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SITUATION MALARIA IN A MUNICIPALITY OF THE LEGAL AMAZON: AN EPIDEMIOLOGICAL ANALYSIS OF CANDEIAS DO JAMARI IN RONDÔNIA, 2012-2016

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ABSTRACT

This research aimed to describe the epidemiological profile of malaria in the municipality of Candeias do Jamari, State of Rondônia, Brazi in the period 2012 to 2016. This is an epidemiological study, descriptive and exploratory, with bibliographic and documentary methods, using secondary, retrospective data and quantitative approach, carried out by collecting information from the Epidemiological Surveillance System information Malaria municipality of Candeias do Jamari. The results show a sharp decline in the number of reported cases, following the framework of most cities of the Brazilian Amazon region. The population was predominantly male. Regarding the female was found records of cases of malaria in pregnant women every year in the analyzed period. The vast majority of malaria cases were caused by Plasmodium vivax in urban areas. Therefore, it prepared a Strategic Planning of Health, which is believed to entail a project management, enabling an analysis of the actual situation, setting a new situation, plan the feasibility of building plan and monitoring. This study sought to contribute to aggregate information about the endemic malaria in the city studied, with data to assist public agencies involved to traçarem new work strategies and disease control. construction plan and feasibility plan monitoring. This study sought to contribute to aggregate information about the endemic malaria in the city studied, with data to assist public agencies involved to traçarem new work strategies and disease control.

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INTRODUCTION

Malaria also known as malaria, malaise, of the marshes, senzão, malaria, malarial or intermittent fever, is described as infectious and parasitic disease, presenting with acute high fever, followed by sweating, chills and headache, which occur in cyclical patterns depending on the type of infective parasites are protozoa of the genus Plasmodium (Ferreira, 2012, LIGHT Neto *et al.,*., 2018). It presents as the etiologic agent a unicellular protozoan of the genus Plasmodium, which is transmitted from person to person through the bite of blood-sucking mosquitoes (females) infected Anopheles, by blood transfusion and through vertical infection (NETTINA, 2012). As the etiological agent, Luz Neto *et al.,*, (2018) indicates the existence of four varieties: The etiologic agent is a protozoan of the genus *Plasmodium* . There are four species: *vivax, falciparum, malariae and ovale.* In Brazil there are the first three species, and the *falciparum* is the cause of severe malaria. These species are very incidents in the North and much of the Midwest region of Brazil.

- **Plasmodium vivax:** is the cause of benign tertian fever; fever occurs every 48 hours interval;
- **Plasmodium falciparum:** the cause of malignant tertian fever. Fever occurs every interval of 36 - 48-36 hours;
- **Plasmodium malariae:** is the cause of benign quartan fever. Fever occurs at each interval of 72 hours;
- **Plasmodium ovale:** is causes malaria ovale. In this type of malaria it is observed that the parasitized red blood cell becomes oval. This species prefers to invade young red blood cells. In Brazil there is no such type of malaria, which is more common in African countries.

