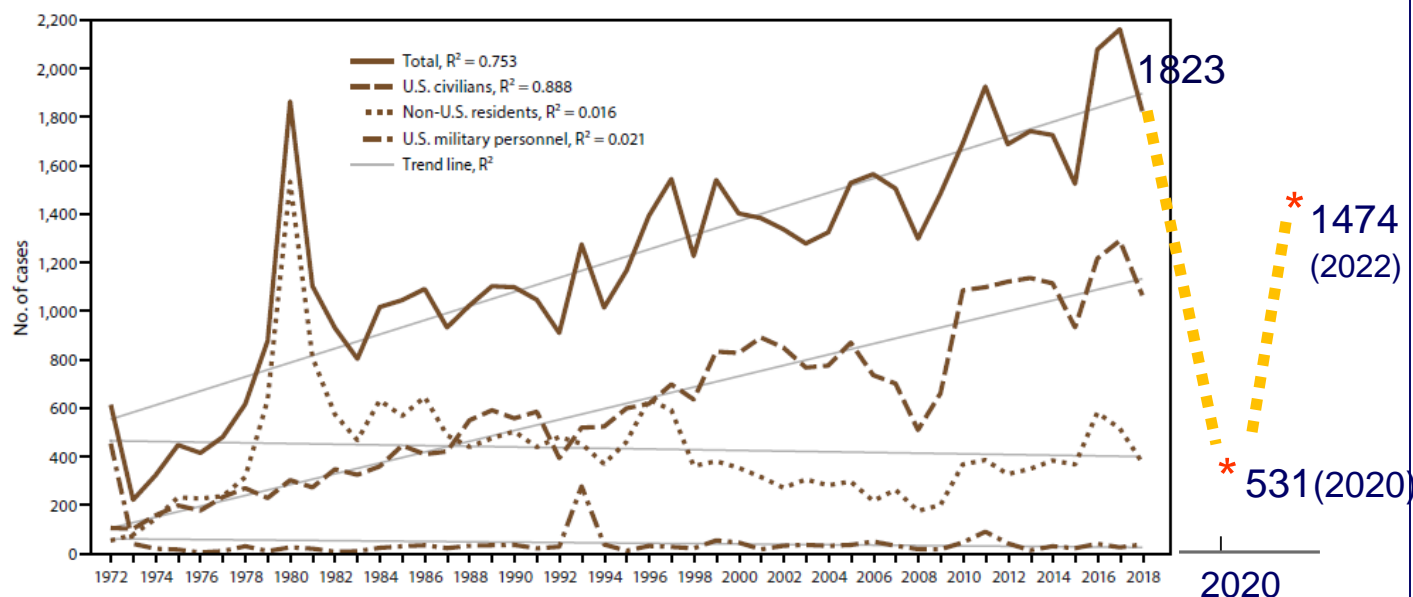
## Further studies?



Rapid blood test for malaria (dipstick) was also positive

# Malaria in US travelers

Number of malaria cases 1972-2018



## Malaria and COVID

- Travel increasing
  - Possible increased transmission in areas to be visited
  - COVID-19 epidemic has led to delays in diagnosis
  - Consider both malaria and COVID in travelers
- (J Travel Med 2021,28:1)

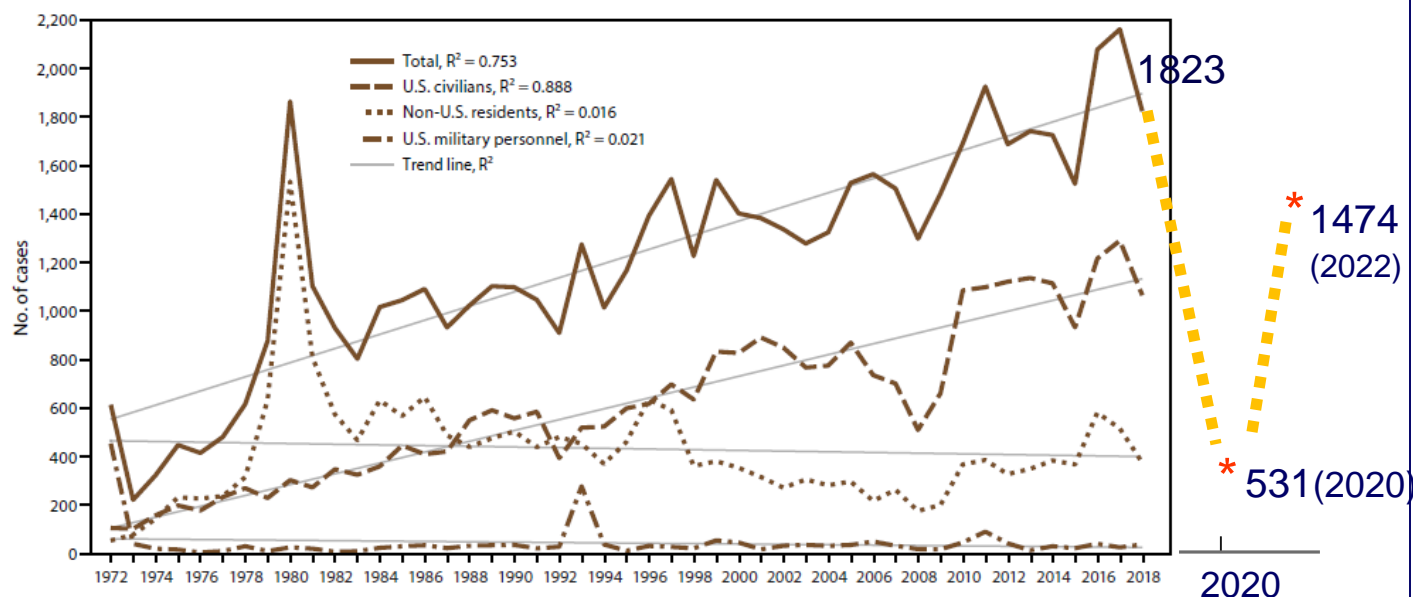
## USA: 1823 imported malaria cases in 2018

- 88%: Africa (West>East), 8% Asia (India>other)
- 7 fatal cases, all acquired in Africa
- US civilians
  - Purpose of travel: visiting friends/relatives (77%)
  - 76%: no prophylaxis



# Malaria in US travelers

Number of malaria cases 1972-2018



## Malaria and COVID

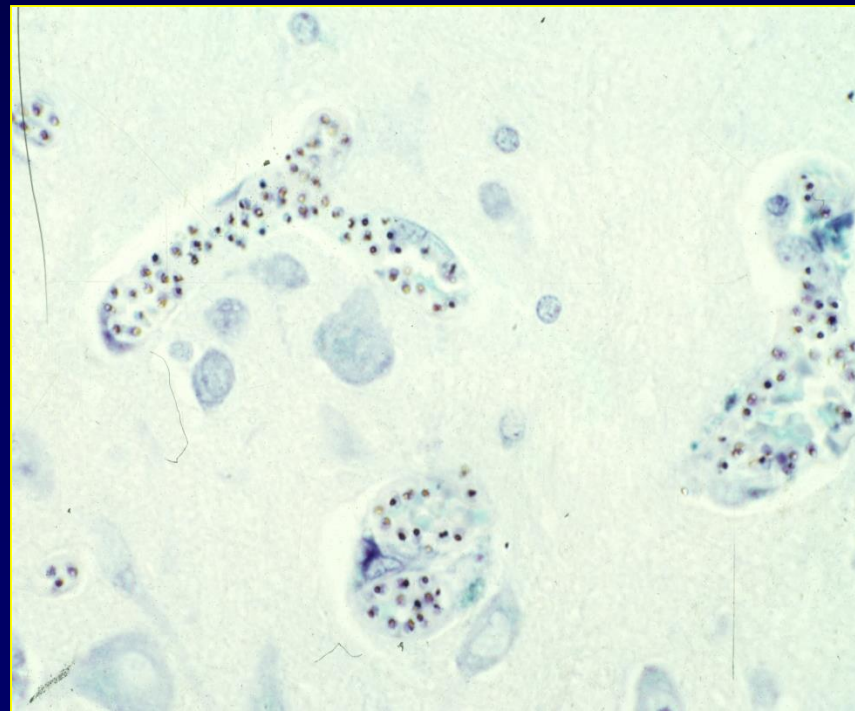
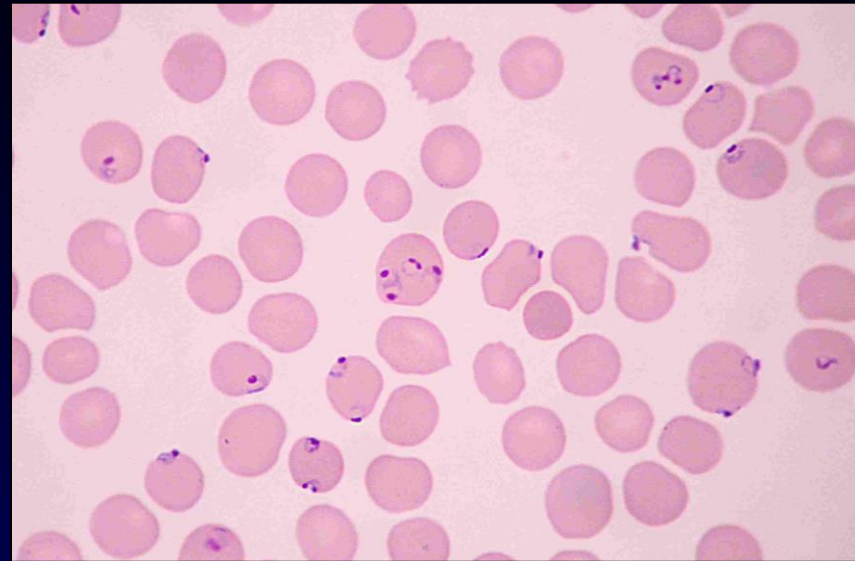
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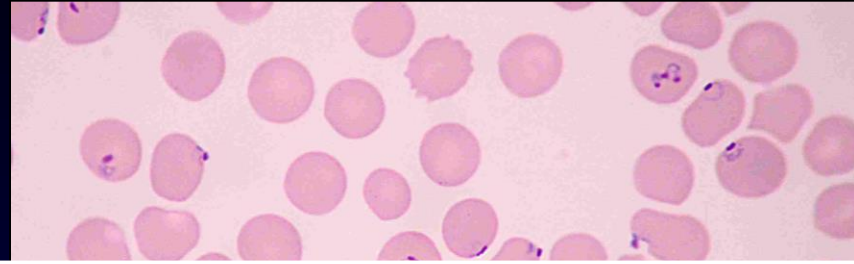
# *Plasmodium falciparum*: life-threatening

