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SCIENTIFIC ARTICLE
Animal Infectious Diseases

Community knowledge on dengue in territories under risk in the state of São Paulo

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ABSTRACT

In the last decades, the global incidence of arboviruses transmitted by the vector *Aedes aegypti* has increased dramatically with the increased oh human mobility and urbanization. The study of the mosquito population is of great importance for public health in countries where climatic and environmental conditions are favorable for the spread of these diseases transmitted by *A. aegypti*. This was a cross-sectional study that assessed causal relationships between why mosquitoes are prevalent in the region studied and socioeconomic variables, practices, knowledge, attitudes, and the effect of the cause in two regions chosen according to vulnerability (São Paulo Social Vulnerability Index). Of the 435 residents interviewed, 95% (413/435) were informed about vector control and claimed to contribute to the day-to-day sanitary practices necessary to combat it, in addition to being able to identify it. Most participants in both regions believed they were at risk, but vector control practices did not match those recorded in the survey. A correlation was found between the population's level of education and the practices observed. Despite the high levels of knowledge and the perceptions of the interviewed population about *A. aegypti*, the erroneous behavior of the residents persisted, thus hindering disease prevention and vector control actions, promoting the conditions conducive to the proliferation of the vector, and, consequently, increasing the risk of disease. The study indicated that one of the most effective means to control the *A. aegypti* vector is a society informed about preventive measures in the surveillance sectors.

Keywords: *Aedes aegypti*; epidemiology; insect vectors.

INTRODUCTION

The dengue virus is an arbovirus of the genus *Flavivirus*, and its transmission to vertebrate animals occurs through arthropods (RUST, 2012) namely the *Aedes aegypti* mosquito. The virus has four serotypes: DEN-1 (isolated for the first time in Brazil in 1981 during an outbreak in Boa Vista), DEN-2 (isolated in 1990), DEN-3 (isolated in 2000), and DEN-4 (isolated during the Boa Vista outbreak in 1981) (TAUIL, 2001).

Despite the application of sufficient resources to vector control in developing countries, inadequate planning of actions makes it difficult to combat the vector (DONALÍSIO; GLASSER, 2002). Local study in a given geographic area that seek to outline a profile of a vectorial transmission cycle or about the population's knowledge about the dynamics

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of some diseases usually focus on the application of preventive actions (LIMA et al., 2010). The population's knowledge, perceptions, and behaviors, combined with their practices, must be taken into account for the effective implementation of disease prevention and control policies (CLARO et al., 2004).

A literature search using the descriptors *community perception*, attitudes, and practices showed that few studies have focused on disease prevention practices in Brazil (CLARO et al., 2004). Considering the importance of practices and knowledge in the disease control and health planning (KENDALL et al., 1991), there is a knowledge gap that needs to be explored. The objective of this study was to evaluate the knowledge, attitudes, and participation of the population in the fight against dengue and to analyze the variables that may facilitate the dissemination of the vector in a city in São Paulo.

METHODS

Study design

This was a cross-sectional study that used quantitative methods. Based on the São Paulo Social Vulnerability Index (IPVS), which consists of a planning tool, based on socioeconomic indicators that classify communities according to vulnerability, the communities of the municipalities of the state of São Paulo were classified into five groups: very low, low, medium, high (urban), and high (rural) vulnerability. Locations of low and very low vulnerability were chosen randomly in the municipality of Fernandópolis.

Study location and population

The municipality of Fernandópolis (SP), located in the extreme northwest of the state of São Paulo, has an area of 550,033 km2 and 67,836 inhabitants. It has typically intense periods of precipitation and high temperature during the year, an environment conducive to the growth and reproduction of mosquitoes and, consequently, dengue transmission.

A sample of 435 residents was chosen randomly, 317 from region 1 (very low vulnerability) and 118 from region 2 (low vulnerability) (SÃO PAULO, 2010). The interviews were conducted between March and August 2017.