For the purposes of this study will be considered only Plasmodium varieties falciparumm and Plasmodium vivax. Worldwide, malaria is one of the most serious public health problems, (TEIXEIRA JUNIOR *et al.,*, 2015; SANTELLI *et al.,*, 2016), being the subject of considerable social and economic losses of populations at risk, especially those who live in precarious situations of housing and sanitation (BRAZIL, 2015). "In Brazil, although the disease be in decline in recent years, the epidemiological situation is worrying" (Mesquita *et al.,*., 2013, p. 12). Much of malaria cases, about 99%, is in the nine states of the Brazilian Amazon, and now the states of Acre, Amazonas, Amapá, Pará and Rondônia are those with higher prevalence (TEIXEIRA JUNIOR *et al.,*., 2015). In 2010 in Rondônia, there were 42,761 cases of malaria, which corresponded to 13.1% of total cases registered in the country that year. The most prevalent in the region agent was Plasmodium vivax (89%), followed by falciparum (10.1%) (SIMÕES *et al.,*., 2014). According to data from the statistics department of the State Surveillance Agency for Health (AGEVISA) published in the Ministry of Health (SESAU) in Rondonia in 2015, Candeias do Jamari is the only county considered high risk status, and is in second place in the country with the highest number of cases (SESAU, 2015). By the numerous works published in the country and in the Amazon region, this study is justified by the unique opportunity to describe the behavior of malaria in one of the municipalities in the state of Rondônia, which as of the Information System data Epidemiological Surveillance - Malaria (SIVEP- malaria) in 2010 and 2011 had their rates of 4,177 and 4,463 cases recorded, corresponding to 10% in 2010 and 15% in 2011 of total cases registered in this state, the second highest record between the towns of Rondônia, surpassed only the capital Porto Velho. In this respect, it is believed that detects the profile of malaria is crucial to scale and discuss the issue with the appropriate health spheres, making it possible to further subsidize actions that can contribute in the formulation of strategies / effective policies in malaria control, as well to strengthen the epidemiological surveillance system in this county. Also studies like this become important for the unveiling of the local reality about one of the main grievances of the Amazon as Malaria. Front of the above, this study has the objective to describe the epidemiology of malaria in the municipality of Candeias do Jamari, Rondônia. In addition, it intends to also prepare a Health Strategic Plan for the city of Candeias do Jamari, based on identified epidemiological profile.

METHODOLOGY

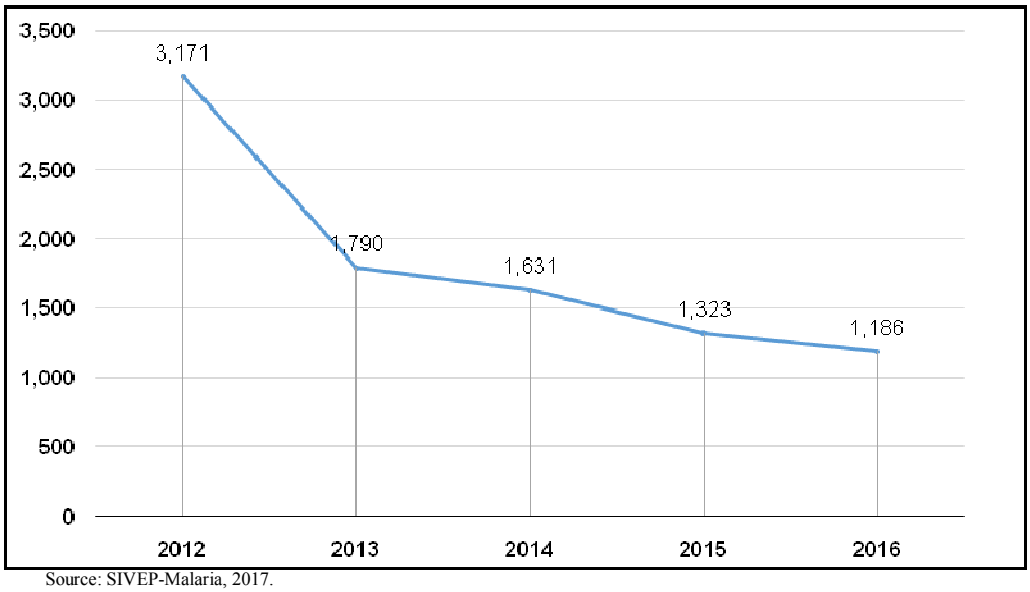
This is an epidemiological study, descriptive and exploratory, with bibliographic and documentary methods, using secondary, retrospective data and quantitative approach, which were researched through SIVEP-Malaria, data relating to the reported cases of malaria in the period from 2012 to 2016, the municipality of Candeias do Jamari - Rondônia. The SIVEP-Malaria is "a Brazilian government program that automatically archives all information about malaria cases recorded in all health and medical practices" (Wiefels *et al.,*., 2016, p. 383). Being the main malaria database in Brazil, and its operation is by inserting inherent information to forms of compulsory notification of the disease in a database served by the Internet, allowing for greater surveillance of the spheres of government (SOUSA *et al.,*., 2015). Because it is a human research, even indirectly, to the development of such research were followed all ethical procedures set out in Resolution no. 466, of December 12, 2012 of the National Health Council (CNS) of the Ministry of Health (MOH) of Brazil. Data collection occurred after the approval of Candeias Health Municipal Jamari - Rondônia, appreciation of the Research Ethics Committee (CEP), which issued a favorable opinion by the Integrated College Aparicio Carvalho, under number 2223303, on August 16, 2017 and the signing of Informed Consent and Informed (IC). Electronic information were then accessed through secondary data, through SIVEP-Malaria databases about malaria cases that occurred in the municipality of Candeias do Jamari - Rondônia between the period 2012 to 2016. With this information, it was then built a new database, and from there the information was processed in a quantitative way, where were tabulated, analyzed and represented by graphs and tables with the help of Microsoft Excel ® 2013 as chosen program to organize and quantify data research and then exported to this data to the EPI info 6.0 **,** to perform statistical analysis. This study was conducted in the municipality of Candeias do Jamari - Rondônia - Brazil, with data collection in August 2017. According SIVEP-Malaria this municipality has 63 localities registered in SIVEP-Malaria classified: 62 are active and one extinct; 55 rural and urban 8. Birth Daughter (2015) points out that this municipality is located north of the State of Rondônia, approximately 20 km from the city of Porto Velho, the state capital. Was created by State Law number 363 of 13 February 1992. The municipality has a land area of 6,843.87 km ^{2} , with a population of 23,573 inhabitants, of these 65.2% living in urban areas and 34, 8% in rural areas, and even 52.2% are male and 47.8% are female

