REVISTA DO INSTITUTO DE MEDICINA TROPICAL DE SÃO PAULO

JOURNAL OF THE SÃO PAULO INSTITUTE OF TROPICAL MEDICINE

ORIGINAL ARTICLE

http://dx.doi.org/10.1590/S1678-9946201759023

Knowledge, attitudes and perceptions regarding lymphatic filariasis: study on systematic noncompliance with mass drug administration

Silvia Cabral[1], Cristine Bonfim[2,3], Rosalira Oliveira[2], Paula Oliveira[4,5], Terezinha Guimarães[4], Eduardo Brandão[5], Ana Maria Aguiar-Santos[5], Zulma Medeiros[5,6]

ABSTRACT

The aim of this study was to investigate the epidemiological characteristics, antigenic profile, perceptions, attitudes and practices of individuals who have been systematically non-compliant in mass drug administration (MDA) campaigns targeting lymphatic filariasis, in the municipality of Olinda, State of Pernambuco, Northeastern Brazil. A pretested questionnaire was used to obtain information on socioenvironmental demographics, perceptions of lymphatic filariasis and MDA, and reasons for systematic noncompliance with treatment. A rapid immunochromatographic test (ICT) was performed during the survey to screen for filariasis. It was found that the survey subjects knew about filariasis and MDA. Filariasis was identified as a disease (86.2%) and 74.4% associated it with the presence of swelling in the legs. About 80% knew about MDA, and the main source of information was healthcare workers (68.3%). For men the main reasons for systematic noncompliance with MDA were that "the individual had not received the medication" (p=0.03) and for women "the individual either feared experiencing adverse reactions". According to the ICT, the prevalence of lymphatic filariasis was 2%. The most important causes of systematic noncompliance were not receiving the drug and fear of side-effects. For successful implementation of MDA programs, good planning, educational campaigns promoting the benefits of MDA, adoption of measures to minimize the impact of adverse effects and improvement of drug distribution logistics are needed.

KEYWORDS: Lymphatic filariasis. Control program. Mass drug administration. Systematic noncompliance.

INTRODUCTION

Lymphatic filariasis (LF) is an endemic neglected disease in tropical and subtropical countries. In view of the human suffering, social stigma and costs associated with LF morbidity, and in response to a specific resolution of the World Health Assembly, the Global Program to Eliminate Lymphatic Filariasis (GPELF) was launched by the World Health Organization (WHO) in 2000, with the objective of eliminating LF as a public health problem by 2020[1,2].

The main strategy of GPELF for halting filariasis transmission consists of reducing the level of infection among humans by means of mass drug administration (MDA) using annual single doses of antifilarial drugs over a period of 4 to 6 years[3-5]. All individuals living in endemic areas, with or without filarial infection, need to be included in MDA[4]. Fifty-five of the 73 endemic countries have active

(1) Fundação Oswaldo Cruz, Centro de Pesquisa Aggeu Magalhães, Programa de Doutorado em Saúde Pública, Pernambuco, Brazil

(2) Fundação Joaquim Nabuco, Departamento de Pesquisa Social, Pernambuco, Brazil

(3) Universidade Federal de Pernambuco, Programa de Pós-Graduação Integrada em Saúde Coletiva, Pernambuco, Brazil

(4) Secretaria da Saúde de Olinda, Pernambuco, Brazil

(5) Fundação Oswaldo Cruz, Centro de Pesquisa Aggeu Magalhães, Departamento de Parasitologia, Pernambuco, Brazil

(6) Universidade de Pernambuco, Instituto de Ciências Biológicas, Pernambuco, Brazil

Correspondence to: Zulma Medeiros
Fundação Oswaldo Cruz, Centro de Pesquisa Aggeu Magalhães, Av. Professor Moraes Rego, s/n, CEP 50670-420, Cidade Universitária, Recife, PE, Brazil.

E-mail: medeiros@cpqam.fiocruz.br

Received: 10 May 2016

Accepted: 31 March 2017

GPELFs. During the first 13 years (2000-2012) of GPELF, 6.37 billion annual single dose anti-filarial drugs were made available annually, of which 4.45 billion doses were consumed by the target populations[6]. This success was due to the efforts of the donor community, health ministries, community volunteers, NGOs and research institutions[7].

In Brazil, GPELF activities have already achieved two major goals: elimination of LF in *Belém*, in the State of *Pará*[8]; and interruption of transmission in *Maceió*, in the State of Alagoas[9]. Despite this progress, LF persists as a public health problem in municipalities of the Metropolitan Region of Recife (Olinda, *Jaboatão dos Guararapes* and Recife), in the State of Pernambuco[10-13]. The treatment regimen adopted in Brazil has consisted of MDA with a single dose of diethylcarbamazine[15].