Survey tool

The survey was carried out using a structured, pretested questionnaire, composed of 18 closed and one open question to obtain qualitative and quantitative data as well as interviewees' opinions. Each question was used a variable for statistical analysis.

During the survey process, the researchers randomly selected a house and approached it; then, a family representative, aged over 18 years old, was explained the purpose of the study and asked to sign the consent form. The questionnaire was administered to the family representative after obtaining informed consent.

In addition to the questionnaire, the conditions of the water tanks in the homes, accumulation of water in plant pots, presence of exposed containers in a position favorable for the storage of water (tires, waste, garbage cans, etc.), gutter and slab obstructions, and drainage.

When asked about accessible means of information on vector (*A. aegypti*) control and disease prophylaxis, the respondents could choose more than one answer, and many interviewees rarely reported only one means of information. The question of education level/literacy was applicable to all members of the residence.

Data analysis

Each question was assigned a score according to the response: zero (0), if the answer was negative ("no") and one (1), if it was positive ("yes"). For data analysis, the answers were transcribed and stored on a Microsoft Office Excel spreadsheet (one for each analysis) and were subjected to absolute frequency and percentage analysis in Epi Info 7.2.

For the analysis of multiple correspondence between mosquitoes and dengue in the blocks of the two localities, the Burtt table was used. The pattern of interrelationship was determined by the residues (difference between the observed and the expected), expressed as standard deviation in which the residue value indicating dependence between the categories was greater than 1.96 for $\alpha = 5\%$ and above 1.60 for $\alpha = 10\%$.

For logistic regression analysis, the two dependent variables, "dengue" and "mosquito," were evaluated separately against the independent variables of sex, outdoor area, swimming pool, vessels inside the residence, vessels outside the residence,

places that could accumulate water, water tank, drains, uncovered garbage, covered garbage, mosquito, vaccinated against an arbovirus, material collection, mosquito breeding, and education (incomplete elementary school, complete elementary school, did not attend, incomplete high school, complete high school, incomplete higher education, complete higher education). For this analysis, the home of each interviewee was used as the observation unit.

Associations with $p < 0.20$ were initially selected in the corrected X^2 test, which were subjected to univariate logistic regression analysis. Subsequently, models with variables that maintained $p < 0.05$ were added to the multiple logistic regression model. In order to analyze the effect of removing a variable from a given model, the likelihood ratio test was performed (NOORDHUIZEN, 2001). In order to determine the presence of a confounding variable, the odds ratio (OR) adjusted by Mantel–Haenszel (THRUSFIELD, 2005) was used.

The analyses were performed using Epi Info software. The fit of the model was assessed using the Hosmer and Lemeshow test in the ResourceSelection package of the R software.

Using a map of the two selected locations, a database was built with the aid of the QGIS program. The database consisted of cadastral, socioeconomic, and cultural information; city hall activities to combat dengue; the presence of animals and their food bowls; the presence of vectors; cases of dengue in the home; and information about the external area of the residence.

Ethics

All respondents signed a consent form approved by the Research Ethics Committee (CEP) of Universidade Estadual Paulista "Júlio de Mesquita Filho," Campus Bauru, on February 17, 2017, under opinion N. 1,930,785. All participants were adults (over 18 years old). The purpose and procedures of the study were explained and disclosed to the participants before obtaining their consent. Participation was voluntary.

RESULTS

Among the residents interviewed, 74.71% (325/435) were women: 76.34% (242/317) in region 1 and 70.34% (83/118) in region 2. The average age was 59 years in region 1 and 50 years in region 2.

In all, 71.26% (310/435) of the households had uncovered areas. As for the presence of containers and utensils, plant pots were found in 40.65% (126/310), followed by construction materials in 11.61% (36/310), garden hoses in 68% (30/310), and dog/cat drinking fountains in 8.39% (26/310) of the households. Regarding the care of plant pots, only 5.48% (17/310) stated that they used chlorine as a preventive measure against the dengue agent.