and are registered in SIVEP-Malaria under number 110080. The final sample included a total of 9,101 reports of malaria cases occurred in the period selected for the study.

RESULTS AND DISCUSSION

No intuito de alcançar os objetivos a partir da análise dos dados, duas categorias foram elencadas, a saber: Perfil epidemiológico da malária no município de Candeias do Jamari, Rondônia; ePlano estratégico situacional para o município de Candeias do Jamari, com base no perfil epidemiológico identificado.

(61%) of cases reported in the analysis period of the study distributed per year: 62% (n = 1,958) in 2012, 52% (n = 1,113) in 2013, 61% (n = 994), 59% (n = 779) in 2015 and 63% (n = 747) 2016. The individuals of the female sex, added a total of 3,510 cases of malaria, which corresponds to 39% of all cases, still being distributed per year: 38% (n = 1,213) in the year 2012, 48% (n = 677) in year 2013, 39% (n = 637) in year 2014, 41% (n = 544) in 2015 and 37% (n = 439) in year 2016. During the sampling interval of the study were reported 9,101 cases of malaria, and of these, 5,591 (61%) occurred in male individuals, especially every year.



Source: SIVEP-Malaria, 2017.

Figure 1. Temporal evolution of malaria cases in the period from 01 January 2012 to 31 December 2016 the municipality of Candeias do Jamari

Epidemiological profile of malaria in the municipality of Candeias do Jamari, Rondônia: The Management of Endemic Diseases of the city studied recorded a total of 9,101 positive cases of malaria during the study period, diagnosed and reported to SIVEP-Malaria during the period. Figure 2 shows how these cases are distributed annually, and 3,171 cases of malaria in 2012, 1,790 cases in 2013, 1,631 cases in 2014, 1,323 cases in 2015 and 1,186 cases in the year 2016. In the analysis of the annual evolution of malaria cases, 2012 was the year that showed cases of malaria on average, totaling 3,171 cases, and in the following years showed a sharp decline in the number of reported cases, following the framework of most of the Amazon cities Nice. This decrease of notification in cases of malaria from 2012 in this study corroborates what was found in the results of a study aiming to describe the incidence of malaria between 2007 and 2014 in the area of influence of the hydroelectric plant (UHE) Belo Monte - PA, showed that from 2012, was observed gradual reduction in cases of notifications of this disease in all municipalities. And this is possibly due to the measures to prevent and control the transmission of malaria (TEIXEIRA-JUNIOR *et al.,*., 2015).

