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Socioeconomic factors associated with compliance with mass drug administration for lymphatic filariasis elimination in Kenya: Descriptive study results

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ABSTRACT

Background: Annual Mass Drug Administration (MDA) to at least 65 – 80% of the population at risk is necessary for Lymphatic Filariasis (LF) elimination. In Kenya, MDA based on diethylcarbamazine and albendazole, using the community-directed treatment (ComDT) approach has been implemented thrice in the Kwale and Malindi districts. To identify the socioeconomic factors influencing compliance with MDA, a retrospective cross-sectional study was conducted in the two districts after the 2008 MDA. **Materials and Methods:** In Kwale, the Tsimba location was selected for high and Gadini for low coverage, while in Malindi, the Goshi location represented high and Gongoni, low coverage. Using systematic sampling, nine villages were selected from the four locations. Quantitative data was collected from 965 systematically selected household heads and analyzed using SPSS v. 15. For qualitative data, which was analyzed manually according to core themes of the study, 80 opinion leaders and 80 LF patients with clinical signs were purposively selected and interviewed, and 16 focus group discussions (FGDs) conducted with adult and youth male and female groups. **Results:** Christians were slightly more (49.1%) in the high compliance areas compared to Muslims (34.3%), while Muslims prevailed (40.6%) in the low compliance areas compared to Christians (29%). On the income level, 27% from the low compared to 12.2% from the high compliance areas had a main occupation, indicative of a higher income, and 95% from the low compared to 78% from high compliance areas owned land, also an indicator of higher economic status. Accurate knowledge of the cause of swollen limbs was higher (37%) in the high compared to 25.8% in the low compliance areas, and so was accurate knowledge about the cause of swollen genitals (26.8% in high compared to 14% in low). Risk perception was higher in the high compliance areas (52% compared to 45%) and access to MDA information seemed to have been better in the high compared to low compliance areas. Patients from the high compliance areas had a higher mean number of years with chronic disease (15.2 compared to 9.7). **Conclusions:** There is a need for more investment in reaching out to groups that are often missed during MDAs. Different strategies have to be devised to reach those in specific religious groupings and those in casual employment. This could include prolonging the duration of MDA to capture those who are out during the week seeking for casual and other forms of employment.

Key words: Albendazole, compliance, diethylcarbamazine, lymphatic filariasis, mass treatment

Introduction

Lymphatic filariasis (LF), a mosquito-transmitted disease is ranked as the second largest cause of disability in the world.[1] Infection leads to a variety of clinical manifestations, including lymphedema / elephantiasis of the limbs and the genitalia (especially scrotal elephantiasis) and hydrocele. About 41 million people worldwide have visible signs of the disease.[2]

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A further 76 million have hidden infections, most often with microfilariae in their blood and hidden internal damage to their lymphatic and renal systems.[3] About 44 million infected patients have recurrent infections and abnormalities of renal functions.[3] Lymphatic Filariasis has been identified as a potentially eradicable disease by the International Task Force for Disease Eradication.[4] In its first eight years, the global elimination program has delivered 1.9 billion treatments to individuals living in 48 of the 83 endemic countries.[5]

Interrupting the transmission of the parasites that cause the disease requires careful identification of the endemic areas as well as the use of drugs designed to reduce microfilaramia and transmission intensity.[6] For elimination to occur, at least 65 – 80% of the eligible populations have to comply with mass treatment annually, about four to six rounds. A number of studies have underscored the importance of compliance with the elimination programs.[7,8] The technical advisory group noted that drug delivery to people who do not consume them has an adverse effect on the program impact. For this reason, it encourages program managers to implement their program using the principal of Directly-Observed Treatment (DOT).[9]

In Kenya MDA for LF has been conducted thrice (2003, 2005, and 2008), in the Kwale and Malindi districts. Data available from the Program for the three rounds of MDA show a drop in the treatment coverage from 85 to 71 to 64.3% for Kwale and 77 to 76 to 62.8% for Malindi. The difference between coverage and compliance means that a large proportion of the population receives the tablets, but does not consume them, and this has been reported in Indian states.[10] This is a problem for the Kenyan LF elimination program. The present study aims at identifying the socioeconomic factors that influence compliance with mass drug administration for LF elimination, with a view of coming up with suggestions for improvement.

