

Chagas Disease – Introduction to Foodborne Transmission

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Illustration by Mark Burckhardt



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DISCLOSURES

- None to report

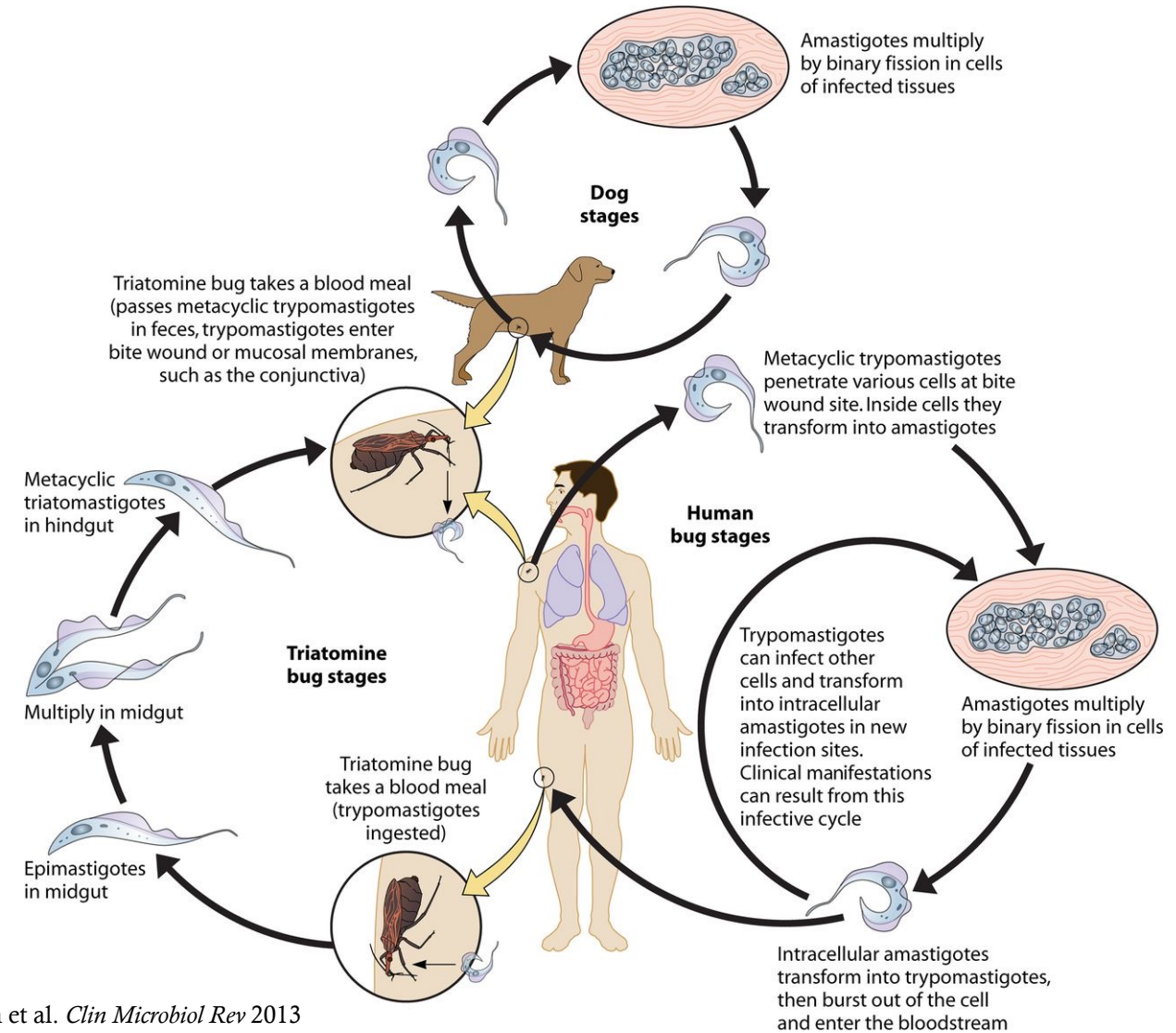


Chinavita, Boyacá, Colombia



THE PARASITE

- *Trypanosoma cruzi* is a kinetoplastid protozoan
- Can infect many **mammalian** hosts during defined stages in its complex life cycle
- Primarily an intracellular pathogen but has hemoflagellate stage
- **Metacyclic trypomastigotes** are the infectious agent
- **Six distinct *T. cruzi* strains (DTU 1 – VI)**
- **Domestic reservoir → dogs**
- **Wildlife reservoir → rodents, raccoons, opossums...**



