



Kissing Bugs Harboring *Trypanosoma cruzi*, Frequently Bite Residents of the US Southwest But Do Not Cause Chagas Disease

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ABSTRACT

BACKGROUND: Kissing bugs are common household pests in the Desert Southwest of the United States. These hematophagous bugs enter homes and suck blood from resident humans and pets. They are vectors of *Trypanosoma cruzi*, an enzootic parasite in small mammals and the cause of Chagas disease in humans. Autochthonous cases of Chagas disease are rare in the United States despite the presence of the vector and parasite. Environmental and biological factors accounting for this phenomenon need studying.

METHODS: Homeowners in Bisbee and Tucson, Arizona captured kissing bugs inside homes during 2017–2018. Bugs were tested for presence of *T. cruzi* by polymerase chain reaction. Residents bitten by kissing bugs were tested for Chagas disease by serology. We evaluated invaded homes in the 2 cities.

RESULTS: Three species of kissing bugs (n = 521) were collected in or near homes. *Triatoma rubida* was the most common triatomine in Tucson; *T. recurva* in Bisbee. *T. protracta* was uncommon. Seventeen percent of bugs captured in Bisbee and 51.1% in Tucson harbored *T. cruzi*. Bite victims (n = 105) recalled more than 2200 bites. Reactions to bites were common, including 32 episodes of anaphylaxis in 11 people (10.5%). Tests for Chagas disease (n = 116) were negative. Median age of houses was 91 years in Bisbee and 7 years in Tucson. Bisbee houses had pier and beam foundations. Tucson houses were built on concrete slabs.

CONCLUSIONS: Kissing bugs harboring *T. cruzi* readily entered new and old homes. Bites of humans caused severe, life-threatening reactions. There was no serological evidence of Chagas disease among those bitten.

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INTRODUCTION

Kissing bugs are the insect vectors of *Trypanosoma cruzi*. *T. cruzi* is estimated to infect 6–7 million people, most of whom reside in South and Central America.¹ As many as

300,000 infected people have immigrated to the United States from endemic areas.² The United States is home to 11 species of kissing bugs found in 27 states. Arizona has 7 species of kissing bugs; all likely harbor *T. cruzi*.³ These true bugs transmit enzootic *T. cruzi* infections to small mammals and can potentially cause Chagas disease in humans.

A study of US blood donors reported 16 cases of presumed autochthonous Chagas disease among more than 30 million units of blood.⁴ Since then, more autochthonous Chagas cases have been reported.^{5,6} Although autochthonous Chagas is rare in the United States, it is important to determine how often it occurs and the risk factors for acquiring the disease.

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The cities of Bisbee and Tucson, Arizona are separated by 100 miles of desert and several thousand feet elevation. These communities were built in unique plant and animal environments that include several kissing bug species. *Triatoma rubida* is the most common kissing bug encountered in the foothills of the Catalina and Rincon Mountains surrounding Tucson (Figure 1A). *Triatoma recurva* is the predominant triatomine in the historic district of Bisbee (Figure 1B). It is the largest kissing bug in the United States. A less frequently encountered triatomine in these same environments is *Triatoma protracta*. All 3 species are potential vectors of Chagas disease in nearby northern Mexico.⁷

We have been interested for several decades in the impact of these bugs on human inhabitants in Arizona where medical visits commonly follow kissing bug bites. Bite victims have become increasingly concerned about the risk of contracting Chagas disease from these encounters. This report describes a 2-year study of people living in Tucson and Bisbee bitten by kissing bugs, the frequency of these bugs in their homes, carriage of *T. cruzi* by the invading bugs, adverse reactions to the bites, and whether any developed Chagas disease.

METHODS

Human Subjects and Domiciles

The study was conducted from April 2017 to October 2018. Participant recruitment for the study included advertisement through a website, <https://kissingbug.medicine.arizona.edu>, local TV, print and public forums. Adult homeowners, family members, or other persons residing in the homes invaded by kissing bugs were eligible to participate in the study. This research was approved by the University of Arizona Institutional Review Board. Participants provided informed, signed consent. They received instructions on how to safely collect kissing bugs. For this purpose, they were provided urine cups with caps, self-sealing plastic bags, plastic forceps, and nitrile gloves. Homeowners filled out a home site evaluation and a bite questionnaire (Supplementary Data, available online) and answered general health questions.