Of the interviewees, 88.51% (385/435) had a water tank, and of these, only 41.56% (160/385) performed cleaning periodically (Table 1). The use of uncovered garbage bins in the peri-domestic area was reported by 11.95% (52/435) of the interviewees and of covered bins by 84.21% (16/317) in region 1 and 69.69% (23/118) in region 2.

The presence of drains in backyards was mentioned by 44.47% and 67.79% of the residents in regions 1 and 2, respectively. Of these, 71.63% in region 1 and 76.25% in region 2 stated that their drains were plugged. Regarding maintenance and care for drains, 14.9% in region 1 and 21.25% in region 2 claimed that they did not perform periodic cleaning. The remainder said they used screens and chlorine. Swimming pools were present in 2.5% (8/317) of the households in region 1 and in 2.5% (1/118) in region 2. Regarding the presence of the vector (Table 2), 65.93% (209/317) in region 1 and 37.29% (44/118) in region 2 never found mosquitoes in their homes.

In region 1, 9.46% of the respondents who reported breeding sites close to homes mentioned the presence of abandoned/closed houses and houses available for rent; for them, these properties represented locations for vector multiplication, since they were not inspected by endemic vector and zoonoses surveillance agencies.

In both regions, the highest prevalence of the vector in the homes was reported in the afternoon period (Table 1). As for the interviewees' knowledge about the diseases transmitted by the vector, 98.11% (312/318) in region 1 and 93.22% (110/118) in region 2 stated that they knew the mosquito was a disease transmitter. Dengue, chikungunya, and zika were the most frequent responses among respondents, while yellow fever was mentioned by only 11.72% (51/435). Of the interviewees, 78.85% (343/435) received a vaccine against some of the diseases transmitted by *A. aegypti* (Table 1). In region 1 and 2, respectively, 69.4% (220/317) and 56.8% (67/118) of the interviewees stated that they did not contract any disease transmitted by *A. aegypti*. In both regions, when asked about the disease transmitted by the vector, the response was dengue. They did not know how to differentiate the clinical symptoms of diseases caused by arboviruses transmitted by *A. aegypti*: 96.53% (306/317) in region 1 and 94.07% (111/118) in region 2.

Table 1. Preventive measures, care in residential environments, and knowledge and information about the vector obtained from interviews with residents of the municipality of Fernandópolis, SP, 2017.

Preventive Knowledge	Question	Answer	Region 1	Region 2	Total
Preventive measures	Garbage dis-covery area	Yes	19/317 (5.99%)	33/118 (27.96%)	52 (11.95%)
	Capped	Yes	16/317 (84.21%)	23/118 (69.69%)	39 (7.38%)
	Has drainage drain	Yes	141/317 (44.47%)	80/118 (67.79%)	221 (50.80%)
	Capped	Yes	101/317 (71.63%)	61/118 (76.25%)	162 (73.30%)
	Take care of the drains	Yes	120/317 (85.10%)	63/118 (78.75%)	183 (82.80%)
	Has a water tank	Yes	280/317 (88.32%)	105/118 (88.98%)	385 (88.50%)
	Covered	Yes	280/317 (100%)	103/118 (98.09%)	383 (99.48%)
	Usually cleans it	Yes	105/317 (37.50%)	55/118 (52.38%)	160 (41.55%)
Knowledge and information about the vector	Presence of mosquitoes	Yes, Few	90/317 (28.39%)	51/118 (43.22%)	141 (32.41%)
		Yes, Many	18/317 (5.67%)	23/118 (19.49%)	41 (9.42%)
		No	209/317 (65.93%)	44/118 (37.28%)	253 (58.16%)
	Schedule	Morning	19/108 (17.59%)	22/74 (29.72%)	41 (22.52%)
		Afternoon	47/108 (43.51%)	37/74 (50.00%)	84 (46.15%)
		Evening	28/108 (25.92%)	25/74 (33.78%)	53 (29.12%)
		Night	38/108 (35.18%)	29/74 (39.18%)	67 (36.81%)
	Do you know what the mosquito can transmit?	Yes	312/317 (98.42%)	110/118 (93.22%)	422 (97.01%)
		No	5/317 (1.58%)	8/118 (6.78%)	13 (2.98%)
	If so, what?	Zika	131/317 (41.32%)	45/118 (38.13%)	176 (40.45%)
		Chikungunya	159/317 (50.15%)	57/118 (48.30%)	216 (49.65%)
		Yellow fever	32/317 (10.09%)	19/118 (16.10%)	51 (11.72%)
		Dengue	307/317 (96.84%)	109/118 (92.37%)	416 (95.63%)
Knowledge about vaccines	Have you al-ready been vaccinated against any of the diseases mentioned above?	Yes	255/317 (80.44%)	88/118 (74.57%)	343 (78.85%)
		No	62/317 (19.66%)	30/118 (25.42%)	92 (21.14%)