Materials and Methods

Study Area
Kwale District is located 40 km south of Mombasa, the second largest city in Kenya and has an area of 8960 km², with a projected population of 583,000 persons.[11] The district lies at an altitude that is between 60 and 135 m above sea level. Malindi District is located 120 km northeast of Mombasa, and lies between latitudes 2.2º and 4º South and between longitudes 39º and 41º East. It covers an area of 7, 605 km², with a total population of 384,643 persons.[12] Both districts are endemic for LF caused by *Wuchereria Bancrofti*, and

studies conducted in the villages of Kwale district have reported 16.0 and 16.4% microfilaria prevalence.[13,14] The villages along the River Sabaki in Malindi have a filarial endemicity of at least 7.1%.[15] The inhabitants in both districts belong to the Miji-Kenda ethnic group and are mainly peasant farmers growing maize and tubers. Coconut, the chief cash crop is produced by a few households and domestic animals include goats, cattle, and sheep. The areas are composed of scattered, mainly grass-thatched houses with mud walls.

Study Design
This was a retrospective cross-sectional that utilized both quantitative and qualitative data collection methods. The data were collected from Kwale and Malindi districts from January to December 2009, after the December 2008 MDA. The National MDA Program data was used to select one high and one low treatment coverage location from each district. In Malindi, the Goshi location represented high and Gongoni, low coverage, while in Kwale, the Tsimba location represented high and Gadini, low coverage. Using systematic sampling, two villages, Kavunyalalo and Magongoloni were selected from the Goshi location and two, Midodoni and Zhogato, from the Gongoni location. Another two villages, Patanani and Mbengani represented Tsimba, while Tzunza, Takawa, and Dzivani represented the Gadini location. A total of 965 households were then systematically sampled and quantitative data collected through an interviewer-based questionnaire that was administered to the household heads or adult representatives. The aim was to assess their knowledge on the cause of LF, risk perception, and access to MDA information.

Eighty opinion leaders (local and church leaders, teachers, chairpersons of community groups and non-governmental organizations) and 80 LF patients with clinical signs of LF were purposively selected and qualitative data collected through in-depth interviews. The aim was to gather their knowledge on the cause of LF, risk perception, knowledge of MDA, and perceptions toward MDA. Additionally, the number of years with chronic disease was also assessed from the patients so as to determine its influence on compliance with MDA. To elicit more information on the perception toward LF and MDA, 16 FGDs were carried out with adult and youth male and female single-sex groups using standard procedures,[16] and they were moderated by the lead author, assisted by trained field assistants using the local languages. The quantitative data was collected before the qualitative data. This was mainly to generate a meaning for the various patterns observed from the preliminary quantitative data analysis.

The dependent variable — *compliance with treatment* — was assessed through verbal interviews with eligible household heads or adult representatives. The independent variables were the sociodemographic and socioeconomic characteristics, knowledge of LF signs and causes, perception of risk of infection, and awareness of MDA. The core themes of the qualitative data included: Knowledge of LF signs and causes, perception of risk of infection, awareness of MDAs and perceptions toward MDA. Similar questions were asked of various types of respondents and the data were triangulated in order to check for consistency and divergence of views.

Ethical Clearance

The study received ethical clearance and approval from the Kenya Medical Research Institute (KEMRI) / National Ethical Review Board (Protocol Number 1077), the World Health Organization, and the Ethical Review Committee (Tropical Diseases Research ID No. A61106). Informed consent was sought from all the study participants. The hard copies of the raw data were stored in secure cabinets and the soft copies in computers, with passwords, for quality control**.**

Data Analysis

The quantitative data were analyzed using the SPSS version 15. The responses to open-ended questions were coded before entry. Equivalent responses were pooled and arranged in different categories. Two-way tables were used to compare categorical data, the statistical significance of differences was assessed by the χ^2 test and a *P* value of 0.001 – 0.05 was considered significant. The qualitative data were analyzed by the core themes of the study. The data were examined separately for clusters that recorded high and low coverage and compliance.

Results

Background Characteristics of the Respondents

A total of 965 household heads with a mean age of 39.5 (SD = 15.6) and a median of 35.0 (range 18 – 92 years) participated in this study. Most (62.6%) of the household heads were female, 80.4% were in marital unions, 9.4%, were single or divorced, and 10.3% were widowed. Two-fifths (40.5%) were Christians, 35.8% Muslims, and 23.7% were non-practicing. The literacy levels were low as nearly one-half (45.8%) had never attended school, while 30.7% had attended, but did not complete primary level. On main occupation, the majority (62.5%) were peasant farmers, 21.3% were casual laborers, fishermen, or business owners. The remaining, less than one-fifth (16.1%), were either salaried workers or housewives [Table 1].

