ETHNOSCIENTIA – ano 06, número 03 - julho/2021 - [ISSN: 2448-1998]
http://dx.doi.org/10.18542/ethnoscientia.v6i3.10514

ARTIGO

CULTURAL KNOWLEDGE AND EXPERIENCES OF TRIATOMINES AND CHAGAS DISEASE IN THE CITY OF MÉRIDA, MEXICO

Alba Rocío VALDEZ TAH*[*1] , Miguel Ángel PINKUS RENDÓN [1]

Abstract:

Human-k triatomine insects' interaction is a milestone in Chagas Disease (CD) prevention and control. We studied and compared ethnoecology and cultural knowledge and experiences about triatomines and Chagas of two urban social groups, and of health technicians of the vector control program in Merida city, southeastern Mexico. We conducted semi-structure interviews: 24 participants living in very low marginalization index (VLMi) and 26 of very high marginalization index (VHMi) areas in Merida, and 15 health workers. Questions focused on ethno-ecology and health-related knowledge of blood-sucking insects, and experiences on triatomine bites and CD, same than treatment and diagnosis of both bites and the disease. A thematic content-analysis and descriptive statistics were followed. Triatomines were considered a health danger due to the perception of them as poisonous and causing infection. Participants of VLMi were more knowledgeable about CD compared to VHMi participants, but they had limited understanding of the overall to chronicity when compared to health technicians. VHMi showed a more elaborate ethno-ecological knowledge about triatomines and had more exposition to them. Across participants, a biased understanding about CD has been recorded, since it was given emphasis only on acute phase aspects but not on chronic symptomatology. Cultural knowledge about CD remains rather theoretical since it keeps a very unfamiliar disease due to the lack of individual and collectively shared experiences on therapeutic itineraries and illness. There is an urgent need to focus on CD also as a chronic disease by giving more visibility to its prevalence, more advances in diagnostic and treatment, a proper medical care need, as well as illness experiences, and its human impact.

Keywords: ethnoknowledge; triatomine; Chagas disease; Yucatan.

[1] Centro Peninsular en Humanidades y Ciencias Sociales, Universidad Nacional Autónoma de México, Ex Sanatorio Rendón Peniche. Calle 43 s/n, Colonia Industrial. C.P. 97150, Mérida, Yucatán, México. *alba.valdeztah@gmail.com

Resumen:

La interacción entre humanos y los insectos triatominos es un hito en la prevención y el control de la enfermedad de Chagas (EC). Estudiamos y comparamos los conocimientos y las experiencias etnoecológicas y culturales sobre estos insectos y la EC en dos grupos urbanos en Mérida, al Sureste de México, y entre los técnicos de salud del programa de control de vectores. Realizamos entrevistas semi-estructuradas a 24 participantes que viven en áreas de la ciudad de muy bajo índice de marginación (MBIM) y a 26 de muy alto índice de marginación (MAIM), y a 15 trabajadores de campo. Se les preguntó sobre su conocimiento etnoecológico, los insectos que chupan sangre, lo relacionado al efecto de

los triatominos en la salud, las experiencias sobre sus picaduras y la EC, que incluyó el tema del tratamiento y diagnóstico. A la información colectada se aplicó un análisis de contenido temático y de estadística descriptiva. Los triatominos se consideraron un peligro por la percepción de que son venenosos y causan infección. Los participantes de MBIM conocieron más sobre la EC en comparación con los participantes de MAIM, pero su comprensión sobre la etapa crónica y el tratamiento necesario fue limitada en comparación con los técnicos de salud. Los participantes del MAIM mostraron un conocimiento etnoecológico más elaborado sobre los triatominos y mayor exposición a los mismos. En general, existió una comprensión sesgada hacia los aspectos de la fase aguda, mientras las otras fases de la enfermedad y sus implicaciones en atención se mantiene a nivel teórico; la extrañeza de los participantes no expertos sobre la EC coincidió con la ausencia de experiencias directas sobre los itinerarios terapéuticos y de lo que implica el padecimiento para las personas afectadas. Es urgente enfocar la EC también como una enfermedad crónica, dando más visibilidad a su prevalencia, a los avances actuales en el diagnóstico y tratamiento, a la necesidad de una atención médica adecuada, así como la experiencia humana que hay detrás.

Palabras clave: etnoconocimientos; triatominos; enfermedad de Chagas; Yucatán.

1. Introduction

Chagas disease (CD), which is caused by the protozoan *Trypanosoma cruzi*, is the most expanded parasitic infection worldwide and causes more than 7,000 deaths annually, mostly in Latin American, according to conservative estimation of international health organizations (PAHO, 2006). Recognized within the group of tropical neglected diseases according to the World Health Organization, CD remains a major public health concern as a leading cause of cardiomyopathy and burden of mortality. While neglect within official health systems in endemic countries, it is widely known its sub-report of both prevalence of individuals infected with *T. cruzi* and individuals in the chronic phase. An evidence of its sub-report is that Mexico has reported less than one hundred new cases each year during the last two decades, while a recent study suggested that prevalence might be more than four million people, a third of whom it is estimated would develop chronic symptomatology (ARNAL *et al.*, 2019).

Infection with the parasite spreads among humans and animal mammals in a zoonotic cycle, and it is mostly transmitted to both by blood-sucking triatomine insects (RASSI *et al.*, 2010). While human infection with *T. cruzi* has traditionally being associated with rural areas, due to human migration to cities and urban growth concomitant with

environmental perturbation, CD has also become an urban phenomenon in the last decades in endemic Latin Americn. A more rapid transformation of natural habitats or enclaves of triatomines and their host mammals, passive transportation of the vector to the domestic in urban contexts, and extension of rural practices that promotes infestation to cities are eco-social process in the urbanization of the problematic.

As a vaccine is not available against infection with *T. cruzi*, exposition to the triatomine or its bite (chagoma or chinchoma) are sentinel events in the epidemiologic surveillance of human acute CD cases in both rural and urban contexts. While acute phase ensues are symptomatology unspecific, if not treated, the infection will progress at long-term to a chronic stage among 30-40% of the cases. Chronic clinic symptoms are characterized by damage to the heart, gastrointestinal tract and/or nervous system, and lead to physical incapacity and death without treatment. Thus, identification of acute CD cases is crucial since early treatment halts or significantly delays potential chronic complications, and provides far better treatment outcomes (VIOTTI, 2006).

While human-triatomine insects' interaction is a milestone in CD prevention and control, there is poor information available on local cultural knowledge from medical anthropology and ethnoscience fields (VENTURA-GARCÍA *et al*., 2013). Research in South America reported a varied of local understandings regarding *T. cruzi* vector-borne transmission, not only between countries, but also between social groups, including among stakeholders as health providers (VILLELA *et al*., 2009; VENTURA-GARCÍA *et al*., 2013; DONOVAN *et al*. 2014; HURTADO *et al*. 2014; ROSECRANS *et al*. 2014; LOPEZ *et al*. 2015; VALDEZ-TAH *et al*. 2015a; DIAS *et al*., 2016; TANGOA-VILLACORTA *et al*., 2017; LUGO-CABALLERO *et al*., 2017; SANMARTINO *et al*., 2018; SALM *et al*., 2019). Such differences were suggested to exist due to unequal socioeconomic levels, and differences regarding education background, rural-urban origin, presence of vector control and health education activities for CD (LOPEZ *et al*. 2015; DIAS *et al*., 2016; SALM *et al*., 2019). In Mexico, few studies about local knowledge have been conducted in rural communities, dismissing the current urban context of *T. cruzi* transmission (ROSECRANS *et al*. 2014; VALDEZ-TAH *et al*. 2015a; TANGOA-VILLACORTA *et al*., 2017).