- High parasitemia
- Only rings on smears: RBCs infected with later stages adhere to endothelium of small blood vessels
- Pathophysiology
  - Severe anemia
  - Blockage of blood flow
  - Systemic and local cytokine production



# *Plasmodium falciparum*: life-threatening

- High parasitemia
- Only rings on smears:  
RBCs infected with later



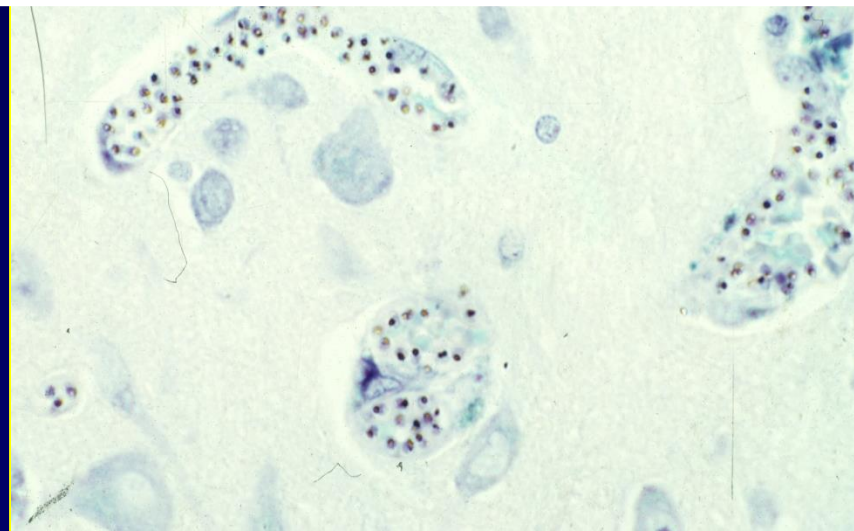
## Falciparum malaria

Progresses rapidly

Life threatening (especially non-immune)

Mimics other infections

- Severe anemia
- Blockage of blood flow
- Systemic and local cytokine production



# Falciparum malaria: complications

- Cerebral malaria, hypoglycemia
- Pulmonary edema
- Renal failure, blackwater fever
- Jaundice, tender hepatomegaly
- Diarrhea, dysentery
- Lactic acidosis
- Severe anemia
- Placental dysfunction



Treatment? (40 y.o. man with fever)



# Treatment of falciparum malaria (USA)

- Oral therapy
  - Artemether-lumefantrine
  - Alternatives:
    - Chloroquine or hydroxychloroquine (sensitive strains)
    - Quinine + doxycycline or clindamycin
    - Atovaquone-proguanil
- Severe falciparum malaria
  - IV artesunate
  - Alt: IV quinidine gluconate + doxycycline or clindamycin



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- Alternatives:

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- IV artesunate

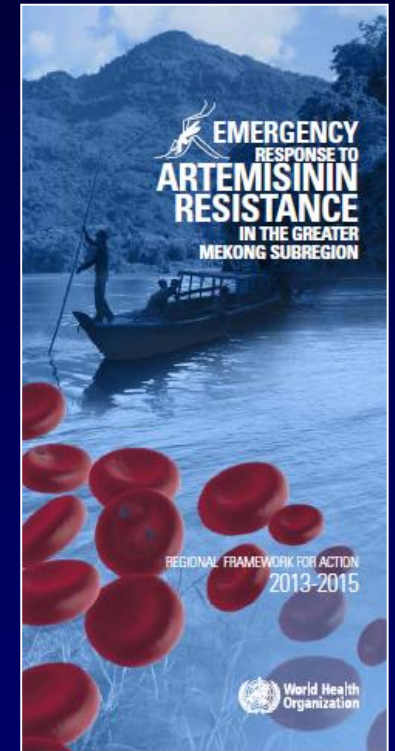
- ~~– Alt: IV quinidine gluconate + doxycycline or clindamycin~~



# Artemisinin combination therapy

- Artemisinins: most rapidly acting antimalarials
- Active against resistant *P. falciparum*
- Improved survival compared with quinine
- Given in combination with second drug (mefloquine, atovaquone-proguanil, lumefantrine, others)
- Indicated during pregnancy
- “Resistance” in SE Asia, Africa

Drugs of choice for treatment of falciparum malaria



# 40-year-old man with severe malaria: appropriate Rx

- IV artesunate: commercially available
- If not in stock: interim treatment orally or via nasogastric tube (artemether-lumefantrine > atovaquone-proguanil, or quinine > mefloquine)
- Artesunate 2.4 mg/kg IV at 0, 12, 24, 48 hr; check parasite density after 3d dose
- When parasitemia  $\leq 1\%$  follow IV artesunate with treatment doses of artemether-lumefantrine, atovaquone-proguanil, quinine plus doxycycline or clindamycin, (mefloquine)

## Manifestations of severe malaria

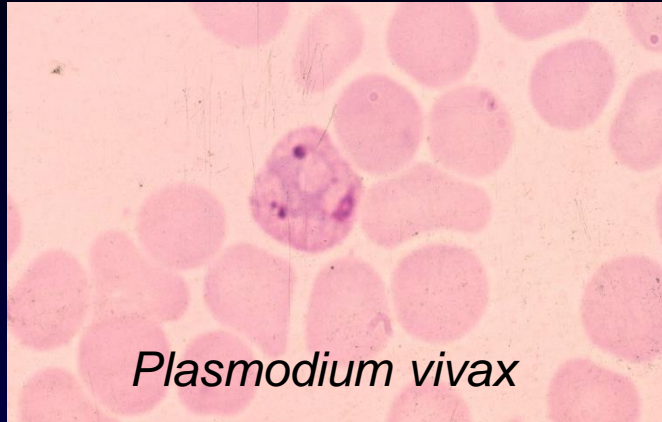
Cerebral malaria (impaired consciousness, multiple seizures)
Acidosis
Pulmonary edema or acute respiratory distress
Severe anemia (hemoglobin <7 g/dL)
Acute renal failure
Hemoglobinuria
Jaundice
Significant bleeding or disseminated intravascular coagulation
Circulatory collapse, shock
Parasitemia >5% of red cells infected
Other: hemoglobinuria, hypoglycemia, failure to feed

Exchange transfusion: no consensus (CDC: no)

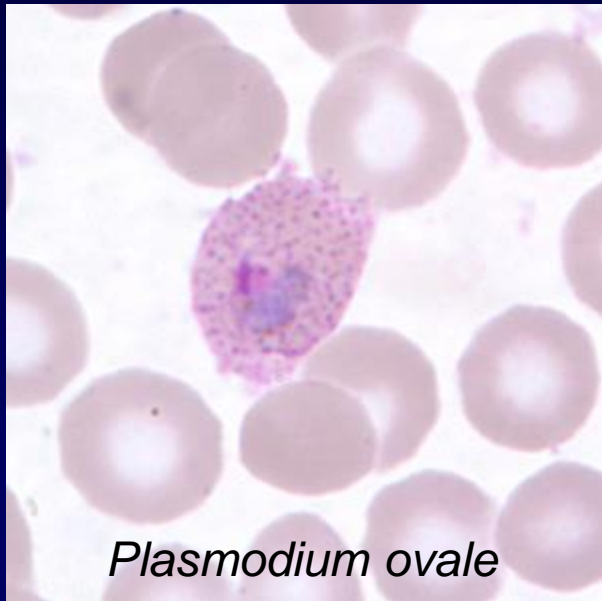
CDC: 770-488-7788 or toll-free 855-8565-4713; 770-488-7100 after hours)



# *Plasmodium vivax, ovale*



*Plasmodium vivax*



*Plasmodium ovale*

- Infect only young cells
- No vascular sequestration
- Death unusual
- Relapses (4+ yrs)
- Treatment:
  - Chloroquine\* and
  - Radical cure to prevent relapses (G-6-PD screen)
    - Primaquine x 2 weeks
    - Tafenoquine single dose (only after chloroquine)

\*Chloroquine-sensitive areas only

What prophylaxis do you recommend for 45-year-old who will spend 2 days in Hanoi and 10 days in rural Sri Lanka?

