

Towards Elimination of Lymphatic Filariasis in Ghana: Refining the Strategy through Quality Improvement

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A THESIS

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“Implementation research is a critical tool for providing the scientific evidence necessary for improving and scaling up public health programmes around the world.”- Dr Marie-Paule Kieny

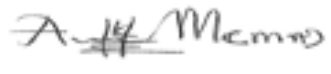


Pictorial depiction of key activities of the PhD study: Starting with the identification of the problem (existence of the LF disease), community data collection, stakeholder engagement to discuss first-phase results. And intervention mapping, community education and drug distribution.

DECLARATION

I, Alfred Kwesi Manyeh do solemnly declare that this thesis is my original work. Where there has been a contribution from other people, this has been duly acknowledged. This thesis being submitted for the degree of Doctor of Philosophy in Epidemiology at the University of the Witwatersrand, Johannesburg, South Africa. It has not been submitted before for any degree or examination at this or any other University.

Name: Alfred Kwesi Manyeh

Signature: 

Date: 18.03.2020

DEDICATION

I humbly dedicate this work to the Almighty God who has brought me this far in my academic pursuit.

I also dedicate this degree to my family: Rosemond Akpene Manyeh; Carl Darwin Dela Manyeh; Alfred Hans Kekeli Manyeh and Ann Xorse Megblemdio Manyeh for their support and understanding through the PhD journey, and for endurance in time of loneliness. I also dedicate it to my mum, Victoria Norviworgbe Asumah and my siblings for their assurance of daily prayers for me during difficult moments and throughout the PhD period.

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PUBLICATIONS ARISING FROM THIS THESIS

This thesis consists of two published academic papers, listed below:

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Two drafted articles from the thesis are under review for publication as listed below:

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Manyeh AK, Ramaswamy R, Chirwa T, Ibisomi L, Baiden F. Towards Elimination of Lymphatic Filariasis in Ghana: Refining the Strategy Through Quality Improvement. *To be published in BMC Implementation Science Journal*.

ABSTRACT

Introduction

The Global Strategy to Eliminate Lymphatic Filariasis (GFELF) through Mass Drug Administration (MDA) has been implemented in Ghana since the year 2000 and transmission has been interrupted in 76 of 98 endemic districts. To improve the MDA in the remaining districts with microfilaria (MF) prevalence above the 1% threshold for the interruption of transmission, there is a need to identify and implement appropriate quality improvement (QI) strategies. This PhD aimed to develop and test quality improvement strategies to effectively eliminate lymphatic filariasis disease as a public health problem in Ghana.

Methods

Due to the complexities associated with implementing evidence-based programs such as the lymphatic filariasis mass drug administration and variability in the context, three-phase cross-sectional implementation research was conducted. In the pre-intervention, need assessment to identify implementation bottlenecks associated with the implementation of lymphatic filariasis mass drug administration in the community and health system levels in the Bole and Central Gonja Districts in Northern Ghana was conducted using a mixed-methods approach. Based on the findings of the initial assessment, a context-specific quality improvement strategy was designed and implemented using intervention mapping strategy in terms of seven domains (actor, the action, action targets, temporality, dose, implementation outcomes addressed, and theoretical justification) in one Plan-Do-Study-Act cycle. The post-intervention phase used RE-AIM (Reach, Effectiveness, Adoption, Implementation, and Maintenance) framework based on a mixed-methods approach to evaluate the context-specific evidence-based quality improvement intervention on the lymphatic filariasis mass drug administration in Bole District of Northern Ghana.

Results

The initial needs assessment shows that the persistent transmission of lymphatic filariasis in the Bole District is characterised by refusal to ingest the drug, self-reported adverse drug reactions, low MDA coverage at the community level, poor adherence to the mass drug administration protocol, poor knowledge about the disease and the mass drug administration exercise.

The intervention phase of the study indicated that it is feasible to develop a context-specific quality improvement strategy for an existing evidence-based intervention based on an initial needs assessment through stakeholder participation using intervention mapping approach. However, working towards quality improvement requires more time than is usually available

in public health service. Sufficient theoretical knowledge of implementation research and experience with technical intervention mapping experts must be available.

