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Retrospective evaluation of the determinants of compliance with the Egyptian mass drug administration programme for lymphatic filariasis

Mohammed Abdelmoneim Abdelhamid Alwehedy[1]*, Ali Alsaid Bohas[2], Atef Hussein Abdelhamid[2], Gehan Abdelrahman Rashed[2], and Marwa Mohammed Ghallab[1]

[1] Department of Parasitology, Faculty of Medicine, Kafrelsheikh University, Kafrelsheikh, Egypt
[2] Department of Parasitology, Faculty of Medicine, Benha University, Banhā, Egypt

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Abstract

Lymphatic filariasis (LF) is a neglected tropical disease capable of causing significant morbidity, disability, and economic burden. Egypt launched the national LF elimination programme in 2000 via mass drug administration (MDA) and was recognized by WHO as having successfully achieved LF elimination in 2017. A cross-sectional study was conducted in a former Egyptian village included in the anti-LF MDA programme, to identify the determinants of individual compliance with MDA. From August 1 to December 31, 2022, all individuals who fulfilled the inclusion criteria were randomly selected from attendees of the Alkorain Endemic Diseases Centre. The study participants were interviewed to recall their MDA participation, and the data were then recorded in a structured questionnaire. Of the 75 individuals studied, 65.3% reported full compliance with MDA, and 57.7% of the non-compliant participants mentioned discontinued drug delivery as the reason for non-compliance. Full compliance was found to be significantly associated with age, education, and LF knowledge level. Moreover, univariate regression analysis showed that adults, males, government employees, those with academy/university education, and those with good LF knowledge had significantly higher odds of full compliance with all MDA rounds compared with children, females, students, those with elementary school education, and those with poor LF knowledge, respectively. However, multivariate analysis indicated that educational level could be the most significant independent predictor of full compliance. Our study concluded that the individual's age, educational level, and knowledge level regarding LF can play a significant role in full compliance with anti-LF MDA programmes.

Introduction

Lymphatic filariasis (LF) is known as one of the neglected tropical diseases caused mainly by *Wuchereria bancrofti* and transmitted through mosquito bites. It has been prioritized for global elimination through the Global Programme to Eliminate Lymphatic Filariasis (GPELF) since 2000. At that time, approximately 1.3 billion individuals living in

***Corresponding author:** *mohamedabdelhamid@med.kfs.edu.eg*
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73 endemic countries were considered at risk of infection, and an estimated 120 million people were infected worldwide, with nearly 40 million suffering from clinically evident disease which varies from acute to chronic manifestations. The most prevalent clinical manifestations of LF include acute adenolymphangitis, hydrocele, lymphoedema and elephantiasis .While chyluria and tropical pulmonary eosinophilia (TPE) are less commonly reported (1, 2). The goal of LF control is to interrupt disease transmission and reduce its associated morbidity and public health effects. Interruption of transmission targets the at-risk people to decrease the microfilarial load in the society below the level at which transmission of LF ceased (3). Despite the attained considerable accomplishment, the initial target of elimination by the year 2020 couldn't be reached in all regions, prompting the WHO to set 2030 as the revised target year (4). Based on WHO guidelines, in 2000 Egypt was among the pioneers to launch the national LF elimination programme (NLFEP), which was implemented via mass drug administration (MDA) using an annual dose of a combination of DEC (6 mg/kg) plus albendazole (400 mg) to all eligible individuals residing in LF-endemic areas (5). In 2017, Egypt no longer required MDA, as the elimination programme targets had been successfully attained, and WHO validated Egypt as the 1st country in the Eastern Mediterranean region to successfully achieve LF elimination (6).

Doubtless, the full success of MDA programmes against LF depends on high rates of drug coverage and individual compliance to ensure consistent drug intake and treatment of all reservoirs of the disease (7). Besides, the key obstacles encountered implementation of these MDA programmes were limited awareness about LF and MDA (objectives and benefits), along with failure to recognize barriers that influence health behavior (limited time, access constraints, and logistic limitations). Additionally, the LF control efforts may fail due to not being suitable for community needs or conflicting with local beliefs about the disease (8, 9). Despite the excellent overall MDA compliance with the Egyptian programme, the individual compliance may significantly vary. So, more studies should be performed to define the determinants of compliance and identify the best public health communication strategies to avoid noncompliance in the following elimination programmes (7). This study aimed to identify the key factors influencing individual's compliance to MDA programmes against LF for providing evidence-based recommendations for future public health interventions and preventive strategy implementation.