Peterson et al. *Clin Microbiol Rev* 2013

TRANSMISSION TO HUMANS

Vector-borne via infected Kissing Bugs

- Feces contains infectious trypomastigote
- Enters through the bite site or mucous membranes

Congenital transmission

- Mother to fetus

Blood transfusion

- Prior to 2007 in the U.S.
- Not all countries routinely screen

Organ transplantation

- Donor-derived infection

Oral ingestion of contaminated foods

- Food contains infected bug(s) and/or fecal material
- Unpasteurized fruit juices: Açaí palm fruit, guava juice, and juice prepared from sugarcane



Rhodnius prolixus taking a blood meal with **fecal drop** (courtesy of WHO)



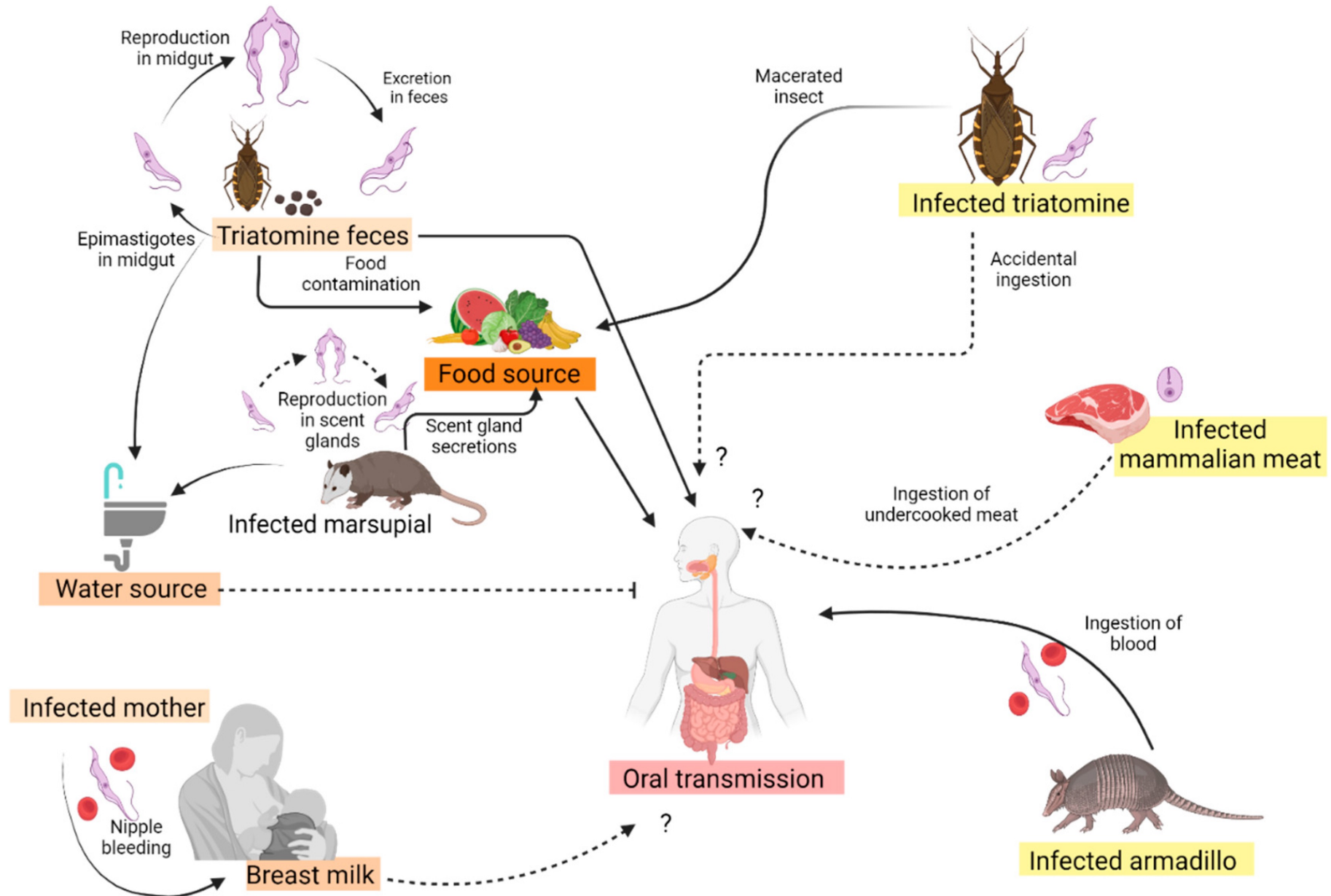
Guava juice



Açaí fruit

Cross-contamination

Direct ingestion



-
- Eating wild game that is raw or undercooked can transmit *T. cruzi* to humans and other hosts
 - In Colombia and certain regions of Latin America there is a cultural practice to drink **armadillo blood**

Liborina, Colombia



PHASES OF CHAGAS

Romaña's sign