In Olinda, MDA was started in 2007. The following criteria for implementing MDA were established: 1) local situation of transmissibility (> 1% prevalence of microfilaremia); and 2) socioenvironmental risk[14]. Accordingly, 14 neighborhoods were considered to be priority 1 (high/ medium environmental risk and detection of transmission) (Figure 1). MDA was started in the Alto do Sol Nascente district and it followed a strategy of door-to-door supervised treatment[16,17].

One challenge within the MDA program has been to achieve and maintain high treatment coverage. Annual MDA carried out at adequate levels of coverage – estimated to be at least 65% of the total population in endemic areas – should ultimately make elimination possible[2]. When a large proportion of the population is not included or refuses to participate in MDA, a potential parasite reservoir is left untreated, thus allowing the maintenance of transmission[18]. People who are systematically noncompliant with MDA threaten the success of the program, especially in areas with high baseline infection rates[19]. Further research to identify individuals who have never participated in MDA is needed[18]. Knowing the individual, social, cultural and health factors that interfere with MDA coverage and influence systematic noncompliance is important for strengthening the program and increasing the treatment coverage.

The present study investigated the epidemiological characteristics, awareness of lymphatic filariasis and MDA, reasons for systematic noncompliance with treatment and antigenic profile of the population living in the endemic area of interest that did not comply with MDA.

MATERIALS AND METHODS

The municipality of Olinda, Pernambuco, has a total territorial area of 41 km^2 and a population of 377,779 inhabitants. In this municipality, the Alto da Bondade district (8,718 inhabitants) and the Alto da Conquista district (8,104 inhabitants) were chosen because they had high prevalence of LF[14], constituted MDA evaluation units and had universal Family Health Program coverage. In these two municipalities MDA was started in 2007[16] and achieved coverage > 86%[17] (Table 1).

The study group comprised individuals who had systematically been noncompliant of the rounds of MDA. A total of 136 individuals were identified through

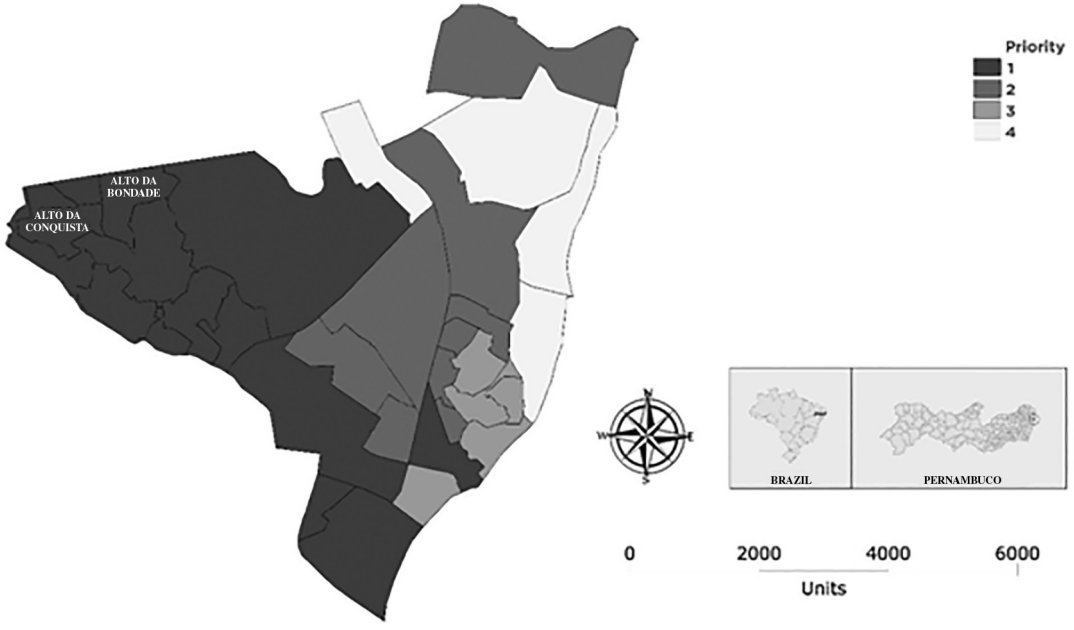

Figure 1 - Map of the priority areas for the elimination of filariasis.

Table 1 - Coverage with annual single-dose DEC in Alto da Bondade and Alto da Conquista, Olinda, Brazil

Ano	Alto da Bondade			Alto da Conquista		
	No. of eligible participants MDA	Noncompliance	Coverage (%)	No. of eligible participants MDA	Noncompliance	Coverage (%)
2007	6.243	1.020	86	7.465	639	92
2008	6.200	606	91	7.228	370	95
2009	6.108	506	92	8.027	533	94
2010	6.097	684	90	7.834	602	93
2011	5.336	318	94	5.238	318	94
2012	4.558	739	86	4.105	167	96
2013	3.674	1.662	69	5.060	220	96

the MDA database of Olinda's Health Department, of whom 114 (83.82%) answered the questionnaire. Among those who did not answer the questionnaire, 15 had changed their addresses, two had died and five refused to participate in the study. Among the 114 individuals who answered the questionnaire, 12 refused to undergo the rapid immunochromatographic test (ICT) for LF and were excluded from the study. Thus, a final total of 102 individuals remained in the study.