Study Sites

Tucson participants resided in the surrounding mountain foothills except for one small ghost town, Cascabel, on the eastern slope of the Rincon Mountains. Cascabel homes were older than the average home age in Tucson, but the terrain and elevation were similar to that of Tucson. The majority of participants in Bisbee resided in the

historical district that was founded in the 1880s in the Mule Mountains.

Trypanosoma cruzi Carriage by Kissing Bugs

Kissing bugs of 3 species were brought to investigators in sealed plastic bags, removed from the bag, and stored in tubes with 100% ethyl alcohol (ETOH) at -20°C . To ensure that no ETOH was present during dissection, samples were washed with sterile water and dried thoroughly prior to dissection. Sterile blades were used to sever the rectum and lower one-third of the abdomen of each bug. The innards of the abdominal fragment of each bug were scraped from the walls of the exoskeleton and added to a sterile tube for DNA extraction. DNA extraction was performed using Qiagen DNeasy Blood and Tissue kit following the manufacturer's recommendations (Qiagen DNeasy, Hilden, Germany). Polymerase chain reaction (PCR) amplification was performed using a maximum of 250 ng of nuclear

CLINICAL SIGNIFICANCE

- In the Southwest United States, kissing bugs frequently invade residential homes, whether new or old homes.
- These kissing bugs frequently harbor (carry) *Trypanosoma cruzi*, the blood parasite that causes Chagas disease, but acquisition of this disease in the United States is rare.
- The home-invading kissing bugs bite the house residents, causing severe allergies, including anaphylaxis.
- However, people bitten by these blood sucking bugs did not have evidence of Chagas disease.

DNA extracted from each sample, with the primer pair TCZ1 (5'-CGAGCTCTTGCCACACGGGTGCT) and TCZ2 (5'-CCTCCAAGCAGCGGATAGTTCAGG).⁸ This primer pair amplifies a 188-bp segment of the 195-bp repetitive nuclear sequence from *T. cruzi*. A positive control was included in each PCR containing purified *T. cruzi* DNA DM28, and was run at a concentration of 145 ng per reaction. Negative controls included a blank sample containing no DNA and DNA extracted from a laboratory-raised kissing bug not exposed to *T. cruzi*.

Testing for Chagas Disease

After informed consent was obtained, individuals were tested for Chagas disease using the US Food and Drug Administration-approved serological test, Chagas Detect Plus Rapid Test (InBios, Seattle, Wash). Trained staff performed the blood tests, and questionable tests were repeated. Indeterminate results were resolved by sending serum to the Centers for Disease Control and Prevention (CDC) for confirmation. The confirmation tests included enzyme immunoassay (EIA) recombinant 3.0 (Weiner Lab, Rosario, Argentina) and Trypomastigote Excreted-Secreted Antigen or TESA (bioMerieux, Buenos Aires, Argentina).

Statistics

The median was used as the measure of home age. The Fisher's exact test was used to compare populations, with significance being $P < .05$. The P -value was not adjusted for multiple comparisons.



Figure 1 Culprits and victims. (A) *Triatoma rubida* (female, 22 mm in length), the predominant kissing bug in Tucson homes. (B) *Triatoma recurva* (male, 32 mm in length; largest kissing bug in the United States), the predominant kissing bug in Bisbee. (C) Typical Tucson home; recent construction, small gravel is the bed for desert surroundings; no basement, concrete foundation, stucco exterior. (D) Bisbee home; wooden exterior, crawl space beneath building and in this case, a chicken coop outside bedroom (chickens are a favorite host for kissing bugs to feed upon). Note the rough ground and large boulders. (E) Local reaction to kissing bug bite with extensive swelling and erythema. (F) Multiple welts from separate bites.