Within ethnoecology, as the scientific study of local ways of understanding the relationships between humans and their natural environment, the subfield of ethnoentomology is associated with the study of perception, situated knowledge, and uses of insects and their ecological aspects in different cultural systems across time and space (POSEY, 1981). However, emphasis has been made on utilitarian insects, edible or with curative properties (RAMOS-ELORDUY *et al*., 2010; ABOYTES *et al*., 2011), and insects of medical importance as vector-borne diseases have been mostly neglected. Few reports in South America have shown that triatomines might be consider of good luck when found at households, as elements in myths, used as curative due to the granted heal properties, or as toys by infants (SALAZAR-SCHETTINO 1983; CABALLERO ZAMORA *et al*., 1999; COSTA NETO 2002; RODRÍGUEZ 2002).

Ethnoknowledge about *T. cruzi* and related CD must be framed within vector control activities by official health authorities and its neglect as a priority of health concern. In Mexico, limited program-driven actions focused on the vector control that included sporadic insecticide spraying campaigns, health education and surveillance activities, while available and free diagnosis and treatment are extremely scarcely offered (MANNE *et al*., 2013). Among the fraction of cases officially report each year, access to treatment and integral medical care is very limited (MANNE *et al*., 2013). As the last

Latin American country to develop a comprehensive national program with a specific governmental budget to operationalized and monitor key aspects of the disease, CD has been largely excluded from the social insurance, and only recently national clinical guidelines and advances in the drug availability took place (RAMSEY 2007; MANNE *et al.*, 2013). As results of such neglect, there is limited awareness among health providers and at-risk population about triatomines risk and CD in the country (VALDEZ-TAH *et al.*, 2015a; TANGOA-VILLACORTA *et al.*, 2017; LUGO-CABALLERO *et al.*, 2017). While health-related knowledge about triatomines might be scarce, ethnoknowledge on human-insect interactions have not been explored.

During conventional health programs failure, socio-cultural aspects about CD are for interdisciplinary and culturally sensitive approaches and more sustainable strategies and therapeutic option (SANMARTINO *et al.*, 2018). Such guidance has taken to Sanmartino *et al.* (2018) to propose an integral understanding of the study of the situated knowledge across the whole spectrum of social actors involved – as health providers – in different contexts. Health stakeholders, as vector control technicians in the Chagas program, have been reported to offer only explanation in biological terms, determined by their professional biomedical training and health systems functionality, and usually underestimate ethnoknowledge of the affected people (VENTURA-GARCÍA *et al.*, 2013; LUGO-CABALLERO *et al.*, 2017; SANMARTINO *et al.*, 2018). While they work embedded them in the scientific knowledge of *T. cruzi* vector-borne transmission, they also belong to a greater system culture and their perspective might enrich an integral understanding of the CD problem.

Addressing contemporaneous complexities of vector-borne transmission of *T. cruzi* in the urban context, we studied and compared ethnoecology, health-related knowledge and experiences regarding triatomines among two socioeconomically different urban groups, and among health technicians of the Chagas program in Merida city, Mexico. Following interdisciplinary background of ethnoecology, this proposal constitutes an innovative way to investigate ethnoecology knowledge interfacing with health belief systems and curative and preventive practices (ELLEN 1993; EMERY *et al.*, 2016) relevant to the design of intervention programs and public health policies for CD in Mexico.

2. METHODOLOGY

2.1 Ethics Statement

The research protocol was approved by the Ethics Committee Review Board from the Faculty of Medicine of the Universidad Autónoma de Yucatán, and by the Secretary of Health of Yucatan to interview the health personnel. All participants were explained about the study's purpose and their rights, and thus consented their participation.

2.2. Study Population

Merida is the greatest urbanization in the Yucatan Peninsula, Mexico. With more than two million of inhabitants, it is considered a socioeconomic and spatial polarized urban setting.Urban marginalization, an index elaborated based on statistic census data of wealth, access to health and education services, and dwelling's physical conditions

showed a concentration of population with very high marginalization index (VHMi) at the south of the city; on the contrary, a very low marginalization index (VLMi) is found at the north of the city (LÓPEZ-SANTILLAR *et al*. 2014; INEGI 2010). For this study, four adjacent Geo-statistic basic areas (AGEB), an aggregate of blocks spatially delimited that allows to link geographic space to socio-demographic data, two from each VHM and VLM indices, were conventionally chosen (Figure 1). Table 1 includes socio-demographic data of the study population. Within each pair of AGEB of VHM and VLM indices, a sub-population was selected to participate in this study.

2.3 Participatory Environmental Mapping (PEM 2.3. Study Design, Data Collection and Analysis)

Within each VHMi-south and VLMi-north cluster described above, participants were selected by using an intentional sampling process characteristic of qualitative research. Households were visited once and randomly to find individuals meeting the inclusion criteria of being male and female adults living in the visited household (e.i. not domestic employees or visitors). These participants, further referred as south and north lay participants, were interviewed between December 2019 and February 2020 and questioned about their ethnoecological and health-related knowledge and experiences regarding: 1) common bloodsucker insects and vector-borne transmission, especially with triatomines; 2) triatomines bites, vector-borne diseases, and CD; and 3) treatment and healing for insect and triatomines bites, and for CD. The first topic included a free listing of most common bloodsucker insects; when kissing bugs were not included, or not known (discharging by name, image, and dry specimen observation), questions were related to the first listed insect.

Excluding the free listing of bloodsucker insects, health personnel were asked the same thematic questions. All of them are or were health field technicians of the Chagas program at the vector-borne department of the Sanitary Jurisdiction #1, Health State Services of Yucatan, that includes Merida city and its metropolitan area. Health personnel were all public governmental employees.

Among lay participants living in Merida, data was collected at interviewers' homes, and in the workplace among health personnel. Digital audios recorded lasted 19-39 minutes and were transcribed to Word. Lay participants sample was defined by theoretical saturation, terminating when no new information or data appeared from each additional respondent, and conceptual insights were well developed.

We used thematic analysis as our main methodological orientation. Maxqda 12 software was used to manage qualitative data for coding, and themes of the interview oriented for thematic analysis. Quantitative data was managed in Microsoft Office Excel spreadsheets and percentages were calculated for descriptive statistics. Once the text was coded for qualitative analysis, categories and themes were crosschecked and analyzed comparatively by socioeconomic group, corresponding to south vs. north lay participants, and by lay participants vs. health personnel. Anonymous participants' quotations illustrate the findings with the following data: interview number; South/North residence or Vector-program worker (S, N, or V, respectively); female-male (F and M, respectively); age; occupation; and born place.