The evaluation results showed that there was an improvement in social mobilisation and sensitisation, knowledge about disease and mass drug administration process, willingness to ingest the medication and adherence to the directly observed treatment strategy. There was an increase in the district mass drug administration coverage and a reduction in self-reported adverse drug reaction.

Conclusion

The level of reach, effectiveness and adoption at district, sub-district and at the individual participants' level suggest that the context-specific evidence-based quality improvement intervention is feasible to implement in lymphatic filariasis hotspot districts based on initial context-specific needs assessment. For Ghana to meet the 2030 NTDs deadline, it is important to identify context-specific need-based quality improvement strategies to deal with implementation bottlenecks in partnership with key stakeholders to make the drug accessible to all eligible individuals in the LF endemic communities. This can be done through the application of appropriate implementation science tools to improve the implementation of the lymphatic filariasis mass drug administration. The study provided the groundwork for future application of implementation science tools and frameworks to design, implement and evaluate context-specific evidence-based quality improvement intervention to improve lymphatic filariasis mass drug administration towards the elimination of the disease as a public health problem in Ghana.

Keywords: Lymphatic Filariasis, Mass Drug Administration, Quality Improvement, Context-specific, Evidence-based, Bole, Northern Ghana.

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ABBREVIATION

ADLA	dermatolymphangioadenitis
ADL	adenolymphangitis
CHPS	Community-Based Health Planning and Services
CEQI	Context-specific Evidence-based Quality Improvement
CDDs	Community Drug Distributors
DCE	District Chief Executive

DEC	Diethylcarbamazine
DDT	dichloro-diphenyltrichloroethane
DHMT	District Management Team
DDHS	District Directors of Health Service
DOT	Direct Observation Treatment
EBIs	Evidence-Based Interventions
EU	Evaluation Unit
GFELF	Global Strategy to Eliminate Lymphatic Filariasis
GHS	Ghana Health Service
GFEP	Ghana Filariasis Elimination Program
IDIs	In-depth interviews
(IM)	intervention mapping
ITFDE	International Task Force for Disease Eradication
KIIs	key informant interviews
LF	Lymphatic filariasis
LLINs	Long-lasting insecticidal nets
MDA	Mass Drug Administration
MoH	Ministry of Health
MF	Microfilaria
NGO	Nongovernmental Organizations
NMCP	National Malaria Control Program
NTDs.	Neglected Tropical Diseases
PI	Principal Investigator
PHC	Population and Housing Census
Pre-TAS	Pre-transmission assessment survey
PDSA	Plan-Do-Study-Act
QI	Quality Improvement
RE-AIM	Reach, Effectiveness, Adoption, Implementation, and Maintenance
RHMT	Regional Health Management Team
SDGs	Sustainable Development Goals
SHHS	Sub-district Heads of Health Service
WHO	World Health Organisation
WHA	World Health Assembly
UNICEF	United Nations International Children's Emergency Fund
UNDP	United Nations Development Programme

CHAPTER 1: INTRODUCTION

“Insanity: doing the same thing over and over again and expecting different result” – Albert Einstein & Narcotics Anonymous.

1.1 Background

My PhD explored factors contributing to the persistent transmission of lymphatic filariasis, developed and implemented quality improvement strategies towards the elimination of lymphatic filariasis in Ghana. The study was in three phases, namely Pre-intervention, intervention and post-intervention.

This chapter presents the background and context of the research that was conducted as part of my PhD. The chapter is divided into seven distinct sections. Section 1.2 summarises what lymphatic filariasis is, how is it transmitted, and the prevalence of the disease. Section 1.3 provides a brief background on the structure of health service management in Ghana. Section 1.4 highlights the structure and operations of the neglected tropical diseases program in Ghana. Section 1.5 focuses on the study problem statement. Section 1.6 provides the aim and objectives of the study. Section 1.7 describes the conceptual framework underpinning this PhD thesis while section 1.7 focuses on the study aim and objectives. Section 1.8 summarises the justification for the study.