Materials and Methods

The study design

A retrospective cross-sectional study was conducted at a former anti-LF MDA-included area (Alkorain village, Sharqia governorate, Egypt) to identify the key factors influencing individual's compliance to the MDA programme against LF. All study participants were randomly selected from attendants of the Alkorain Endemic Diseases Centre from those who fulfilled the inclusion criteria during the period from 1st August to 31st December 2022. The inclusion criteria included Alkorain village residents aged ≥2 years at the time of MDA implementation, who had received at least one MDA round. Individuals with unclear information or those who were not permanent residents during the MDA were excluded.

The study participants were interviewed to recall their experienced MDA participation, and then data were recorded in a structured questionnaire, including sociodemographic data and previous MDA-associated data (compliance, number of received rounds, side effects, and causes of non-compliance). The estimation of the knowledge level about LF was performed according to Jaiyeola *et al*. (10) [a score of 1 was given for each correctly answered question, while a score of 0 was assigned for incorrect responses. Then the median score was determined, and those who scored less than the median were categorized as having "poor knowledge", whereas those who scored equal to or above the median were classified as having "good knowledge"].

Statistical analysis

The data were analyzed using the Statistical Package for the Social Sciences (SPSS) 22.0 software (IBM Microsoft). Kolmogorov-Smirnov test was used to test quantitative data normality of distribution. Qualitative data were described using number and percent. Quantitative data were described using range (minimum and maximum), mean, standard deviation. The comparison between groups was done using Chi-square test and Monte Carlo tests (when more than 20% of the cells have expected count less than five). Binary logistic regression analysis was used to analyze the relationship between a binary dependent variable and one or more independent variables. P value <0.05 was adopted as the level of significance and P value <0.001 was considered as highly significant.

Results

The study participants were 75 individuals involved in the previous MDA programme, and their retrospectively collected data revealed that 65.3% underwent all five rounds of MDA, and 85.3% didn't experience any side effects. The most mentioned side effect was dizziness (10.7%). While 34.7% of them mentioned non-compliance to all MDA rounds, mostly due to discontinued drug delivery by the health team (57.7%) (**Table 1)**. Moreover, there was no statistically significant difference between males and females in experiencing side effects from the previous MDA (P= 0.707). The proportions of experiencing side effects were 15% and 14.5% in males and females, respectively (**Table 2)**.

Table 1. The studied individuals' participation, side effects, and non-compliance related to the former anti-lymphatic filariasis mass drug administration (MDA).

Variable		Frequency (%)
Number of received MDA rounds		
	1 round	10 (13.3%)
	2 rounds	6 (8%)
	3 rounds	7 (9.3%)
	4 rounds	3 (4%)
	5 rounds	49 (65.3%)
Experienced side effects from MDA		
	No	64 (85.3%)
	Dizziness	8 (10.7%)
	Nausea /vomiting	1 (1.3%)
	Chest /upper limb pain	1 (1.3%)
	Fever	1 (1.3%)
Total		75 (100%)
Causes of non-compliance		
	Not getting the drug from the health team	15 (57.7%)
	Pregnancy	3 (11.5%)
	Non-presence at home at the time of the next MDA round	3 (11.5%)
	Fear of side effects	5 (19.2%)
Total		26 (100%)

Table 2. Comparison of experiencing side effects related to the former mass drug administration (MDA) according to sex.

Variable (Sex)	No side effects	Dizziness	Nausea/vomiting	Chest/upper limb pain	Fever	Total	Test (P-value)
Male	17 (85%)	2 (10%)	1 (5%)	0 (0%)	0 (0%)	20 (26.7%)	MC (P = 0.707)
Female	47 (85.5%)	6 (10.9%)	0 (0%)	1 (1.8%)	1 (1.8%)	55 (73.3%)	

Statistically significant (*).
The Monte Carlo test (MC) was used to compare the difference in experiencing MDA-related side effects by sex .