About one-quarter (24.6%) of the opinion leaders interviewed were local leaders, 23.2%, Christian religious leaders, and another 23.2%, social group leaders. Islamic leaders and traditional herbalists accounted for 5.8% and 4.3%, respectively. Teachers and policemen represented 18.9% of this group.

Nearly two-thirds (64%) of the LF patients had hydrocele, 35%, lymphedema, and only 1% had both manifestations. The mean age of the patients was 52.4 years; the youngest was 22 and the oldest 98 years old. Slightly more than two-thirds (67.5%) were male, one-half was from the high and one-half from the low compliance areas.

Religion and Compliance with Mass Treatment

Religion was significantly associated with compliance; *P* < 0.001 (χ^2 = 24.021; df 3). Although about one half (49.1%) from the high compared to 34.3% from the low compliance villages were Christians, 40.6% from the low compared to 29% from the high compliance villages were Muslims [Table 2].

Socioeconomic Factors and Compliance with Mass Treatment

The main occupation, an income indicator, was significantly associated with compliance; *P* < 0.001 (χ^2 = 48.086; df 7), business, fishing, and casual labor, occupations associated with relatively high income in the study area were more common (27%) in the low than (12.2%) in the high compliance villages. Peasant farming, an indicator of the low socioeconomic status, was more common (68.5%) in the high than in the low (58.2%) compliance villages [Table 3].

Ownership of land was significantly associated with compliance (*P* < 0.001 (χ^2 = 70.341; df 3), 95% from low compared to 78% from high compliance villages owned land [Table 4]. There was also a significant association of ownership of residential housing structures with compliance (*P* < 0.01 (χ^2 = 15.772; df 3). Of the total respondents who owned the housing structure that they lived in, 59% were from the low and 41% from the high compliance villages.

Knowledge of LF and Compliance with Treatment

Knowledge of signs of lymphedema (swollen limbs) was associated with compliance: *P* < 0.001 (χ^2 = 28.700; df 1), 71% from the high compared to 54% from the low compliance villages knew the signs of lymphedema. Furthermore, knowledge of cause of lymphedema was significantly associated with compliance; *P* < 0.05 (χ^2 = 29.511; df 15), while slightly more (37%) from the high compared to 25.8% in low compliance villages had the correct knowledge of the cause of lymphedema,

Table 1: Distribution of respondents by background characteristics

Background characteristic	Frequency	%
Age (n=965)		
15-24	150	15.5
25-34	293	30.3
35-44	203	21.0
45-54	141	14.6
> =55	178	18.5
Education (n=965)		
Never attended school	442	45.8
Incomplete primary	308	30.7
Completed primary	172	17.8
Completed secondary	22	2.3
Tertiary education	22	2.3
Main Occupation (n=965)		
Peasant farmer	603	62.5
Housewife	123	12.7
Casual laborer	88	9.1
Small /big business	74	7.6
Fisherman	44	4.6
Salaried	33	3.4

Table 2: Religion and compliance with mass treatment

Religion	Low coverage		High coverage		Total
	n	%	n	%	N
Christian	193	34.3	198	49.1	391
Islam	228	40.6	117	29.0	345
Non-practicing	141	25.1	88	21.8	229
Total	562	100	403	100	965

Low coverage: Areas which attained 60% and below MDA treatment coverage
High coverage: Areas which attained 80% and above MDA treatment coverage

Table 4: Ownership of land and compliance with mass treatment

Household owns land	Low coverage		High coverage	
	n	%	n	%
Owns	534	95	314	77.9
Rents/Leases	2	0.4	7	1.7
No rent, with owner's consent	23	4.1	48	11.9
Squatting	3	0.5	34	8.4
Total	562	100	403	100

Low coverage: Areas which attained 60% and below MDA treatment coverage,
High coverage: Areas which attained 80% and above MDA treatment coverage

Table 3: Main occupation and compliance with mass treatment

Main Occupation	Low coverage		High coverage	
	n	%	n	%
Peasant Farming	327	58.2	276	68.5
Business	44	7.8	25	6.2
Fishing	42	7.5	2	0.5
Casual Labor	66	11.7	22	5.5
Housewife	62	11	61	15.1
Others	21	3.7	17	4.2
Total	562	100	403	100

Low coverage: Areas which attained 60% and below MDA treatment coverage,
High coverage: Areas which attained 80% and above MDA treatment coverage

the misconceptions (witchcraft, rain, malnutrition, inheritance, etc.) on the cause of lymphedema or a lack of knowledge were more prevalent in the low compared to the high compliance villages [Table 5].