RESULTS

Characteristics of Homes Invaded by Kissing Bugs in the 2 Arizona Communities

Tucson is located in the Lower Sonoran Life Zone and has an elevation of 2389 feet. The annual precipitation is 11 inches. Bisbee is nearly twice as high in elevation (5538 feet) and within the Upper Sonoran Life Zone. The annual precipitation is 19 inches, almost twice that of Tucson. June is the hottest month in both cities and usually heralds the annual monsoon rains. The housing stock in both communities is structurally very different, as dictated by the terrain. In Tucson the median age of homes invaded by kissing bugs was 7 years. Almost all the homes were built on concrete slabs poured on level ground in gravelly desert where prickly pear and cholla cactus are common (Figure 1C). Pack rats (*Neotoma albigula*) make their nests beneath these cacti and the nests are inhabited by *T. rubida*⁹ (Figure 1A). Houses in Bisbee were, on average, more than 10 times older than houses in Tucson (Table 1) and featured composite and wooden floors constructed over concrete pillars, wooden pillars, or concrete walls with a crawl space. Foundations in Bisbee were constructed above hard rocky terrain (Figure 1D). This is the habitat of *T. recurva* (Figure 1B). Other features of home construction did not differ between the 2 communities (Table 1).

Kissing Bugs and Carriage of *Trypanosoma cruzi*

Participants returned 521 kissing bugs, including adults and nymphs of 3 kissing bug species captured within or immediately outside their homes. Kissing bugs were mostly collected in May through August in both communities, with

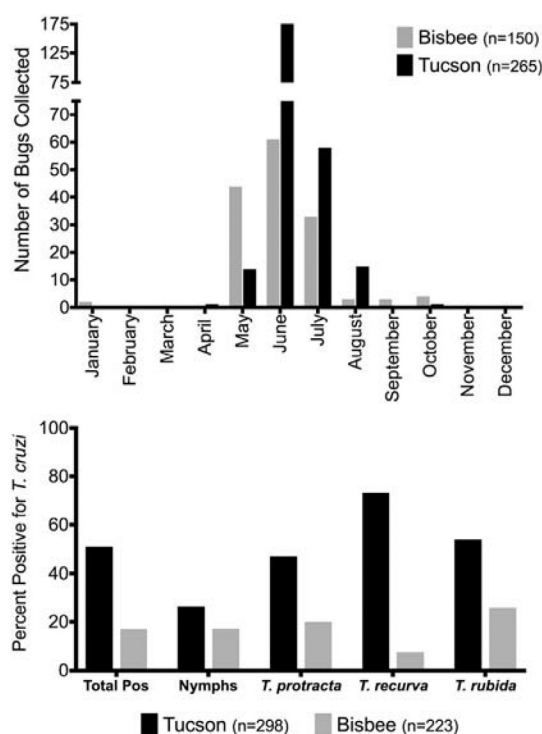


Figure 2 Kissing bugs captured in and around homes in Tucson and Bisbee, Ariz. **Top:** Months of the year bugs were captured in homes (many specimens from both cities were not dated and not included in the graph). **Bottom:** rates of carriage of *Trypanosoma cruzi* by the 3 home invasive species.

Table 1 Characteristics of Tucson and Bisbee Domiciles Invaded by Kissing Bugs

Demography	Tucson	Bisbee
Population (2010)	520,116	6090
Median age of homes	7 y	91 y
Average persons per residence	2.1 persons	2.2 persons
Average indoor pets per residence*	4	2
Wild animals around home	Javelina, coyote, pack rat, cottontail rabbit	Raccoon, rock squirrel, coyote, javelina, mule deer, rats
Features of homes	n = 72 n (%)	n = 23 n (%)
Composite or wood siding	5 (6.5%)	3 (13.1%)
Brick siding	23 (30%)	4 (17.4%)
Use air conditioning*	61 (79.2%)	8 (34.8%)
Use pest control service	14 (18.2%)	4 (17.4%)
Use pesticides in home	26 (33.8%)	7 (30.4%)
Foundation	Concrete slab	Crawl space/pier and beam