Table 2. Perception of the vector.

Perception of the vector		Region 1	Region 2	Total
Total respondents		**317**	**118**	**435**
Has anyone had any disease caused by the vector?	yes	97 (30.59%)	51 (43.22%)	148 (34.02%)
Frequency at which the residence is inspected by surveillance agencies (for endemic vectors and zoonoses)	once	192 (60.56%)	55 (46.61%)	247 (56.78%)
	twice	6 (1.89%)	9 (7.62%)	15 (3.44%)
	three times	119 (37.53%)	54 (45.76%)	173 (39.77%)
Was any material or water sample collected?	Yes	1 (0.31%)	5 (4.23%)	6 (1.37%)
In what period is the elimination of larvae and breeding places carried out?	rain	237 (74.76%)	70 (59.32%)	307 (70.57%)
	dry	24 (7.57%)	13 (11.01%)	37 (8.50%)
	both	56 (17.66%)	35 (29.66%)	91 (20.91%)
Breeding grounds close to the house or neighborhood	yes	30 (9.46%)	58 (49.15%)	88 (20.22%)

Data obtained from interviews with residents of the municipality of Fernandópolis, SP, 2017.

In all households investigated, there was a home visit by agents of endemic vector and zoonoses surveillance. The existence of mosquito breeding sites close to the homes was not observed by 90.54% (287/317) of respondents in region 1 and 50.84% (60/118) in region 2.

Among the means of disseminating information on arboviruses transmitted by *A. aegypti,* the most frequently mentioned means were television (region 1: 70.2%, n = 281; region 2: 33.5%, n = 73), followed by community health workers (region 1: 8.2%, n = 33; region 2: 21.5%, n = 47).

In both regions, 34.09% (405/1,188) of the residents had incomplete elementary education, 9.93% (118/1,188) had completed elementary school education, 6.57% (78/1,188) had incomplete high school education, 17.93% (213/1,188) had completed high school education, 2.95% (35/1,188) had incomplete higher education, and 22.14% (263/1,188) had completed higher education.

On multiple logistic regression, the variables "accumulated water" (OR = 15.5; 95% CI = 1.9–122.2; p = 0.009), "breeding site" (OR = 2.4; 95% confidence interval [CI] = 1.4–4.1; p = 0.000), "high school" (OR = 1.8; 95% CI = 1.1–2.8; p = 0.007), and "drains" (OR = 2.5; 95% CI = 1.7–3.9; p = 0.000) were strongly associated with the variable "mosquito." Schooling was associated with the breeding variable of the vector, whether natural (squares, playgrounds) or artificial (rental houses, abandoned property). The Hosmer and Lemeshow test proved the fit of the model (p = 0.9781).