Acute Phase – fever, lymphadenopathy, malaise/fatigue

- Majority are **asymptomatic**, only some will develop febrile illness
- Symptoms if present can last weeks to months, then resolve
- Immunocompromised → can develop encephalitis, myocarditis, tamponade
- **Romaña's sign**: seen when infection enters the mucosa of the orbit

Chronic Phase

- After acute infection people enter the “indeterminate” or “determinate” phase
- Those with indeterminate disease remain **asymptomatic** but typically reveal serologic evidence of infection
- This lasts many years and may resolve spontaneously or progress to chronic disease.
- Affects two major organ systems, the **cardiac and gastrointestinal systems**



Munoz-Saravia SG et al. Heart Failure Reviews 2010.

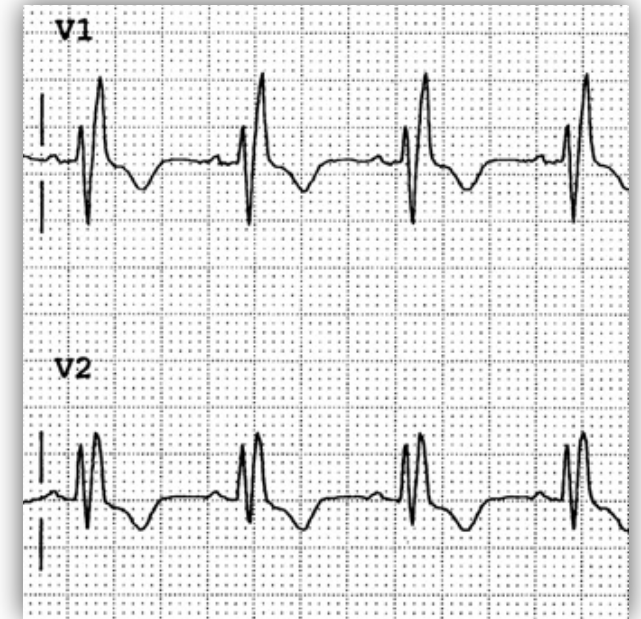
CHAGAS HEART DISEASE

Electrical abnormalities typically arise first

- **Right bundle branch block** >> Left bundle branch block
- 1st degree, 2nd degree and complete heart block
- Feared complication is **Sudden Cardiac Death**