*P value < .05.

stragglers collected in September and October in Bisbee (Figure 2, Top). The most active month for each city was June. Tucson homes were invaded by 298 kissing bugs, of which 51.1% (152) harbored *T. cruzi*, as determined by PCR. Kissing bugs from Bisbee (n = 223) had a *T. cruzi* carriage rate of 17% (38/223) (Figure 2, Bottom). The carriage rate of *T. cruzi* by nymphs was higher in Tucson at 26.3% than in Bisbee, 17.2%.

Victims of Kissing Bug Bites

Bite victims (n = 105) ranged in age from 18–81 years, with 64% women and 36% men. Three bite victims called 911 and went to emergency departments after being bitten. Following a bite, a large number of victims complained of local allergic phenomena such as swelling and itching (Table 2, Figure 1E). Anaphylaxis occurred in 10 individuals in Tucson and 1 in Bisbee (10.5% of bite victims). Seven individuals had one episode of anaphylaxis, 1 person had 2 episodes, 1 had 3 episodes and 2 had > 10 episodes. The majority of these individuals kept an EpiPen (Mylan; Canonsburg, Pa) in their home. Aside from the anaphylaxis episodes, a number of victims suffered systemic signs of allergy such as “itching all over,” dizziness, and rash (Table 2). One individual from Bisbee (not in this study)

Table 2 Reactions to Kissing Bug Bites in Residents of the 2 Cities

	Tucson n = 94 n (%)	Bisbee n = 11 n (%)	Total n = 105 n (%)
None*	9 (9.6)	5 (45.5)	14 (13.3)
Local Itching*	74 (78.7)	5 (45.5)	79 (75.2)
Wet	72 (76.6)	6 (54.5)	78 (74.3)
Swelling	55 (58.5)	3 (27.3)	58 (55.2)
Pain	18 (19.1)	2 (18.2)	20 (19.0)
Systemic allergic symptoms			
Called 911 and went to ED	3 (3.2%)	0	3 (2.9)
Dizzy	12 (12.8)	0	12 (11.4)
Rash	20 (21.3)	0	20 (19.0)
Chest pain	4 (4.3)	0	4 (3.8)
Swelling of the lips	4 (4.3)	0	4 (3.8)
Swelling of the face	5 (5.3)	0	5 (4.8)
Swelling of tongue	5 (5.3)	0	5 (4.8)
Short of breath	13 (13.8)	0	13 (12.4)
Itching entire body	21 (22.3)	1 (9.1)	22 (20.9)
Feeling of unease	23 (24.5)	1 (9.1)	23 (22.9)

ED = emergency department.

*P value < .05.

suffered several episodes of anaphylaxis and moved from Bisbee to escape kissing bugs (personal communication).

Kissing bug bites occurred mostly at night while the victims were sleeping (Table 3). Women were bitten more often than men even when couples slept together. A number of bite victims in Bisbee related that *T. recurva* (a less cryptic species than *T. rubida*) attempted to feed during daylight hours. Because of the nocturnal biting habits of the bugs, victims changed their sleeping habits and a sizable minority slept under mosquito netting in both communities (Table 3). Many victims awoke with multiple bite sites (Table 3, Figure 1F).

Differences in reaction to kissing bug bites between residents of the 2 communities were confined to itching at the bite site (greater in Tucson residents) and the lack of symptoms or reactions to bites in almost half of the Bisbee

victims, 45.5%, as compared with only 10.3% of victims in Tucson (Table 2). It was assumed that Bisbee residents who had so few reactions to bites were likely less concerned about kissing bugs. However, this was not the case. When residents were asked, “on a scale of 1 to 10 with 10 being very afraid and 1 being least afraid, how afraid are you of kissing bugs?” only a quarter (24.4%) of Tucson residents scored 8-10, whereas 45.4% of Bisbee residents judged their fear of kissing bugs to be between 8 and 10. The greater fear among Bisbee residents might be due to the intensity of exposure to kissing bugs. For example, there were 10 bugs captured per household in Bisbee compared with 3.3 bugs per household in Tucson. Another possible explanation could be that *T. recurva*, found in historical Bisbee, frequently feeds during the day and is fully one-third larger than *T. rubida*.