There was a significant association between dengue as a dependent variable and the neighborhood as an independent variable in regions 1 and 2 (OR = 0.18; 95% CI = 0.11–0.29; p = 0.000). In this study, region 2 was strongly associated with the dengue variable.

Multiple correspondence analysis (Table 3) showed that "mosquito" was correlated with "uncovered area," "water tank," "drains," "vaccinated," "close breeding area," and "incomplete elementary school"; all of these showed residue values and dependence, with results above 1.96 for α = 5%. It seems that the "neighborhood" in both regions took preventive measures to reduce the spread of mosquitos. Further, the variable "vaccinated" showed a correlation with "vector." "Water tank," "drains," "nearby breeding sites," and "incomplete elementary education" correlated with the "vector," with the habits of residents being more relevant in region 2 than in region 1 (Table 3). The results of the correspondence analysis (Table 3) were similar to those of the logistic regression analysis, with only "water tank" showing a significant value.

Table 3. Results of the multiple correspondence analysis.

Variables	M ≤ 2	p <	M > 2	p	D < 2	D ≥ 2
Region 1	1.0		−1.8		1.0	−1.0
Region 2	−2.4		4.4	0.01	−2.5	2.6
Discovered area ≤ 3	1.3		−2.5		0.1	−0.1
Discovered area >3	−1.7		3.1	0.01	−0.1	0.1
Quantity vessels outside <30	0.5		−1.0		−0.8	0.9
Quantity vessels outside≥ 30	−0.9		1.6	0.10	1.3	−1.4
Water tank <3	1.5	0.12	−2.8		−0.1	0.2
Water tank ≥ 3	−2.2		4.0	0.01	0.2	−0.2
Drains ≤ 2	1.4	0.14	−2.6		0.3	−0.3
Drains >2	−2.7		5.0	0.01	−0.5	0.6
Vaccinated ≤ 2	1.8	0.06	−3.3		−0.5	0.5
Vaccinated > 2	−2.0		3.6	0.01	0.6	−0.6
Dengue < 2	0.3		−0.5		–	–
Dengue ≥ 2	−0.3		0.6		–	–
Mosquito ≤ 2	–		–		0.3	−0.3
Mosquito >2	–		–		−0.5	0.6
Nearby breeding ground = 0	1.4	0.16	−2.5		0.5	−0.5
Nearby breeding ground >1	−1.9		3.4	0.01	−0.7	0.8
Incomplete elementary school <5	1.2		−2.2		0.0	−0.0
Incomplete elementary school ≥5	−2.0		3.7	0.01	−0.1	0.1

"Mosquito" (M), "dengue" (D), and the other variables were obtained from interviews with the residents of the municipality of Fernandópolis, SP, 2017.

The variable "dengue" showed a significant correspondence with region 2. The results presented in Table 3 justify this result. After correlating the indicators of sanitation and environmental health with the prevalence of dengue, it was possible to identify a greater number of cases of the disease in areas where sanitary conditions are precarious, proving the assumption that sanitary and environmental conditions are directly related to the level of health practices carried out by the population (Table 3).

DISCUSSION

This study aimed to evaluate the knowledge, attitudes, and participation of the population in the fight against dengue and health and environmental risk factors involved in the spread of the vector in a city in São Paulo. An acceptable level of knowledge about the vector was observed; the interviewees had knowledge about the environment and shared it with other inhabitants of the region, but a major proportion did not understand the harm that the vector can cause. Both regions are in an area with a high risk of infection, as per the environmental and social factors, and, consequently, conducive to any disease carried by the vector, as observed on both multivariate and logistical analyses of the *very low vulnerability* area.

With regard to attitudes and knowledge about the vector, the interviewees were able to identify places close to and within the residence that could act as a vector proliferation focus. Similarly, KUMARAN et al. (2018) found that 95% of the population was able to identify mosquito breeding sites. Examples of places that could accumulate water were empty objects, vacant lots, and closed houses for rent.