Progressive heart failure

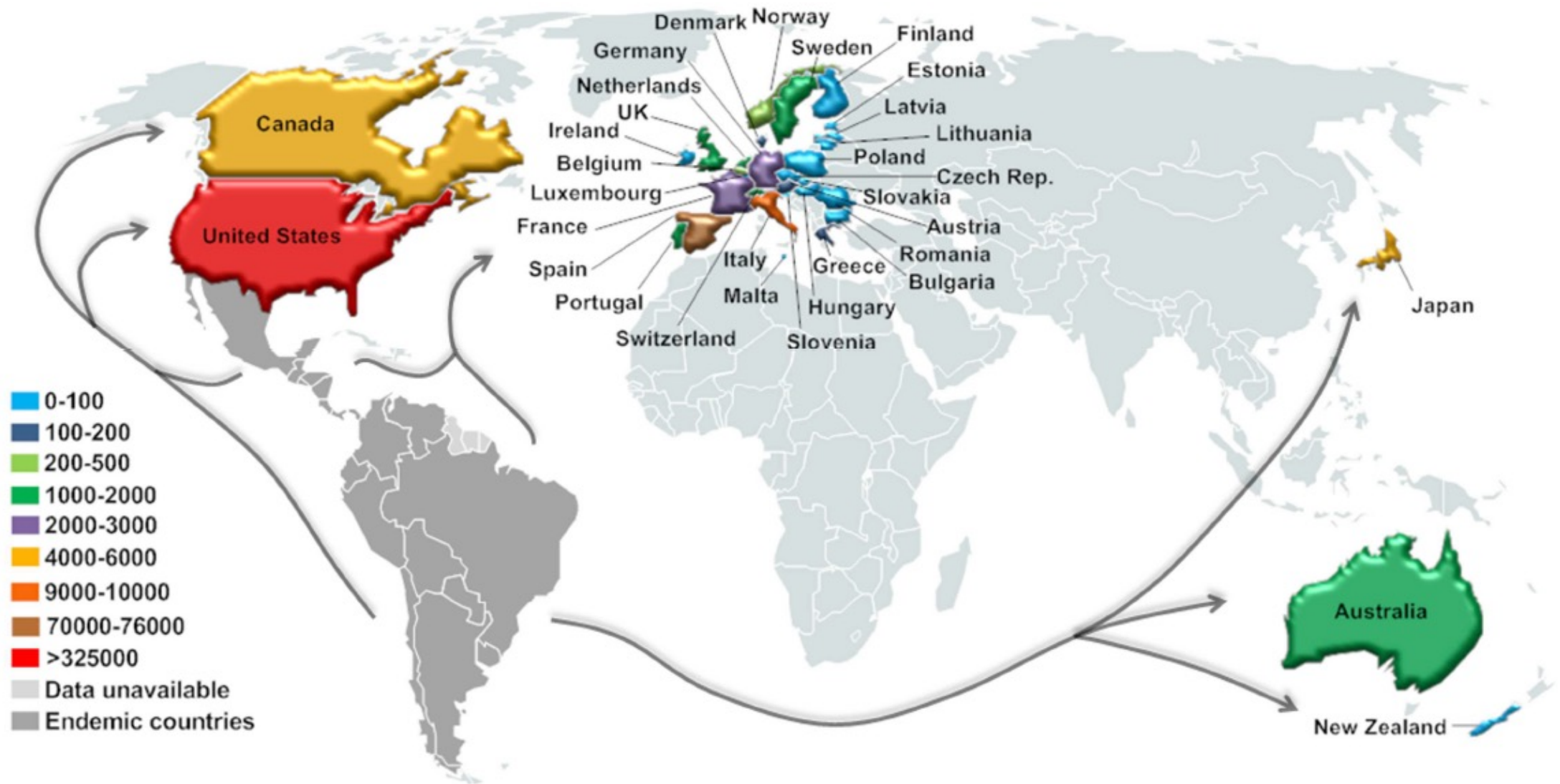
- Progressive Heart Failure with reduced Ejection Fraction (HFrEF)
- Non-ischemic cardiomyopathy
- Left ventricular apical aneurysm