1.2 Lymphatic filariasis

Lymphatic filariasis (LF) is a debilitating disease caused by filarial worms *Wuchereria bancrofti* (*W. bancrofti*), *Brugia malayi* (*B. malayi*) and *Brugia timori* (*B. timori*) that live in the human lymphatic system. This parasitic filarial infection is transmitted by the female Culex Anopheline Mosquitoes at night [1]. During a blood meal, infective larvae enter the bite wound and move to the lymphatic vessels and lymphatic nodes [2, 3]. During the process of infection, the thread-like worms of genus *Wuchereria* and *Brugia*, move into the lymphatic system, grow into adult worms and reproduce [1]. As they multiply, they block the lymphatic vessels which maintain the delicate fluid that maintains a balance between the tissues and blood [1].

As the parasites live in the lymphatic nodes, which are essential components of the body's immune system, they damage and block the lymphatic system thereby preventing the appropriate circulation of lymphatic fluids through the human body. The uncirculated

lymphatic fluids lead to the clinic manifestation of LF in the extremities of the body. This result in clinical signs such as lymphedema (swelling of limbs or breasts), and hydrocele (scrotal swelling in men) [4]. Painful episodes of fever can accompany this. People with lymphedema are prone to bacterial infections that can lead to a mobility-limiting condition where the skin thickens and hardens (elephantiasis) [4].

Some manifestations of LF begins with acute attacks of adenolymphangitis (ADL) which are often characterised by constitutional signs and symptoms such as fever, general malaise, pain, tenderness and swelling [5, 6]. There may also be the passing of Chyluria - a condition caused by leakage of lymphatic fluid into the kidneys, which turns the urine milky white [7]. Lymphatic filariasis can also present rheumatic symptoms and mono-arthritis of a knee or ankle joint that ensues after antifilarial treatment. This is common in children in filarial-endemic areas [7].

About 67 million individuals are infected with LF, and 36 million individuals are living with hydrocele and lymphedema globally [8, 9]. LF is the second major cause of permanent disability worldwide [8, 9]. Africa accounts for nearly 30% of the global burden of this disease [10]. In West Africa, the condition is prevalent in poor communities and least developed areas [8, 9]. The disease weakens the socio-economic and welfare of affected individuals and their communities.

1.3 Ghana Health Delivery System

Ghana is a West African country with an estimated population of 27 million people in 2014 [11]. The country has 216 administration districts in 10 regions with an estimated gross national income per capita of US\$ 1590 [11].

Ghana Health Service (GHS) is the implementing agency of the Ministry of Health (MoH) responsible for health service delivery in Ghana. Health management in the country is decentralized. The Service is made up of the Primary level at the district, the secondary level at the region, and the tertiary referral level. District Management Team (DHMT) led by a District Director of health services, is responsible for health service delivery at the district level. The District Director of health services reports to the District Chief Executive (DCE). A Regional Health Management Team (RHMT) led by Regional Director of health services and reports to the Regional Minister, who is responsible for the regional health service delivery. At

the National Headquarters and tertiary level, the Director-General of GHS and Chief Executives of Tertiary Hospitals reports to the Minister of Health who is responsible for health care delivery in the entire country [12].