- a) Weekly chloroquine
- b) Daily doxycycline
- c) Weekly mefloquine
- d) Daily atovaquone-proguanil (Malarone<sup>R</sup>)
- e) Tafenoquine
- f) None of the above

# Malaria: chemoprophylaxis

- No chloroquine resistance:  
weekly (hydroxy-) chloroquine
- Chloroquine-resistance:
  - Doxycycline
  - Atovaquone-proguanil
  - Mefloquine (not border areas in SE Asia)
- Tafenoquine

Note: chloroquine, doxycycline, mefloquine, atovaquone-proguanil do not prevent relapses of *P. vivax* or *ovale*



# Tafenoquine for prevention of malaria

- Analog of primaquine (8-aminoquinoline)
- Approved by FDA 2018
- Active against all stages of parasite
- Once weekly dosing
- Contraindicated: pregnancy, G6PD deficient

Regimen Name	Timing	Dosage
Loading regimen	For each of the 3 days before travel to a malarious area	200 mg (2 of the 100 mg tablets) once <u>daily</u> for 3 days
Maintenance regimen	While in the malarious area	200 mg (2 of the 100 mg tablets) once <u>weekly</u> – start 7 days after the last loading regimen dose
Terminal prophylaxis regimen	In the week following exit from the malarious area	200 mg (2 of the 100 mg tablets) one-time 7 days after the last maintenance dose

45-year-old who will spend 2 days in Hanoi and 10 days in rural Sri Lanka

What do you recommend?

- a) Weekly chloroquine
- b) Daily doxycycline
- c) Weekly mefloquine
- d) Daily atovaquone-proguanil (Malarone<sup>R</sup>)
- e) None of the above

There is no transmission of malaria in either location






Mefloquine resistance

[https://www.cdc.gov/malaria/travelers/country\\_table/a.html](https://www.cdc.gov/malaria/travelers/country_table/a.html)

## Malaria Information and Prophylaxis, by Country




A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

Country	Areas with Malaria	Drug Resistance <sup>2</sup>	Malaria Species <sup>3</sup>	Recommended Chemoprophylaxis <sup>4</sup>	Key Information Needed and Helpful Links to Assess Need for Prophylaxis for Select Countries
Vietnam	Rural areas only. Rare cases in the Mekong and Red River Deltas. None in the cities of Da Nang, Hai Phong, Hanoi, Ho Chi Minh City (Saigon), Nha Trang, and Qui Nhon.	Chloroquine and Mefloquine	<i>P. falciparum</i> 65%; <i>P. vivax</i> 35%; <i>P. knowlesi</i> , <sup>7</sup> <i>P. malariae</i> , and <i>P. ovale</i> rare	Provinces of Dac Lac, Gia Lai, Khanh Hoa, Kon Tum, Lam Dong, Ninh Thuan, Binh Phuoc, Binh Duong, Dak Nong, Tay Ninh: Atovaquone-proguanil, doxycycline, or tafenoquine <sup>5</sup> . Other areas with malaria except Mekong and Red River Deltas: Atovaquone-proguanil, doxycycline, mefloquine, or tafenoquine <sup>5</sup> . Mekong and Red River Deltas: None (mosquito avoidance only). <sup>6</sup>	1) City(ies) of travel 2) Province(s) of travel 3) Region(s) of travel <a href="#">Map of provinces of Vietnam to look up if a city is within a certain province</a>  <a href="#">Map of provinces within the Red River Delta</a>  <a href="#">Map of the Mekong Delta Area</a> 
Sri Lanka	None	Not applicable	Not applicable	Not applicable	

[https://www.cdc.gov/malaria/travelers/country\\_table/a.html](https://www.cdc.gov/malaria/travelers/country_table/a.html)

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Sri Lanka	None	Not applicable	Not applicable	Not applicable	

No malaria in Hanoi

No malaria in Sri Lanka



# 23-year-old woman with fever and rash 3 days after returning from vacation in Bahia, Brazil

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- Abrupt onset: fever, chills, headache, myalgia, arthralgia
- Temperature 102° F, diffuse rash, lymphadenopathy
- WBC 3400 with normal differential, platelets 120,000

Differential diagnosis?





# Diagnosis?

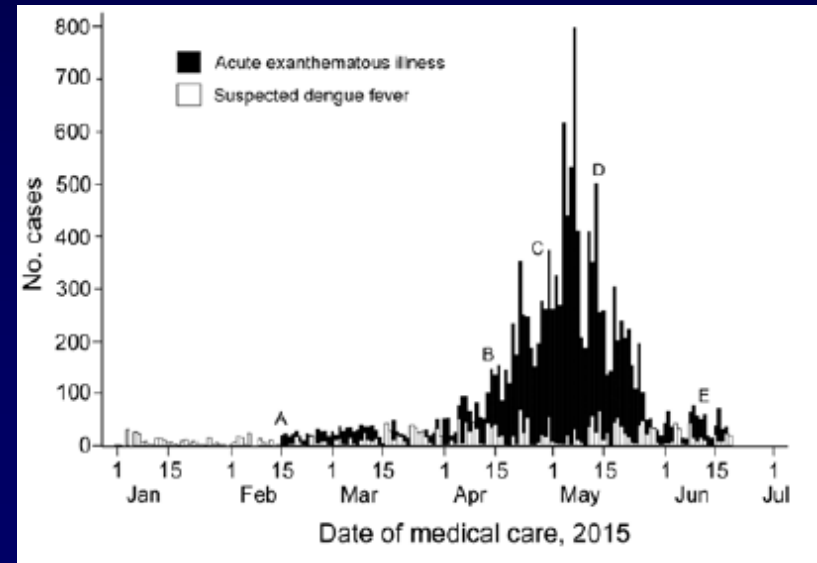
- Dengue
- Chikungunya
- Zika
- Acute HIV
- EBV
- Measles
- Rubella
- Parvovirus
- Enteroviruses
- Rickettsial infection
- Gr A streptococcus
- Syphilis
- Typhoid
- Leptospirosis
- Drug reaction
- Mpox (Monkeypox)
- Other

# 23-year-old woman with fever and rash

- Clinical diagnosis: dengue
- Confirmed retrospectively with serology (IgG, IgM)
- Afebrile on 7<sup>th</sup> day; prolonged fatigue for several weeks

## **Outbreak of Exanthematous Illness Associated with Zika, Chikungunya, and Dengue Viruses, Salvador, Brazil**

Cristiane W. Cardoso,<sup>1</sup> Igor A.D. Paploski,<sup>1</sup>  
Mariana Kikuti, Moreno S. Rodrigues,  
Monaise M.O. Silva, Gubio S. Campos,  
Silvia I. Sardi, Uriel Kitron, Mitermayer G. Reis,  
Guilherme S. Ribeiro



# Classic dengue

- Incubation period 1-7 days, up to 14+ days
- 5-7 days of fever; often biphasic
- Rash in ~50%: flushlike, later macular or morbilliform
- Serologic tests negative during first 5-7 day
  - CDC: symptoms  $\leq 7$  days: PCR, dengue virus antigen testing (NS1); IgM antibody test if PCR and antigen test negative
  - CDC: symptoms  $> 7$  days: IgM antibody test
- Immune enhancement with second infections: dengue shock syndrome, dengue hemorrhagic fever

## Reported fatal imported dengue cases

**Table 1.** Overview of published cases of imported dengue with fatal outcomes (n=9)

Year	Gender	Age	Country of residence	Country of dengue acquisition	Cause of Death	Time of death (DPSO)days	Dengue diagnosis and serotype		Primary/Secondary dengue infection			Ref.
									IgM	IgG		
1998	F	25	Netherlands	Thailand	Cerebral edema	6	RT-PCR	DENV-3	Prim.	1/128	1/16	<sup>20</sup>
2002	F	32	Finland	SE Asia	Cerebral hemorrhage	37	PRNT	DENV-1/2	Prim.	POS	NEG	<sup>13</sup>
2005	F	28	USA	Mexico	-	-	-	-	-	-	-	<sup>18</sup>
2005	F	30	Norway	Mexico	Subarachnoid hemorrhage	8	RT-PCR	DENV-2	Prim.	POS	NEG	<sup>14</sup>
2008	F	50	Norway	Thailand	DSS	7	RT-PCR	DENV-1	Prim.	POS	NEG	<sup>15</sup>
2009	M	54	Netherlands	Saint Martin	DSS	4	RT-PCR	DENV-2	Prim.	NEG	NEG	<sup>16</sup>
2009	F	21	Germany	Ecuador	Postoperative hemorrhage	11	RT-PCR	DENV-1	Sec.	1/20	1/2560	<sup>17</sup>
2012	F	63	USA	USA	Hemophagocytic lymphohistiocytosis	38	RT-PCR	DENV-3	Prim.	POS	-	<sup>19</sup>
2015	F	34	Australia	Papua New Guinea	Myocarditis/cerebral edema	6	RT-PCR	DENV-3	Prim.	POS	NEG	<sup>21</sup>

F = female; M = male; DSS = dengue shock syndrome; DPSO = days post symptom onset; RT-PCR = real-time reverse transcription polymerase chain reaction; PRNT = plaque reduction neutralization testing; DENV-x indicates dengue serotype; Prim. = primary; Sec. = secondary; POS = positive; NEG = negative; - = data missing.