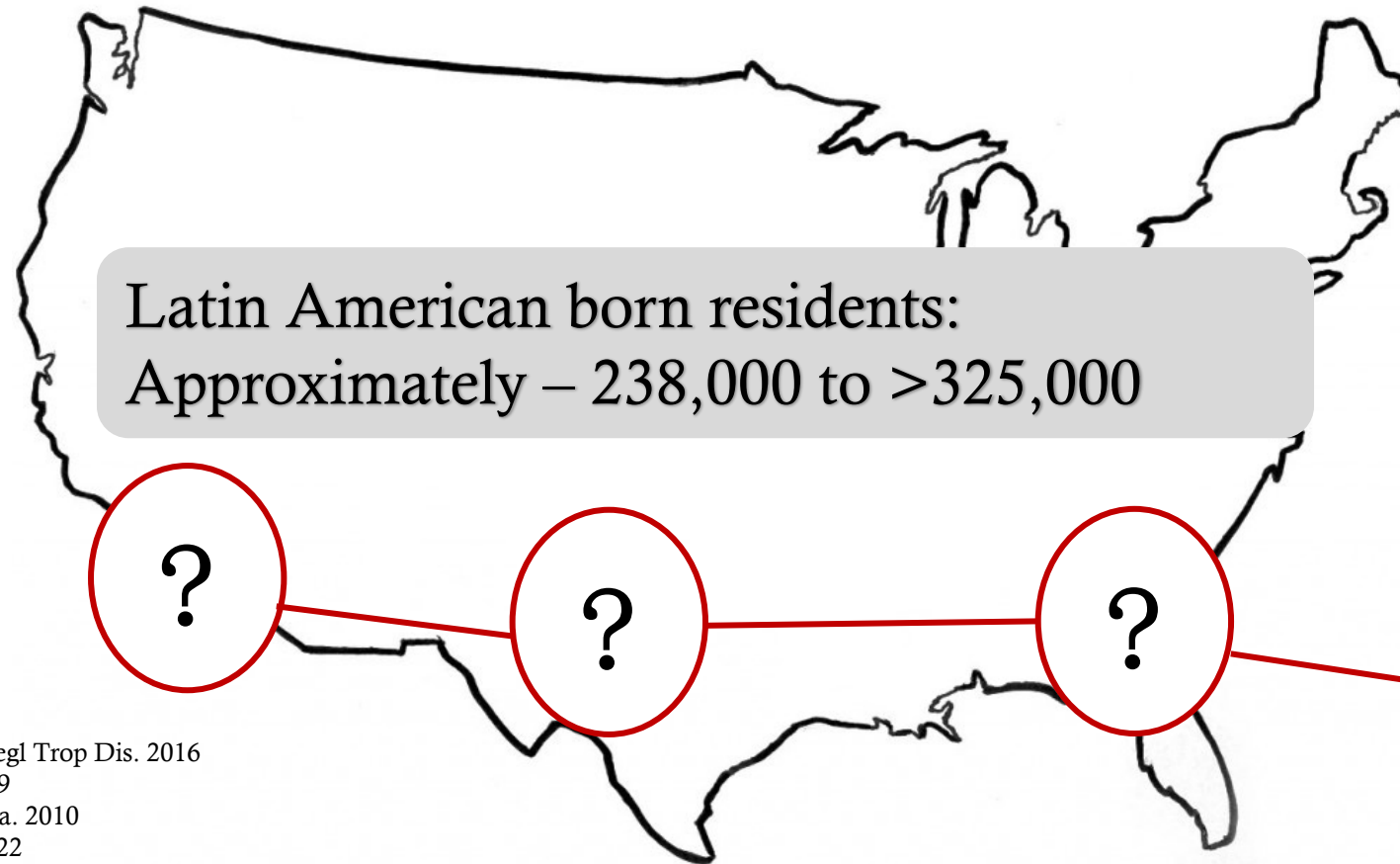
CHAGAS DISEASE IN 2024

- WHO estimates up to **6-7 million** people globally are infected with *Trypanosoma cruzi*
- Endemic in 21 Latin American countries (70 million at-risk)
- Approximately 10 -14,000 people die yearly from Chagas disease (likely grossly under-estimated)
- **WHO 2015 > 1 million have Chagas heart disease worldwide**
- **Worldwide < 10% diagnosed or <1% received treatment**