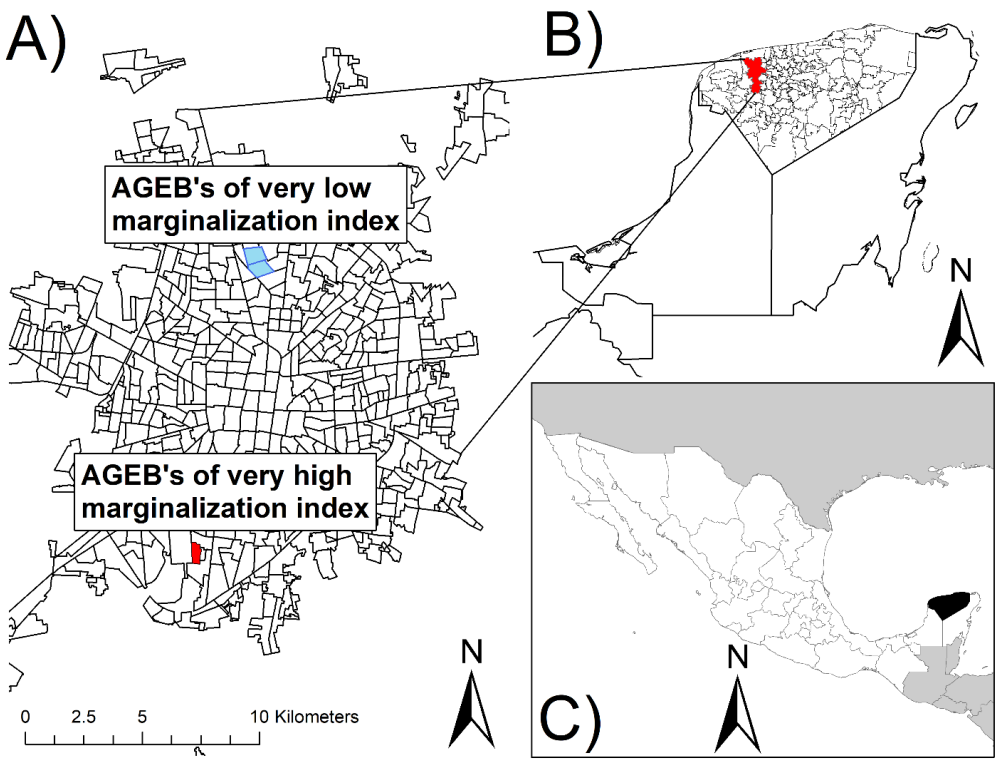

Figure 1: Localization of AGEB Very High Marginalization index at the south of Mérida city, and the Very Low Marginalization index at the south of the city. 1B, C. Localization of Mérida, Yucatan, Mexico. Source: Instituto Nacional de Estadística y Geografia (INEGI). Consejo Nacional de Población. Grado de Marginalización Urbana por AGEB, 2010.

Table 1. Socio-demographics characteristics of the study population at Mérida City.

AGEB Location / Population	North - Very low marginalization AGEB*	South -Very high marginalization AGEB^
Inhabitants	4,443	2,443
Women / men	2,347 / 2,087	1,218 / 1,225
% individual illiterate (>15 years old)	1.3%	15.8%
% individual with any grade or complete basic education (9 years of school)	15.5%	44.2%
% post-basic education - % education media superior (12 years/high school) - Education superior (bachelor)	61.1% - 23.7% - 60.4%	7.5% - 70.6% - 19.2%
% individuals speaking an indigenous language (3 years-old and older)	5.6%	14.6%
% Economic active population that are actually working	98.1%	98.7%
% individual that have a social security and health services	81.5% -67.2%	64.7% - 58.1%

Source: Instituto Nacional de Estadística y Geografía (INEGI). Censo de Población y Vivienda 2010.
*AGEB: 3105000011542, 3105000011557

^AGEB: 3105000016045, 3105000013869

3. Results

3.1. Sample Characteristics

A total of 65 individuals participated: 30 females and 35 males. Twenty-four corresponded to lay participants from north residences and 26 were south residents. All 15 health workers that are currently (or were) enrolled to the CD program were interviewed. The bulk of participants were born in Mérida, while 21.5% were born in other municipalities and other states (Table 2). North residents were older, spoke less Mayan language and had a much more years of school when compared to south participants. Formal private and governmental employment and social security benefits were more prevalent among north lay participants and health personnel.

Table 2. Study participants' socio-demographics characteristics

Participants / Individual Characteristic	North	South	Health personnel Chagas' program
Sex	54% women 46% male	62% women 38% male	7% women 93% male
Age (mean)	53 years-old	35 years-old	39.5 years-old
Born place: Mérida Other municipalities Other states	 62.5% 12.5% 25%	 65.4% 30.8% 3.8%	 73% 20% 7%
Speaks/Understands Mayan language	8.3%	50%	26.6%
Education: In/complete basic (9 grades) High school Graduated studies <	 12.5% 12.5% 75%	 73% 23% 4%	 13% 60% 27%
Job/occupation:	Housewife: 30% Student: 4% Retired: 33% Public service employee: 12.5% Private sector employee: 12.5% Informal auto-employment: 4% Entrepreneur: 4%	Housewife: 50% Student: 7.7% Public service employee: 7.7% Private sector employee: 19.3% Informal auto-employment: 7.7% Entrepreneur: 3.8% Unemployed: 3.8%	Public service employee: 100%
Social security*: IMSS-ISSSTE INSABI Private security	 75% 0% 25%	23% 77% 0%	100% 0% 0%

The Mexican health care system is divided into the Instituto Mexicano de Seguro Social (IMSS), which covers workers in the private sector, and the Instituto de Seguridad y Servicios Sociales de los Trabajadores (ISSSTE), which covers workers in the public sector. The Instituto del Bienestar (before Seguro Popular de Salud), was launched recently in 2019, aims at covering the 48 million the lowest income quintile left uninsured by IMSS and ISSSTE programs [10]. These programs provide basic health care and medicine to patients, and some health education. Source: Database of the project voices and discourses of the pik: and approach to Chagas disease in Yucatan.

3.2 Bloodsucking Insects and Ethnoecology Knowledge

Mosquitoes and ticks were mentioned more frequently as bloodsucker insects than kissing bugs, regardless the zone of residence (Table 3). Kissing bugs were acknowledged as pic (Mayan name), 'chinche hocicona', 'chupasangre', and 'chinche morena.' Interestingly, triatomines were equivalent mentioned than, and even compare to, cockroaches among the south participants. Nine participants that did not listed the vector at first instance, recalled knowing it when later asked.

Table 3. Most common bloodsucker insects

#	North participants	Percentage*	South participants	Percentage*
1	Mosco, mosquito	28%	Mosco, mosquito	29.8%
2	Garrapata (Tick)	18.2%	Garrapata	14.9%
3	Pic (Kissing bug)	14.6	Pic	13.7%
4	Pulgas (Flea)	8.5	Cucaracha	13.7%
5	Cucaracha (Cockroach)	6%	Pulgas	5.7%
6	Piojos (Louse)	3.7%	Araña	2.3%
7	Chinche (Bug)	3.7%	Sanguijuela	2.3%
8	Tábano (Horsefly)	3.7%	Tarántula	2.3%
9	Araña (Spider)	1.2%	Abejas	2.3%
10	Sanguijuela (Leech)	1.2%	Chinche/Tábano	1.1%

Source: Database of the project voices and discourses of the pik: and approach to Chagas disease in Yucatan.

Lay participants' first acknowledge on kissing bugs was heterogeneous and four categories were created to give a fair picture of it (beyond a dichotomous answer of 'yes' and 'no') (Table 4A). A more percentage of north lay participants did not know the vector or know them only through images/information that reached them mostly from social media. On the contrary, an important number of south informants recalled familiarity toward kissing bugs, corresponding to their higher report of domestic incidence and bites (Table 4B). The familiarity category included knowing the insect closely (sometimes from childhood), being well-knowledge about its behavior and major aspects, and close experiences to it, as commonly finding at home or biting.

Knowledge on kissing bugs among lay participants correspond to the insect's adult phase, but not for nymphs, what was found different from health workers who are knowledgeable about its reproduction cycle. Among the former, nine were familiar to the insect since childhood and other three only partially knew them before their enrollment to the program (Table 4). They named kissing bugs as 'triatomine' and 'T. dimidiata'.

Among all respondents, familiarity to kissing bugs was found largely concomitant with their rural origin or descend, or previous background of visiting/working those areas. It was also the case among participants (both lay participants and health personnel) that grew up in old downtown 'colonias' (neighborhoods) of Merida. A health worker born and raised in the 'centro' (old downtown) of the city explained his encounter with the kissing bug: "[…] because backyards were large, I mean, at my grandmothers' house, it was big and there were chickens and more, there we live together with the insect [kissing bug], I even just to play with it" (Vector, M, 45, Merida).