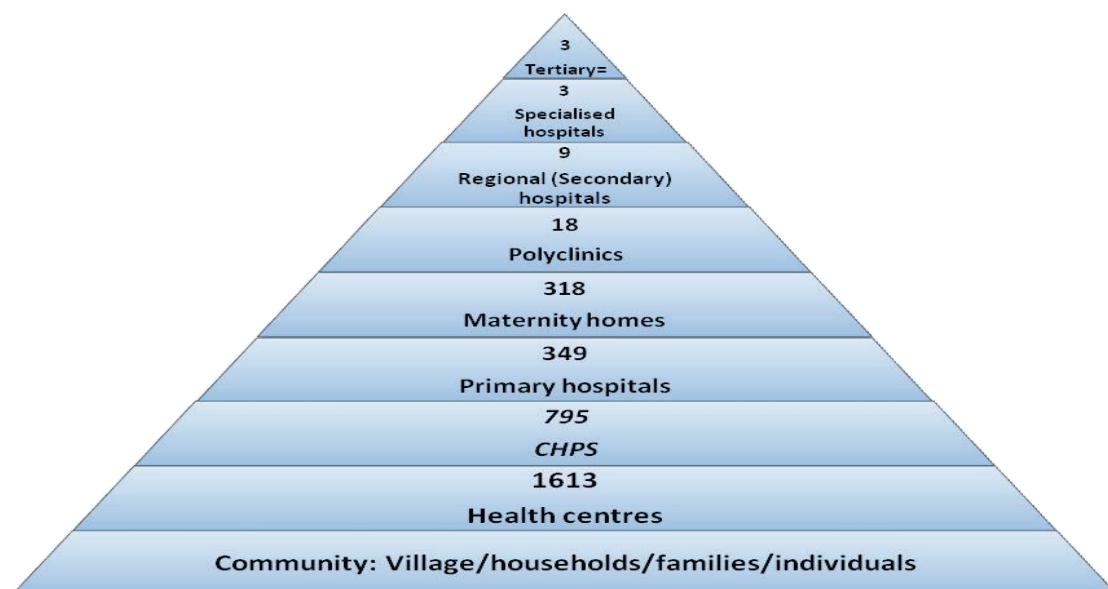


Figure 1: Level of Health Service Delivery in Ghana

The Primary Health Care delivered at the district level comprised of Community-Based Health Planning and Services (CHPS) compounds, clinics, health centres and hospitals. The health centres are responsible for providing clinical, public health, and maternity services to the catchment population. It uses facility-based services, outreaches, and mass campaigns in partnership with communities, community institutions, leaders, community-based health workers and volunteers. The district hospital serves as the first level of referral point at the primary level. They provide out-patient and in-patient, surgical, laboratory and maternity services. At the secondary level, the regional hospital is the secondary referral point and offers specialised services. At the tertiary level, teaching hospitals are at the apex of specialized care in Ghana, as shown in Figure 1[12].

1.4 Ghana Neglected Tropical Diseases Program

The government of Ghana through the Ministry Health and Ghana Health Services in conjunction with supporting partners established a Neglected Tropical Diseases (NTDs) Program to work towards prevention, control, elimination of 12 neglected tropical diseases by 2020 of which LF is one. The program focused on preventive chemotherapy and transmission

control to eliminate LF. Other conditions targeted by the program are onchocerciasis, schistosomiasis, soil-transmitted helminthiasis and trachoma [12].

The main objective of the NTDs program is to integrate these diseases in the area of mass drug preventive chemotherapy and case search and management to improve mobilisation of resources and maximise the efficient use of resources for better public health impact in Ghana. The NTDs program is under the Ghana Health Service is based on five major pillars of the Ghana Health Sector which are: financial and geographical accessibility, quality of care, efficiency, collaboration and equitable distribution of resources.

The NTDs program in Ghana has medium-term policies and priorities within the health sector strategic plan. There are individual coordinating bodies for specific program activities and a national steering committee known as the NTDs Intra Country coordinating Committee within the GHS, as shown in Figure 2.