The study participants revealed that the rate of full MDA compliance was significantly influenced by individual's age, educational level, and knowledge level about LF (P< 0.05). Adults showed higher compliance (74.1%) compared to children (42.9%), while participants with good knowledge were more compliant (76.5%) than those with poor knowledge (41.7%), and university/academy attendants displayed higher compliance (91.7%) compared to illiterate and lower educational levels. Besides, compliance was non-significantly higher among males (75%), and governmental employees (92.3%) compared to females (61.8%) and other occupations, respectively (P> 0.05) (**Table 3)**. The univariate logistic regression analysis showed that adults had significantly higher odds of compliance with all MDA rounds compared to children (cOR = 3.81, P= 0.013). While females appeared to have non-significant lower the odds of full compliance compared to males (cOR = 0.54, P = 0.293). While compared to government employees, students showed significantly lower odds of full compliance (cOR= 0.11, P= 0.043). Besides, participants with elementary school education had significantly lower odds of compliance compared to those with academy/university education (cOR= 0.02, P= 0.004). In addition, participants with a good level of LF knowledge had significantly higher odds of compliance (cOR= 4.55, P= 0.004) compared to those with poor knowledge. Whereas the multivariate analysis indicated that the level of education could be the most significant independent predictor of full MDA compliance, as elementary education remained significantly associated with lower odds of compliance (aOR= 0.03, P= 0.028) compared to academy/university-level education (**Table 4)**.

Table 3. The distribution of compliance to all five rounds of the former mass drug administration (MDA) based on age, sex, occupation, education, and knowledge levels.

Variable		Full compliance	Non-compliance	Total	Test (P-value)
Age					
	≤ 15 years	9 (42.9%)	12 (57.1%)	21 (28%)	χ^2 = 6.51 (P = 0.015*)
	> 15 years	40 (74.1%)	14 (25.9%)	54 (72%)	
Sex					
	Male	15 (75%)	5 (25%)	20 (26.7%)	χ^2 = 1.13 (P = 0.412)
	Female	34 (61.8%)	21 (38.2%)	55 (73.3%)	
Occupation					
	Students	21 (56.8%)	16 (43.2%)	37 (49.3%)	MC (P = 0.16)
	Government employee	12 (92.3%)	1 (7.7%)	13 (17.3%)	
	Private employee	6 (75%)	2 (25%)	8 (10.7%)	
	Unemployed	10 (58.8%)	7 (41.2%)	17 (22.7%)	
Education					
	Illiterate	6 (85.7%)	1 (14.3%)	7 (9.3%)	MC (P < 0.0001*)
	Elementary school	2 (20%)	8 (80%)	10 (13.3%)	
	Preparatory school	4 (50%)	4 (50%)	8 (10.7%)	
	High school	26 (68.4%)	12 (31.6%)	38 (50.7%)	
	Academy/University	11 (91.7%)	1 (8.3%)	12 (16%)	
Knowledge					
	Good level	39 (76.5%)	12 (23.5%)	51 (68%)	χ^2 = 8.73 (P = 0.004*)
	Poor level	10 (41.7%)	14 (58.3%)	24 (32%)	

Significant (*).
The Chi-square test (χ^2) was used to compare the difference in full MDA compliance frequency by age, sex, and knowledge level.
The Monte Carlo test (MC) was used to compare the difference in full MDA compliance frequency by occupation and education.

Table 4. Logistic regression analysis for factors affecting compliance to all five rounds of the former mass drug administration (MDA).