Knowledge of the signs of hydrocele (swollen genitals) was also associated with compliance; $P < 0.001$ ($\chi^2 = 21.734$; df 1), 81% from the high compared to 68% from the low compliance villages knew the signs of hydrocele. Furthermore, knowledge of the cause of hydrocele was also significantly associated with compliance; $P < 0.001$ ($\chi^2 = 49.758$ df = 16). Knowing that hydrocele was caused by a mosquito bite was more prevalent in the high compared to the low compliance villages (26.8 and 14.1% respectively) and misconceptions about the cause of hydrocele were more common in the low compliance villages [Table 6].

The majority of the participants of three FGDs from the low compliance villages had misconceptions (including witchcraft and heredity) about the cause of swollen limbs, further indicating the inadequacy of knowledge in the low compliance villages. Moreover, some participants of one female FGD from a low compliance village indicated that they had no idea of what caused swollen limbs. A large number of participants of two FGDs from the low and two from the high compliance villages also had misconceptions on the causes of swollen genitals and indicated sexual intercourse, witchcraft, and heredity as the causes of LF infection. A male participant in one FGD conducted in the low compliance area stated that:

"Swollen genitals are caused through sexual intercourse, this is when you have an affair with a woman whose husband has swollen genitals then you acquire the disease."

Knowledge of the cause of chronic disease due to LF was, however, not different in patients from both types of villages, slightly less than one-fifth of all the patients prominently reported that LF was caused by witchcraft, nearly two-fifth indicated that they did not know the cause, while only one-tenth had correct knowledge – that mosquitoes transmitted and caused LF. A large majority of the patients indicated that pain and swelling of limbs and genitals were signs of LF.

Table 5: Responses on causes of lymphoedema

Responses on causes of lymphoedema	Low coverage		High coverage	
	n	%	n	%
Witchcraft	28	5.0	13	3.2
Rain	6	1.2	2	0.5
Blood	21	3.7	8	2.0
Mosquitoes	145	25.8	149	37.0
Do not Know	314	55.9	216	53.6
Cold climate	3	0.5	2	0.5
Malnutrition	10	1.8	2	0.5
Walking for long	5	0.9	0	0
Inheritance	7	1.2	2	0.5
God's will	5	0.9	1	0.25
Nervous breakdown	5	0.9	0	0
Excessive water in joints	5	0.9	3	0.75
Poor hygiene	5	0.9	2	0.5
Others	3	0.5	2	0.5
Total	562	100	403	100

Low coverage: Areas which attained 60% and below MDA treatment coverage, High coverage: Areas which attained 80% and above MDA treatment coverage

Table 6: Responses on causes of hydrocele

Responses on cause of hydrocele	Low coverage		High coverage	
	n	%	n	%
Witchcraft	25	4.4	14	3.5
Rain	9	1.6	1	0.25
Blood	33	5.8	14	3.5
Mosquitoes	79	14.1	108	26.8
Do not Know	343	61.0	236	58.6
Sex with a hydrocele patient	8	1.4	6	1.9
Malnutrition	20	3.6	7	1.7
Walking for long	5	0.9	0	0
Cold climate	6	1.1	0	0
Poor hygiene	8	1.4	2	0.5
Others	16	2.8	15	3.7
Total	562	100	403	100

Low coverage: Areas which attained 60% and below MDA treatment coverage, High coverage: Areas which attained 80% and above MDA treatment coverage
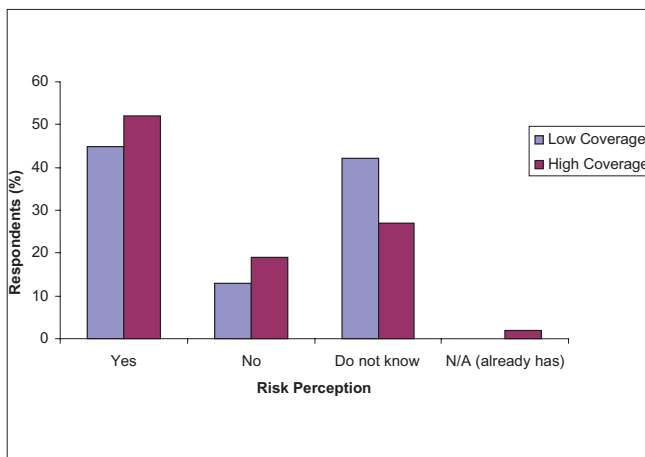
Figure 1: Respondents' perception of risk of LF infection. The bars represent percentages of populations' perception of risk of infection in Low coverage areas with MDA treatment of 60% and below. High coverage areas with MDA treatment of 80% and above

