

Original Article

Malaria knowledge and treatment adherence in a Brazilian Amazon community

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Abstract

Introduction: Malaria remains an important public health problem despite recent scientific breakthroughs regarding knowledge about malaria and treatment strategies. The objective of this study was to analyze malaria patients' knowledge about the disease, its treatment and prevention, linking it to drug treatment adherence.

Methodology: A descriptive, cross-sectional, epidemiological survey study was conducted in the district of Três Fronteiras-MT. The study included 618 individuals who were interviewed and examined for *Plasmodium* infection. Of the 52 patients diagnosed with malaria, 27 were visited at home for an interview about malaria knowledge and treatment adherence. Treatment adherence was evaluated by self-reports and drug conference.

Results: A total of 18 patients had satisfactory knowledge (66.6%) and 9 were evaluated as having unsatisfactory knowledge (33.4%) about malaria. Of the 27 malaria patients, 21 (77.8%) reported having taken all the medication as prescribed, in the correct period of time and dosage, and had no medication tablets remaining. The majority (72.2%) of patients who had satisfactory knowledge, as well as the majority (88.8%) of those who had unsatisfactory knowledge, adhered to the malaria treatment.

Conclusions: This study revealed a high proportion of patients with satisfactory prior knowledge about malaria and revealed that this knowledge was not related to disease treatment adherence. These results have implications for planning strategies for malaria control in the region and could contribute to the reduction in the cases of non-adherence to malaria treatment.

Key words: adherence medication; malaria; health knowledge.

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Introduction

Despite recent scientific breakthroughs about malaria and treatment strategies, this disease remains an important public health problem, especially in less economically developed regions. Malaria contributes to morbidity and mortality in addition to the significant costs of its treatment and control [1]. Antimalarials have been shown to be effective in controlling the disease [2]. However, one of the continuing problems is therapeutic failure as a result of several factors, including non-adherence to drug treatment [3]. In addition to compromising the effectiveness of the treatment, non-adherence can lead to an increased number of relapses or recurrences [4], along with accelerating parasite resistance to drugs.

Different factors can hinder treatment adherence for various diseases, such as those related to drug therapy (drug side effects, improvement of symptoms); socioeconomic factors (income, place of residence,

education, migration); cultural factors (beliefs, use of alternative therapies); those related to patients (cognitive and sensory deficits); and services and health teams (access, communication) [5,6]. Some studies suggest that knowledge about the disease and its treatment is one of the patient-related factors [4,7-9]. According to the World Health Organization (WHO), the knowledge that patients have about the disease, along with other factors that are yet not fully understood, have an influence on treatment adherence [5]. However, there is controversy in the literature regarding the relationship between people's knowledge about the disease, the treatment, and the way they take care of their health, *i.e.*, their treatment adherence.

Some authors claim that knowledge favors treatment adherence, as it helps patients more fully understand their treatment and the therapy's function and goals. This helps patients feel more motivated to follow health professionals' recommendations [10-12].

However, studies that investigate the relationship between knowledge and treatment adherence do not always show a positive association between these variables [7,13,14]. Many studies have been conducted on adherence/non-adherence to treatment. When reviewing the literature, we found that there are still few adherence studies related to malaria treatment, and even fewer investigations in Latin America. Despite the increasing number of studies on knowledge, perceptions, and individuals' practices regarding malaria, Latin American studies with this purpose are still limited [15-17].

Our goal in this research was to analyze the knowledge of patients with malaria regarding the disease, its treatment, and its prevention, linking it to drug treatment adherence.

Methodology

This was a descriptive, cross-sectional, epidemiological survey study, conducted in the district of Três Fronteiras, located 370 km from the community of Colniza, in the northeastern region of the State of Mato Grosso, Brazil. The study area is located in the southern part of the Brazilian Amazon, where malaria is considered endemic and *Plasmodium vivax* is the predominant parasite species. The region registered approximately 249,190 cases of *P. vivax* malaria (87.5%) and 32,153 cases of *P. falciparum* malaria (12.5%) in 2011. These data are also consistent with the numbers from Central and South America [18,19].

The population of the district at the time of the study was estimated by the municipal health authorities to be 606 people, which included adults and children [20]. Everyone who lived in the coverage area of that district during the study period comprised the study population and was screened for *Plasmodium* infection. Those considered eligible for the adherence analysis were people 18 years of age or older diagnosed with *P. vivax* or *P. falciparum* infection during the screening and who had received medication for its treatment. Those with mixed infection were excluded, because this type of infection is rare in the study region and the scheme for its treatment is different from the others. Pregnant women, patients with severe or complicated malaria, or those showing cognitive and communication difficulties, were also excluded.