Home visits were made, and these 102 individuals consented to participate in the project through signing an informed consent statement. They were then given a semi-structured questionnaire with questions on socioenvironmental demographics, LF, MDA and the reasons for systematic noncompliance with treatment. Following this, the ICT was applied to screen for filariasis[20]. The test was performed in accordance with the manufacturer's instructions and the results were read by specialized technicians 10 minutes later. Among the individuals who tested positive in the antigen assay, 10 mL of venous blood was drawn between 11:00 pm and 01:00 am in order to detect microfilaria by means of the membrane filtration method[21].

The data gathered were stored and analyzed using the Epi Info statistics package, version 7 (Centers for Disease Control and Prevention, Atlanta, GA, USA).

This study received prior approval from the institution's Research Ethics Committee (CAAE 0015.0.095.000-11). LF-positive cases were treated in Olinda's Health Department.

RESULTS

The prevalence of systematic noncompliance was higher among women than among men (1.7:1). The mean age of the systematically noncompliant individuals was 49 years (range: 7 to 99 years). Regarding marital status, the largest proportion of the individuals declared that they were married (42.2%). A lack of formal schooling was noted in 16.7% of the population (Table 2).

All the homes visited were masonry constructions, of which 86.3% had an external wall coating; 8.8% of the homes consisted of one room. Sewage disposal from 86 (84.3%) of these homes was into a rudimentary cesspit. It should be noted that in the cases of 14 homes (13.7%),

Table 2 - Demographic characterization of the systematic noncompliance population with mass drug administration, Olinda, Brazil

Demographic variables	n (%)
Gender	
Female	65 (63.7)
Male	37 (36.3)
Age (years)	
7 – 14	8 (7.8)
15 – 24	11 (10.8)
25 – 64	53 (52.0)
65 – 99	30 (29.4)
Marital status	
Married	43 (42.2)
Single	30 (29.4)
Widowed	19 (18.6)
Separated	10 (9.8)
Educational level	
Illiterate	17 (16.7)
Incomplete primary education (years 1-5)	33 (32.4)
Complete primary education (years 1-5)	16 (15.7)
Incomplete primary education (years 6-9)	11 (10.8)
Complete primary education (years 6-9)	2 (1.9)
Incomplete secondary education	5 (4.9)
Complete secondary education	18 (17.6)

sewage was discharged directly into ditches. The most prevalent form of water supply in the homes was from the general water supply network. Regarding solid waste disposal, 93 (91.2%) of the interviewees declared that their garbage was collected by the municipal public services. Regarding monthly family income, 33.3% earned up to one minimum wage (Table 3).

Table 3 - Socioenvironmental characterization of the systematic noncompliance population with mass drug administration, Olinda, Brazil

Socioenvironmental variables	n (%)
Construction material of the internal walls of the home	
Masonry with coating	88 (86.3)
Masonry without coating	14 (13.7)
Number of rooms in the home	
1	9 (8.8)
4 to 6	56 (54.9)
7 or more	37 (36.3)
Sewage disposal system in the home	
Rudimentary cesspits	86 (84.3)
Ditch	14 (13.7)
Other	2 (2.0)
Water supply system in the home	
General water supply network	93 (91.3)
Well on the property	3 (2.9)
Well outside the property	3 (2.9)
Other	3 (2.9)
Domestic waste disposal	
Collection by public services	93 (91.2)
Burning	7 (6.9)
Disposed of in ditches or fields	2 (1.9)
Family income/month (minimum wage= BRL 268)	
None	2 (1.9)
Up to 1 minimum wage	32 (31.4)
From 1 to 4 minimum wages	68 (66.7)

Approximately 90% of the interviewees identified LF as a disease, the majority being women ($p>0.05$), and 74.4% reported that a swollen leg was the main symptom. Approximately 20% "claimed that LF is transmitted by mosquitoes", and most women "answered that the disease can be cured" ($p<0.05$). Treatment with diethylcarbamazine was cited by 62.9% of the 70 individuals who claimed that LF can be cured (Table 4).