Regarding knowledge and attitudes, the variables "accumulated water," "uncovered area," and "drains" were strongly correlated to the etiological agent and the presence of the vector in each region, indicating the risk to the residents. Some interviewees from the low vulnerability region reported they did not clean their environment. Others believed that health is associated with external and social factors, such as keeping the house and the perimeter clean. XU et al. (2019) found similar results, where the interviewed population engaged in daily cleaning of their environment. The practice of cleaning the perimeter of the residence is one of the main factors of the Clean Yard Project, which integrates surveillance information and strategies of vector control with social mobilization (TAPIA-CONYER et al., 2012).

As for the attitude of the population, some interviewees reported that they were not responsible for the garbage in their community and that the city authority was. Unpaved areas at the end of the streets were used as a garbage dumping site. According to ALMEIDA et al. (2007), garbage collection cannot reflect the local situation, as many areas have illegal dumping sites, despite the provision of regular services, which was clear in this study, where the practices of the inhabitants of the region did not depend on the provision of garbage collection services.

Mosquitoes appeared in the dry season due to the intense heat and more in the afternoon, different from the results of XU et al. (2019), whose study sample did not experience mosquito bites during the day. However, in this study it was observed that the houses were well maintained only during the monsoon season, when surveillance officers visit frequently. A study by TAPIA-CONYER et al. (2012) revealed that households not evaluated by health agents had a two- to-four-fold greater risk of dengue cases than households that were evaluated. In this study, it was found that the population lacks information and that health agents play a crucial role in controlling the spread of the vector, since they have direct contact with the residents, which makes it possible to clarify and resolve doubts. In fact, it was highlighted as the most common means of information in the studied regions.

With regard to attitudes in the multivariate analysis, vaccination stood out. Vaccination was mentioned as a part of preventive practice, but the population is unaware that vaccines are only partially effective (LINDSAY et al., 2017). Vaccinated people stop cleaning the place they live in and, consequently, there is rift between them and non-vaccinated individuals (TAPIA-CONYER et al., 2012). The association between "vaccinated" and "dengue" in the multivariate analysis shows that the population that is vaccinated, is likely to show a relapse in home care, resulting in the high risk of dengue in the population that is not vaccinated.

The level of education was important and correlated with the presence of the agent and, consequently, with home/environment care. Although populations with a low level of education influence the development of breeding sites, they do not exclude the responsibility of populations with a high level of education and good socioeconomic conditions (DONALÍSIO; GLASSER, 2002). The educational level of a population can influence their basic sanitation and lead to an increase in the number of breeding sites and, consequently, the spread of disease. The education

of the population can be facilitated by the epidemiological surveillance agency, where health education actions become more efficient with the use of important tools to sensitize the population in adopting changes in habits (FEITOSA et al., 2015).

In the studied regions, there was a large number of people who had contact with the vector and consequently contracted the disease. Half of the interviewees reported the presence of the vector in their homes and of pots in their backyards or other utensils that can store water. In region 2, the number of residents who had contracted a disease and those who had not were very similar. Of note, they were not informed about the results of the laboratory tests and some respondents answered no to the question, which could have altered the exact number of dengue cases and, consequently, the assessment of the neighborhoods surveyed.

The interviewees in the very low vulnerability regions were sure that they were facing health and environmental risk, as demonstrated by the multivariate analysis ($p < 0.05$), similar to the studies that support the hypothesis of the relationship between sanitation and dengue (GUBLER, 1998; TEIXEIRA et al., 2013).

This study has some obvious limitations. More attention was given to the quantitative than to the qualitative method, so the differences between the two sampled regions could not be highlighted. Further qualitative studies are needed to better understand the population. Some residents restricted entry to their homes, so their living environment could not be fully observed. Some participants responded "I don't know" to some questions, e.g., differentiation of diseases carried by the same vector.