Only one secondary infection  
8/9 primary infections

## CORRESPONDENCE



### Fatal Dengue Acquired in Florida

N Engl J Med 2021; 384;23

Freise et al. *Tropical Diseases, Travel Medicine and Vaccines* (2021) 7:23  
<https://doi.org/10.1186/s40794-021-00148-0>

Tropical Diseases,  
Travel Medicine and Vaccines

## CASE REPORT

Open Access

Gallbladder Wall Thickening associated with Dengue Shock Syndrome in a German traveller – no indication for surgical therapy – a case report

Noemi F. Freise<sup>\*</sup> , Björn Jensen, Verena Keitel and Tom Luedde



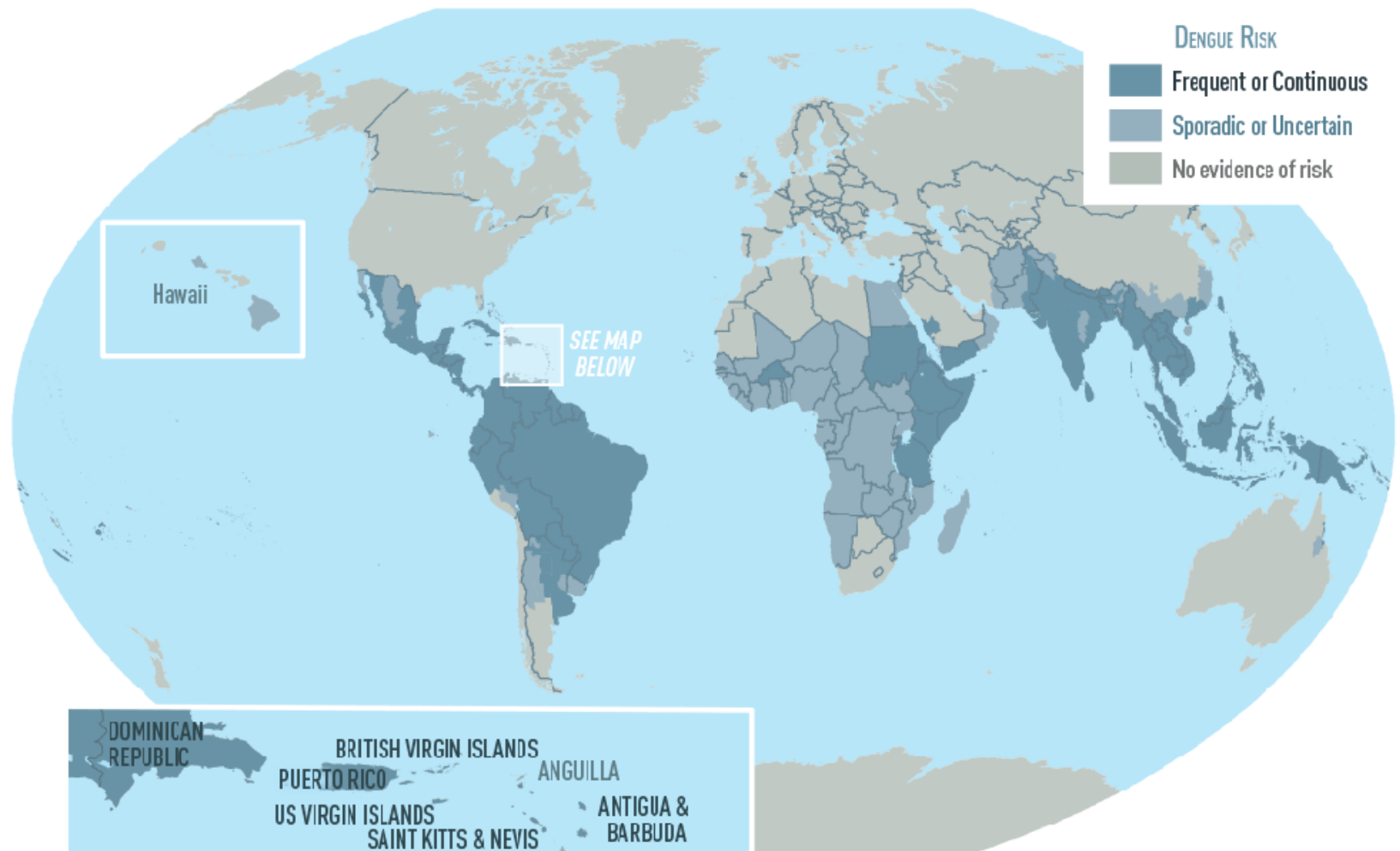
# Chikungunya

- ‘That which bends up’ in the Kimakonde language of Mozambique’
- Dengue-like illness except  $\geq 1/3$  patients have incapacitating arthralgia/arthritis lasting months or years

# Zika

- Like dengue + joint swelling, conjunctivitis
- Infection during pregnancy: microcephaly, fetal brain defects
- Increase in Guillain-Barre syndrome
- Sexual transmission

Clinical differentiation of dengue, zika, and chikungunya, difficult: avoid NSAIDs



## Dengue 2022

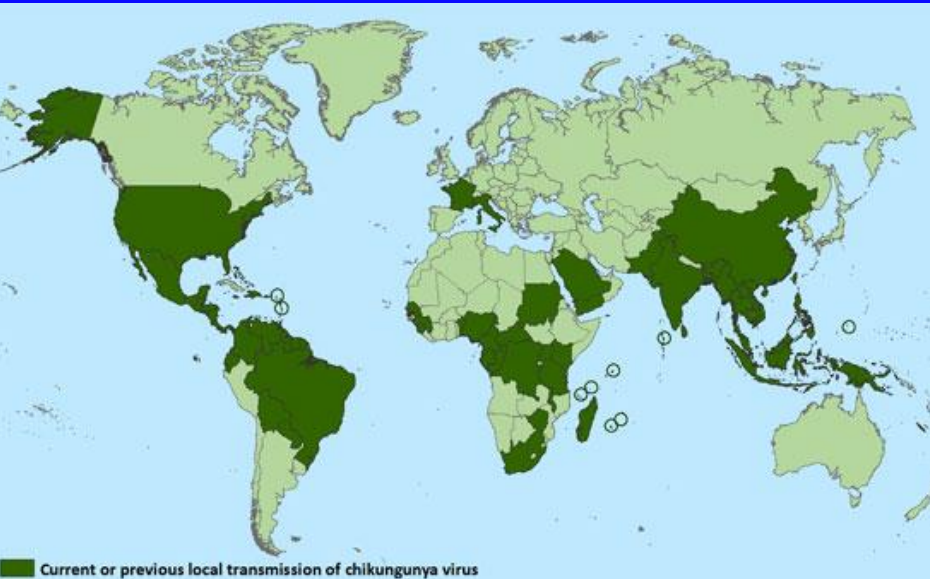
~100 million cases/yr

~22,000 deaths/yr

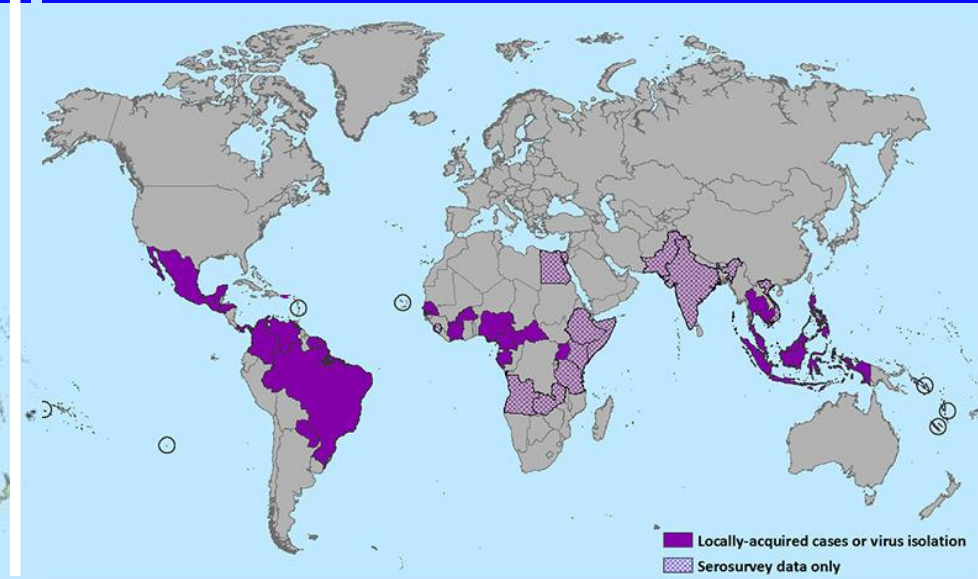
Vectors:

*Aedes aegypti* > *A. albopictus*

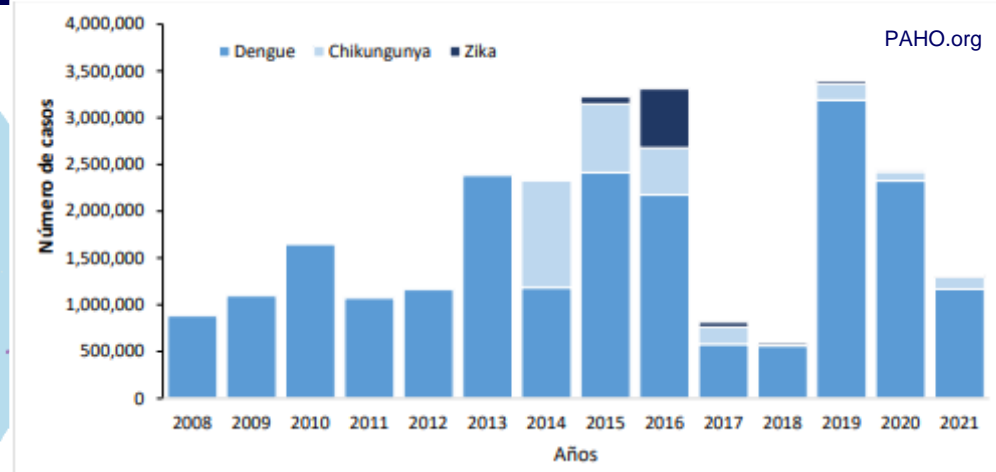
# Countries and territories where chikungunya cases have been reported



# Countries and territories where Zika cases have been reported



## Areas with risk of Zika



Cases of dengue, chikungunya, Zika in the Americas 2008-2021



# Approximate ranges of *Aedes aegypti* and *A. albopictus* in the United States, 2017 (CDC)





## Symptoms of Zika

Many people won't have symptoms or even know they are infected with the virus. The illness is usually mild with symptoms lasting for several days to a week.

**Zika can also be sexually transmitted from an infected person to his or her male or female partners, so travelers should use condoms.**

### Pregnant?

- Do not travel to areas with Zika.
- If you must travel to these areas, talk to your doctor first.
- Strictly follow steps to prevent mosquito bites during your trip.

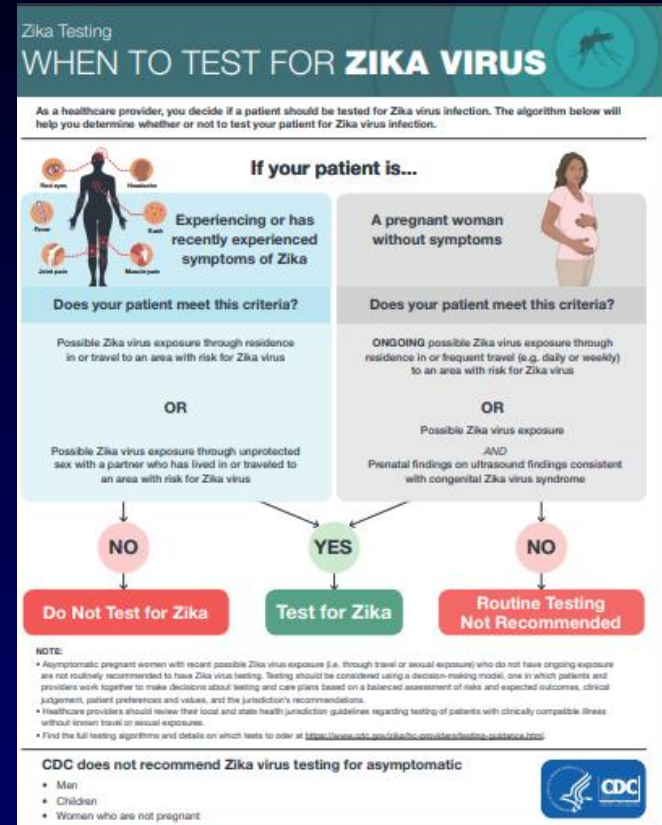


### Trying to become pregnant?

- Before you travel, talk to your doctor about your plans to become pregnant and the risk of getting Zika.
- Strictly follow steps to prevent mosquito bites during your trip.

Morbidity and Mortality Weekly Report

**Update: Interim Guidance for Health Care Providers Caring for Pregnant Women with Possible Zika Virus Exposure — United States (Including U.S. Territories), July 2017**



# 42-year-old man with diarrhea after travel to Thailand

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- Chills, cramps, watery diarrhea on return flight
- Self-treated with levofloxacin
- Markedly improved after 3 days; one loose stool/day
- 36 hours after stopping levofloxacin: chills, diarrhea, crampy abdominal pain

# 42-year-old man with recurrent diarrhea after travel to Thailand

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Most likely diagnosis?

- Treatment failure
- Amebic dysentery
- *Clostridioides difficile* colitis
- Falciparum malaria

# 42-year-old man with recurrent diarrhea after travel to Thailand

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- Fecal leukocytes: few/hpf
- Stool for ova and parasites: negative
- Assay for *C. difficile* toxin: negative
- Stool culture: Campylobacter resistant to quinolones

Treatment: azithromycin 1 gm po

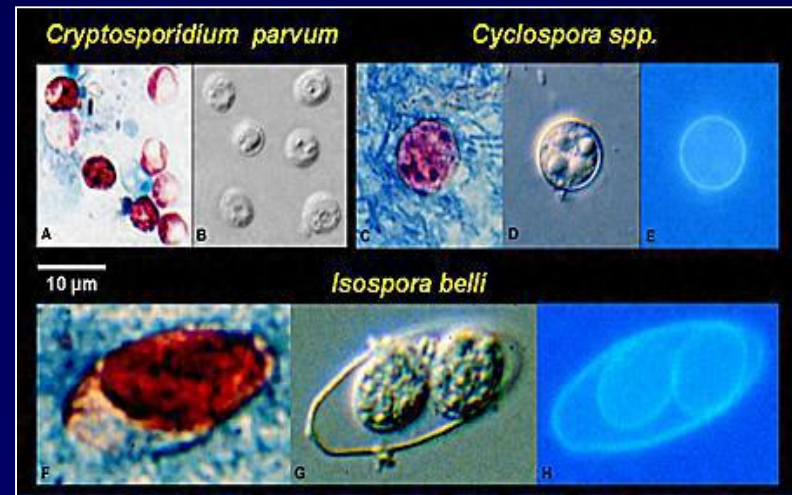
Acute illness subsides, but 6 months later he still has frequent loose stools, cramps

# Persistent travelers' diarrhea

- Diarrhea lasting > 2-3 weeks
- Six months following bout of diarrhea, 6-18% experience chronic GI symptoms
- Three major categories:
  - Infections
  - Chronic gastrointestinal disease unmasked by enteric infection (e.g., inflammatory bowel disease, celiac sprue)
  - Post-infectious processes

# Persistent travelers' diarrhea: infectious causes

- Protozoan infections most common (*Giardia*, *Cryptosporidium*, *Cyclospora*, *Cystoisospora*, *Dientamoeba fragilis*, *Entamoeba histolytica*)
- Helminths less common: *Strongyloides*, *Schistosoma*
- Bacteria: *C. difficile*, Enteroadherent *E. coli*; tropical sprue
- Multi-pathogen molecular assays available



CDC-DPDx

# Persistent travelers' diarrhea: post-infectious causes

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- Post-infectious malabsorption
  - Lactase deficiency
  - Bacterial overgrowth
- Post-infectious irritable bowel syndrome

Our patient: probable irritable bowel syndrome

# Diarrhea: strategies for travelers

## Prevention

- Food & beverages
  - “Boil it, cook it, peel it or forget it!”
  - Easier said than done
- Hand hygiene
- Chemoprophylaxis (high risk travelers)
  - Bismuth subsalicylate (65% protection)
  - Rifaximin (70-80% protection)
  - Fluoroquinolones (effective, not recommended)
  - ETEC vaccines

## Empirical treatment

- Fluids
- Loperamide 4 mg x1, then 2 mg for each loose stool up to 16 mg/day; not in dysentery)
- Bismuth subsalicylate  
+/-
- Antibiotics (severe cases)
  - Azithromycin 1gm x1;  
500 mg x 1 + loperamide;  
500 mg x 3days
  - Nondysenteric cases  
Rifaximin 200 mg TID x3 days (max); rifamycin-SV now FDA-approved



# Antimicrobials Increase Travelers' Risk of Colonization by Extended-Spectrum Betalactamase-Producing *Enterobacteriaceae*

Anu Kantele,<sup>1,2,3,4</sup> Tinja Lääveri,<sup>1,2</sup> Sointu Mero,<sup>5</sup> Katri Vilkkman,<sup>2,3</sup> Sari H. Pakkanen,<sup>3</sup> Jukka Ollgren,<sup>6</sup> Jenni Antikainen,<sup>5</sup> and Juha Kirveskari<sup>5</sup>

<sup>1</sup>Department of Clinical Medicine, University of Helsinki, <sup>2</sup>Division of Infectious Diseases, Department of Medicine, Helsinki University Hospital, and <sup>3</sup>Department of Bacteriology and Immunology, University of Helsinki, <sup>4</sup>Aava Travel Clinic, Medical Centre Aava, <sup>5</sup>Department of Clinical Microbiology, Helsinki University Hospital, University of Helsinki, and <sup>6</sup>National Institute for Health and Welfare, Helsinki, Finland

(See the Editorial Commentary by Connor and Keystone on pages 847–8.)