Table 4 shows that awareness of MDA was reported by 80.4% of the interviewees, being 69.5% women, "who said that family healthcare professionals were their main source of information. MDA was perceived to be a drug that is distributed by family healthcare professionals" (39%). The women also considered that "MDA was a positive benefit for the population" ($p< 0.05$) and "believed that the medication caused adverse reactions" ($p< 0.05$)

For men the main reasons for systematic noncompliance with MDA were that "the individual had not received the medication" ($p< 0.05$) and for women "the individual either feared experiencing adverse reactions to diethylcarbamazine" ($p< 0.05$), and for both sexes "the individual had not taken the drug because he did not have the disease" (Table 4).

Among the population studied, two cases (one male and one female, aged 13 and 39 years, respectively) tested positive for LF antigens. These cases did not show microfilaremia in the night membrane filtration method.

DISCUSSION

The population that was systematically noncompliant with MDA in the area analyzed was mainly composed of married women with low educational levels. Previous studies have shown that females frequently present lower rates of compliance with MDA. The reasons cited have included pregnancy, lactation and fear of spontaneous abortion, along with domestic situations in which women are prohibited from participating in MDA because of their husbands' negative beliefs about it[22]. This finding indicates that there is a need for a differentiated approach towards the female population in order to achieve more effective treatment coverage.

LF is considered to be one of the main neglected diseases and is predominantly distributed in areas with poor social conditions and deficient sanitary infrastructure[23]. The results from the present study indicate that, for more than 90% of the population studied, water was supplied and solid waste was collected by public services. However, the sewage disposal system exhibited favorable conditions for *Culex quinquefasciatus* to breed[24]. For approximately 85% of the homes, sewage disposal consisted of discharge into rudimentary cesspits, while for 13.7% this was done into open ditches. Studies conducted in the Metropolitan Region of Recife have correlated the endemicity of LF with the population's social and environmental conditions. Poor environmental conditions were associated with family income ≤ 268 USD/month in 30% of the cases. Areas with worse socioenvironmental conditions were at higher risk of exhibiting this parasitosis[14,25].

The main tool for eliminating LF in endemic areas is MDA. However, its application is not satisfactory in all endemic countries, given that low compliance with treatment

Table 4 - Knowledge of lymphatic filariasis and MDA, and reasons for systematic noncompliance according to sex in Alto da Bondade and Alto da Conquista, Olinda, State of Pernambuco, Brazil

Lymphatic filariasis-related variables	n (%)	Female (%)	Male (%)
What is Filariasis?			
It is a disease that leads to swelling of the leg*	53 (51.9)	41 (77.4)	12 (22.6)
It is a disease that leads to swelling of the leg and is transmitted by the *muriçoca* (mosquito)	16 (15.7)	09 (56.3)	07 (43.7)
It is a disease transmitted by the *muriçoca* (mosquito)	08 (7.8)	03 (37.5)	05 (62.5)
It is a disease that leads to swelling of the leg and testicles	07 (6.8)	03 (42.9)	04 (57.1)
It is a disease	04 (3.9)	01 (25)	03 (75)
Other (It is a disease that causes redness of the leg; Blood worm)	05 (5.0)	02 (40)	03 (60)
Does not know how to describe it	04 (3.9)	03 (75)	01 (25)
Did not respond	05 (5.0)	03 (60)	02 (40)
Can Filariasis be treated?			
Yes*	70 (68.6)	44 (62.9)	26 (37.1)
Can be cured if treated early	21 (30.0)	--	--
If the prescribed medication is taken correctly	19 (27.2)	--	--
Medication plus test	04 (5.7)	--	--
Does not know or did not respond	26 (37.1)	--	--
Does not know*	16 (15.7)	11 (68.75)	05 (31.25)
MDA treatment-related variables			
Have you heard of Mass Treatment?*			
Yes*	82 (80.4)	57 (69.5)	25 (30.5)
No	20 (19.6)	08 (40)	12 (60)
Source of information on Mass Treatment?			
Community health agent or other health professional	56 (68.3)	39 (47.6)	17 (20.7)
Family member/friend/neighbor	11 (13.4)	8 (9.8)	3 (3.7)
Media	06 (7.3)	4 (4.9)	2 (2.4)
Flyer/advertising materials	01 (1,2)	0	1 (1.2)
Other	02 (2.4)	2 (2.4)	-
Does not know	06 (7.3)	4 (4.9)	2 (2.4)
How is Mass Treatment performed?			
Mentions how the medication is distributed and/or dosage*	32 (39.0)	23 (71.9)	09 (28.1)
Mentions that it is necessary to take the medication*	20 (24.4)	15 (75)	05 (25)
Does not know	16 (19.5)	08 (50)	08 (50)
Confuses the treatment with the test	04 (4.9)	03 (75)	01 (25)
Ignored	05 (6.1)	03 (60)	02 (20)
Other (Use of repellents)	05 (6.1)	05 (100)	-
Opinion on Mass Treatment			
Considers it beneficial to the population*	70 (85.3)	48 (68.6)	22 (31.4)
Does not know	06 (7.3)	04 (66.7)	02 (33.3)
Criticizes the follow-up	03 (3.7)	03 (100)	-
Other	03 (3.7)	02 (66.7)	01 (33.3)
Reasons for treatment noncompliance -related variables			
The medication causes adverse reaction			
Yes*	51 (62.2)	36 (70.6)	15 (29.4)
No	16 (19.5)	09 (56.2)	07 (43.8)
Does not know	15 (18.3)	12 (80)	03 (20)
Reason for noncompliance with MDA*			
Did not receive the medication/the health professional failed to deliver it*	21 (20.6)	07 (33.3)	14 (66.7)
Fear of experiencing adverse reactions*	26 (25.4)	20 (76.9)	06 (23.1)
Did not accept treatment because does not have the disease	12 (11.8)	06 (50)	06 (50)
Has a preexisting condition*	10 (9.8)	10 (100)	-
Believes there are restrictions due to age	05 (4.9)	03 (60)	02 (40)
Does not like to take drugs	03 (2.9)	02 (66.7)	01 (33.3)
Would only take it if prescribed	02 (2.0)	02 (100)	-
Other (Fear to die; The medicine is not suitable for all cases of the disease; The medication is not suitable for children)	18 (17.7)	11 (66.1)	07 (39.9)
Did not respond	05 (4.9)	03 (60)	02 (40)