According to the study Brito, Vital and Santana (2016) between the years 2003 and 2012 were reported 3,761,792 malaria cases throughout Brazil. During this period the state with the largest number of cases was the Amazon with 1,331,797 cases, followed by Pará and Rondônia with 1,009,030 with 649,181 cases, which reinforces the endemicity of the disease in the Amazon region. Table 1 shows a predominance of cases of malaria in males, for a total of 5591

The data obtained in this study related to the genre are similar to those evidenced in studies described in the Amazon region (Maciel, Espinosa; ATANAKA-Santos, 2013; Albarado *et al.,*, 2015; Hermes *et al.,*, 2013;. Parise 2014; Sousa *et al.,*., 2015) and southeastern Brazil (Catraio *et al.,*., 2011). For Catraio *et al.,*. (2011), the processes that lead males to develop malaria in higher percentage than women, are due to the insertion of the first in front of work, that is, more and more man develops activities that require larger displacement. Of the 3,510 cases of malaria reported in women in SIVEP-Malaria in Candeias do Jamari municipality in the period from January 01, 2012 to December 31, 2016, 3% (n = 95) occurred in pregnant women. Regarding the period analyzed each year was recorded cases of malaria in pregnant women. However, the year that had more reported cases was 2012 with 36 cases, followed by the year 2014 with 18 cases in 2015 to 15 cases, with 14 cases in 2016 and 2013 with 12 cases. To evaluate the occurrence of malaria infection, it was possible to detect the occurrence of malaria in pregnancy, which accounts for 3% of cases reported among women during the research, representing a serious public health problem, in virtue of disease impact on the mother-fetus. Researchers discuss about the dire need of studies that depict the percentage of malaria in pregnant women. Once such knowledge is essential to effect and / or to develop specific policies for prevention and control of malaria in pregnant women, because pregnant women are more prone to infection of this disease because of their immune status is low, so torna- worrying cases of malaria in this age (Albarado *et al.,*, 2015;. Sousa *et al.,*, 2015.). Martins (2014) explains that in cases of malaria in pregnant women mortality is very

Table 1. Number of cases of malaria, for sex, for the period from 01 January 2012 to 31 December 2016 the municipality of Candeias do Jamari

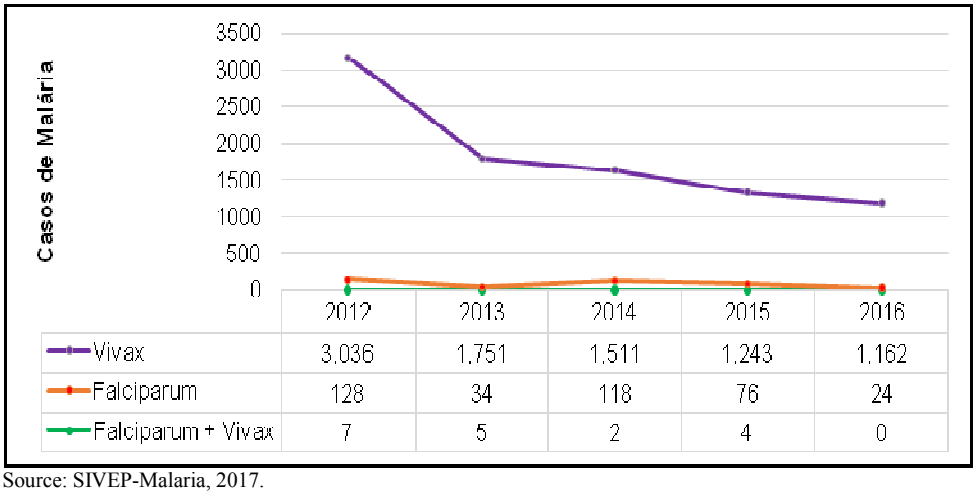
SEX	YEARS										Total	
	2012		2013		2014		2015		2016			
	Nº	%	Nº	%	Nº	%	Nº	%	Nº	%	Nº	%
M	1.958	62	1.113	52	994	61	779	59	747	63	5.591	61
F	1.213	38	677	48	637	39	544	41	439	37	3.510	39
T	3.171	100	1.790	100	1.631	100	1.323	100	1.186	100	9.101	100