Data were collected through interviews during the period of 1 July–28 July 2011, just after the rainy season, when access to the region was possible. Three procedures were performed during the field survey. First, on a home interview, all residents of the study district were administered a structured questionnaire

that included demographic, epidemiological, and clinical information. Second, a search for malaria parasites by light microscopy was conducted. A thick blood smear from each patient was prepared using approximately 5 μ L blood, which was uniformly distributed over 1.5 cm² over a glass slide. After air-drying, the smears were stained and parasites were sought by microscopic examination at 1,000 \times magnification. Third, all malaria patients were administered a questionnaire at the home interview that consisted of two sections: one contained questions on knowledge about malaria treatment and prevention, and the other section contained questions that focused on treatment adherence.

The questions about knowledge were elaborated in accordance with the information recommended by the Brazilian Malaria Control Program [21]. Two procedures were used to evaluate patient adherence to therapy. Patients were asked and responded to the question, "Could you take the prescribed medications?" Additionally, the contents of envelopes and blister packs of medication were inspected. The protocol standardized by the Amazon Network for the Surveillance of Anti-Malarial Drug Resistance, Amazon Malaria Initiative, was used in order to evaluate adherence to treatment, which can be summarized as an interview with the patient and verification of the number of remaining drug tablets on the day projected for completion of treatment [22].

When assessing knowledge about disease transmission, treatment, and preventive measures, the answers considered correct were those compatible with information recommended by the Brazilian Malaria Control Program [21]. Those patients who correctly answered questions about the treatment, prevention, signs, and symptoms of malaria, and who had at least three correct answers out of the four questions about disease transmission, were considered to have satisfactory knowledge. Patients who did not answer two or more of the aforementioned questions were considered to have unsatisfactory knowledge. After asking patients about taking the medication as prescribed, they were classified as adherent if they reported having taken all the medication as prescribed, in the correct period of time and dosage, and had no medication tablets remaining. Patients were classified as non-adherent if they had any remaining medication tablets or stated any irregularity in compliance with the treatment regimen.

The data that was obtained was organized into a database with the aid of EpiData 3.1, and indicators were created to assess patient knowledge and adherence

to treatment. Descriptive analysis was performed using absolute and relative frequency; the results were presented as charts and tables and analyzed based on the theoretical framework elaborated on the subject.

This research was approved by the research ethics committee of the University Hospital Julio Muller under protocol no. 982/2010.

Results

In the original study, 618 individuals were interviewed and examined from the district population screening. This resulted in 52 patients diagnosed with malaria. Seven patients who were under the age of 18, and two patients who received a different treatment than the one recommended by the Brazilian Malaria Control Program were excluded from the study. In addition, 16 patients were not analyzed because they were not at home at the time researchers returned for the treatment adherence evaluation. The remaining 27 malaria patients were infected by *P. vivax* (n = 21) and *P. falciparum* (n = 6).

P. vivax-infected patients received four chloroquine pills on the first day and three pills on the second and third days (total of 10 pills) and two primaquine pills once a day for seven days (a total of 14 pills). *P. falciparum*-infected patients received a fixed combination of artemether plus lumefantrine, consisting of four pills every 12 hours for three days (a total of 24 pills).

The sociodemographic data of the 27 participants of this study showed that most of them were young adults (18–35 years of age), male (70.4%), and unmarried (63%). The majority of them had completed more than four years of schooling (66.7%) and reported previous malaria treatment (92.6%), mainly for *P. vivax* infection (74.1%). Most of them were miners (55.5%) from the northern region of the country (81.5%), living at the local mining site together with other people (81.6%), and with an income between USD 3,600 and USD 10,800 per year (85.1%) (see Table 1).

The results of the assessment of knowledge about malaria showed that the majority (66.7%) of the

Table 1. Distribution of patients according to sociodemographic characteristics.

Sociodemographic characteristics		n	%
Gender	Female	8	29.6
	Male	19	70.4
Age group (years)	18–35	15	55.5
	36–59	11	40.8
	≥ 60	1	3.7
Marital status	Single	17	63.0
	Married	8	29.6
	Divorced	1	3.7
	Widowed	1	3.7
Years of education	None	3	11.1
	1–4	6	22.2
	≥ 4	18	66.7
People at home	Relatives	5	18.4
	Other	21	81.6
Place of residence	Mining	7	23.0
	Logging	6	22.2
	Rural village	2	7.4
	Agricultural	2	7.4
Region of origin	Northern	22	81.5
	Midwest	2	7.4
	Northeast	3	11.1
Income (US\$/year)	≤ 3,600	4	14.9
	3,600–10,800	23	85.1
Occupation	Housewife	3	11.1
	Mining	15	55.6
	Agriculture	3	11.1
	Logging	6	22.2
Type of parasite infection	<i>Plasmodium vivax</i>	20	74.1
	<i>Plasmodium falciparum</i>	7	25.9
Previous malaria treatment	No	2	7.4
	Yes	25	92.6