*p < 0,05

is a serious obstacle[26]. There is no doubt that the success of LF elimination programs depends largely on their capacity for reaching and maintaining high levels of compliance with MDA[27]. In this regard, surveys on awareness, attitudes and practices are considered to be essential for sensitizing the population regarding disease and the importance of MDA[28]. In Brazil, the present study was the first to investigate systematic noncompliance with MDA.

In this study, almost all the individuals studied recognized LF as a disease and were able to describe a symptom. However, despite their knowledge of LF, this did not seem to affect their low compliance with MDA. Studies conducted on populations in endemic areas in India[29], Tanzania[30] and Malaysia[31] revealed that there were individuals with little or no awareness of LF, even though the areas were considered endemic.

In the present study, more than half of the interviewees associated LF with its chronic forms (i.e. "swelling of the leg", "swelling of the testicles" and "swelling of the leg and testicles"). In endemic areas, popular awareness of the disease is common, especially with regard to chronic clinical LF. However, most people are unaware of the role of mosquitoes in transmission of this parasitosis[32]. In Olinda, Brazil, less than one-fourth of the interviewees were aware of the role of *C. quinquefasciatus* in LF transmission.

For control or elimination strategies regarding a given disease to be successful, the population involved firstly needs to be aware of the disease. In the municipality of Olinda, MDA is performed by family healthcare professionals. Most of the interviewees were aware of MDA, and the major sources of information were community health agents or other healthcare professionals. In a study in India, the people who administered the drug were the most important people in MDA programs, and their attitude determined whether compliance would be low. Thus, training and capacity building are essential for increasing compliance with MDA[33]. Effective drug delivery strategies and repeated home visits are needed in order to improve coverage[34].

Furthermore, the media (television, radio and flyers and other advertising materials) are also relevant means of communication regarding MDA. Visual and oral media are strategic tools for communication because they can reach uneducated population segments[35]. In Brazil, family healthcare is a model in which the population covered has a relationship of trust with the physicians, nurses and health agents at the healthcare unit and in home visits[36]. Thus, the MDA coverage supported by these professionals is an important model for tackling both LF and other diseases, such as hypertension and diabetes[36].

In the present study, one of the factors correlated with systematic noncompliance with MDA was fear of occurrence of adverse reactions. Studies conducted in India[29,37-41] and Haiti[42] have shown that fear of adverse reactions was the reason for systematic noncompliance that was most cited in the populations studied. In Kenya, adverse reactions experienced after drug consumption also contributed to low compliance[43].

In the present survey, one of the main reasons for systematic noncompliance with MDA consisted of refusal of treatment because of not being ill: the interviewees stated that they did not have the disease and, hence, did not need treatment. Among the many reasons for systematic noncompliance with MDA, one important reason is that individuals do not see any morbidity caused by filariasis, in their immediate surroundings. Currently, because of worldwide efforts over the years, the frequency of individuals exhibiting chronic manifestations, such as elephantiasis and hydrocele, continues to decrease. Hence, filariasis is becoming less of a reason for societal concern[33]. In a study on the population of *Jaboatão dos Guararapes*, Medeiros *et al*.[13] reported prevalence rates of 0.07% and 0.78% for elephantiasis and hydrocele, respectively.

Another major reason for systematic noncompliance is that drug use is associated only with treatment and not with prophylaxis[33,44,45]. Approximately two-thirds of the infected population remain asymptomatic, and these individuals might not be aware of the benefits of treatment[40]. Albuquerque *et al*.[46] observed a frequency of filariasis of 6.2% in the population of Recife, Brazil. In a study on 9,520 individuals in the municipality of *Jaboatão dos Guararapes*, Brazil, 323 were microfilaremic and 199 were asymptomatic (61.6 %)[47].

