American Trypanosomiasis (Chagas Disease)

Chagas disease is a parasitic infection caused by the protozoan flagellate *Trypanosoma cruzi*, which is spread to animals and people by means of vector-borne transmission. The disease is found only in the Americas, commonly South America, Central America, and Mexico. In countries where Chagas is endemic, the principal method of transmission is through contact with fecal matter from an infected triatomine bug. The triatomine bug, also known as the kissing bug, bites a person or animal host, ingests a blood meal, and then defecates on the host. The host might accidentally scratch or rub the feces into the bite wound, eyes, or mouth, thereby allowing the *T. cruzi* parasite to enter the body through mucous membranes or bloodstream.[1, 2, 3]

Infection with Chagas disease can also occur through congenital transmission, transfusion of blood or blood products, organ transplantation, consumption of uncooked food contaminated with feces from infected bugs, and accidental laboratory exposure. Chagas disease is not transmitted from person-to-person.[1, 2, 3]

A. Agent:
Trypanosoma cruzi.

B. Clinical Description:
There are two phases of Chagas disease: the acute and chronic phase. Both phases can range from asymptomatic to life threatening. The majority of Chagas disease cases are asymptomatic. When symptoms do occur, children are more likely to develop clinical manifestations than adults.[1, 2, 3, 4]

The **acute phase** is characterized by the first 8 weeks of infection, detectable parasitemia, and asymptomatic or symptomatic manifestations of the disease. In the acute phase there can be swelling of the eyelid on the side of the face near the bite wound or where the bug feces were deposited or accidently rubbed into the eye (Romaña's sign). In some patients a red nodule or chagoma develops at the site of original inoculation (usually face or arms) with surrounding skin becoming hardened (indurated) and later hyperpigmented (lasting up to 8 weeks). Other symptoms include fever, rash, vomiting, diarrhea, hepatomegaly, splenomegaly, and lymphadenopathy. More serious, life threatening acute myocarditis and meningoencephalitis is rare but can also develop.[1, 2, 3, 4, 14]

Even if symptoms develop during the acute phase, they usually fade away on their own, within a few weeks or months. However, if untreated, infections can be lifelong. In people who have suppressed immune systems, Chagas disease can reactivate with parasites found in the circulating blood. This occurrence can potentially cause severe disease.[1, 2, 3, 4]

The **chronic intermediate** or **indeterminate phase** occurs after the acute phase when infected individuals enter into a prolonged **asymptomatic** form of the disease. The infection remains silent during this phase and few or no parasites are found in the bloodstream. During this time,

most people are unaware of their infection. Many people remain asymptomatic for their entire life and never develop chronic Chagas-related symptoms. However, when a patient with chronic *T.* cruzi infection becomes immunosuppressed, for example due to receiving an organ transplant, high levels of parasitemia may reappear due to failure of immune control and increased intracellular *T.* cruzi replication (**reactivation**).[14]

It is estimated that 20 – 30% of infected people will develop the **chronic symptomatic phase** of Chagas disease. This phase is characterized by undetectable parasitemia and severe life-threatening cardiac or intestinal medical complications. Sequelae are serious, irreversible and include cardiomyopathy, conduction abnormalities, heart failure, altered heart rate or rhythm (arrhythmia), and sudden death. Also important is intestinal tract involvement with dilation of the esophagus (megaesophagus) and colon (megacolon), leading to difficulties with eating or passing stool.[1, 2, 3, 4, 14]

Congenital Chagas disease can develop due to mother-to-child transmission of the infection. Most babies born with congenital Chagas disease show mild or no symptoms. However, if untreated, the infection will last a lifetime, and these infants risk developing symptoms of chronic Chagas disease later in life. These infants may present with low birth weight, premature birth, low Apgar scores, anemia, thrombocytopenia, gastrointestinal megasyndromes (megaesophagus, megacolon), hepatomegaly, splenomegaly, pneumonitis, respiratory distress, and/or anasarca.[14]

- Differential Diagnosis:

  Mild to severe allergic reactions, including **anaphylaxis**, can be associated with Triatomine bug bites but are a separate health issue unrelated to *T. cruzi* infections. However, as such reactions can cause a variety of symptoms, some of which might be mistaken for acute phase symptoms, they need to be differentiated from those of acute phase chagasic infections. These include intense itching of the scalp, palms, and soles of the feet, welts, rashes, fever, nausea, vomiting, diarrhea, body aches, and cramps. More serious symptoms involve fainting, and swelling throughout the body, especially of the tongue and throat (if these symptoms develop the individual will require immediate medical attention, call the Arizona Poison and Drug Information Center 1-800-222-1222).[13] The latter can make speaking, breathing, and swallowing difficult.[5, 6,7] The key to a differential diagnosis is the onset of symptoms: allergic reactions arise within hours of bites and dissipate a few hours to a day later whereas acute phase chagasic symptoms develop a few days to two weeks after inoculation and last for upwards of 3 months.[1,2]

C. Reservoirs:

Various native rodents and other small mammals serve as the reservoir for *T. cruzi*. In Arizona and much of the America Southwest, native wood rat populations (colloquially referred to as 'pack rats') of the genus *Neotoma* are recognized as the principal reservoir.[7, 8, 9]

D. Mode of Transmission:

The most common means of transmission is through contact with the feces of infected triatomine bugs (commonly called 'Kissing' or 'Conenose bugs').[7, 8, 9] The kissing bug bites and sucks blood from infected animals or people. This is how the bug gets the *T.* cruzi parasites. Infected kissing bugs then pass the parasite in their feces. T. *cruzi* contained in the feces enters

the bloodstream through a wound or an intact mucosal membrane, such as the conjunctiva (membrane around the eyes). Infections occur less frequently through congenital transfer from mother-to-baby, transfusions with contaminated blood products, organ transplants from chagasic donors, laboratory accidents, or eating infected bugs or contaminated food or drink.[1, 2, 3]

E. Incubation period:
The symptomatic acute phase of Chagas disease begins 5-14 days after inoculation with infective feces; 30-40 days in infections acquired through blood transfusion; and 1-3 days in some newborn infants with congenital infection.[1, 2, 3]

In the chronic phase, symptoms occur in 20-30% of infections following a period of 10-40 years after the acute phase. The asymptomatic period between the acute phase and onset of chronic manifestations is often referred to as the chronic intermediate or indeterminate phase.[1, 2, 3]

F. Period of Communicability:
In the acute phase *T. cruzi* organisms are commonly present in the blood and may persist in small numbers throughout life in symptomatic and asymptomatic individuals.[1, 2, 3]

G. Susceptibility and Resistance:
All ages are susceptible, but the acute phase is usually more severe in younger people. Immunosuppressed people, especially those with AIDS, are at risk of serious infections and complications. Resistance is not documented.[1, 2, 3]

H. Treatment:
Antiparasitic treatment is recommended for all cases of acute or reactivated Chagas disease and for congenital and chronic *T. cruzi* infection in children up to age 18. Treatment is strongly recommended for adults up to 50 years old with chronic infection who do not already have advanced cardiomyopathy. For adults older than 50 years with chronic *T. cruzi* infection, the decision to treat with antiparasitic drugs should be individualized, weighing the potential benefits and risks for the patient. Physicians should consider factors such as the patient's age, clinical status, preference, and overall health.[10]

For cardiac or gastrointestinal problems resulting from Chagas disease, symptomatic treatment to help manage the signs and symptoms of infection may be helpful. However, once the characteristic pathology is established (e.g., dilated cardiomyopathy, megaesophagus), antiparasitic treatment will not reverse it. Patients should consult with their primary health care provider. Some patients may be referred to a specialist, such as a cardiologist, gastroenterologist, or infectious disease specialist.[1, 2, 10]

The two drugs used to treat infection with *T. cruzi* are nifurtimox and benznidazole. Benznidazole is approved by FDA for use in children 2 – 12 years of age and is available from http://www.benznidazoletablets.com. Nifurtimox is FDA approved for treatment of children from birth to younger than 18 years and is commercially available for pharmacies to purchase from several drug wholesalers.[10]

Contraindications for treatment include severe hepatic and/or renal disease. As safety for infants exposed through breastfeeding has not been documented, withholding treatment while

breastfeeding is also recommended.[10] The following table outlines recommended dosage regimens by age group:

DRUG	AGE GROUP	DOSAGE & DURATION[10]
Benznidazole	2-12 years of age	5-8 mg/kg per day orally in 2 divided doses for 60 days
Nifurtimox	Birth to younger than 18 years of age, weighing at least 2.5kg	Body weight ≥ 41 kg: 8-10 mg/kg day orally in 3 divided doses for 60 days. Body weight < 41 kg: 10-20 mg/kg per day orally in 3 divided doses for 60 days.