In disregard of residence, lay participants associated both rainy and hot season as favorable for the kissing bugs (Tabla 4C). However, hot-dry conditions were larger found ideal by south lay participants, as a young female illustrated: "I have not seen them [kissing bugs] by now (February), but in hot season is when mostly they are seen. My dog kills them, two or three pics each time…" (South, F, 36, housewife, Peto).

Table 4. Knowledge, perception of danger and experiences of kissing bugs vectors among participants according to their group of residence and among health personnel

	North n=24	South n=26	Health personnel n=15
A) Kissing bugs' knowledge			Before program:
-Does/Did not know it:	8 (33.3%)	4 (15.4%)	3 (20%)
-By image/information:	9 (37.9%)	9 (34.6%)	2 (13.3%)
-Only by identification:	2 (8.3%)	2 (7.7%)	1 (6.7%)
-Familiarity:	4 (16.6%)	11 (42.3%)	9 (60%)
B) Kissing bugs' experiences*	n=15	n=22	
-Found at home:			4 (26.7%)
-Bite experience:	6 (25%)	16 (72.7%)	1 (6.6%)
	0 (0%)	7 (27%)	
C) When kissing bugs are found the most?*	n=15 -Does not know: 7 (29.1%) -Rainy season/humidity conditions: 6 (25%) -Hot season: 3 (12.5%)	n=22 -Hot season: 10 (45.5%) -Does not know: 6 (27.3%) -Rainy season: 5 (22.7%) -All-year round: 1 (4.5%)	-Hot season: 13 (86.7%) -Associated to humidity conditions: 2 (13.3%)
D) Where kissing bugs are found the most?*	n=15 -Outside/associated to vegetation: 11 (73.3%) -Associated to dark, humid and rock: 3 (20%) -At home: 1 (6.7%) -Anywhere: 1 (6.7%)	n=22 Associated to vegetation: 9 (40.9%) Domestic places: 9 (40.9%) Associate to animals: 2 (9%) Does not know: 2 (9%)	Places close to animals and places around the house: 100%
E) What they eat/source of food?*	n=15 -Blood-meals from humans and animals: 9 (60%) -Other insects, leaves, plants: 4 (26.7%) -Does not know: 4 (26.7%)	n=22 -Blood-meals from humans and animals: 18 (%) -Other insects, leaves, plants: 2 (9%) -Does not know: 1 (4.5%)	-Blood-sucking from humans and animals: 15 (100%)
F) Are kissing bugs perceived as dangerous to human health?*	n=15 Yes: 15 (100%): - CD or similar chronic symptoms: 9 (60%) -Acute infection: 4 (26.7%) -Wound bite: 2 (13.3)	n=22 No: 3 (13.6%) Yes: 19 (86.4%): - CD, affecting organs and bones: 6 (27.3%) -Acute symptoms / blood infection: 4 (18.2%) -Wound bite: 7 (31.8%) -Does not know: 2 (9%)	Yes: 15 (100%)
G) What to do when found kissing bugs at home?^	n=15 Reported it to health authorities: 5 (33.3%) Kill it/take it out: 6 (40%) Go to the doctor (if bites): 3 (20%) Do not touch it: 1 (6.7%)	n=22 Kill it/take it out: 15 (68.2%) Do not know: 5 (22.7%) Reported it to health authorities: 2 (9%)	Avoid flip-flop: 6 (40%) Do not touch it and burned it: 8 (53.3%) Did not mentioned: 1 (6.7%)

*Asked among those who declared to know kissing bug through image/information, and thus identify or are familiar to them (excluding those who declared not to know them).

^Included what they did when found it at home and, in theory, what they would do if found it at home.

Source: Database of the project voices and discourses of the pik: and approach to Chagas disease in Yucatan.

Among lay respondents, outdoor vegetation areas were found as ideal places for kissing bugs, as the listed places recalled: trees, parks, gardens, 'monte' (wild forest), undergrowth, and 'terrenos baldíos' (wasteland lots) (Table 4D). Such notion regarding vegetation as ideal for triatomines is illustrated in the next quotation: "[…] it seems to me an outside insect […] I mean, it can be in places like gardens, isn't like, for example, as a mosquito that can be found inside the house" (North, Female, 33, postgraduate student, Merida). In conjunction with that idea, the south group of participants also recalled on places both inside and around home as places where kissing bugs might be found: "It [kissing bug] hides at dark places, like behind the bed" (Male, 18, student, Merida), and "[…] under rocks, in the backyard" (Female, 38, domestic employee, Homun). Both types of inside and outside sites as ideal for kissing bugs are constructed on the reported largely social lay understanding that humidity and darkness – prevalent in the 'monte' and vegetation – are ideal and commonly observed favorable for all listed insects (Table 3), but especially for mosquitoes. As a participant explained when thinking in general for all insects: "I imagine that is where they spawn. Maybe the rain makes them to produce offspring" (North, Male, 51, governmental employee, Merida).

Ethnoknowledge on the vector-borne transmission among health technicians was more elaborated (when compared to lay participants) based on scientific information. Biology terms were prevalent in their descriptions, and they offered detailed explanations of kissing bug's life cycle and behavior. Comparing to the lay participants, they straight-up recalled dry season as the most important one for the insect and associated their domestic infestation to the presence of domestic animals held around the house, such as rats and opossums (and not to vegetation). The 'monte' (wild forest) pop-up as an ideal place for triatomines because the presence of host animals that are sources of blood for triatomines: "[…] the pic looks for the animals, because they are in the 'monte', while they have blood-meals they stay there" (Male, 50, health technician, Maxcanu).

Among the lay-group, animals and humans were the most frequently mentioned food sources for kissing bugs (Table 4E). However, there was not consensus regarding their primary preference: "Well, I imagine that [kissing bug] prefers animals, livestock in rural communities, where they are more common" (North, Male, 51, governmental employee, Merida); "I know they bite on [humans] arms, but I don't know if they feed on animals" (South, Male, 18, student, Merida). It was interesting that even when recalling its blood-sucking behavior, they were referred to also as insectivores or plant-eating insects, according to their association to vegetation: "[…] my common though is that all insects are plant-eating or that they feed on other small insects" (North, Female, 33, postgraduate student, Merida).

Regardless the zone of residence, lay participants identified kissing bugs as dangerous, and causing a health damage potentially fatal (Table 4F). Although Chagas disease has not been mostly acknowledged, north-side residents, compared to south ones, mentioned kissing bug as associated to a not-very clear disease entity that was even misspelled: 'Llagas', 'Chakras'. Furthermore, health damage caused by this vector was largely thought as the consequence of its bite itself, as a sort of poisonous insect: "[…] its venom is toxic, and it invades blood" (North, Female, 41, domestic employee, Chiapas), or as causing acute symptoms "[…] it can cause fever, body pain […] like a type of dengue" (North, Female, 55, housewife, Merida). In fact, recalls of triatomines as poisonous and infectious insects were more extended among south lay participants (Table 4F), illustrated by the following descriptions: "[After the bite] it goes eating your skin,

burning, filling out with infection until you die" (Female, 34, housewife, Merida), and "[…] it can cause reactions, fever, and headache" (Female, 19, student, Merida). Kissing bugs' relationship with a type of disease like Chagas was much less straightforward among the south group.

Regardless the residence zone, the bulk of participants considered kissing bugs as carrying poison, venom, or other similar compounds (toxic and acid substance, "ponzoña", contamination, and infection) that explained a range of acute reactions and allergies after biting. A female south lay participant explained as follows: "I imagine that pics eat other little insects, and other stuffs, and they mix everything, and because of that it became toxic. So, when they bite, all that poison inside them it is transmit to your body" (Female, 38, domestic employee, Homun).