In South Asia, 80% of travelers who received antibiotics for treatment of travelers' diarrhea became colonized with ESBL-producing bacteria

# Subclinical chronic infections of immigrants and returning long-term expatriates

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- Tuberculosis
- HIV
- Hepatitis B
- Chagas' disease
- Strongyloidiasis
- Schistosomiasis
- Cysticercosis

## Case history

27 y.o. immigrant from rural El Salvador receives a letter after donating blood at her local blood bank. Her blood tested positive for infection with *Trypanosoma cruzi*.



She has no symptoms. Physical examination is negative. CBC, diff, LFTs are all normal

Does she have Chagas disease?

Does she need further evaluation or treatment?

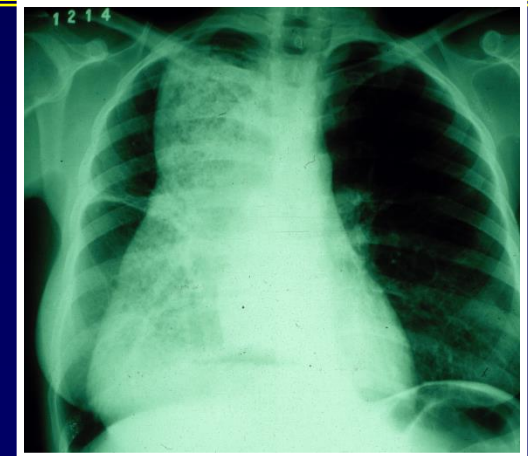
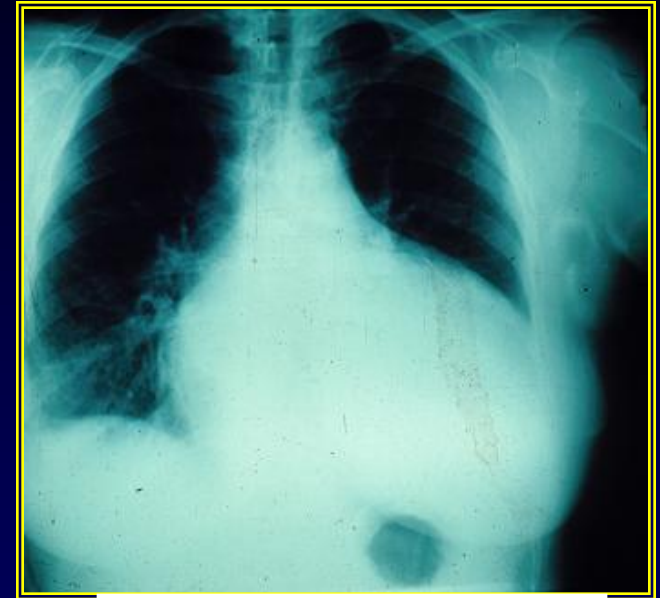
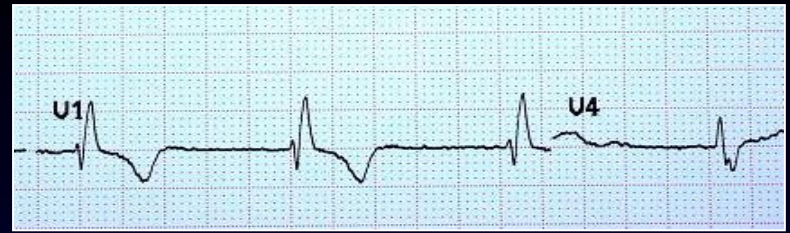
# Chagas disease (American trypanosomiasis)

- ~250,000 immigrants with *T. cruzi* infection in US
- Most unaware of infection
- Most US blood banks screening blood donors
- Diagnosis
  - History of exposure: Latin America, not Caribbean; poor housing; history of blood transfusion; infected mother or sibling
  - Serology: 2 or more tests (IFA, ELISA, Western blot, etc.)



# Chronic Chagas disease

- 70-80%: subclinical
- Chronic cardiomyopathy: CHF, arrhythmias (sudden death), heart block, thromboembolism, RBBB common on ECG
- Megaesophagus, megacolon
- Reactivation in HIV-infected, other immune-suppressed: CNS lesions mimic toxoplasmosis, acute myocarditis
- Congenital transmission



Megaesophagus

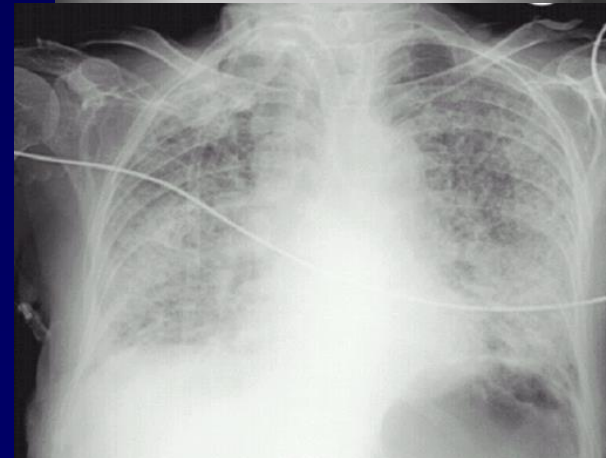
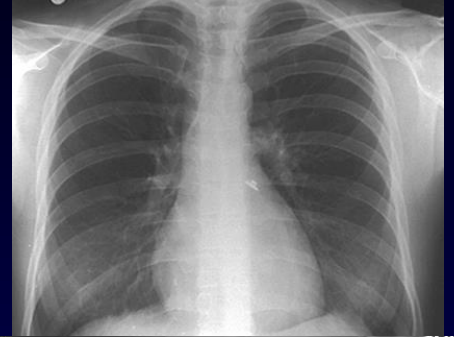
# Treatment of *T. cruzi* infection

- Always offer:
  - Acute, congenital, reactivated infection in immunocompromised host
  - Persons < 18 years
  - Women of childbearing age (prevent transmission to fetus)
- Consider: other persons 18-50 years of age (without advanced cardiomyopathy)
- Not offer: advanced cardiomyopathy
- Benznidazole or nifurtimox: FDA approved, available commercially



# 32 y.o. man from Ecuador with renal failure

- Living in US for 8 years
- Evaluation for kidney transplant
  - Epigastric pain; endoscopy: duodenitis
  - WBC 7900, 9% eosinophils
- 6 weeks after renal allograft:
  - Temp 102.5°
  - Abdominal pain
  - Diarrhea (heme +)
  - Blood cultures + for *E. coli*
  - Broad spectrum antibiotics
  - Progressive respiratory failure

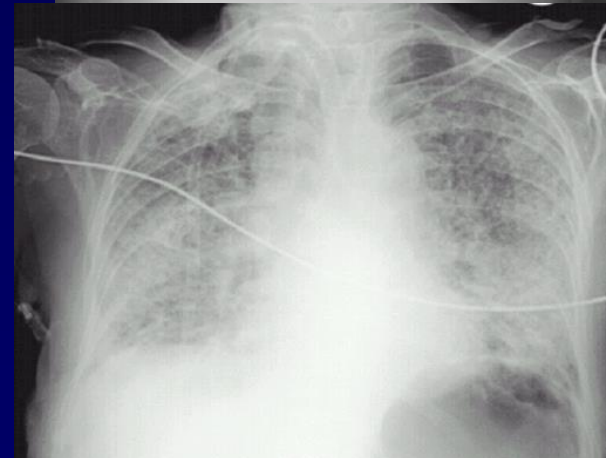
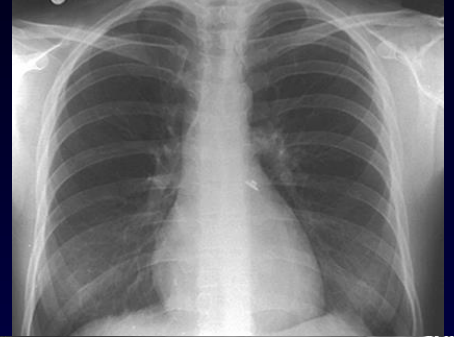