A total of 116 residents were tested for Chagas disease. Nine were weakly positive and 107 were negative. Serum from the 9 individuals was sent to the CDC for confirmation. All were negative by EIA recombinant 3.0 and TESA. The CDC testing protocol is the standard for diagnosis of *T. cruzi* infection.

DISCUSSION

We studied more than 100 individuals who, in the aggregate, were bitten several thousand times by kissing bugs, but no one was infected with *T. cruzi*. The rarity of autochthonous Chagas disease in the United States is commonly ascribed to several factors, including claims that housing stock in the US is more pest proof than in Latin America. Chagas disease in Latin America is strongly associated with rural poverty,¹⁰ and houses infested with kissing bugs often lack foundations, windows, doors, and screens. Dirt floors and thatched roofing are common and these structures can be infested with thousands of bugs, and residents are bitten more than a thousand times.^{10,11} Our data indicate that the nature of the housing stock does not explain the rarity of autochthonous Chagas disease in the United States. For example, housing stock in Tucson and Bisbee, although quite different in age and foundations, was readily entered by kissing bugs. The important factor determining kissing bug entry into homes is their location within kissing bug habitat. Homes in Tucson are surrounded by cacti and are invaded by *T. rubida*, whereas homes in Bisbee are built on rocky sites and are invaded by *T. recurva*. Our findings are similar to a study conducted in Merida, Yucatan where the house type did not determine the entry of *T. dimidiata*.¹² Home entry was associated with a cluttered peridomestic habitat. Few homes in our study had such peridomestic habitats.

In Tucson the predominant home intruder was the nocturnal kissing bug, *T. rubida*. The niche for these bugs is pack rat nests, where they acquire *T. cruzi*. Examination of blood smears of more than 100 pack rats captured in the Catalina foothills surrounding Tucson demonstrated *T. cruzi* to be present in about half the samples (personal

Table 3 Features of Kissing Bug Bites

Characteristic	Tucson n = 94 n (%)	Bisbee n = 11 n (%)	Total n = 105 n (%)
Bitten while sleeping	82 (87.2)	8 (72.7)	90 (85.7)
Changed sleeping habits	30 (31.9)	4 (36.4)	34 (32.4)
Used mosquito nets*	10 (10.6)	4 (36.4)	14 (13.3)
Multiple bites same night	62 (66)	4 (36.4)	66 (62.9)
Bitten on face	15 (16)	1 (9.1)	16 (15.2)
Bitten on arms*	51 (54.2)	1 (9.1)	52 (49.5)
Bitten on legs	53 (56.4)	4 (36.4)	57 (54.3)
Bitten on back*	37 (49.4)	0	37 (35.2)
Used over-the-counter medications	33 (35.1)	4 (36.4)	37 (35.2)

*P value < .05.

communication, C. Sterling). *Triatoma rubida* entered houses after evening dispersal flights in late May and June, attracted to lights outside and inside houses.^{3,13} *Triatoma recurva* is the predominant kissing bug in Bisbee and is active day and night. We encountered this species walking outside houses in the afternoon, and it commonly feeds on people during daylight. This kissing bug may prefer to feed on larger animals. For example, it is found in the underground nests of rock squirrels (*Spermophilus variegatus*),¹⁴ and, of 37 *T. recurva* collected in Bisbee, vertebrate-specific 12S DNA was sequenced from abdomens of 17 bugs: 5 bugs had fed on dog, 4 on human, 1 on deer, 1 on striped skunk, 1 on cat, and 1 on mouse (4 sequences were not found on BLAST search) (unpublished data, P. Dorn). Although the carriage rate of *T. cruzi* was higher among *T. rubida* than *T. recurva* (51.1% vs. 17%), homeowners in both communities were at risk for infection. A recent study by us documented the alarming frequency with which kissing bugs harboring *T. cruzi* feed on humans in the Southwest.¹⁵ Carriage rates of *T. cruzi* by *T. rubida* vary widely, depending upon bug populations sampled. For example, 41% of 158 *T. rubida* collected across Tucson during 2006 were PCR-positive for *T. cruzi*,¹⁶ whereas 32/128 (25%) *T. rubida* captured in 2009 in a zoological park near Tucson were positive for *T. cruzi*.¹⁷