*Questions regarding treatment should be directed to CDC's Parasitic Diseases Inquiries (404-718-4745; chagas@cdc.gov).

I. Kissing Bugs Control

In the United States, consult a pest control expert before using insecticides against kissing bugs, as there are none specifically approved for them here. To prevent Kissing bugs infestations at home it is helpful to[10, 13]:

- Seal cracks and gaps around windows, walls, roofs, and doors so bugs cannot enter your home
- Install screens on windows and doors and repair any holes or tears
- Keep yard lights away from your house because lights can attract the bugs
- Remove wood, brush, and rock piles near your house
- Prevent pack-rats from nesting
- Seal off any entrances to attics or crawl spaces
- Have pets sleep indoors, especially at night
- Keep your house and any outdoor pet resting areas clean, in addition to periodically checking both areas for the presence of bugs

J. Kissing bugs testing

CDC offers *Trypanosoma cruzi* (Chagas infection) testing of kissing bugs that come in contact with humans. They also offer identification via submission of a picture and testing for bugs identified as triatomine (agent of Chagas disease). Please refer to the ADHS Kissing Bug Submission Protocol for more information regarding submission of kissing bugs to CDC for *T. cruzi* testing.

Disease Management

K. Clinical Case Definition: see section B, clinical description.

L. Laboratory Criteria for Diagnosis:[14]

The diagnosis of Chagas disease can be made by observation of the parasite in a blood smear by microscopic examination. Thick and thin blood smears are made and stained for visualization of parasites. However, a blood smear works well only in the acute phase of infection when parasites are seen circulating in blood.[1, 2, 11]

Diagnosis of chronic Chagas disease is made after consideration of the patient's clinical findings, as well as by the likelihood of being infected, such as having lived in an endemic country.

Diagnosis is generally made by testing with at least two different serologic tests using two different antigen preparations (such as the *T. cruzi* IgG test performed at CDC).[11]

Confirmatory Testing

Acute Chagas Disease:

- Visualization of *T. cruzi* by microscopy (wet mount-microscopic examination, thick and thin smears-Giemsa stain) performed on any tissue or body fluid, OR
- Detection of *T. cruzi* DNA by molecular testing (e.g., NAAT, metagenomic sequencing) performed on any tissue or body fluid

Chronic Chagas Disease:

- Detection of IgG antibodies specific to *T. cruzi* by at least two diagnostic tests using two different antigen preparations

Congenital Chagas Disease:

- Visualization of *T. cruzi* by microscopy (e.g., wet mount-microscopic examination, thick and thin smears-Giemsa stain) performed on any tissue or body fluid (collected from the fetus or infant within three months of delivery to gestational parent), OR
- Detection of *T. cruzi* DNA by molecular testing (e.g., NAAT, metagenomic sequencing) performed on any tissue or body fluid (collected from the fetus or infant within three months of delivery to gestational parent)

Presumptive Testing

Chronic Chagas Disease:

- Detection of IgG antibodies specific to *T. cruzi* by a single diagnostic test; OR
- Positive blood, organ, or human cells, tissues and cellular and tissue based products (HCT/P) donor screen for *T. cruzi*.

M. Epidemiologic Linkage Criteria

Acute Chagas Disease

- Suspected triatomine of kissing bug exposure (e.g., bite, triatomine found in bed, etc.) within the 3 months prior to specimen collection, OR
- Residence for at least 6 months in a Chagas endemic country*, which concluded within the 3 months prior to specimen collection, OR
- History of donor-derived infection in the recipient of organ or HCT/P transplant within the 3 months prior to specimen collection, OR
- History of donor-derived infection in the recipient of a blood transfusion within the 3 months prior to specimen collection

Chronic Chagas Disease

- Gestational parent that delivered a fetus or infant with confirmed congenital *T. cruzi* infection

**Argentina, Belize, Bolivia, Brazil, Chile, Colombia, Costa Rica, Ecuador, El Salvador, French Guiana, Guatemala, Guyana, Honduras, Mexico, Nicaragua, Panama, Paraguay, Peru, Suriname, Uruguay, and Venezuela.*

N. Case Classification:

Please refer to the ADHS Case Definitions for Communicable Morbidities: Chagas Infection and Related Disease (American trypanosomiasis) for information regarding case classification.