North lay participants claimed that, if found at home, kissing bugs would be mostly killed or reported to health authorities (Table 4G). However, with less domestic incidence, their answers were rather hypothetical and contradictory since, when they are found, people do kill them. This same pattern was also true among south lay participants. No kissing bug's incidence or bite was reported to the vector control department at the SSY by lay participants or family members.

3.3. Chagas Disease Knowledge and Lived-Experiences

When asked about the health damages related to the pic, half of north lay participants (6/15) mentioned Chagas' term, and/or chronic symptomatology, and on the contrary, it was almost absent among south participants (Table 4F). North participants described the heart and the brain as affected human organs: "The pic goes to the heart" (North, Male, 60, retired, Merida); "[…] once having the disease, it does not go away, it keeps active […] it can reactivate anytime" (North, Female, 55, housewife, Merida). However, despite knowledge accuracy about CD, they declared only recently became aware about the topic and were not familiar to CD or the vector. During the interview process, a participant, who first focused on kissing bug' skin damage after biting, learned it in his childhood, later he claimed that "[…] to be honest, on the other day in internet I saw something strange because I never knew it [triatomines] as that dangerous […] I never knew of someone getting ill due to the pic's bite" (Male, 60, taxi driver, Tekax).

While south lay participants reported more familiarity to kissing bugs, only 5 out of 22 have mentioned Chagas or chronic symptoms alike. A few of them actually heard about its medical importance for the first time when interviewed for this study: "¿Chagas? I don't know. It sounds very strange, and no, I have never heard about it" (South, Male, 20, unemployed, Merida). Only one south participant, whose neighbor was diagnosed with CD, described some characteristics of the illness experience: "[…] one cannot make strong jobs because anytime you get very agitated, and you can have a stroke or something like that" (South, Female, 32, housewife, Oxkutzcab).

Altogether, lay participants living at both sides of the Merida city had a limited understanding on the overall process from vector-borne infection with *T. cruzi* to chronic symptoms of CD. Transmission through kissing bugs' feces, as the only way of transmission, was mentioned only once, but no other ways of transmission as congenital or through blood-donation. Knowledge and experiences on diagnosis, treatment and medical care while advancing from acute to chronic Chagas stages were virtually absent.

Among health personnel, chronic phase of CD was more elaborated when compared to the lay group. Some even used metaphoric terms to describe it: "[…] the parasite already cysted and crack the heart" (Male, 50, Maxcanu), and explained it through an illness experience: "[…] it gets a time when you cannot do anything because you get to much agitated" (Male, 37, Merida). However, even among them, CD's chronic symptomatology was much less addressed in comparison with their widely manifested biological and ecological knowledge on vector-borne transmission of *T. cruzi*. This biased explanation of CD was found even when explicitly asked about CD disease and its characteristics:

> Interviewer: How do you explain CD?
>
> V11: Well, we can identify it through a pic bite. Normally when the pic took a blood meal, bite goes sometimes under notice, is when we see the chagoma. That is when a person needs to take a test, and everything to discharged [acute infection], if the kissing bugs left the infection. (Male, 24, health technician, Merida).

Among lay participants and health workers, a very low proportion of them claimed to have relatives or acquaintances affected by CD. Only one case was reported in each group of residents, and none was in the personal life of health personnel (not through their work activities).

3.4. Health Care Seeking for Kissing bug Bites and CD

Among north lay participants, a kissing bug bite should, at least in theory, prompt a visit to the physician. However, a chinchoma/chagoma was recalled as difficult to identify or easily confused with other insect bites: "[…] I imagine it's like the cockroach bite, or similar […]" (N4: Male, 70, retired, Uman). Both cockroaches and kissing bugs bites are believed to grow bigger and more prompt to infection than other normal insect bites. Among north residents, only two passed through experiences of cockroaches and a tick bite, which were described as deserving medical care; usually, homemade remedies as commercial eucalypt ointment, creams found at pharmacies, and antiseptics were used to treat insects' bite.

When an insect bite develops 'out of normal', some changes are observed on the wound: it expands, endures more days than expect, produces pus and more annoyances. And when having fever, it is identified as crucial moments to seek medical care. However, this domestic evaluation considers the perceived vulnerability of the person bitten, among allergic persons, seniors and children, poor-nourish and persons perceived with weak body, skin and blood, and among those with pre-existing chronic disease, as diabetes and low immune system health care seeking is usually promptest. Vulnerability was explained by participants as a heterogeneous reaction among different persons to the bite of the same insect: "Well, I think because of the skin sensibility, each person has a different type, or also, maybe because the type of blood […]" (North, Female, 33, postgraduate student, Merida).

Among south lay participants who have reported themselves (or a family member) being - bitten by kissing bugs, only three of these health events were followed by seeking of medical care. The chinchomas/chagomas were identified - or suspected to - when the insect was catch in fragrant or when found later full of blood. When physician

was not visited, remedies as commercial eucalypt ointment with salt, creams found at pharmacies, antiseptics (all mentioned by the north group), and others as lemon or sour orange juice, garlic, wash with water and soup, merthiolate, and alcohol were applied.

Mothers from the south group who sought for health care after a triatomine bite on their children described very different experiences in this sense:

1) The bite was followed by fever and a serious wound that worsened due to pre-existent health conditions that triggered health care seeking. Physician's diagnosis and prescription was focused on the dermatologic damage itself, but not mentioned or recommended a *T. cruzi* diagnostic lab test, and CD risk was not explained. The mother is still suspicious that might be a cockroach bite, even when a kissing bug was found after the bite, describing it as 'dangerous'.

2) The kissing bugs were known to be dangerous to health, and one was found next to the chinchoma/chagoma. When seeking treatment, only a topic ointment was recommended by the physician. CD risk was not explained and therefore failed to diagnostic: "No, he [the doctor] only said that I give him antibiotic, because when it bites it leaves […] like its poison there, and that it's what it makes to swallow" (South, Female, 34, housewife, Merida).

3) The mother was not aware neither kissing bug danger nor CD; however, the chinchoma/chagoma was followed by a scheduled medical appointment and then observed by the physician, who was a specialist on infectious diseases. CD was explained and a test for T. cruz was applied. In this circumstantial way, the mother knew about CD; however, after a kissing bug has bitten on herself she did not follow the same medical case seeking:

> Well, I put a bit of alcohol and other stuffs [on the chinchoma], moms always seek how to care their children, no? And, after that, when visiting the doctor, I told him 'Look doctor, my daughter was bite by a bichito [little insect] like this and this', and he told me 'Oh, maybe it was a pic', and I said 'What?!', and he repeated 'A pic' and I was like […] pfff [acting all surprise] […] then, he send some test […] (South, Female, 41, house wife, Merida).

Although not familiar to CD, or maybe because of it, altogether lay participants recalled only on biomedical care as the most pertinent to treat it. This is true since vaccines, antidotes, medicine, antibiotics, pills, treatment, and laboratories were mentioned to be need for CD, even when none of them has never gone through a *T. cruzi* diagnostic test and virtually no one knows or have heard about a CD patient's experience. Only two North lay participants claimed about anti-parasite treatment, and the need of continuous medical monitoring for the chronic stage: "It needs medical care, even in hospitals, and has constant medical care […]" (North, Female, 55, housewife, Merida). No specific home remedy, herbal or alternative therapy was mentioned.