The adverse health effects of kissing bug bites is concerning. These bugs are the most common cause of anaphylaxis from insect bites in the United States.¹⁸ Other allergic reactions can be as dramatic (and frightening) as anaphylaxis, as shown in Figure 1E. Cutaneous reactions are often erythematous, itchy, and may last for several weeks. The association of anaphylaxis and kissing bug bites is often overlooked because the bug is frequently not observed, and victims arrive at night at emergency departments.¹⁹ Triatomine saliva is highly allergenic, a property observed in Latin America.²⁰ However, no cross-reactivity exists among species of kissing bugs.^{21,22} In our study, 10.5% (or 11 individuals) experienced one or more episodes of anaphylaxis. At least 2 individuals have died from anaphylaxis following kissing bug bites in the United States.^{23,24}

Kissing bug bite victims in our study suffered over 2200 bites, but no one was infected with *T. cruzi*. In rural Latin America, transmission of *T. cruzi* formerly occurred in homes infested with great numbers of bugs, often 6000–8000 (in all stages of the bug life cycle). Feces fell upon the inhabitants²⁵ and multiple bites occurred daily.¹⁰ After biting and feeding, the kissing bug defecates feces laden with *T. cruzi* that is rubbed into the bite wound, leading to infection. Homes in the United States are not infested by such large numbers of kissing bugs. In one home in rural New Orleans, 96 adult bugs were collected, and kissing bug fecal smears were present on the walls and on a nightgown. *Trypanosoma cruzi* was cultured from blood of the resident.^{26,27} Successful kissing bug eradication programs in South America have reduced transmission of disease through biting, but have paradoxically led to uncovering outbreaks of Chagas disease attributed to contamination of

food and drink with *T. cruzi*.²⁸ This could be a means by which autochthonous Chagas is acquired in the United States, because homes are not heavily infested. After entering a building, kissing bugs wander anywhere. For example, 2 elderly women residents of nursing homes in Tucson had kissing bugs removed from their mouths; one, a dead *T. rubida* removed from the buccal folds 14 days after biting the tongue and the other, a live *T. rubida* photographed on the tonsil (unpublished data). Transmission of *T. cruzi* following a bite may be rare in the Southwest. We have found that kissing bugs in southern Arizona do not defecate on their host²⁹ and, although called “kissing bugs,” they rarely feed near mucosal surfaces on the face, arms and legs being the preferred anatomic site of attack (Table 3).

Previous US studies have surveyed the interaction of residents with kissing bugs around homes and documented widespread biting within communities.^{30,31} This is the first comprehensive study of invaded domiciles, presence of *T. cruzi* in the invading bugs, and allergic reactions to kissing bug bites. As severe as some of these encounters were, no transmission of *T. cruzi* to bite victims occurred.

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SUPPLEMENTARY DATA

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.amjmed.2019.06.016>.

SUPPLEMENTARY DATA

Survey ID: _____



Knowledge, Attitudes, and Behaviors

Kissing Bug Bite Survey

Kissing Bug Research Project

2018

Survey ID: _____

Knowledge, Attitudes, and Behaviors - Kissing Bug Bite Survey**Age:****Gender (Please circle one)****Male****Female****Do not wish to answer****Zip code at which you encountered kissing bug:**

Circle all answers that pertain to your experiences with kissing bugs1. Have you seen a kissing bug **inside** your house?**Yes or No**2. Have you seen a kissing bug **outside** your house?**Yes or No**3. Have you been **bitten** by a kissing bug?**Yes or No****If bitten, did it occur while you were **sleeping**?****Yes or No****If bitten while you were not sleeping, explain circumstances:**

Survey ID: _____

Please circle **“Yes”** or **“No”** if you think a bug below is a **“Kissing Bug”**.