The correlation of data by multivariate analysis was performed in blocks, which may have limited or masked the correlations. Due to the data collection method, it was not possible to perform analysis at the individual level. The comparison between variables and responses was carried out by logistic regression, obtaining similar results, but weak correlations. However, both regions showed a significant risk of disease before adjusting for the vector, and the results show that the regions had a high number of dengue cases even though the populations had a high level of knowledge.

The regions studied in this research were based on the geographical location, so further studies considering the specificities of each region are needed. However, the classification of areas presented here can be useful for designing a methodology for epidemiological surveillance and improving knowledge on the distribution of the vector and affected residents, such that providing control actions can be taken to the disease.

The studied population had satisfactory knowledge about the dynamics of vector control and prevention measures; however, it is necessary that the knowledge is put into practice in daily life in addition to keeping the region clean. The prevention measures can be supported by public policies on basic sanitation and regular garbage collection services. There is still low intervention mobilization in large proportion of the population in the environments that are shared, which generates dissatisfaction among other residents.

AUTHORS' CONTRIBUTIONS

Conceptualization: Ferraudo, A.S.; Picinato, M.A.C.; Pereira, L.E.C. **Investigation:** Barbosa, K.F.D.; Pereira, L.E.C. **Methodology:** Ferraudo, A.S.; Picinato, M.A.C.; Mathias, L.A. **Data analysis:** Ferraudo, A.S.; Mathias, L.A. **Writing – original draft:** Pereira, L.E.C. **Writing – review & editing:** Ferreira, E.M.; Mathias, L.A.; Arcêncio, R.A.

AVAILABILITY OF DATA AND MATERIAL

All data generated or analyzed during this study are included in this published article.

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CONFLICTS OF INTEREST

All authors declare that they have no conflict of interest.

ETHICAL APPROVAL

This study was approved by Research Ethics Committee of Universidade Estadual Paulista "Júlio de Mesquita Filho," Campus Bauru, on February 17, 2017, under opinion No. 1,930,785.

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REFERENCES

ALMEIDA, M.C.M.; CAIAFFA, W.T.; ASSUNCÇÃO, R.M.; PROIETTI, F.A. Spatial vulnerability to dengue in a Brazilian urban area during a 7-year surveillance. *Journal of Urban Health*, Switzerland, v.84, n.3, p.334-335, 2007. https://doi.org/10.1007/s11524-006-9154-2

CLARO, L.B.L.; TOMASSINI, H.C.B.; ROSA, M.L.G. Prevenção e controle do dengue: uma revisão de estudos sobre conhecimentos, crenças e práticas da população. *Cadernos de Saúde Pública*, Rio de Janeiro, v.20, n.6, p.1447-1457, 2004. https://doi.org/10.1590/S0102-311X2004000600002

DONALÍSIO, M.R.; GLASSER, C.M. Vigilância entomológica e controle de vetores do dengue. *Revista Brasileira Epidemiológica*, São Paulo, v.5, n.3, p.259-279, 2002. https://doi.org/10.1590/S1415-790X2002000300005

FEITOSA, F.R.S.; SOBRAL, I.S.; JESUS, E.N. Socio-environmental indicators as subsidy to the prevention and control of Dengue. *Revista Eletrônica em Gestão, Educação e Tecnologia Ambiental*, Santa Maria, v.19, n.3, p.351-368, 2015. https://doi.org/10.5902/2236117018239

GUBLER, D.J. Dengue and dengue hemorrhagic fever. *Clinical Microbiology Reviews,* Washington (DC), v.11, n.3, p.480-496, 1998. https://doi.org/10.1128/CMR.11.3.480

KENDALL, C.; HUDELSON, P.; LEONTSINI, E.; WINCH, P.; LLOYD, L.; CRUZ, F. Urbanization, dengue and the health transition: anthropological contribution to international health. *Medical Anthropology Quarterly*, Arlington, v.5, n.3, p.257-268, 1991. https://doi.org/10.1525/maq.1991.5.3.02a00050