O. Classification of Import Status:
An 'Internationally Imported Case' is defined as a case in which *T. cruzi* infection results from exposure triatome bugs outside the U.S. 1-3 weeks prior to onset of acute symptoms. A 'U.S. Acquired Case' is defined as a case in which the patient had not been outside the U.S. prior to onset. If infection was thought to occur in Mexico or Canada, mark as *bi-national* in MEDSIS.

P. Laboratory Testing:
Microscopy and molecular tests are most effective during acute infections or in the event of suspected reactivation. Circulating parasite levels decrease rapidly one to two months after initial infection and are undetectable by microscopy during the chronic phase. Diagnosis of chronic Chagas disease is made by serologic tests for antibody to the parasite. A single serologic test is not sufficiently sensitive and specific to make the diagnosis. The standard approach is to apply at least two different *T. cruzi*-specific IgG diagnostic tests using at least two different antigen preparations. Antigen preparations used in tests for *T. cruzi*-specific IgG can be broadly categorized into two groups: whole parasite antigen preparation and recombinant antigen preparation. The use of two different antigen preparations optimizes sensitivity and specificity, as no individual test for *T. cruzi*-specific IgG is adequately sensitive and specific.[12, 14]

Q. Assessing Laboratory Results:
Some blood centers test blood donations that are reactive (positive) by the blood screening test with an investigational assay, radioimmunoprecipitation assay (RIPA). Donors who are positive on the screening test can no longer donate blood, regardless of their supplemental test or RIPA result. Donors are contacted by the blood center and are requested to contact their physician.[12]

R. Outbreak Definition:
An unexpected increase in cases of Chagas disease that is clustered by time, place, or person (ex. people that might be part of the same cohort).

Investigation Guidelines

S. Time Frame of Reporting[16]:
Chagas disease is reportable in Arizona by laboratories only. Laboratories should submit a lab report (*Trypanosoma cruzi*) within five working days after obtaining a positive test result.

T. Investigation and Reporting Formats:
Please refer to the Department-provided formats for submitting Epidemiologic Investigation Reports [Excel] for guidance on the required investigation fields and forms for the relevant morbidity. All the investigation forms can be found on the ADHS Forms for Reporting and Investigation.

U. Investigation Steps:
Epidemiological investigation report should be submitted in MEDSIS by filling out the Travel Table and the DSO morbidity 'type'.

ADHS' Chagas Case Classification Algorithm and available on the ADHS Investigation Manual provides information regarding classifying and investigating Chagas disease cases and are available on the ADHS VBZD Resources page.[15]

Specific procedures for investigating Chagas disease cases will be case-dependent. Factors that may affect the investigation include: symptomatology, exposure to kissing bugs, travel history, and differentiation between actual chagasic symptoms and bite-related allergic reactions. Upon identification of a case under investigation, ADHS and the local health department should work together, in coordination with ASPHL and CDC, to develop a plan for the investigation.

Local health department investigators are responsible for:

- Communicating with ADHS investigators to coordinate the investigation based on current information available for Chagas disease.
- Obtaining medical records from the case's health care provider and interviewing the case, as needed, to determine medical information (illness course, severity, complications); travel history and kissing bug bites; blood transfusions or organ transplants; and other relevant information.
- Coordinating submission of additional laboratory specimens, as needed. Most commonly, if an individual is positive for *T. cruzi* IgG by blood screening, additional commercial diagnostic tests are indicated. If this second test is also IgG positive, then confirmatory testing can be done at CDC. Working with ADHS and other partners to conduct contact investigations, conduct additional surveillance, implement control measures following an environmental assessment, or provide educational information, as needed.