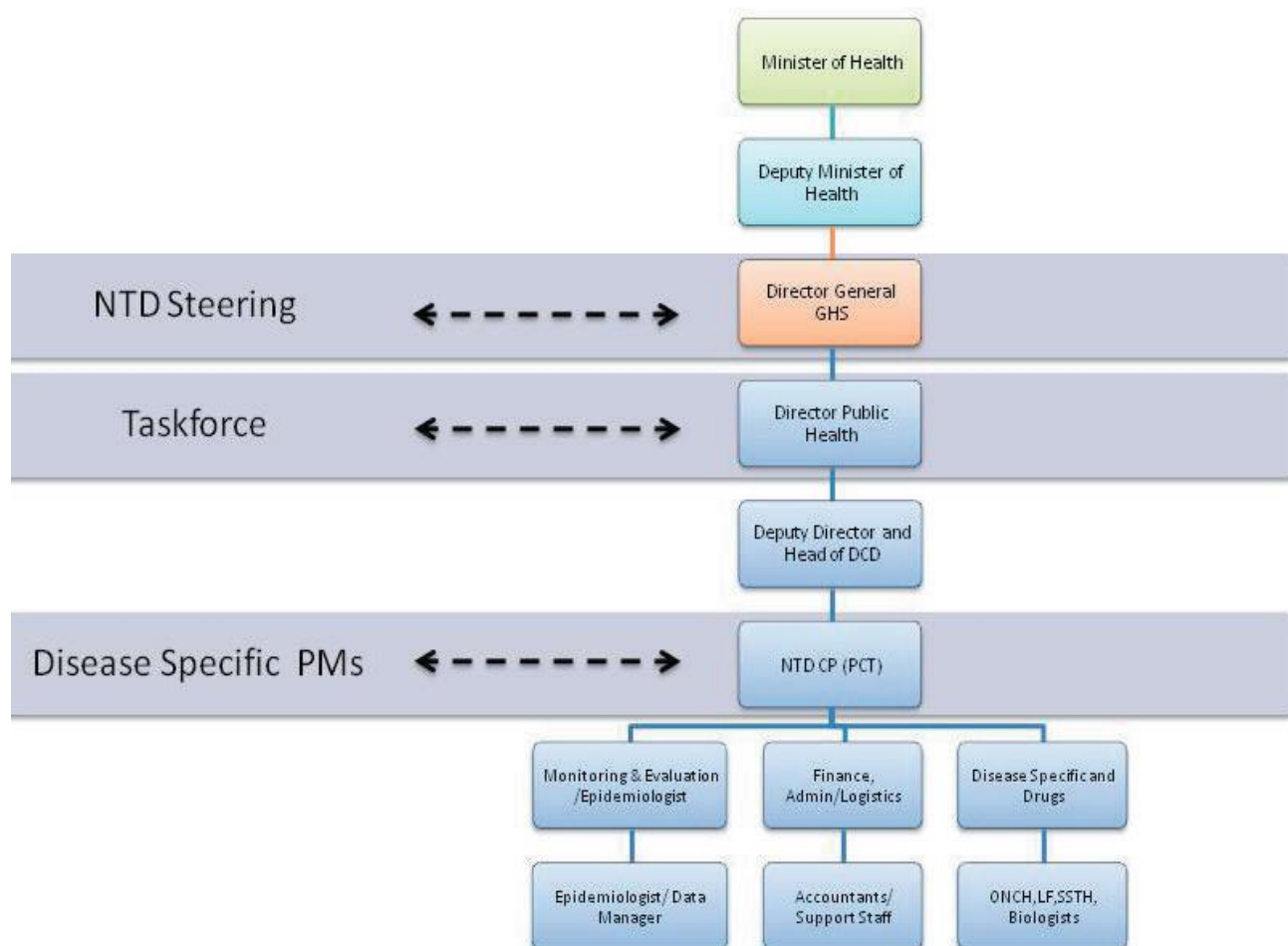


Figure 2. The organisation of the Neglected Tropical Diseases Program within GHS.

The Ghana NTDs program is aligned with the WHO AFRO strategy for NTD control in Africa and has adopted the WHO recommendation for LF elimination. The preventive chemotherapy strategy towards the elimination of LF in Ghana is through mass drug administration strategy. The LF Mass Drug Administration (MDA) program in Ghana has been implemented at the community level with the support of volunteer community drug distributors [12].

After mapping and determination of baseline LF prevalence in Ghana, 98 administrative districts located in eight out of 10 regions were found to be endemic districts need to receive MDA as shown in Figure 3 [12].