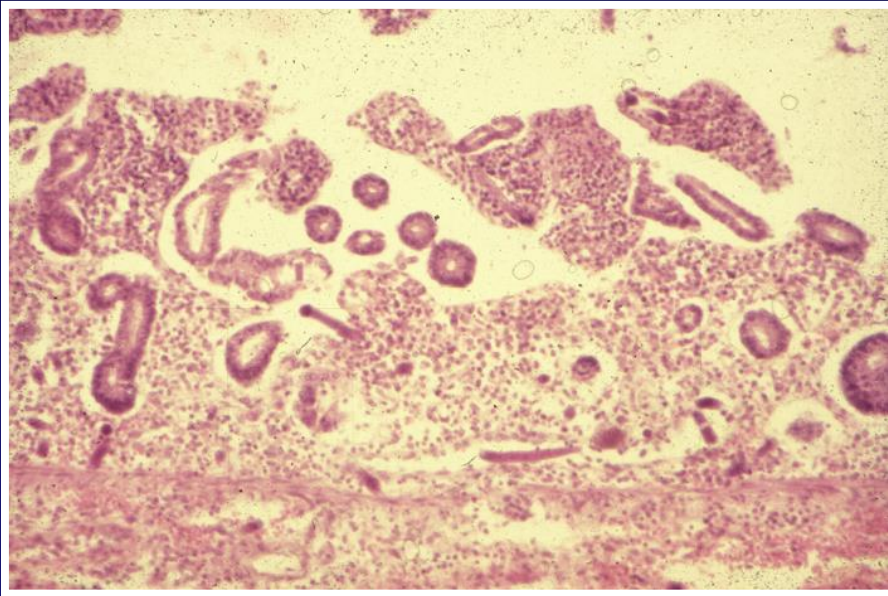
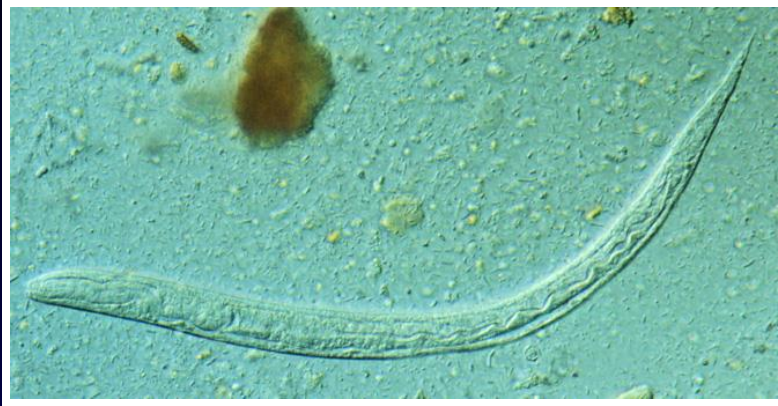
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  - Progressive respiratory failure

## Diagnosis?



# Bronchoscopy



- Filariform larvae of Strongyloides stercoralis
- Immunosuppression held
- Daily ivermectin per N-G tube
- *E.coli* meningitis
- Post-mortem: larvae throughout gut, lungs, brain, heart

**Disseminated  
strongyloidiasis**

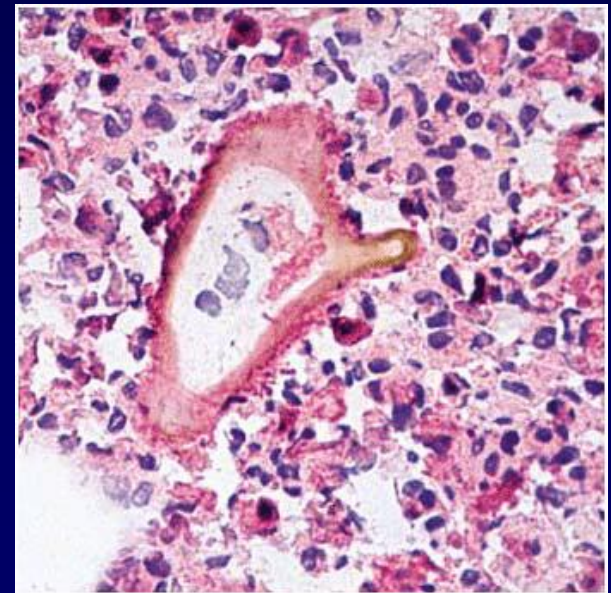
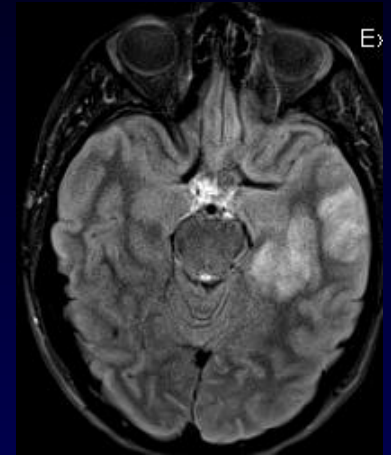
# *Strongyloides stercoralis*

- Able to complete life cycle in host without exogenous reinfection
  - Infection life-long
  - Eosinophilia in >75%
  - Potential for life threatening hyperinfection/dissemination (corticosteroids, HTLV-1>>>HIV, malnutrition)
- Diagnosis of chronic infection: serology more sensitive than microscopic examination of stool
- Treatment: ivermectin 200 mcg/kg PO x 1



# 25-year-old woman with seizure

- Spent a semester in Ghana
- Avoided swimming in fresh water
- 4 years later: seizure
- MR of brain: suspicious for tumor
- Craniotomy
- After recovering, recalled walking barefoot along the side of a river one afternoon
- Treated with praziquantel



*Schistosoma mansoni*

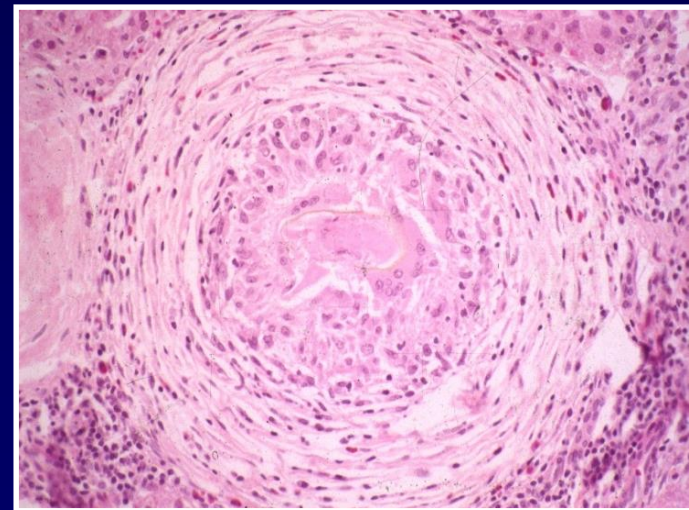


# Schistosomiasis

- Contact with snail-infested fresh water
- Acute infection: first exposure, fever, eosinophilia, urticaria, abdominal pain, cough
- Chronic disease: granulomatous response to eggs in tissue, fibrosis
- Multiple complications including ectopic egg deposition with disastrous complications (spinal cord, central nervous system)
- Diagnosis: Eggs in stool/urine, serology (especially travelers)
- Treatment: praziquantel



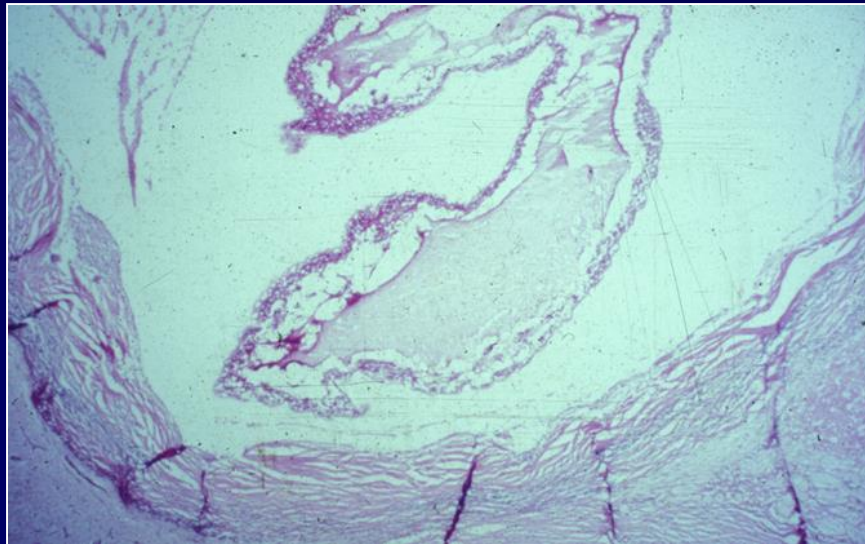
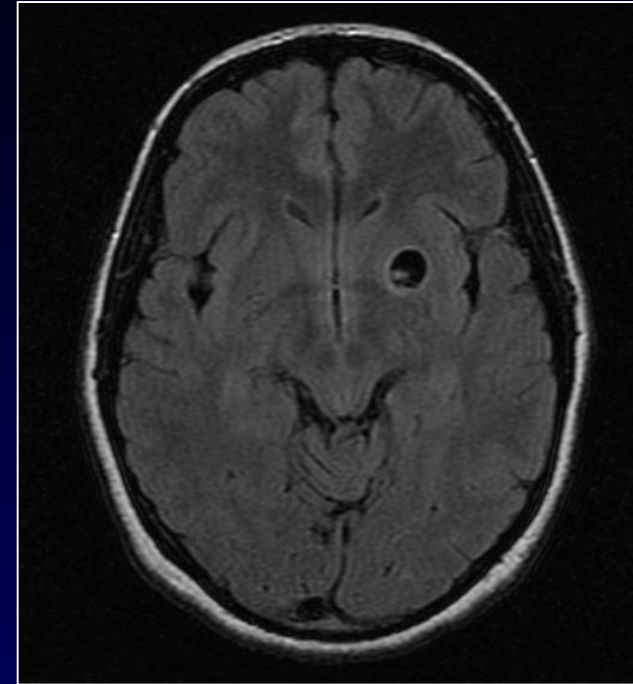
*Schistosoma mansoni*