Among health personnel, while describing very specifically the chinchoma/chagoma as red, itching, big as the bottom of an oil-bottle, they believe it is very difficult to identify it. The time of the biting was pointed out as a crucial moment to diagnose acute *T. cruzi* infections; after it, a blood test should be applied within 15 next days after infection. Only a third of the health personnel remembered to have had blood-test for *T. cruzi* detection on them, either as blood-donation or as part of a biosecurity protocol at work. Anti-parasite drug for Chagas was recalled to cure or alleviate *T. cruzi* infection, a

long-term and hard treatment that needs medical evaluation before begun. It is precisely in the knowledge about treatment that we found the deepest difference – comparing with the other themes – between the group of lay participants and the health workers

4. Discussion

Gaining insights into the processes that increase human vulnerability to *T. cruzi* infection in situated contexts is fundamental to design and orient health interventions of prevention, control, and care (VALDEZ-TAH *et al.*, 2015a; SANMARTINO *et al.*, 2018). We studied and compared sociocultural knowledge and experiences about kissing bugs and CD among participants from opposed socioeconomic backgrounds, and among health personnel in Merida, Yucatan. The study contributes to the scarce of qualitative studies (from an emicist perspective) among different social groups, identified as priorities for research (VENTURA-GARCÍA *et al.*, 2013). As far as we know, this is the first qualitative study conducted in a Mexican urban context, thus contributing to a handful of them in Latin-America.

Our data demonstrates that lay participants have a general awareness about the kissing bugs as dangerous to human health, but a heterogeneous knowledge about their association to a chronic disease. Ethnoknowledge on kissing bugs' specific behavior, such as their blood-feeding and seasonality, was more elaborated among participants of rural background who reported a higher interaction with this vector, and the bulk of them live at the south of Merida. Comparing with lay participants, health technicians reported a more detailed and scientific accurate knowledge on the overall process from infection to treatment; however, it was biased toward the parasite's vector-borne transmission. In addition, the former's knowledge was based on their enrollment to the CD program but not as being at-risk population as massive health education programs have being absent.

In Merida, kissing bugs were first reported in 1940, when it was a city of 60,000 inhabitants. Recently, Guzmán and colleagues (2007) demonstrated not only persistence of the vector that transiently enters households in this urban encroachment, but also the feasibility of vector-borne transmission of *T. cruzi* to humans. Due to the risk that constitutes at both urban and rural contexts it is worrisome that triatomine vector is not very well known as vector of Chagas disease among lay participants, especially when compared to mosquitoes. Furthermore, the danger of kissing bugs was mostly related to a dermic damage and acute infection, rather than to CD and a complete understanding of their public health concern. This echoe other findings of low medical importance of kissing bugs in rural communities of the Yucatan Peninsula. In Calakumul area, interaction with the vector and its bites were considered rather normal due to environmental and dwellings conditions (VALDEZ-TAH *et al.*, 2015a). Weak understanding of CD was found in rural communities even after being target by scientific research projects (ROSECRANS *et al.*, 2014).

According to previous research, a more elaborated ethnoecological knowledge among lay participants of rural background may result of their actual more interaction with the insect, associated to environmental and living conditions, and with a familiar and a social net widely knowledgeable about the insect (ROSECRANS *et al.*, 2014; VALDEZ-TAH *et al.*, 2015a; SALM *et al.*, 2019). Rural communities in Yucatan not only reported a

higher domestic infestation of kissing bugs, but a higher greater risk of infection and humans' prevalence of *T. cruzi* infection (DUMONTEIL *et al.*, 2014; WALECKX *et al.*, 2015). However, it is needed to say that biological and ecological factors in transmission are per se insufficient to understand the human risk for CD; exposition to triatomines potentially infected with *T. cruzi* constitutes a danger when concomitant to social vulnerability generated by socioeconomic conditions that embedded people's livelihood activities that put them at risk (hunting, agriculture, livestock of animals), unprotected houses, unequal access to medical care in general, and particularly, a neglect on CD within the health care Mexican system (VALDEZ-TAH *et al.*, 2015a; VALDEZ-TAH *et al.*, 2015b).

Although kissing bugs were found distributed in all Merida, they were more associated to empty lots and large 'patios' (backyards) that preserve vegetation, as the ones found in old downtown (GUZMAN-TAPIA *et al.*, 2007). Such places harbor both domestic and wild animals, and altogether with family pets, attract kissing bugs around the houses and are themselves reservoirs of *T. cruzi*. This echoes some participants' observations of kissing bugs while growing up, when residential and large patio houses were extended at the city downtown, before the current gentrification process due to tourism and urban growth, pronounced during the last two decades.

While rural background and residence in oldest zone of Merida may give some insight about ethnoknowledge and experiences about kissing bugs for some participants, poor understanding of CD as a public health problem deserves a different discussion. Certainly, the unspecific and silent symptomatology during acute and indeterminate phases, and chronic stage cases among 30% of the infected people (RASSI *et al.*, 2010) might make difficult to elaborate emic disease concepts, etiology, and therefore, a specific ethno-medicine practices for the disease. While the former remains a possibility, other studies have suggested to seek for socio-demographic differences that might explain different understandings about CD and the kissing bugs' risk due to its deep root into structural forces (DIAS *et al.*, 2016; LÓPEZ *et al.*, 2016; SALM *et al.*, 2019). In Bolivia, a higher education level was associated to a better knowledge between kissing bugs and CD, which happened to be urban informants (SALM *et al.*, 2019). Merida north residents hold a higher level of education (comparing with other participants' groups), and although they mentioned more frequently Chagas or related-chronic symptomatology, they also hold a limited understanding of the overall process from T. cruzi infection to treatment in later chronic stages. In addition, their knowledge was not expressed as truly owned ("I've been told that […]") but rather as an unfamiliar knowledge surrounded by skepticism: "¿Are people really affected by Chagas here?", "And that Chagas problem, does it affect a lot of people?" Knowledge about CD among population in this endemic area, if some, remain rather theoretical, as was also found in rural Yucatan communities (ROSECRANS *et al.*, 2014; VALDEZ-TAH *et al.* 2015b).

A wide consensus among urban participants is about the lack of close CD experiences and knowledge through health institutions (e.i., undergone a blood-test for diagnosis, kissing bug control activities, physicians' recommendations, massive and permanent health campaigns, etc.). These findings shed light on other major structural factors that precede and embed the low level and biased social knowledge on the issue. Major awareness of kissing bug was as a poisonous and infectious insect among the lay-group, and a greater focus on vector-borne transmission (acute phase) among health technicians it is framed in current Mexican national guidelines that stressed on vector control program for surveillance, house insecticide spraying applied, and major efforts

to diagnostic acute cases –after a kissing bug bite – on a case by case basis (RAMSEY 2007). On the other hand, limited social understanding of CD as a long-term, silent, disability and potentially fatal chronic condition should be understood as embedded in the systematic and historical neglect on the access for diagnosis at primary care, treatment, and medical care for already infected or ill patients in the Mexican health sector (RAMSEY 207; MANNE *et al.*, 2013).

In Yucatan, the CD health program has initiated activities in 2004-2005, with very limited financial means, if any, to operate (according to the testimony of stakeholders that launched it). Thus, in an endemic country where only a fraction of people infected by T. cruzi are diagnosed, and less than 1% received treatment, at-risk population would lack of knowledge about biomedical concepts, and therapeutic itineraries within both biomedical and ethnomedical systems. While neglected by health authorities, sociocultural aspects and chronic illness experiences of persons affected by Chagas would remain also without being elaborate or largely invisible (FORSYTH 2017; SANMARTINO *et al.*, 2018).