Risk Perception and Compliance with Mass Treatment
Perception of risk of LF infection also influenced compliance, $P < 0.001$ ($\chi^2 = 34.579$ df = 3). A slightly higher proportion (52%) of household heads from the high compared to 45% from the low compliance villages perceived themselves to be at risk of LF infection.

Furthermore, in a female FGD in a high compliance village, some participant stated that it is only the men who do not sleep under a mosquito net that are at risk of getting swollen genitals, while some participants within the same group stated that both men and women are at risk of getting swollen limbs and genitals.

A higher proportion (42%) of household heads from the low compared to 27% from the high compliance villages stated that they did not know whether they were at risk of LF infection [Figure 1]. In five FGDs, three from the low and two from the high compliance villages, a majority of the participants indicated that it was mainly the aging men with multiple sex partners who were at risk of LF infection, and some participants of four FGDs, three from the low and one from the high compliance villages indicated that young children, through inheritance, were most at risk of LF infection. In a male FGD in one low compliance village a participant stated that:

"It is mostly the children who are born while their mother and father are sick."

Disease Burden and Compliance with Mass Treatment
The mean number of years with chronic disease was significantly different in both groups of the LF patients; $P < 0.05$ ($\chi^2 = -2.152$, df = 72). Patients from the high compliance areas had a higher (15.2) mean number of years with chronic disease compared to those from the low compliance areas (9.7).

Knowledge of MDA and Compliance with Mass Treatment
Knowledge of MDA was not associated with compliance, 73% of the household heads from the low and 78% from the high compliance villages reported that they knew about MDA. Moreover, there was no difference in the knowledge of MDA among the opinion leaders and LF patients from both types of villages; most (nine in every ten) of the opinion leaders and about four-fifths of the patients knew about MDA.

There was also no difference in the knowledge of the

method of drug distribution used among the opinion leaders and the LF patients. Most (nine in every ten) of the opinion leaders and four-fifths of the patients from both types of villages knew that house-to-house was the method of drug distribution used during MDA.

Knowledge of who distributes the drugs during MDA, among the opinion leaders from both types of villages, was not different. A majority (nine in every ten) indicated that the drugs were distributed by the CDDs. However, there was a difference in knowledge of who distributes the drugs during MDA among the LF patients. Slightly more, four-fifths of the patients from the low compared to two-thirds from the high compliance villages indicated that the CDDs distribute the drugs during MDA.

The Majority of the patients from both types of villages knew why MDA was conducted, although a slightly higher proportion, four-fifths from the low compared to three-quarters from the high compliance villages knew that MDA was done to prevent and control LF. Most (nine in every ten) of the opinion leaders from both types of villages had the correct knowledge of why MDA was done.

Knowledge of when MDA was done was inconsistent in both groups of opinion leaders and of the patients and only one-half of the patients could recall that MDA had been done in the year 2008.

Discussion

The current study aimed at identifying the socioeconomic factors associated with compliance with MDA for LF elimination. The results demonstrate that compliance with MDA was higher among the Christians than among the Muslims and non-practicing community members. In Sri Lanka, Weerasooriya *et al.*,[17] have alluded to the importance of exploring cooperation from religious leaders, especially in Muslim areas, as Muslims do not traditionally allow strangers in their homes. The main challenge that this poses for the Program implementers is, how to engage with religious leaders. What inroads can be utilized to engage meaningfully with such leaders in a health Program? Koenig[18] observed that it is because of the extensive involvement of persons in religious groups that beliefs and activities relating directly to health, health practices or health care are promoted, and the overall impact of religion on health can have enough public health significance.