KUMARAN, E.; DOUM, D.; KEO, V.; SOKHA, L.; SAM, B.; CHAN, V.; ALEXANDER, N.; BRADLEY, J.; LIVERANI, M.; PRASETYO, D.B.; RACHMAT, A.; LOPES, S.; HII, J.; RITHEA, L.; SHAFIQUE, M.; HUSTEDT, J. Dengue knowledge, attitudes and practices and their impact on community-based vector control in rural Cambodia. *PLoS Neglected Tropical Diseases*, San Francisco, v.12, n.2, e0006268, 2018. https://doi.org/10.1371/journal.pntd.0006268

LIMA, A.M.A.; ALVES, L.C.; FAUSTINO, M.A.G.; LIRA, N.M.S. Percepção sobre o conhecimento e profilaxia das zoonoses e posse responsável em pais de alunos do pré-escolar de escolas situadas na comunidade localizada no bairro de Dois Irmãos na cidade do Recife (PE). *Ciência & Saúde Coletiva*, Rio de Janeiro, v.15, n.suppl.1, p.1457-1464, 2010. https://doi.org/10.1590/S1413-81232010000700057

LINDSAY, S.W.; WILSON, A.; GOLDING, N.; SCOTT, T.W.; TAKKEN, W. Improving the built environment in urban areas to control Aedes aegypti-borne diseases. *Bulletin World Health Organization*, Geneva, v.95, n.8, p.607-608, 2017. https://doi.org/10.2471/BLT.16.189688

NOORDHUIZEN, J.P.T.M.; THRUSFIELD, M.V.; FRANKENA, K.; GRAAT, E.A.M. *Application of quantitative methods in veterinary epidemiology*. Wageningen: Wageningen Academic Publishers, 2001. 429p. https://doi.org/10.3920/978-90-74134-89-7

RUST, R.S. Human arboviral encephalitis. *Seminars in Pediatric Neurology*, Columbus, v.19, n.3, p.130-151, 2012. https://doi.org/10.1016/j.spen.2012.03.002

SÃO PAULO. Assembleia Legislativa do Estado de São Paulo. São Paulo: Secretaria de Economia e Planejamento. *Índice paulista de vulnerabilidade social*, 2010. Available from: http://ipvs.seade.gov.br/view/index.php. Access on: 17 Apr. 2017.

TAPIA-CONYER, R; MÉNDEZ-GALVÁN, J; BURCIAGA-ZÚÑIGA, P. Community participation in the prevention and control of dengue: The patio limpio strategy in Mexico. *Paediatrics and International Child Health*, England, v.32, n.suppl.1, p.10-13, 2012. https://doi.org/10.1179/2046904712Z.00000000047

TAUIL, P.L. Urbanização e ecologia do dengue. *Cadernos de Saúde Pública*, Rio de Janeiro, v.17, n.suppl, p.S99-S102, 2001. https://doi.org/10.1590/S0102-311X2001000700018

TEIXEIRA, M.G.; SIQUEIRA JUNIOR, J.B.; FERREIRA, G.L.C.; BRICKS, L.; JOINT, G. Epidemiological trends of dengue disease in Brazil (2000–2010): A systematic literature search and analysis. *PLoS Neglected Tropical Diseases*, San Francisco, v.7, n.12, p.e2520, 2013. https://doi.org/10.1371/journal.pntd.0002520

THRUSFIELD, M. *Veterinary epidemiology*. Iowa: Blackwell Publishing, 2005. 888p.

XU, J. W.; LIU, H.; AI, D.; YU, Y.; YU, B. The Shan people's health beliefs, knowledge and perceptions of dengue in Eastern Shan Special Region IV, Myanmar. *PLoS Neglected Tropical Diseases*, San Francisco, v.13, n.6, p.e0007498, 2019. https://doi.org/10.1371/journal.pntd.0007498

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