In the population investigated, two cases tested positive in the ICT and both of them were amicrofilaremic. In the future, these individuals would possibly become microfilaremic if they were not treated. Thus, they would have the capacity to participate in the local transmission cycle, given that the environmental conditions are favorable for *C. quinquefasciatus* to breed[10,25]. The impact of MDA is assessed through sentinel and spot-check sites in order to provide program managers with precise information on the evolution of infection, so that decisions can be made[2]. However, it should be noted that these ICT-positive individuals not characterized as a sentinel group and were resistant to MDA for four consecutive rounds. We suggest that the transmission assessment survey (TAS) or cross-sectional surveys is included as a diagnostic tool with microfilaraemia and/ or antigenaemia (ICT or filariasis test srip) and/ and antibody in people who are systematically noncompliant with MDA. They will be used as technical validation indicators of lymphatic filariasis elimination as a public health problem in GPELF.

Pre-MDA educational campaigns need to emphasize the message that all individuals who live in endemic areas are at risk of infection and that even asymptomatic individuals may have become infected[40]. Campaigns on the importance of MDA need to aim the demystification of the risk of becoming ill through treatment with diethylcarbamazine. Furthermore, communities need to be made aware of the medication used as well as of the potential adverse reactions, and need to know that healthcare professionals are on standby and are qualified/ trained to treat them. The aim here is to gain the community's trust and thus increase compliance with MDA.

The present study had the limitation that no assessment was made on the impact of the population that was systematically noncompliant with MDA, regarding transmission of the infection. Nonetheless, the lack of previous investigations on this population in Brazil provided the justification for conducting this study, with the aim of contributing to educational campaigns and improving the strategies for drug distribution, and thus increasing the coverage of MDA.

The results of this research recommend the use of different PGELF strategies in Brazil according to the sex of the person who has systematic being noncompliant with MDA, for example, the men should receive home visits for distribution of the drug and women should receive information on the reasons for treatment compliance.

The success of GPELF depends on compliance with MDA and the risks of systematic noncompliance are significant and cannot be ignored. These include the possible appearance of resistance to drugs, the need for additional treatment rounds (with their respective costs) and "campaign fatigue" within the community and healthcare services[48,49]. Attention focusing on the population that is systematically noncompliant with MDA is crucial for ensuring adequate compliance with treatment and thereby optimizing actions and resources. The results from the present study revealed an evident need for surveillance of this population. Such observations will provide important information for achieving the goal of eliminating LF.

REFERENCES

1. World Health Organization. Global programme to eliminate lymphatic filariasis: progress report, 2013. Wkly Epidemiol Rec. 2014;89:409-18.
2. World Health Organization. Monitoring and epidemiological assessment of mass drug administration in the global programme to eliminate lymphatic filariasis: a manual for national elimination programmes. Geneva: WHO; 2011.
3. Ottensen EA. The global programme to eliminate filariasis lymphatic. Parasitol Int. 1998;47 Suppl:23-48.
4. Ottesen EA, Duke BO, Karam M, Behbehani K. Strategies and tools for the control/elimination of lymphatic filariasis. Bull World Health Organ. 1997;75:491-503.
5. World Health Organization. Global programme to eliminate lymphatic filariasis. Wkly Epidemiol Rec. 2010;85:365-72.
6. Ramaiah KD, Ottesen EA. Progress and impact of 13 years of the global programme to eliminate lymphatic filariasis on reducing the burden of filarial disease. PLoS Negl Trop Dis 2014;8:e3319.
7. World Health Organization. Global programme to eliminate lymphatic filariasis: progress report, 2011. Wkly Epidemiol Rec. 2012;87:346-56.
8. Freitas H, Vieira JB, Braun R, Medeiros Z, Rocha EM, Aguiar-Santos A, et al. Workshop para avaliação da situação epidemiológica da filariose linfática no Município de Belém, Pará, norte do Brasil. Rev Soc Bras Med Trop. 2008;41:212-6.
9. Simonsen PE, Mwakitalu ME. Urban lymphatic filariasis. Parasitol Res. 2013;112:35-44.
10. Bonfim C, Netto MJ, Pedroza D, Portugal JL, Medeiros Z. A socioenvironmental composite index as a tool for identifying urban areas at risk of lymphatic filariasis. Trop Med Int Health.2009;14:877-84.
11. Braga C, Dourado I, Ximenes R, Miranda J, Alexander N. Bancroftian filariasis in an endemic area of Brazil: differences between genders during puberty. Rev Soc Bras Med Trop. 2005;38:224-8.
12. Fontes G, Leite AB, Lima AR, Freitas H, Ehrenberg JP, Rocha EM. Lymphatic filariasis in Brazil: epidemiological situation and outlook for elimination. Parasit Vectors. 2012;5:272..
13. Medeiros Z, Bonfim C, Alves A, Oliveira C, Netto MJ, Aguiar-Santos AM. The epidemiological delimitation of lymphatic filariasis in an endemic area of Brazil, 41 years after the first recorded case. Ann Trop Med Parasitol 2008;102:509-19.
14. Braga C, Ximenes RA, Albuquerque M, Souza WV, Brayner F, Silva L, et al. Avaliação de indicador sócio-ambiental utilizado no rastreamento de áreas de transmissão de filariose linfática em espaços urbanos. Cad Saúde Pública. 2001;17:1211-8.
15. World Health Organization. Integrated preventive chemotherapy for neglected tropical diseases: estimation of the number of interventions required and delivered, 2009-2010. Wkly Epidemiol Rec. 2012;87:17-27.
16. Olinda. Secretaria Municipal de Saúde. Diretoria de Vigilância à Saúde. Coordenação Municipal de Doenças Endêmicas. Relatório comparativo dos modelos de tratamento coletivo da filariose em Olinda: Salgadinho e Sítio novo X Alto da Bondade e Alto da Conquista. Olinda: Secretaria Municipal de Saúde; 2008.
17. Rocha A, Marcondes M, Nunes JR, Miranda T, Veiga J, Araújo P, et al. Programa de controle e eliminação da filariose linfática: uma parceria da Secretaria de Saúde de Olinda-PE, Brasil, com