CHAGAS DISEASE IN THE UNITED STATES



Latin American born residents:
Approximately – 238,000 to >325,000

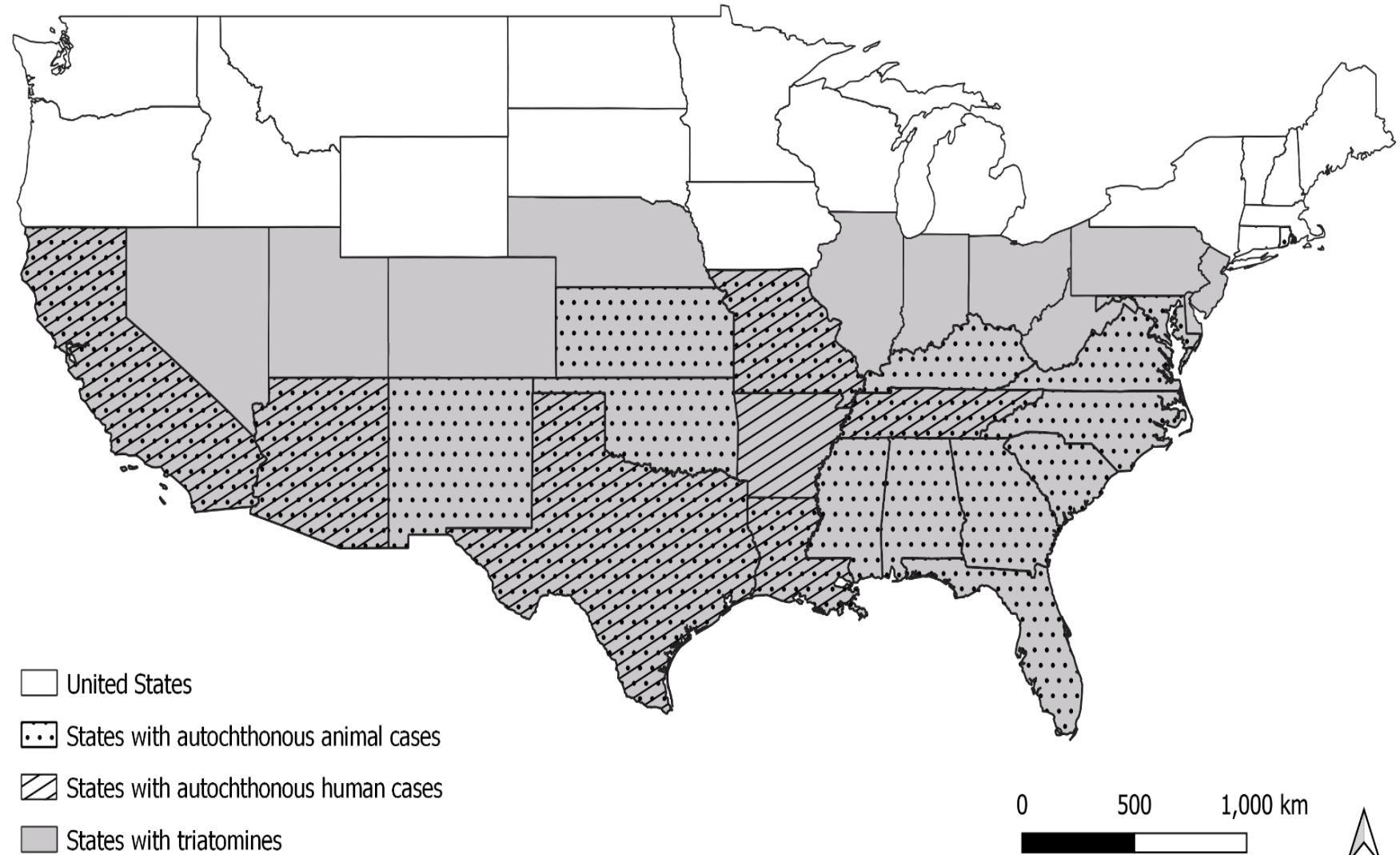


Autochthonous

≈ 10,000?

Manne-Goehler J, *et al.* PLoS Negl Trop Dis. 2016
Bern C, *et al.* Clin Infect Dis. 2009
Schmunis GA, *et al.* Acta Tropica. 2010
Irish A, *et al.* Emerg Infect Dis 2022

Endemic?



Beatty NL et al.
unpublished data, 2024

FOODBORNE TRANSMISSION - CHAGAS

- **Contaminated fruit juices with kissing bug feces or macerated bug in preparation of fruit and/or juice**
 - Açaí palm fruit
 - Guava fruit
 - Tangerine and mandarin juice
 - Raw sugar cane
- **Ingestion of food/or drink which was contaminated by kissing bug feces in the home**
 - Certain vectors which are “peridomestic” have been implicated in oral transmission
- **Ingestion of wild game meat or blood from infected animal**
- **Opossum anal secretions contaminating food or preparation surfaces**



Açaí palm fruit grown at monoculture farm in northern Brazil

FOODBORNE TRANSMISSION - CHAGAS



Mango and Papaya being sold at street stand in Medellín, Colombia



Banana, Guava and Passion Fruit being sold as juice near Tunja, Colombia



Açaí fruit being brought in from Amazon basin headed to Manaus, Brazil

FOODBORNE TRANSMISSION - CHAGAS



Panstrongylus geniculatus found in a home in Liborina, Colombia

Vectors associated with suspected oral transmission:

- *Panstrongylus geniculatus*
- *Triatoma dimidiata*
- *Triatoma venosa*
- *Panstrongylus rufotuberculatus*