Yes

No



Yes

No



Yes

No

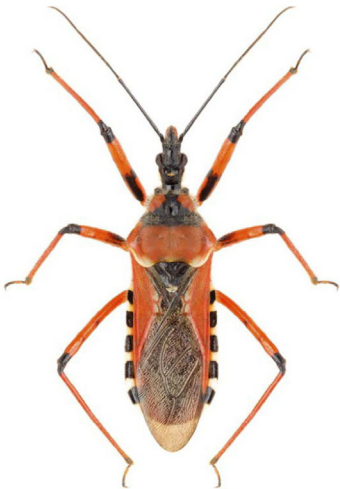


Yes

No

Survey ID: _____

Please circle **“Yes”** or **“No”** if you think a bug below is a **“Kissing Bug”**.



Yes **No**



Yes **No**



Yes **No**



Yes **No**

Survey ID: _____

Circle all answers that pertain to your experiences with kissing bugs

4. Have you **changed your sleeping habits** because of kissing bugs?

Yes or No

5. Do you sleep under a **mosquito net**?

Yes or No

6. If you were bitten by a kissing bug, did you **experience** any of the following: **(circle all that apply)**

- | | |
|---|------------------------------|
| - Red welt at bite site | - Pain to touch at bite site |
| - Itchiness at bite site | - Itchiness throughout body |
| - Multiple bite sites | - Dizziness |
| - Diffuse skin rash | - Chest pain |
| - Swelling at bite site | - Swollen lips |
| - Swollen face | - Swollen tongue |
| - Shortness of breath
(difficulty breathing) | - Feeling of "uneasiness" |

7. What **sites have been bitten** before on your **body**? **(circle all that apply)**

- | | |
|--------|--------------------------------|
| - Face | - Neck |
| - Arms | - Legs |
| - Back | - Hands |
| - Feet | - Other regions: (Please List) |

Survey ID: _____

Circle all answers that pertain to your experiences with kissing bugs

8. What **intervention** did you take after being bitten? (circle all that apply)

- | | |
|--|--|
| - Called 911 (went to emergency room) | - Called Poison Control Center |
| - Washed bite site | - Put lotion on bite site |
| - Applied herbal topical lotion | - Applied topical medicine :
(such as anti-itch cream) |
| - I did nothing after I was bitten | - Other intervention: (please explain) |
-
-

Took over the counter medication

- | | |
|----------------------|------------|
| - Aspirin | - Tylenol |
| - Ibuprofen (Motrin) | - Benadryl |
| - Other medications: | |
-
-

9. How many **times** have you been bitten by a kissing bug? (circle one)

- | | |
|--------|----------|
| - Once | - 11-50 |
| - 2-4 | - 51-100 |
| - 5-10 | - >100 |

10. Do you have a **known anaphylaxis** to a kissing bug bite?

Yes or No

If so, do you have an **epinephrine autoinjector** (pen) to use in case you are bitten again?

Yes or No

Survey ID: _____

Circle all answers that pertain to your experiences with kissing bug

11. **How many episodes of anaphylaxis** have you had due to a kissing bug bite? (circle one)

None	3	6	9
Once	4	7	10
2	5	8	>10

12. If you ever sought medical attention after a kissing bug bite, did you feel the **provider had knowledge of kissing bug bites?**

- Yes

- No

- Does not apply (have not seen a provider)

13. Knowing kissing bugs bite at night, **how safe do you feel at bedtime?**

(1 being least safe and 10 being most unsafe)

1 2 3 4 5 6 7 8 9 10

14. How **afraid** of kissing bugs are you on a scale of 1 - 10?

(1 being not afraid and 10 being most afraid)