Moreover, vector control in the CD national program is overshadowed by other vector control activities such as dengue, and to a lesser extent, malaria (Ramsey 2007). The importance of mosquitoes and dengue was widely evidenced in participants' descriptions since this pop-up spontaneously and frequently. They reported more than 20 cases of mosquito-borne diseases among themselves and family members, and therapeutic itinerary was found more elaborated: "Well, the disease invites you to sleep a lot. If fever is high, we know paracetamol is the only we can take, and just rest […]" (North, Female, 58, housewife, Mérida). Same familiarity about mosquitoes was found in rural Yucatan Peninsula (ROSECRANS *et al.*, 2014; VALDEZ-TAH *et al.*, 2015a) and among Calakmul resident's mosquitos and dengue understandings were activated to anchor knew information about kissing bugs and CD (VALDEZ-TAH *et al.*, 2015b).

According to our own and others' study findings, the focus on the danger of kissing bug and the vector-borne transmission in health policy and operative programs may require a different focus. In Brazil, evaluating the first Chagas preventive programs, MAGNANI *et al.* (2007) concluded that the emphasis placed on the disease and patients, –rather than the vector, contributed to a rapid and effective response since it provoked awareness of people, and led to new preventive practices. Other studies pointed out that preventive programs should care of the people long-time infected, and those cursing the chronic CD to avoid the emerging of social meanings as the ones found among neglected patients: death, fear, suffering, distrust, and despair, that cause social suffering and affect health seeking behaviors (MAGNANI *et al.*, 2007; FORSYTH 2017; SANMARTINO *et al.*, 2018). We believe that efforts in public health in Yucatan, and in Mexico, through the appropriate address of CD through education campaigns, program-driven actions for control and prevention, and medical care not only would tackle an urgent public health, but also it will make the disease more socially visible in the region in its entire complexity, and even more important, it will improve patients' illness experience and their health outcomes.

Within the traditional approach of CD as a public health concern, ethnoknowledge and cultural beliefs have been assumed as "barriers" to health programs goals (ROSECRANS *et al.* 2014; VENTURA-GARCÍA *et al.*, 2013), since they are usually different from policy makers, clinicians, and researchers' views (LUGO-CABALLERO *et al.*, 2017; SANMARTINO *et al.*, 2018), as differences found in this study between lay participants

and health technicians. However, if we consider that long-time interaction between local population and kissing bug, sociocultural knowledge orally transmitted may have resulted in precisely a more elaborated ethnoknowledge on its biology, ecology and health damages, then a different focus should include it as assets in the institutional efforts toward Chagas control and prevention in order to build bridges with biomedicine (VENTURA-GARCÍA *et al.*, 2013).

According to social representations' theory, novel scientific information (as CD transmitted by a pic) is socially "anchored" through pre-existing and familiar knowledge (SANMARTINO *et al.*, 2018). Meaning that social understanding of novel scientific data is not a closed and pure model, but rather a syncretic one since it nourishes from different sociocultural views, information disseminated, and lived experiences (MAGNANI *et al.*, 2007; VENTURA-GARCÍA *et al.*, 2013; VALDEZ-TAH *et al.*, 2015; FORSYTH *et al.*, 2017; SANMARTINO *et al.*, 2018). Thus, transdisciplinary activities that addressed local population's views might be a successful way to create links with biomedical knowledge, opening new possibilities for CD prevention and management.

5. Conclusions

Our research proposal, study design and findings offer an innovative for an interdisciplinary dialogue and interchange of ethnoscience with health public and medical anthropology disciplines to contribute for a more integral understanding of the multidimensional of Chagas disease. Our findings regarding social knowledge and experiences about kissing bugs and CD give insights of the sociocultural aspects that have placed while embedded in its neglect from the official biomedical system. There is an urgent need to address the different dimensions of the problematic through program-driven to prevent new infections and to offer an integral medical care of infected and ill individuals. Such action –and not only education and health promotion efforts – would contribute to Chagas popular recognition and knowledge by triggering organic conversations in the public domain about individual and collective experience on the problematic, and therefore, more sociocultural elaborations on CD may emerge.

6. Acknowledgements

Thanks to the Servicios de Salud de Yucatán, health technicians of the program of vector control disease and residents of the visited areas of Mérida. A postdoctoral scholarship was granted to Alba Rocío Valdez Tah by UNAM, Becaria del Programa de Becas Posdoctorales in the UNAM, Centro Peninsular en Humanidades y Ciencias Sociales, guided by Dr. Miguel Ángel Pinkus Rendón. Special thanks to Dr. Mauricio López for their review of the English draft.

Referências –

ABOYTES, R. D; CASTRO-RAMÍREZ, A. E. Etnoentomología maya en el centro de Quintana Roo, México. In: Bello, E. B.; Estrada-Lugo, E. I. Cultivar el territorio maya. Conocimiento y organización social en el uso de la selva. Red ISA, El Colegio de la Frontera Sur, Mexico: Universidad Iberoamericana, 2011.

ARNAL, A.; WALECKX, E.; RICO-CHAVEZ, O.; HERRERA, C. Estimating the current burden of Chagas disease in Mexico: A systematic review and meta-analysis of epidemiological surveys from 2006 to 2017. PLoS Neglected Tropical Disease, v. 13, n. 4, 2019. Available from: https://doi.org/10.1371/journal.pntd.0006859 Accessed on: Jul.28, 2021.

CABALLERO-ZAMORA A.; DE MUYNCK, A. Actitudes y creencias de los indios Quechuas de la provincia Zudañez, Departamento de Chuquisaca, Bolivia, frente al vector de la enfermedad de Chagas. In: Cassab, J. A.; Noireau, F.; Guillen, G. La enfermedad de Chagas en Bolivia. Conocimientos científicos al início del Programa Control (1998–2002). La Paz, Bolivia: Ministerio de Salud y Previsión Social, p. 171-194, 1999.

COSTA NETO, E. M. The use of insects in folk medicine in the State of Bahia, Northeastern Brazil, with notes in insects reports elsewhere in Brazilian folk medicine. Human Ecology, v. 30, n. 2, p. 245-263, 2002.

DIAS, J.; MOTA-QUEIROZ, D.; DIOTAIUTIL, L.; ROCHA-PIRES, H. Knowledge of triatomines insects and of the Chagas disease among people from localities which have different levels of vector infestations. Ciencia & Saude Coletiva, v. 21, n.7, p. 2293-2304, 2016.

DONOVAN, S.; STEVENS, M.; SANOGO, K.; MASROOR, N.; BEARMAN, G. Knowledge and perceptions of Chagas disease in a rural Honduran community. Rural Remote Health, v. 14, n.3, p. 2845-2850, 2014.

DUMONTEIL, E.; NOUVELLET, P.; ROSECRANS, K.; RAMIREZ-SIERRA, M. J.; GAMBOA-LEON, R.; CRUZ-CHAN, V.; ROSADO-VALLADO, M.; GOURBIERE, S. Eco-Bio-Social determinants for house infestation by non-domiciliated Triatomadimidiata in the Yucatan Peninsula, Mexico. PLoS Neglected Tropical Disease, v. 7, n.9, 2014. Available from: https://doi.org/10.1371/journal.pntd.0002466 Accessed on: Jul.28, 2021.

ELLEN, R. The cultural relations of classification. Cambridge: Cambridge University Press, 1993. 344 p.

EMERY, M. R.; HURLEY, P. Ethnobiology in the city: embracing the urban ecological moment. Journal of Ethnobiology, v. 36, n. 4, p. 807-819, 2016.

FORSYTH, C. 'I cannot be worried': Living with Chagas disease in tropical Bolivia. PLoS Neglected Tropical Disease, v. 11, n. 1, 2017. Available from: https://doi.org/10.1371/journal.pntd.0005251 Accessed on: Jul.28, 2021.