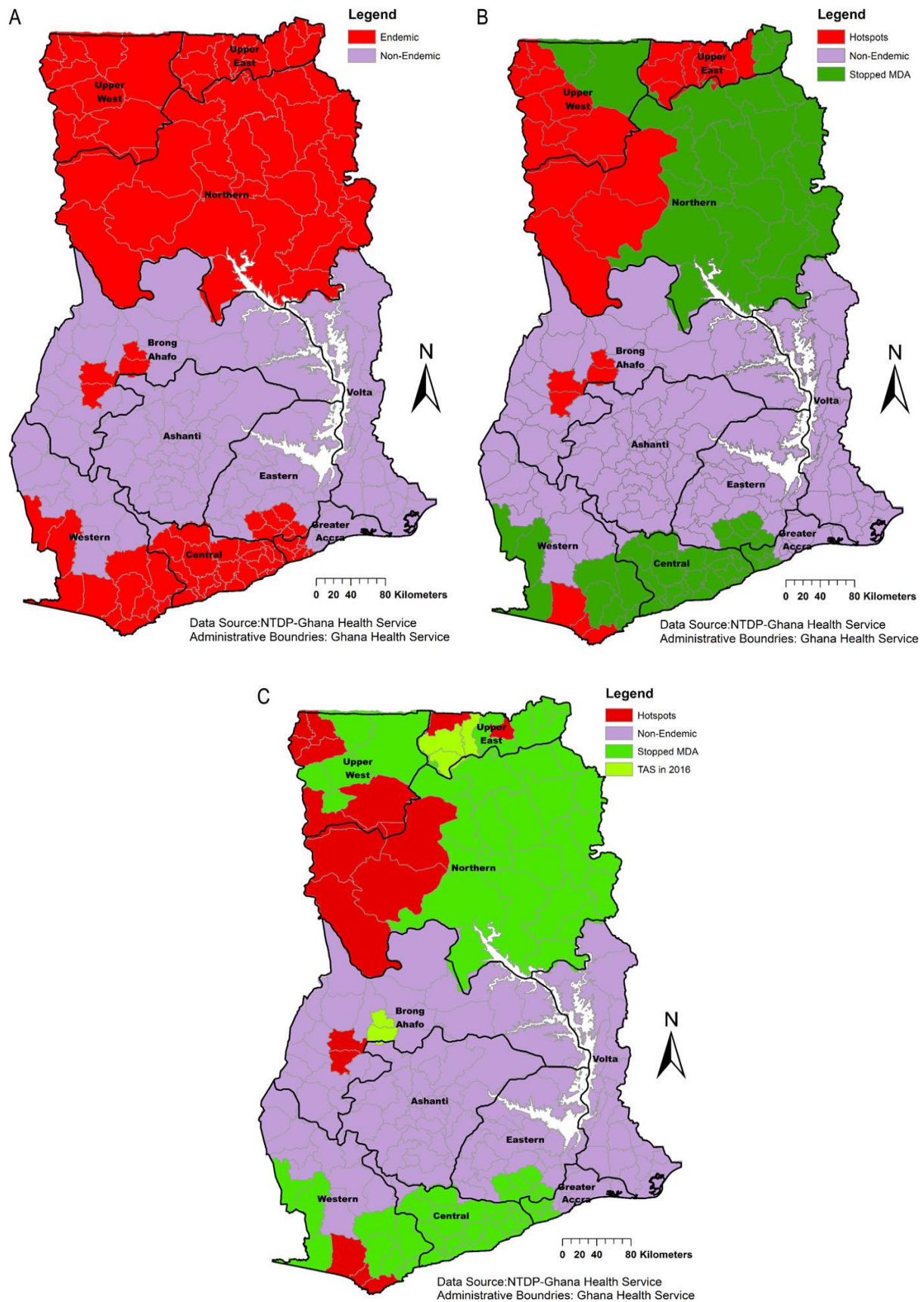


Figure 3: Geographical distribution of lymphatic filariasis in Ghana. (A) in 2000–2004; (B) 2014; (C) 2016. [11]. MDA: Mass Drugs Administration; NTDP: Neglected Tropical Diseases Programme; TAS: Transmission Assessment Survey.