participants had satisfactory knowledge. On the other hand, nine (33.4%) patients were assessed as having unsatisfactory knowledge because they did not correctly answer all of the questions that were determined to be necessary for minimum satisfactory knowledge. Even having incorrectly answered some questions about the disease and its transmission, most

patients correctly answered the questions determined to be necessary to measure knowledge about malaria. Of the 27 respondents, 100% knew the signs and classic symptoms of malaria. In addition, most (89%) patients knew that malaria is transmitted by mosquito bite and that the periods in higher-risk places for contracting malaria are at dawn and dusk and near forests and water

Table 2. Results of the knowledge of malaria assessment among malaria patients.

Result	QUESTION SUBJECTS n (%)				KNOWLEDGE n (%)	
	Signs and symptoms	Transmission	Treatment	Prevention	Satisfactory	Unsatisfactory
Knew	27 (100)	24 (88.9)	22 (81.5)	23 (85.2)	18 (66.7)	9 (33.3)
Did not know	-	3 (11.1)	5 (18.5)	4 (14.8)		

Table 3. Distribution of patients according to sociodemographic characteristics, assessment of knowledge about the disease, treatment and prevention, and treatment adherence.

Sociodemographic characteristics	Satisfactory knowledge				Unsatisfactory knowledge			
	Treatment adherence		Non-adherence to treatment		Treatment adherence		Non-adherence to treatment	
	n	%	n	%	n	%	n	%
	13	72.2	5	27.8	8	88.8	1	11.2
Gender								
Female	5	38.5	2	30.0	1	12.5	-	-
Male	8	61.5	3	60.0	7	87.5	1	100.0
Age group (years)								
18–35	4	30.8	4	80.0	6	75.0	1	100.0
≥ 36	9	69.2	1	20.0	2	25.0	-	-
Marital status								
Single	7	53.8	3	60.0	6	75.0	1	100.0
Not single	6	23.2	2	30.0	2	25.0	-	-
Years of education								
≤ 4	2	15.4	-	-	7	87.5	-	-
≥ 4	11	84.6	5	-	1	12.5	1	100.0
People at home								
Relatives	5	38.5	1	20.0	-	-	-	-
Others	8	61.5	4	80.0	8	100.0	1	100.0
Brazilian region of origin								
Northern	9	69.2	5	-	8	100.0	-	-
Midwest	2	15.4	-	-	-	-	-	-
Northeast	2	15.4	-	-	-	-	1	100.0
Income (US\$/year)								
≤ 3,600	2	15.4	1	-	1	12.5	-	-
3,600–10,800	11	84.6	4	-	7	87.5	1	100.0
Occupation								
Housewife	2	15.4	1	-	-	-	-	-
Mining	7	53.8	4	-	3	37.5	1	100.0
Agricultural	-	-	-	-	3	37.5	-	-
Logging	4	30.8	-	-	2	25.0	-	-
Type of parasite infection								
<i>P. vivax</i>	9	69.2	4	80.0	6	75.0	1	100.0
<i>P. falciparum</i>	4	30.8	1	20.0	2	25.0	-	-
Previous malaria treatment								
No	-	-	-	-	-	-	-	-
Yes	13	100.0	5	100.0	6	75.0	1	100.0

zones, respectively. The rainy season was the season most conducive to acquiring the disease. In terms of treatment, 22 patients (81%) correctly answered the questions about the need for compliance with the proposed malaria therapeutic regimen. However, among them, 14 took into account not only the standard treatment but also the concomitant use of other drugs (painkillers, for example), complementary measures (rest, abstention/restriction of food and alcoholic drinks), or complementary therapies (teas, baths). Finally, 85% of the patients believed that malaria can be prevented and were able to name at least one preventive measure (see Table 2). The main measures reported were staying away from the woods (66.6%), avoiding fishing or swimming in the river at dawn and dusk (77.7%), using repellents (74.1%), and using mosquito nets (74.1%). The less commonly mentioned measures were drug prophylaxis (14.8%) and draining of the mosquito breeding sites (4.7%).