o Serviço de Referência Nacional em Filarioses. Rev Patol Trop. 2010;39:233-49.

18. Mathieu E, Direny AN, de Rochars MB, Streit TG, Addiss DG, Lammie PJ. Participation in three consecutive mass drug administrations in Leogane, Haiti. Trop Med Int Health. 2006;11:862–8.
19. El-Setouhy M, Abd Elaziz KM, Helmy H, Farid HA, Kamal HA, Ramzy RM, et al. The effect of compliance on the impact of mass drug administration for elimination of lymphatic filariasis in Egypt. Am J Trop Med Hyg. 2007;77:1069-73.
20. Weil GJ, Lammie PJ, Weiss N. The ICT filariasis test: a rapid-format antigen test for diagnosis of bancroftian filariasis. Parasitol Today. 1997;13:401-4.
21. Dennis DT, Kean BH. Isolation of microfilariae: report of a new method. J Parasitol. 1971;57:1146-7.
22. Talbot JT, Viall A, Direny A, de Rochars MB, Addiss D, Streit T, et al. Predictors of compliance in mass drug administration for the treatment and prevention of lymphatic filariasis in Leogane, Haiti. Am J Trop Med Hyg. 2008;78:283-8.
23. Streit T, Lafontant JG. Eliminating lymphatic filariasis: a view from the field. Ann N Y Acad Sci. 2008;1136:53-63.
24. Regis L, Oliveira CM, Silva-Filha MH, Silva SB, Maciel A, Furtado AF. Efficacy of Bacillus sphaericus in control of the filariasis vector Culex quinquefasciatus in an urban area of Olinda, Brazil. Trans R Soc Trop Med Hyg. 2000;94:488-92.
25. Bonfim C, Alves A, Costa TR, Alencar F, Pedroza D, Portugal JL, Medeiros Z. Spatial analysis and privation index to identify urban areas with a high risk of lymphatic filariasis. Trop Med Int Health. 2011;16:748-55.
26. Kimura, E. The Global Programme to Eliminate Lymphatic Filariasis: History and achievements with special reference to annual single-dose treatment with diethylcarbamazine in Samoa and Fiji. Trop Med Health. 2011;39:17-30.
27. Krentel A, Fischer PU, Weil GJ. A review of factors that influence individual compliance with mass drug administration for elimination of lymphatic filariasis. PLoS Negl Trop Dis. 2013;7:e2447.
28. Mathieu E, Lammie PJ, Radday J, Beach MJ, Streit T, Wendt J, et al. Factors associated with participation in a campaign of mass treatment against lymphatic filariasis, in Leogane, Haiti. Ann Trop Med Parasitol. 2004;98:703-14.
29. Karmakar PR, Mitra K, Chatterjee A, Jana PK, Bhattacharya S, Lahiri SK. A study of coverage, compliance and awareness about mass drug administration for elimination of lymphatic filariasis in a district of West Bengal, India. J Vector Borne Dis. 2011;48:101-4.
30. Mwakitalu ME, Malecela MN, Pedersen EM, Mosha FW, Simonsen PE. Urban lymphatic filariasis in the metropolis of Dar es Salaam, Tanzania. Parasit Vectors. 2013;6:286.
31. Al-Abd NM, Nor ZM, Ahmed A, Al-Adhroey AH, Mansor M, Kassim M. Lymphatic filariasis in Peninsular Malaysia: a cross-sectional survey of the knowledge, attitudes, and practices of residents. Parasit Vectors. 2014;7:545.
32. Rath K, Nath N, Shaloumy M, Swain BK, Suchismita M, Babu BV. Knowledge and perceptions about lymphatic filariasis: a study during the programme to eliminate lymphatic filariasis in an urban community of Orissa, India. Trop Biomed. 2006;23:156-62.
33. Nujum ZT, Remadevi S, Nirmala C, Rajmohanan K, Indu P, Nair SM. Factors determining noncompliance to mass drug administration for lymphatic filariasis elimination. Trop Parasitol. 2012;2:109-15.