The study results also showed that in areas where community members had a main occupation indicative of high income level, and where land and housing structure ownership were common, also indicative of a high socioeconomic status, compliance with MDA tended to be low as compared to areas where community members had a low income level and a low socioeconomic status. This study confirmed results from other studies that those in higher socioeconomic status often do not take advantage of free medical interventions. Could this be due to the fact that they do not feel that they are at risk? Could it be due to the fact that they are certain they would access treatment if needed? Although Nandha *et al.*,[19] showed that income level seemed to play an independent significant role, compliance being lowest among the high-income group; there is need for investigation targeted at the wealthier group, to understand this phenomenon and devise mechanisms of motivation.

Furthermore, in areas where community members were engaged in main occupations such as fishing, business, and casual labor, indicating frequent absenteeism from their homes, compliance with MDA was relatively low. Addressing the challenges on compliance that result from occupations that take people away from their homes during MDA remains a key challenge. This is more so if the work involves taking people to areas not covered by the Program, which limits access to such people. Movement in search of casual employment has been found to limit access to treatment. A similar observation has been made by Yirga *et al.*,[20] who noted that those who were unemployed moved to areas where casual business opportunities were available, and therefore, did not comply with treatment.

In the current study, higher levels of knowledge that mosquitoes transmit LF were associated with taking the drugs during MDA. It was also apparent from the participants' sentiments that knowledge about the consequences of the disease enhanced compliance. Similarly, a study done in Leogane, Haiti Mathieu *et al.*,[21] found that persons who knew that LF was transmitted by mosquitoes were more likely to have participated in MDA than persons who did not. However, generally the study populations had relatively low levels of knowledge of cause of LF. The study results demonstrate that if people have low levels of knowledge, they are not likely to comply with the treatment, and these findings are similar to the findings of Rajendran *et al*,[22] and Babu *et al.*,[10] which highlighted that people with low knowledge of LF disease give low priority to its prevention. Moreover, results of the current study show that misconceptions of the cause of LF were very common in the study areas, suggesting a need for the elimination campaign to invest more resources to educate people on the signs,

causes, and susceptibility to the disease, as well as, on the need to take drugs during MDA. Lack of adequate knowledge of the cause of LF has earlier been reported in a study done in Kenya by Amuyunzu,[23] where a majority blamed it on witchcraft, eating burnt or bad food, and sexual transmission, with a minority relating it to mosquitoes.

In the study areas where there was a perception of high risk of LF infection, the results showed that there tended to be better compliance with MDA. This result is in tandem with the findings of Yirga *et al.*,[19] and Nuwaha *et al.*,[24] which positively associated high risk perception with compliance. To address the target communities' knowledge and perception gaps, in Haiti, Mathieu *et al.*,[25] highlighted the importance of knowledge, attitudes, and perception surveys and their influence on behavior, for example, in the participation in public health Programs such as LF elimination. The World Health Organization further recommends that knowledge, attitude, and practice (KAP) surveys be integrated with drug coverage surveys[26] and be utilized to provide valuable information for Program managers, permitting them to adapt health-education messages to changes in public knowledge and attitude, over time. The current study addresses some of the key issues that could be utilized to inform the Program implementation team as it plans its next MDA. The results should, however, be interpreted with caution due to the fact that part of the qualitative data were collected three months after the 2008 MDA, which could have introduced a recall bias.

The current study results further revealed that compliance was higher among patients with a higher mean number of years with chronic disease, than among those with a lower disease burden. This result demonstrates the influence of chronic infection on the willingness to comply with treatment and concurs with the result of a study done in Tahiti,[27] where people were reported to seek diethylcarbamazine (DEC) voluntarily during attacks of lymphangitis.

Results of the current study also indicate that access to information on MDA, was better among the community members in high compared to those in the low compliance areas. This reflects the value of adequate community sensitization and awareness creation on the compliance with treatment for LF elimination and for other similar campaigns. Similarly results of the study by, Wanji *et al.*,[28] on community-directed delivery of doxycycline for the treatment of onchocerciasis, in areas co-endemic with loiasis, in Cameroon, showed that due to the social awareness campaign, the population was well-informed of the

process and the role to play, which contributed to the success of the Program.

Conclusions

This study result highlights the need for investment in reaching out to groups that are often missed during MDAs. It also highlights the need for different strategies to reach those in specific religious groupings and those that are forced to be away from their communities at certain periods of MDA. This could include prolonging the duration of MDA to capture those who are out during the week seeking casual and other forms of employment. There is a need for sustainable investment and commitment in health education to improve the communities' knowledge of the signs, causes, susceptibility, and prevention of LF infection, which would change their misconceptions and myths.

Acknowledgments

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