Variables		cOR (95% CI)	P- value	aOR (95% CI)	P- value
Age					
	≤ 15 years	1		1	
	> 15 years	3.81 (1.3 - 10.9)	0.013*	0.81 (0.1 - 6.4)	0.844
Sex					
	Male	1		1	
	Female	0.54 (0.2 - 1.7)	0.293	1.28 (0.2 - 7.2)	0.78
Occupation					
	Government employee	1		1	
	Private employee	0.25 (0.02 - 3.4)	0.295	0.76 (0.1 - 14.4)	0.856
	Unemployed	0.12 (0.01 -1.2)	0.065	0.19 (0.02 - 2.2)	0.185
	Students	0.11 (0.01 - 0.9)	0.043*	0.16 (0.01 - 2.1)	0.167
Education					
	Academy/University	1		1	
	Elementary school	0.02 (0.002 - 0.3)	0.004*	0.03 (0.001 - 0.7)	0.028*
	Preparatory school	0.09 (0.01 - 1.1)	0.057	0.17 (0.01 - 4.6)	0.289
	High school	0.19 (0.02 - 1.7)	0.14	0.18 (0.01 - 2.3)	0.183
	Illiterate	0.55 (0.03 - 10.4)	0.687	0.38 (0.01 - 12.5)	0.59
Knowledge					
	Poor level	1		1	
	Good level	4.55 (1.2 - 12.9)	0.004*	2.05 (0.6 - 7.5)	0.281

Significant.(*)
Crude odds ratio (cOR), Adjusted odds ratio (aOR), indicator (ind.), Confidence interval (CI).

Discussion

LF is a neglected tropical disease which typically occurs when filarial parasites are transmitted to humans through mosquito bites. *Wuchereria bancrofti* is responsible for more than 90% of infections in which man is the only definitive host. This disease can lead to significant morbidity, disability, and economic burden on both individuals and communities (11). Since ancient Egyptian times, LF has been recognized especially in Nile Delta region. In 2000, with reference to WHO recommendations, Egypt was among the pioneers to launch the NLFEP based on implementation of MDA, vector control measures, morbidity management, and prevention of disability (5). In 2017, Egypt was the first of the eastern Mediterranean countries to be acknowledged by WHO for attaining the successful elimination of LF (2).

In the present study, most of participants (65.3%) underwent all 5 rounds of the prior anti-LF MDA programme. In this context, Abd Elaziz et al. (12) stated that the population's compliance rate to all anti-LF MDA rounds was 85.3% in various Egyptian villages. While in a study on residents of former LF-endemic areas in 5 Egyptian governorates, Abdel-Shafi et al. (13) found that 71.7% of studied people received all MDA rounds. Moreover, the survey performed by Dahesh and Ibrahim (14) in some Egyptian villages of Giza governorate, revealed that 73.8% of respondents received MDA against LF. In our study, 34.7% of MDA-included individuals mentioned non-compliance to all rounds of the previous MDA, due to discontinued drug delivery by the health team (57.7%), fear of side effects (19.2%), pregnancy (11.5%), and non-presence at home during time of the next round (11.5%). These findings could reveal the logistic challenges and limited resources during MDA implementation in this village. Conversely, in Egyptian villages, Abd Elaziz et al. (12) clarified that reasons for non-compliance to MDA were absence from home (28.3%),

pregnancy (23.3%), fear of adverse reactions (12.6%), and missed drug delivery by the team (10.9%). However, in an Indian LF-endemic district, Ratna et al. (15) found that the most frequently mentioned reason for MDA non-adherence was being not interested in participation (69%).

The studied participants revealed that the rate of full compliance to the prior anti-LF MDA rounds differed significantly by age, educational level, and LF knowledge level ($P<0.05$), with higher compliance among adults, those with good knowledge about LF, and university/academy attendants. However, the compliance was non-significantly higher among males and governmental employees.

The identified higher compliance rate among adult individuals, is in accord with studies conducted by Abd Elaziz et al. (12), Mihretu et al. (16), and Kesuma et al. (17) in Egypt, Ethiopia, and Indonesia, respectively. While the discovered higher compliance rate among people attending academies/universities is in agreement with Titaley et al. (18) and Ratna et al. (15), who declared that individuals attaining higher education had higher compliance rates with the LF-MDA programme in Indonesia and India, respectively. In addition, the higher compliance rate among our study participants with a good LF knowledge level is in line with Abd Elaziz et al. (12), Ginandjar et al. (19), and Widawati et al. (20), in Egypt, Indonesia, and India, respectively.

In our study, the rate of full compliance to the previous MDA was non-significantly higher in males than females. Likewise, El-Setouhy et al. (7) revealed that rates of compliance to MDA did not differ significantly by sex in an Egyptian village (in Giza governorate). Whereas, Abd Elaziz et al. (12) found that compliance to MDA against LF in some Egyptian villages was significantly higher in males than females. Moreover, Government employees had a non-significant higher compliance rate (92.3%) compared to other occupations. This finding is in accord with results reported by Ginandjar et al. (19) in Indonesia. Conversely, Titaley et al. (18) found formal sector workers were less likely to comply with anti-LF MDA programme compared to housewives in Indonesia.