*Granuloma around egg*

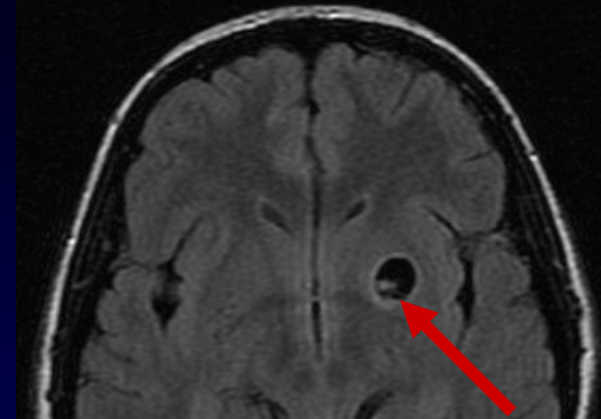
# Cysticercosis (*Taenia solium*)

- Ingestion of pork tapeworm eggs (not pork)
- Most common presentation: seizures several years after infection due to inflammation around degenerating cysts



# Cysticercosis (*Taenia solium*)

- Diagnosis:
  - CT or MR pathognomonic if scolex visualized
  - ELISA and immunoblot (CDC)
- Treatment (when indicated):
  - High dose albendazole and/or praziquantel
  - Funduscopic examination
  - Corticosteroids, anticonvulsants
  - Surgery, shunts
- Search for tapeworm carrier in household





# Skin lesions in returning travelers

- Teenager with an itchy rash
- Developed after 10-day vacation in Trinidad
- Worsened despite 7-days of amoxicillin



Diagnosis?



Cutaneous larva migrans (creeping eruption)

# Cutaneous larva migrans (creeping eruption)

- Infection with dog or cat hookworms (*Ancylostoma braziliensis*, others)
- Contact of bare skin with contaminated, usually sandy, soil
- Diagnosis: clinical
- Treatment
  - ivermectin 200 mcg/kg PO QD x1-2 days
  - albendazole 400 mg PO QD x3 days



*J Travel Med*, 2021, 10.1093

# Cutaneous lesions in returning travelers

- Cutaneous larva migrans — 25 percent
- Pyoderma — 18 percent
- Arthropod-reactive dermatitis — 10 percent
- Myiasis — 9 percent
- Tungiasis — 6 percent
- Urticaria — 5 percent
- Fever and rash — 4 percent
- Cutaneous leishmaniasis — 3 percent

# Healthy 47-year-old man with skin lesions

- One week earlier he left West Africa
- 5 days in five-star hotel, ate only hotel food, slept in an air-conditioned room with the windows closed
- He walked on the beach outside the hotel, swam in the chlorinated hotel pool, and lounged on wooden cots near the pool
- No history of insect bites, but sensation of bites and small red bumps on his buttocks and thighs



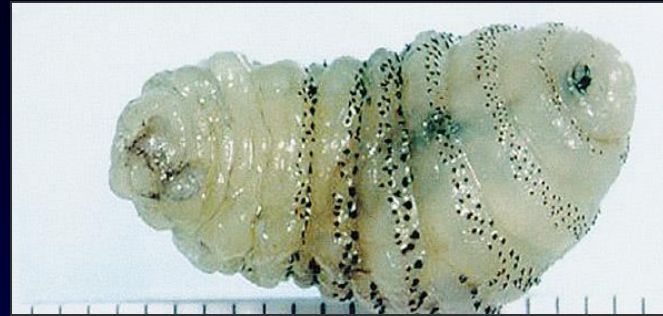
- On flight to US: numerous boils several centimeters in diameter; unable to sit because of pain
- Back in US, the lesions increasing in size in front of his eyes
- In EW reports things moving inside, blowing bubbles in bathtub

Diagnosis?



# Furuncular myiasis

## (infestation with maggots--fly larvae)



- Tumbu fly: (*Cordylobia anthropaga*): sub-Saharan Africa
  - Eggs deposited on sandy or clothes contaminated with urine or sweat
  - Larvae hatch, penetrate skin to subcutaneous tissue where they feed and grow
  - Larval chamber becomes boil-like and inflamed
  - 10-14 days later mature larvae falls out of lesion, pupates on ground
- Human botfly (*Dermatobia hominis*): Latin America
- Treatment: extraction (squeezing, suffocation; excision)

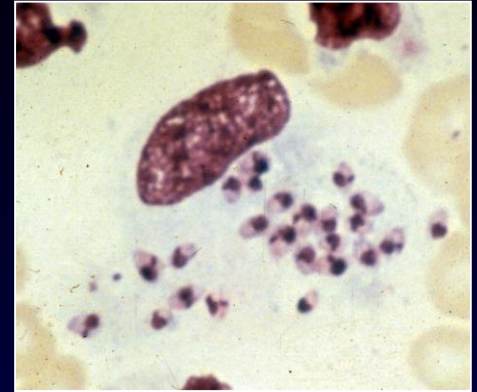
## 45-year-old biologist worked in Peruvian forest

- Age 30 years: received 10 days of injections for painless, slowly expanding ulcers
- Lesions healed in ~2 months
- 15 years later presents with mouth ulcer



# Leishmaniasis (*Leishmania braziliensis*)

- Diagnosis:
  - Biopsy, scrapings, aspirate
  - Smears, culture, molecular studies
- Treatment:
  - IV lipid-associated amphotericin compounds
  - Oral miltefosine
  - Parenteral pentavalent antimony
- Complication: mucosal leishmaniasis



# Take home points

- Include travel-related infections when formulating differential diagnoses
- Falciparum malaria can be rapidly fatal and should be ruled out in all febrile patients returning from malaria-endemic areas regardless of clinical presentation
- Infectious diseases among immigrants and short-term travelers often differ; important infections of immigrants are often subclinical at the time of entry
- Most travel-associated infectious diseases can be prevented by inquiring about patients' travel plans and providing advice, vaccines and prophylactic medication

A young man returns from Haiti with fever and headache. His temperature is 103° F but he appears well. Laboratory studies show mild anemia, thrombocytopenia, and normal renal function . A blood smear shows a few rings of *Plasmodium falciparum*.

- Treatment of choice:
- a. Chloroquine
  - b. Mefloquine
  - c. Quinine + doxycycline
  - d. Quinidine +clindamycin
  - e. Artemether/lumefantrine



- Treatment of choice:**
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  - c. Quinine + doxycycline
  - d. Quinidine +clindamycin
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Artemisinin combination therapy is the treatment of choice for all cases of falciparum malaria because of more rapid action and increased survival compared to other agents.

High doses of corticosteroids can predispose which of the following to overwhelming and potentially fatal infection?

- a. Falciparum malaria
- b. Babesiosis
- c. Giardiasis
- d. Strongyloidiasis
- e. Schistosomiasis



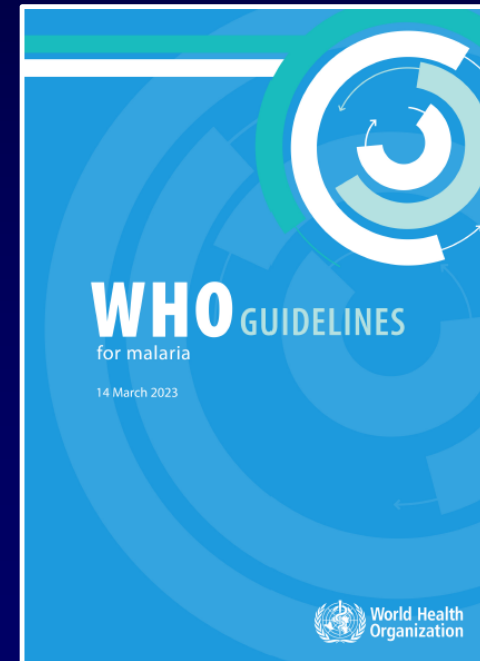
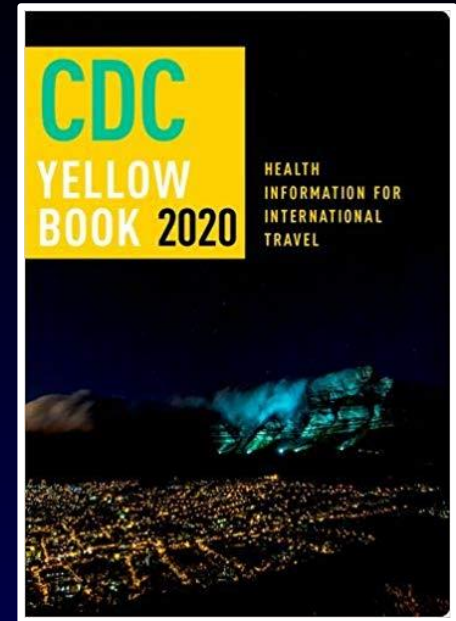
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- d. Strongyloidiasis \*
- e. Schistosomiasis

Splenectomy (not steroid therapy) is associated with overwhelming malaria and babesiosis; steroids accelerate *Strongyloides* replication; schistosomes do not replicate in the host.

# References

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Thank you!