ADHS investigators are responsible for:

- Communicating with local health department investigators, ASPHL, and CDC to coordinate the investigation based on current information available for Chagas disease.
- Working with ASPHL to ensure blood and tissue specimens are sent to CDC for confirmatory testing following protocols for testing and submission from the Association of Public Health Laboratories.
- Identifying an appropriate investigation form.
- Assisting the local health department in gathering case information, as needed.
- Working with the local health department, CDC, and other partners to conduct contact investigations, conduct additional surveillance, implement control measures following an environmental assessment, or provide educational information, as needed.

V. Outbreak Guidelines:

While outbreaks involving multiple cases of Chagas disease have not been reported in the U.S., extensive investigations, confirmatory laboratory testing, and control measures may be needed if such events should occur. These will be situation-dependent and determined through consultation among the involved agencies.

W. Special Situations:

Guidance will be provided or determined based on the situation and information known at the time. Some special situations that may require additional investigation or response include: an environmental assessment to determine exposure risks to kissing bugs and/or level of bug infestation, contaminated blood or tissue products, and other risk factors potentially exposing individuals to *T. cruzi* infections. For the rare instances of transfusion or transplant-transmitted *T. cruzi* infections or congenital Chagas cases, PCR should be performed at CDC.

References

1. Heymann, DL, ed., Control of Communicable Diseases. Manual, 19th Edition. Washington, DC, American Public Health Association, 2008: pp. 630-639.

2. American Academy of Pediatrics. 2021 Red Book: Report of the Committee on Infectious Disease, 32nd Edition. Illinois, Academy of Pediatrics, 2021.

3. Centers for Disease Control and Prevention. Chagas Disease: About Chagas Disease. https://www.cdc.gov/chagas/about/index.html

4. Centers for Disease Control and Prevention. Chagas Disease: Preventing Chagas Disease. https://www.cdc.gov/chagas/prevention/index.html

5. Centers for Disease Control and Prevention. Chagas Disease: Bugs Commonly Confused with Triatomine Bugs. https://www.cdc.gov/chagas/bugs/index.html

6. Klotz, J.H., Dorn, P.L., Logan, J.L., et al. "Kissing Bug": Potential Disease Vectors and Cause of Anaphylaxis. Clinical Infectious Diseases 50(12): 1629-1634; 2010.

7. Smith, RL, Venomous Animals of Arizona. Tucson: Cooperative Extension, College of Agriculture, University of Arizona, 1982, pp. 38-40.

8. Stoops, ED, Martin, J, Scorpions and Venomous Insects of the Southwest. Phoenix: Golden West Publications, 1995, pp. 80-81.

9. Werner, F, Olson, C. Insects of the Southwest. Tucson: Fisher Books, 1994, pp. 22-23.

10. Centers for Disease Control and Prevention. Chagas Disease: Treatment of Chagas Disease. https://www.cdc.gov/chagas/treatment/index.html

11. Centers for Disease Control and Prevention. Chagas Disease: Clinical Testing and Diagnosis for Chagas Disease. https://www.cdc.gov/chagas/hcp/diagnosis-testing/index.html

12. Centers for Disease Control and Prevention. DPDx – Laboratory Identification of Parasites of Public Health Concern: American Trypanosomiasis. https://www.cdc.gov/dpdx/trypanosomiasisAmerican/index.html

13. Shujuan Li, Dawn H. Gouge, Shakunthala Nair, Alfred J Fournier and W. Eugene Hall: Arizona Kissing Bugs, For pest management and Extension professionals. The University of Arizona Cooperative Extension. March 2019 https://repository.arizona.edu/handle/10150/670095

14. Arizona Department of Health Services. Case Definitions for Communicable Morbidities: 2025. 2025 [cited 2025June6]; Available from: https://www.azdhs.gov/documents/preparedness/epidemiology-disease-control/disease-investigation-resources/casedefinitions/case-definitions.pdf

15. Arizona Department of Health Services. Chagas Case Classification Algorithm. [cited 2025June6]; Available from: https://www.azdhs.gov/documents/preparedness/epidemiology-disease-control/vector-borne-zoonotic-diseases/chagas-case-classification-algorithm.pdf

16. Arizona Administrative Code. [cited 2025June16]. Available from: http://apps.azsos.gov/public_services/Title_09/9–06.pdf