34. Angadi MM, Shashank KJ, Rohith M. Coverage and compliance of mass drug administration for elimination of lymphatic filariasis in endemic areas of Bagalkot District, Karnataka. Natl J Integr Res Med. 2015;6:50-3.
35. Krentel A, Fischer P, Manoempil P, Supali T, Servais G, Ruckert P. Using knowledge, attitudes and practice (KAP) surveys on lymphatic filariasis to prepare a health promotion campaign for mass drug administration in Alor District, Indonesia. Trop Med Int Health. 2006;11:1731-40.
36. Brasil. Ministério da Saúde. Secretaria de Atenção à Saúde. Departamento de Atenção Básica. Política Nacional de Atenção Básica. Brasília: Ministério da Saúde; 2012.
37. Aswathy S, Beteena K, Leelamoni K. Mass drug administration against filariasis in India: perceptions and practices in a rural community in Kerala. Ann Trop Med Parasitol. 2009;103:617-24.
38. Babu BV, Kar SK. Coverage, compliance and some operational issues of mass drug administration during the programme to eliminate lymphatic filariasis in Orissa, India. Trop Med Int Health. 2004;9:702-9.
39. Babu BV, Mishra SA. Mass drug administration under the programme to eliminate lymphatic filariasis in Orissa, India: a mixed-methods study to identify factors associated with compliance and non-compliance. Trans R Soc Trop Med Hyg. 2008;102:1207-13.
40. Hussain MA, Sitha AK, Swain S, Kadam S, Pati S. Mass drug administration for lymphatic filariasis elimination in a coastal state of India: a study on barriers to coverage and compliance. Infect Dis Poverty. 2014;3:31.
41. Waseem A, Dorle AS, Mannapur BS, Vetri S. Coverage and compliance of mass drug administration for elimination of lymphatic filariasis in Bijapur District, Karnataka. Ann Community Health. 2014;2:6-10.
42. Mathieu E, Direny AN, de Rochars MB, Streit TG, Addiss DG, Lammie PJ. Participation in three consecutive mass drug administrations in Leogane, Haiti. Trop Med Int Health. 2006;11:862-8.
43. Njomo DW, Amuyunzu MN, Magambo JK, Ngure PK, Njenga SM. Factors associated with the motivation of community drug distributors in the Lymphatic Filariasis Elimination Programme in Kenya. South Afr J Epidemiol Infect Dis. 2012;27:66-70.

44. Babu BV, Satyanarayana K. Factors responsible for coverage and compliance in mass drug administration during the programme to eliminate lymphatic filariasis in the East Godavari district, South India. Trop Doct. 2003;33:79-82.
45. Ramaiah KD, Das PK, Appavoo NC, Ramu K, Augustin DJ, Kumar KN, et al. A programme to eliminate lymphatic filariasis in Tamil Nadu State, India: Compliance with annual single dose mass treatment and some related operational aspects. Trop Med Int Health. 2000;5:842-7.
46. Albuquerque MF, Marzochi MC, Sabroza PC, Braga MC, Padilha T, Silva MC, et al. Bancroftian filariasis in two areas of Recife, Brazil: pre-control observations on infection and disease. Trans R Soc Trop Med Hyg. 1995;89:373-7.
47. Bonfim C, Lessa F, Oliveira C, Evangelista MJ, Espírito Santo M, Meireles E, et al. The occurrence and distribution of lymphatic filariasis in Greater Metropolitan Recife: the case of an endemic area in Jaboatão dos Guararapes, Pernambuco, Brazil. Cad Saúde Pública. 2003;19:1497-505.
48. Stolk WA, de Vlas SJ, Borsboom GJ, Habbema JD. LYMFASIM, a simulation model for predicting the impact of lymphatic filariasis control: quantification for African villages. Parasitology. 2008;135:1583-98.
49. Smits HL. Prospects for the control of neglected tropical diseases by mass drug administration. Expert Rev Anti Infect Ther. 2009;7:37-56.