Source: SIVEP-Malaria, 2017.
Note: M = Male; F = female; T = Total

Table 2. malaria cases in pregnant women in the period from 01 January 2012 to 31 December 2016 the municipality of Candeias do Jamari

Malária Cases in Women	YEARS										Total	
	2012		2013		2014		2015		2016			
	Nº	%	Nº	%	Nº	%	Nº	%	Nº	%	Nº	%
Not Pregnant	1.177	97	665	97	619	97	529	97	435	99	3.415	97
Pregnant	36	3	12	3	18	3	15	3	14	1	95	3
Total	1.213	100	677	100	637	100	544	100	439	100	3.510	100

Source: SIVEP-Malaria, 2017.



Source: SIVEP-Malaria, 2017.

Figure 2. Annual distribution of malaria cases reported in the period from January 1, 2012 to December 31, 2016 the city of Candeias do Jamari, according to the parasitic species

expressive, which makes health officials worry about the monitoring of cases and their sites of infection in this population, since it is of paramount importance that can do both early diagnosis and prompt treatment of these patients decreased the risk of life the mother and the fetus.

For Sousa *et al.*,. (2015 p 45), it is important to note that: The main complications of malaria in pregnancy are related to the integrity of the mother-child dyad. Changes arising from the pregnancy (especially the immune nature) weaken the mother's body, making it more susceptible to severe forms of the disease, the most frequent abortion and premature delivery - especially in low to moderate transmission areas. Tobón-Castaño *et al.,* (2011) cite other malaria complications during pregnancy such as neonatal death, cerebral malaria, pulmonary edema, hypoglycemia, severe anemia, which represent a constant threat to the maternal organism. Malaria remains one of the most important causes of morbidity and mortality in tropical regions of the world, and second Lapouble, Santelli and Muniz-Junqueira (2015) infection with Plasmodium vivax has a considerably lower mortality, its geographic distribution is much wider and their frequency it is much higher than Plasmodium falciparum in Brazil. Among the 9,101 cases of malaria reported in SIVEP-Malaria in Candeias do Jamari municipality in the period from January 1, 2012 to December 31, 2016, the findings showed that the predominant parasite species was Plasmodium Vivax with 95% (n = 8,703) followed by Plasmodium falciparum with 4% (n = 380) and mixed malaria (Plasmodium falciparum Plasmodium vivax +) with 1% (n = 18). It showed a higher prevalence in all the years of research, infection with Plasmodium Vivax. In 2012, this species was responsible for 3,036 cases of malaria, keeping downward trend over the years (2013, 2014, 2015 and 2016, with 1,751, 1,511, 1,243 and 1,162 cases, respectively). Infection with Plasmodium falciparum, also show the highest peak in the year 2012 (128 cases), decreasing in 2013 (34 cases), with considerable increase in 2014 (118 cases), with a further decline in 2015 (76 cases) 2016 (24 cases). Mixed forms of malaria (Plasmodium falciparum Plasmodium vivax +) are also evidenced in research, which accounts for approximately 1% of all cases. Brito, Vital and Santana (2016) conducted a study covering the period 2003 to 2013 in Rio Preto da Eva - Amazon and showed that this region Plasmodium vivax is also the predominant infecting form. In addition, during this period we have also been reported cases of people infected with Plasmodium falciparum and mixed malaria (Plasmodium falciparum Plasmodium vivax +), in quantities of Plasmodium vivax. Another important study of the incidence and prevalence of Plasmodium vivax cases of Plasmodium falciparum and Plasmodium mixed was

performed by Parise (2014) in the municipality of Palmas - Tocantins that detected in the period 2000 to 2013, 68.85% (n = 526) cases by Plasmodium vivax, followed by 18.59% (n = 42) of Plasmodium falciparum cases, 12.04% (n = 92) mixed cases of malaria (Plasmodium vivax +) and further 0.52% (n = 04) cases of Plasmodium malariae. For analysis of the localities most affected by malaria in the municipality researched in the period 2012-2016, it was possible to establish the ranking of the 10 localities of this municipality that had the highest incidence of people infected with the disease under study, as shown in Table 3. When making the sum of malaria cases of the five districts in urban areas (TV, Palheiral, Union, Santa Isabel and Santa Leticia) and five locations in rural areas (Bom Jesus, Wonder, Amazonas Flower 01, line 43-A and Amazon flower 02) Candeias do Jamari municipality, there was a higher incidence rates for malaria in urban areas with the amount of 3,881 cases, while in rural areas there were 879 cases.