As shown in Figure 4, after 2–3 years implementation of the MDA in an endemic district, a midterm evaluation was conducted to evaluate the impact of MDA intervention. After five years, a first pre-transmission assessment survey (Pre-TAS) is undertaken in sentinel sites. The sentinel sites were earlier identified in all endemic districts. Pre-TAS involves collecting night blood samples from at least 300–500 individuals aged five years old and above. Prevalence of LF is estimated by the proportion of confirmed microfilariae cases identified among the screened individuals. When prevalence is above 1%, the endemic district is declared to have failed. The Pre-TAS and MDA are continued for two or more years before another Pre-TAS is conducted. Following ten years of MDA with prevalence (more than 1%) of microfilariae, the endemic district is termed a ‘hotspot’. If the prevalence is less than 1%, TAS is conducted to assess whether to halt or continue the MDA as per the WHO recommendation [13]. Per the WHO recommendation, LF endemic countries must implement a post-MDA surveillance in districts that have stopped MDA to supplement the TAS to prevent recurrence [14].

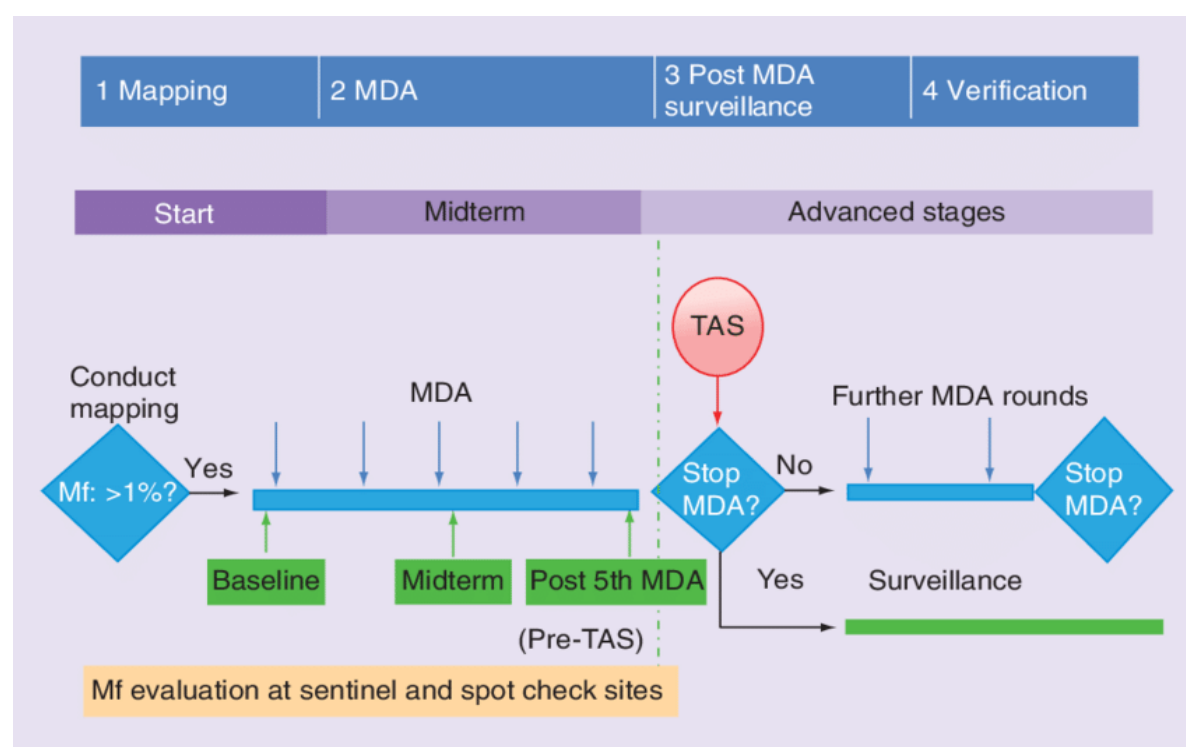


Figure 4: Program steps to interrupt the transmission of lymphatic filariasis

The WHO also recommends vector control strategies which include the use of long-lasting insecticidal nets (LLINs) and indoor residual spraying [15]. In Ghana, vector control activities are part of the National Malaria Control Program (NMCP). While the LLINs are distributed

nationwide to every household, the indoor residual spraying intervention is conducted in only selected districts across the country.