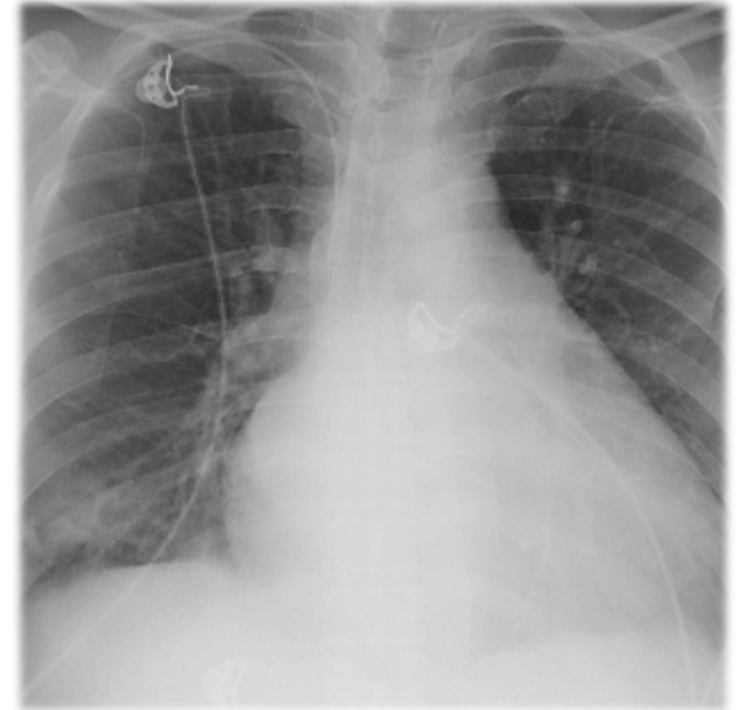
DOMESTIC SCENARIO FOR ORAL CHAGAS



Triatoma venosa

CLINICAL MANIFESTATIONS - FOODBORNE CHAGAS

- Most will develop **acute Chagas disease**
- Fever, generalized lymphadenopathy, bilateral facial edema
- Acute myocarditis and cardiomyopathy
- Splenomegaly and hepatomegaly
- Incubation period after consumption: 3-22 days
- One crushed bug contains >600,000 parasites
- **Largest oral outbreak: Caracas, Venezuela (2007)**
 - Consumption of contaminated guava juice
 - Elementary school children and staff
 - N=119 confirmed or suspected (N=103 confirmed)
 - 75% were symptomatic and 20% were hospitalized
 - 44 patients had documented parasitemia
 - **One child (5 yo) died from cardiomyopathy**
 - N=68/103 (68%) had ECG changes



Cardiomegaly seen on CXR in someone with Chagasic cardiomyopathy

Chart 9.2 – Recommendations for etiological treatment of Chagas disease according to disease phase or clinical form and age group.

Phase/form of CD	Age group	Etiological treatment
Acute or congenital	All age groups	1 st line: benznidazole 2 nd line: nifurtimox
Chronic indeterminate or digestive	Children (≤ 12 years) and adolescents (13-18 years)	1 st line: benznidazole 2 nd line: nifurtimox
	Adults < 50 years	1 st line: benznidazole Do not use nifurtimox
	Adults ≥ 50 years	Shared decision-making: possibility of treatment, if there is no contraindication 1 st line: benznidazole Do not use nifurtimox
Not advanced chronic cardiac (stage: B1*)	All age groups	Shared decision-making: possibility of treatment, if there is no contraindication 1 st line: benznidazole Do not use nifurtimox
Chronic cardiac or digestive (advanced phase)	All age groups	Do not treat

**See Table 5.2 for the cardiopathy stages. Adapted from Protocolo Clínico e Diretrizes Terapêuticas em DC, 2018 (Brazil, 2018).⁸*

FOODBORNE CHAGAS - SUMMARY

- **Oral transmission needs attention and further research.**
- Consumption of certain fruit juices in endemic regions can be contaminated with the parasite.
- Certain kissing bug vectors are found invading homes and suspected to be associated oral contamination of food preparation surfaces.
- Consumption of raw or undercooked wildlife or raw blood consumption can be associated with oral Chagas disease.
- Oral Chagas disease typically leads to **acute illness** and **potentially fatal** without prompt antiparasitic treatment.





THANK YOU!

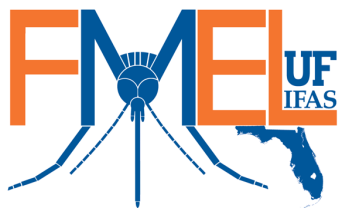


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