Table 3. Top 10 cities with the highest number of malaria cases in the period from 01 January 2012 to 31 December 2016 the municipality of Candeias do Jamari.

Position	Area	SIVEP Code	Locale Neigborhood or Rural Field	MALARIA CASES					
				2012	2013	2014	2015	2016	Total
1ª	U	6	Satélite	412	235	317	276	269	1509
2ª	U	7	Palheiral	322	176	197	127	78	900
3ª	U	4	União	275	172	154	132	87	820
4ª	U	5	Santa Izabel	80	184	39	30	23	356
5ª	U	62	Santa Leticia	97	42	58	64	35	296
6ª	R	3	Bom Jesus	115	63	60	26	20	284
7ª	R	24	Maravilha	100	43	22	14	6	185
8ª	R	78	Flor do Amazonas 01	89	24	36	5	2	156
9ª	R	20	Linha 43-A	57	24	25	22	5	133
10ª	R	79	Flor do Amazonas 02	69	26	16	5	5	121

Source: SIVEP-Malaria, 2017.
Note: Rating = Position in descending order of total malaria cases. Area (U = Urban, R = rural).

Table 4. Prioritized Problems, Goals and sectors involved in the Situational Strategic Plan.

prioritized problem	Morbidity and mortality from malaria in Candeias do Jamari
Goals	GENERAL: Organize and direct promotion, prevention, effective control and reduction of malaria in the municipality of Candeias do Jamari within 12 months. SPECIFIC: • identify early cases of malaria in the city and improve epidemiological surveillance in order to ensure that it is carried out the reporting and investigation of cases; • Lay tactics to reduce the transmission of diseases, through the monitoring and control of vector and its breeding grounds; • To promote the training of health professionals aimed at reducing the cases of malaria; • Carry out joint actions to control malaria with neighboring municipalities.
Involved sectors	Zoonosis Control Division (DCZ); Vector Control Division (CVD); Municipal Coordination of Malaria (CMM); Municipal Health Secretariat (SEMUSA)

Source: D'Agostin and Alves, 2017.

Looking at Table 3, there is predominance of malaria in urban locations in the city studied. One possible explanation for this, according Birth-Daughter (2015) is that this city has few tourist attractions in both rural and urban areas, represented by waterfalls, farm hotels and tourist center on the edge of Candeias river, the latter being located within the urban area. It is important to note that these entertainment venues are actively frequented during the season with less rainfall in the period from April to September, which corresponds to the Amazonian summer. Much of malaria cases are registered in rural areas, however, in recent years, the percentage of participation in urban areas is increasing, especially in large cities. That is, even with the absolute decrease in the number of malaria cases in recent years, there has been increase in the size of cases occurring in urban areas (BRAZIL, 2015). Corroborating the findings of this research in terms of locations, cite the study Brito, Vital and Santana (2016) carried out in order to analyze the epidemiological profile of Rio Preto da Eva - Amazonas regarding malaria in period 2003 to 2013, where the highest incidence of cases occurred in the urban area of the municipality.

Situational Strategic Plan (PES) for the city of Candeias do Jamari, based on identified epidemiological profile: The Candeias do Jamari municipality has shown a decrease in the total number of malaria cases. However, despite a significant decrease from the year 2012 in this city, you still need to worry about the index maintenance and have a careful attention to patients with relapsed. Thus, it is expected that through this PES prepared where the priority problem part listed by scoring several actors, is contemplating and actions can be carried out fully, since this planning is presented as an appropriate tool to project management because it allows an analysis of the actual situation, setting a new situation, plan the feasibility of building plan and monitoring. The PES has been used successfully in various health services in different areas, by allowing the questioning of reality and building consensus on collective bargaining (GIL; LUIZ; GIL, 2016), it is useful to assist in the understanding of the needs sites and areas that require further attention by the management (DRIES *et al.,*., 2016). The actions that will lead to change of problematic situations prioritized based on the epidemiological profile in the city have been set. It is important to note that for each objective actions were outlined that could interfere with the reality of the Municipal Program for Malaria Control (PMCM) of which are presented below:

Objective 1: To early identify the cases of malaria in the city and improve epidemiological surveillance in order to ensure that it is carried out the reporting and investigation of cases.