When assessing treatment adherence, 21 (77.8%) out of the 27 malaria patients reported having taken all the medication as prescribed, in the correct period of time and dosage, and had no medication tablets remaining (Table 3). The majority (72.2%) of patients who had satisfactory knowledge, as well as the majority (88.8%) of those who had unsatisfactory knowledge, adhered to the treatment program. Those who had satisfactory knowledge and adhered to the treatment program (13 patients) were mostly men, 36–59 years of age, unmarried, with more than four years of schooling, who had reported previous malaria treatment in their lifetime. The eight patients who had unsatisfactory knowledge and adhered to the treatment program were younger and had fewer years of education. A similar result (*i.e.*, low influence of knowledge about malaria on treatment adherence) was observed in patients coming from northern Brazil who had an annual income of USD 3,600–10,800, were infected with *P. vivax*, and reported having undergone previous treatment for malaria.

Discussion

This study, located within a Brazilian Amazonian community, stands out as research conducted in an endemic area of malaria. The study is also important because it focuses on people's knowledge about malaria as one of the factors associated with non-adherence to the treatment. Treatment adherence has implications for control of the disease within the region.

In the present study, we found a high proportion of patients who reported prior knowledge about malaria. In the region where the research was conducted, there

are constant actions conducted by health service agents for case reduction, including guidelines on the identification of signs and symptoms, treatment, and the use of individual and collective preventive measures. Such actions are in line with a recommendation from the WHO [23] concerning the need to reduce the lack of knowledge about malaria, such as the ability to recognize the signs and symptoms of the disease, treatment, and awareness of the need for early diagnosis and treatment.

Corroborating the results of this research, several studies in different regions concluded that patients somehow recognize the signs and symptoms of malaria as well as its mode of transmission and prevention [24–29]. In a recent study developed in Colombia, the authors found that most of the participants had a high level of knowledge about malaria [30]. This knowledge is more common in endemic areas [31], leading us to believe that knowledge about the disease in the patients in this study seems to be the product of their individual and social experience, as a result of the constant presence of the disease in their daily lives.

Our study also showed that a high proportion of patients adhered to their malaria treatment, regardless of their prior knowledge about the disease. People's knowledge about health issues can arise from formal education as well as their experiences [32,33]. Research has advocated that people's knowledge about the disease, as well as its treatment and prevention, contributes to their adherence to therapies [28–31]. Nevertheless, in this study, we found no association between patients' knowledge and malaria drug treatment adherence. This result suggests that malaria treatment adherence is not necessarily related to people's knowledge about the disease. Factors other than knowledge may have influenced adherence to treatment as well.

Several reasons may have led the five patients in this study to not adhere to treatment, even though they displayed satisfactory knowledge. They may not have adhered to treatment because of rapid improvement in symptoms, the long distance between their homes and the health unit, or because they do not consider malaria as a disease that merits concern. Adherence to treatment is a complex phenomenon that involves multidimensional issues in terms of physical, psychological, socio-environmental, and cultural aspects [34]. Adherence may be affected by the patient's motivation or trust in treatment, access to free medication and its short duration scheme, as well as a good relationship with health professionals and

appropriate guidelines concerning drugs and their effects that they offer.

Considering that adherence is a behavior that is influenced by several factors, we believe that the patients with unsatisfactory knowledge may have adhered to treatment for other reasons. In a recent literature review, we found that the patients' adherence to malaria treatment was influenced by several contributing factors, with knowledge about the disease being the most frequently mentioned. However, other reasons, such as those related to symptom severity, health services quality (the supervised dose and free medication), drugs (the use of pictorial figures on the packaging of antimalarial drugs), and health professionals (appropriate guidance about drugs and their effects), could not be disregarded [35].

Regardless of the reasons leading such patients to adhere to treatment, there is no doubt that people's knowledge about the disease and treatment contributes to the improvement of health behavior. The positive impact of knowledge about malaria treatment has been substantiated in previous research [25,36-39]. Knowing the signs and symptoms of the disease, its transmission mode, and preventive measures are factors that allow people not only to protect themselves through appropriate preventive measures, but also to seek early diagnosis and an initiation of antimalarial treatment.

Knowledge about drug administration, ingestion care, and possible side effects increases the likelihood of treatment adherence. It is important to highlight that the treatment reduces signs and symptoms, prevents the disease transmission cycle to others, reduces recurrences and relapses, and reduces antimalarial drug resistance.

The main limitation of this study is the small sample size, which did not allow statistical tests for further verifications. However, the descriptive results of this study are important, and it is hoped that they can subsidize future investigations. We suggest intervention studies to check prophylactic or therapeutic actions in order to evaluate the effectiveness of health education measures that improve malaria treatment adherence. Health actions performed from this perspective provide those living with the imminent risk of malaria with tools that enable them to be active in controlling and treating the disease.

Conclusions

The main result of this study was the finding that there was a high proportion of patients with satisfactory prior knowledge about malaria, and that this knowledge was not related to adherence to treatment. The results of

this research have implications for planning actions in the region for malaria control that can contribute to a reduction in the cases of non-adherence to malaria treatment.

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