GUZMÁN-TAPIA, Y.; Ramírez-Sierra, M. J.; Dumonteil, E. Urban infestation by Triatoma dimidiata in the city of Mérida, Yucatán, México. Vector Borne & Zoonotic Disease, v. 7, n.4, p. 597-606, 2007. https://doi.org/10.1089/vbz.2007.0133

HURTADO, L; CALZADA, J.; PINEDA, V.; GONZALEZ, K.; SANTAMARÍA, A.; CÁCERES, L.; WALD, C.; SALDAÑA, A. Conocimientos y factores de riesgo relacionados con la enfermedad de Chagas en dos comunidades panameñas donde Rhodnius pallescens es el vector principal. Biomédica, v. 34, p. 260-270, 2014.

INSTITUTO NACIONAL DE ESTADÍSTICA Y GEOGRAFÍA (INEGI). Censo de Población y Vivienda, 2010.

LÓPEZ-SANTILLÁN, R.; RAMÍREZ-CASTILLO, L. A. Crecimiento urbano y cambio social: escenarios de transformación de la zona metropolitana de Mérida, 2nd edition. Merida, Mexico: Universidad Nacional Autónoma de México, 2014. 256 p.

LÓPEZ, S. M.; SALOMÓN, O. D. Conocimiento, percepción y actitud sobre la enfermedad de Chagas en un centro de referencia urbano. **Revista de Patología Tropical**, v. 44, n.4, p. 409–422, 2015.

LUGO-CABALLERO, C.; DZUL-ROSADO, K.; DZUL-TUT, I.; BALAM-MAY, A.; ZAVALO-CASTRO, J. Conocimiento sobre enfermedades transmitidas por vector (dengue, rickettsiosis y enfermedad de Chagas) en médicos. **Gaceta Médica de México**, v. 153, p. 321-328, 2017.

MAGNANI, C.; GUIMARAES, B.; DIAS, E. Representações, mitos e comportamentos do paciente submetido ao implante de marcapasso na doença de Chagas. **Cadernos de Saúde Pública**, v. 23, n.7, p. 1624-1632, 2007.

MANNE, J. M.; SNIVELY, C.; RAMSER, J.; SALGADO, M.; BARNIGHAUSEN, T.; REICH, M. Barriers to treatment access for Chagas disease in Mexico. **PLoS Neglected Tropical Disease**, v. 7, n. 10, 2013. Available from: doi.org/10.1371/journal.pntd.0002488 Accessed on: Jul.28, 2021.

RAMSEY, J. M. Chagas disease transmission in Mexico: A case for translational research, while waiting to take disease burden seriously. **Salud Pública de México**, v. 49, número especial, p. 291-295, 2007.

RASSI, A. J.; RASSI, A.; MARIN-NETO, J. A. Chagas disease. **Lancet**, v. 375, n. 9723, p. 1388-1402, 2010.

RAMOS-ELORDUY, J.; PINO, J. M. Insectos comestibles y medicinales en San Simón Tlatlahuiltepec, Xaltocan, Tlaxcala. In: Cruz-Miranda, G. et al. **Entomología Mexicana 9**. México: Sociedad Mexicana de Entomología, 2010.

RODRÍGUEZ, M. Etnoconocimiento de los vectores de la enfermedad de Chagas de las comunidades indígenas Ticuna y Huitoto del trapecio amazónico, departamento del Amazonas, Colombia. In: Guhl, F.; Schofield, C. J. Memorias ECLAT-AMCHA. **Taller Internacional sobre Vigilancia de la Enfermedad de Chagas de la Región del Amazonas**. Brasil: CIMPAT-Universidad de los Andes, p. 71-78, 2002.

ROSECRANS, K.; CRUZ-MARTIN, G.; KING, A.; DUMONTEIL, E. Opportunities for improved Chagas disease vector control based on knowledge, attitudes and practices of communities in the Yucatan Peninsula, Mexico. **PLoS Neglected Tropical Disease**, v. 8, n.3: e2763, 2014. Available from: https://doi.org/10.1371/journal.pntd.0002763 Accessed on: Jul.28, 2021.

Pan American Health Organization (PAHO). **Quantitative estimation of Chagas disease in the Americas**. OPS/HDM/CD/425-06, Montevideo, 2006.

SALAZAR-SCHETTINO, M. P. Customs which predispose to Chagas' Disease and Cysticercosis in Mexico. **American Journal of Tropical Medicine and Hygiene**, v. 32, n.5, p. 1179-1180, 1983.

SALM, A.; GERTSCH, J. Cultural perception of triatomine bugs and Chagas disease in Bolivia: a cross-sectional field study. **Parasite & Vectors**, v. 12, n. 291, p. 01-19, 2019. Available from: https://doi.org/10.1186/s13071-019-3546-0 Accessed on: Jul.28, 2021.

SANMARTINO, M.; AMIEVA, C.; MEDONE, P. Representaciones sociales sobre la problemática de Chagas en un servicio de salud comunitaria del Gran La Plata, Buenos Aires, Argentina. **Global Health Promotion**, v. 25, n.3, p. 102-110, 2018.

TANGOA-VILLACORTA, A.; GAMBIO-LEON, R.; RUBIO-MARTINEZ, S.; SUAREZ-RODRIGUEZ, C. Knowledge of Chagas disease among elementary school students in two rural and urban of the southern huasteca of San Luis Potosi, Mexico. Procedia Social Behavior and Science, v. 237, p. 1254-1259, 2017.

VALDEZ-TAH, A.; HUICOCHEA-GOMEZ, L.; NAZAR-BEUTELSPACHER, A.; ORTEGA-CANTO, J.; RAMSEY, J. Vulnerabilidad humana para la transmisión vectorial de Trypanosoma cruzi a través de los procesos de salud-enfermedad y de la apropiación social del territorio. Salud Colectiva, v. 11, n.2, p. 191-210, 2015a.

VALDEZ-TAH, A.; HUICOCHEA-GOMEZ, L.; ORTEGA-CANTO, J.; NAZAR-BEUTELSPACHER, A.; RAMSEY, J. Social representation and practices towards triatomines and Chagas disease in Calakmul, Mexico. Plos One, v. 10, n. 7, 2015b. Available from: https://doi.org/doi:10.1371/journal.pone.0132830 Accessed on: Jul.28, 2021.

VENTURA-GARCÍA, L.; ROURA, M.; PELL, C.; POSADA, E.; GASCON, J.; ALDASORO, E.; MUÑOZ, J.; POLL, R. Socio-cultural aspects of Chagas disease: A systematic review of qualitative research. PLoS Neglected Tropical Disease, v. 7, n. 9, 2013. Available from: https://doi.org/doi:10.1371/journal.pntd.0002410 Accessed on: Jul.28, 2021.

VIOTTI, R. Long-term cardiac outcomes of treating chronic Chagas disease with benznidazol versus no treatment: a nonrandomized trial. Annals of Internal Medicine, v. 144, n.10, p. 724-734, 2006.

VILLELA, M. M.; PIMENTA, D.; ACÁCIO-LAMOUNIER, P.; DIAS, J. Avaliação de conhecimentos e práticas que adultos e crianças têm acerca da doença de Chagas e seus vetores em região endêmica de Minas Gerais, Brasil. Cadernos de Saude Pública, v. 25, n.8, p. 1701–1710, 2009.

WALECKX, E.; CAMARA-MEJIA, J.; RAMIREZ-SIERRA, M.; CRUZ-CHAN, V.; ROSA-VALLADO, M.; VAZQUEZ-NARVAEZ, S.; NAJERA-VAZQUEZ, R.; GOURBIERE, S.; DUMONTEIL, E. An innovative ecohealth intervention for Chagas disease vector control in Yucatan, Mexico. Transactions of the Royal Society of Tropical Medicine and Hygiene, v. 109, n.2, p. 143-149, 2015. https://doi.org/10.1093/trstmh/tru200

Recebido em: 10/05/2021
Aprovado em: 05/06/2021
Publicado em: 29/07/2021