In the present study, the univariate logistic regression analysis examining factors influencing full MDA compliance showed that adults, males, government employees, those with academy/university education and those with good LF knowledge had significantly higher odds of compliance with all MDA rounds compared to children, females, students, those with elementary school education and those with poor LF knowledge, respectively. However, the multivariate analysis indicated that the level of education could be the most significant independent predictor of full MDA compliance, as elementary education remained significantly associated with lower odds of compliance (aOR= 0.03, P= 0.028) compared to academy/university-level education.

Generally, adults typically have greater health awareness and can independently make their own medical decisions, while children are more reliant on their guardians in their medical service seeking behavior (21). Moreover, the gender differences in compliance, with males showing higher adherence, have been variably reported in the literature. Likewise, Shuford et al. (22) have reported higher compliance among males due to more exposure to health campaigns or occupational mobility, while Cantey et al. (23) have declared the higher compliance among females due to their role in family health decisions. Doubtless, government employees have easier participation in public health programmes, and relatively higher trust in governmental health interventions, so formal employment can be associated with better health-seeking behavior and MDA participation (21). Whereas participants with good knowledge about LF were more likely to comply due to their awareness of the role of MDA programmes in prevention and elimination of LF transmission and its consequences (24). Importantly, higher educational attainment can enhance comprehension of health messages, understanding risks, and trusting public health interventions, thereby facilitating adherence (25).

In the current study, 85.3% of the participants can tolerate drugs of anti-LF MDA rounds without any side effects. While the most experienced side effect was dizziness (10.7%), followed by nausea/vomiting, fever, and body aches. These results are in accord with Abd Elaziz et al. (12), who found that anti-LF MDA-associated side effects were reported by only 18.5% of individuals receiving mass therapy in various Egyptian villages. Dizziness was the most common adverse reaction mentioned by MDA-compliant persons (14.8%), followed by nausea or vomiting and fever.

In addition, Inkane et al. (26) stated that only 6.85% of individuals who received the mass therapy against LF experienced side effects in India. However, in Kenya, Kulkarni *et al*. (27) reported that the incidence of MDA-associated adverse reactions in a LF-endemic district was 14.68%, and the most common mentioned side effect was fever (96.53%), followed by dizziness (1.73%).

In this study, there was a non-significant difference between males and females in experiencing side effects from previous MDA (P>0.05) with a higher prevalence of side effects mentioned by females (73.3%) than males (26.7%). Similarly, Lima et al. (28) and Khaemba et al. (29) demonstrated that female participants non-significantly experienced more MDA-associated adverse events than males in Brazil and Kenya, respectively. Conversely, in Egypt, Abd Elaziz et al. (12) demonstrated that female participants significantly experienced more MDA-associated adverse events than males.

Conclusions

Our study findings conclude that the individual's age, educational level, and level of knowledge about LF can play a significant role in full compliance to anti-LF MDA programmes. Besides, the higher compliance rates were found among adults (74.1%), those with good knowledge (76.5%), and university/academy attendants (91.7%). While the multivariate analysis revealed that higher educational attainment could be the most significant independent predictor of full compliance to anti-LF MDA programmes. So, MDA programmes should prioritize targeted, accessible, and culturally appropriate health intervention strategies, particularly for populations with lower educational levels. Finally, further wide-ranging studies are required to clearly understand the key factors influencing individual compliance to MDA programmes against LF.

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Conflict of Interest Statements

The authors declare that there is no conflict of interests.

Ethical Approval

The ethical approval was obtained from the Research Ethics Committee of the Faculty of Medicine, Benha University, Banhā, Egypt (Approval No. MD 18-7-2022). The study was conducted in accordance with the Declaration of Helsinki. Written informed consent was obtained from all adult participants prior to enrolment.

Artificial Intelligence Statement

The authors declare that there was no use of AI-assisted technologies for assisting in the writing of the manuscript.

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