Actions

- Notify investigate and monitor suspected cases of malaria;
- house research and active search for new suspected cases of malaria;
- Consolidate data from death investigations for suspected malaria;
- database research and records of clinics and hospitals of the municipality; and
- Improvement of active search activities.

Objective 2: Lay tactics to reduce the transmission of diseases, through the monitoring and control of vector and its breeding grounds .

Actions

- Review the quantitative properties for the control actions vector home / house;
- To visit home / home 100% of urban property for disposal or treatment of breeding sites; and
- Follow up and monitoring of vector control activities.

Objective 3: To promote the training of health professionals aimed at reducing the cases of malaria **.**

Actions

- Mark monthly meeting with the Primary Care;
- Utilization of Community Health Agents (CHA) to operate in malaria disease;
- Agreeing on goals and actions with primary care; and
- Train doctors and nurses to detect serious cases.

Objective 4: Undertake joint actions to control malaria with neighboring municipalities.

Actions

- Hold quarterly meetings (annual) coordination with neighboring municipalities involved in cross-border malaria control;
- To visit each year to exchange experience with neighboring municipalities involved in cross-border malaria control; and
- Conduct joint supervision visits with neighboring municipalities in the region in the activities of malaria.

Final considerations: In this study, by analyzing the annual evolution of malaria cases in Candeias do Jamari municipality in the period from 2012 to 2016, it was revealed that 2012 was the year with the highest average of the reported cases. In the following years he showed a sharp decline in the number of reported cases, following the framework of most cities of the Brazilian Amazon region. The population was predominantly male. In relation to women in the period reviewed each year they had cases of malaria in pregnant women. However, the occurrence of malaria in pregnancy occurred in 3% of cases reported among women during the research. The distribution profile of the parasitic species introduced in this study shows that Plasmodium vivax is the most prevalent and is consistent with those found in studies in the Amazon region. Regarding the locations of the municipality researched with the highest incidence, it was observed that had higher incidence rates for malaria in urban areas. When making comparisons between these findings with the results revealed in other states, it is perceived conflicting results, where a search brought results that corroborate the study and other research presented divergent results. It is believed that this fact is related to the reality of each studied site. Therefore, it prepared a Strategic Planning of Health, which is believed to stimulate a project management, enabling an analysis of the actual situation, setting a new situation, plan the feasibility of building and monitoring of the plan in the municipality. The main conclusions of this study, it was found that malaria cases have shown an annual decrease of cases of people infected between the years 2012 to 2016 in Candeias do Jamari. In part, this progress can be attributed to the actions and to combat malaria initiatives undertaken in the State of Rondônia, Brazil.

However, these programs need to undergo constant improvements in order to maintain their quality and coverage, as this disease remains a serious public health problem, affecting economic and social form the country and the state, by virtue of its high incidence and the debilitating effects that contribute to the reduction of the population's quality of life. Given the findings in this study is recommended to continuously monitor the number of cases of malaria and greater involvement of social mobilization and health education in the development of control strategies in order to improve adherence to appropriate treatment for patients as well as the use of personal protective methods of the areas identified by the study as possible areas of maintenance of transmission, especially regarding the targeting of actions and allocation of resources. This study sought to contribute to aggregate information about the endemic malaria in the municipality of Candeias do Jamari, Rondônia, with data to assist public agencies involved to traçarem new work strategies and disease control. Representing a start for further research, serving as a reference and encouragement in order to give continuity to it, since such research can and should to base a better steering control strategies more specific malaria to each affected area.

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