1 2 3 4 5 6 7 8 9 10

15. How **frustrated** are you with kissing bugs on a scale of 1 - 10?

(1 being not frustrated and 10 being extremely frustrated)

1 2 3 4 5 6 7 8 9 10

Survey ID: _____

Comments:



Peri-domiciliary Questionnaire

Kissing Bug Research Project

2018

KISSING BUG RESEARCH SURVEY
INDIVIDUAL/HOUSEHOLD QUESTIONNAIRE

NAME: _____ **DATE:** _____

STREET ADDRESS: _____

PHONE NUMBER: _____

GEOGRAPHIC LOCATION: _____
(For UofA Clinic to fill in)

I _____ Agree to participate in the Kissing Bug Research
Survey and understand that all information provided will be kept private and confidential.

Participant Signature: _____

Surveyor Signature: _____

Survey ID: _____

Survey ID: _____

HOME	How long have you lived in your home?	Do you own or rent: RENT OWN		Approximately how old is your home?	How many people live in the home?
ANIMALS	Do you have any pets?	What type and how many of each?		Do the dogs sleep inside or outside?	Notes:
	Yes	_____ Dog(s)		IN OUT	
	NO	_____ Cat(s)		Do the cats sleep inside or outside?	Notes:
		_____ Other(s)		IN OUT	Notes:
	Do you have any livestock?	If yes how many/ what kind?		Within the last month have you seen wild, stray animals, or rodents in your house, attic or under your house?	
	YES NO			YES NO	
AIR CONDITIONING & DOORS AND WINDOWS	Do you have air conditioning?	During the last month, how often did you use the air-conditioning at night?		Additional notes:	
	YES NO	4 or more nights 3 or less nights Never			
	Do you have screen on your windows?	During the last month, how often do you leave windows open?		Additional notes:	
	YES NO	4 or more nights/week 3 or fewer nights/week Never			
PESTICIDES	Do you apply any pesticides INSIDE your home?	Do you apply any pesticides OUTSIDE your home?		Additional notes:	
	YES NO	YES NO			
	Do you use a professional pest control service?	If yes, where?		What is the name of the company?	
	YES NO	Inside Outside Both			
KNOWLEGDE	Have you ever seen this insect? (Show Pinned bug) YES NO	Where have you seen this insect? Inside Outside Both	If inside your house, where have you seen it?	When did you last see this bug?	
			If outside your house, where have you seen it?		

Survey ID: _____

HOUSEHOLD ATTRIBUTES	Is the house a primary house or a secondary structure? Primary Secondary	Is the house (circle all that apply): RAISED CONCRETE FOUNDATION BRICK Have SIDING	Assess structural Integrity of Residence (1-3): 3 (good or great condition) 2 (decent condition; some holes but generally intact) 1 (poor condition; many holes, missing siding, rotting wood)	What type of material is the roof made of? Creosote tile/shingle Ceramic Tile Metal Other:
	From the perimeter of the house, does there appear to be holes or burrows under the house? YES NO	If yes, how many?		
	Does the home have screens on its doors? YES NO	If yes, the present condition of the door screens appears to be: (Holes larger than a dime) All screens Intact (No holes) Some screens have holes Many screens have holes	How many doors have screens: How many doors do not have screens?	Additional notes:
OUTBUILDINGS	What number of outbuildings are on the property?	What type are these outbuildings? Garage Storage Shed Barn Trailer Other	Additional notes:	
OTHER	Does the property have?	Y/N	Additional comments:	
	Woodpile			
	Kennel			
	Chicken Coop			
	Construction Debris			
	Abandoned Car			
	Busted concrete pile			
	Wood or stone bordered beds			
ENVIRONMENTAL CHARACTERS	Does the property have landscaping (purposely planted vegetation) on any of the exterior walls of the residence? Yes No	If yes, does the landscaping encircle house? YES (landscaping encircles house) No (some non-maintained vegetation or landscaping is adjacent to house)	How well maintained is the landscaping? 2 (well maintained, few weeds) 1 (poorly maintained, over-run with weeds)	

This image shows a blank sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.