People who already have the clinical manifestation of the disease (elephantiasis and hydrocele), clinical case-management such as surgery may be carried out to alleviate the discomfort, pain, and suffering. The process of the MDA intervention in Ghana adopted WHO guidelines which ensures that the medicines are administered to all eligible individuals in endemic areas through directly observed therapy strategy [16].

1.5 Problem statement

Although MDA is the most practical and feasible evidence-based intervention recommended by WHO for the elimination of LF, after 15 years of implementation of this evidence-based intervention, the transmission of the disease persists in 22 districts in Ghana.

Bole is one of the 22 LF hotspot districts in Ghana with microfilaria prevalence of 1.9% in 2016. Some communities in the district have microfilaria prevalence as high as 5.9% after over a decade of implanting the evidence-based intervention (LF MDA). This shows that quite a significant number of people in the district are living with symptomatic and asymptomatic infections which serve as a source of infection to others. Treating all potential reservoirs of infection destroys the microfilaria parasite present in the populations which in turn reduce the causes of infection and hence, the transmission can be lowered significantly, and disease can be eliminated as a public health problem.

This persistent transmission of LF in the Bole District of Northern Ghana is due to implementation bottlenecks in executing the evidence-based intervention. These implementation gaps may have arisen due to challenges in the health system, the endemic communities, implementation process and or at the level of individual community members.

While the target for the 2020 roadmap on neglected tropical diseases (NTDs) is fast approaching, there is a need for a concerted effort and focused attention to address the implementation challenges to improve the quality and effective implementation of the WHO recommended strategy for elimination of LF transmission.

1.6 Aims and objectives of the study

1.6.1 Overall aims

To develop and test quality improvement strategies to effectively eliminate lymphatic filariasis disease as a public health problem in Ghana.

1.6.2 Research Questions

The research explored factors contributing to the persistent transmission of lymphatic filariasis, developed and implemented quality improvement strategies towards the elimination of lymphatic filariasis in Ghana in an attempt to answer the following research questions:

1. What is the level of coverage of LF MDA in Bole and Central Gonja Districts of Northern Ghana?
2. What factors contributed to the interruption of transmission of LF in Central Gonja District of Northern Ghana?
3. Why has the implementation of MDA programme failed to achieve the elimination of transmission of LF after ten years of implementation?
4. What context-specific evidence-based quality improvement strategy can best improve compliance and coverage of LF MDA in Bole District of Northern Ghana?
5. What is the process and impact of the context-specific evidence-based quality improvement strategies on LF MDA coverage and compliance in Bole District of Northern Ghana?

1.6.3 Objectives

1.6.3.1 Pre-intervention Phase

1. To assess the level of coverage of the lymphatic filariasis mass drug administration in Bole and Central Gonja Districts of Northern Ghana.
2. To investigate factors that contributed to the interruption of transmission of lymphatic filariasis in Central Gonja District in Ghana.
3. To investigate factors contributing to the persistent transmission of lymphatic filariasis in Bole District of Ghana.

1.6.3.2 Intervention Phase

4. To design and implement a quality improvement strategy based on findings of objectives 2 and 3 to improve coverage and compliance of lymphatic filariasis mass drug administration in Bole District of Ghana.

1.6.3.3 Post-intervention phase

5. To evaluate the quality improvement strategy on the level of coverage and compliance to lymphatic filariasis mass drug administration in the Bole District of Ghana.

1.7 Justification for the study

In June 2001, Ghana became one of the first West African countries to implement the MDA strategy through the Ghana Filariasis Elimination Program (GFEP). The target of the GFEP is to reduce the LF prevalence level to $< 1\%$ after four to six rounds of MDA with high-coverage ($>80\%$) [17].

However, after 15 years of implementing the MDA program in Ghana, a total of 76 districts out of the first 98 LF endemic districts achieved the target [18]. The remaining 22 districts still have prevalence above the 1% threshold [18] and are now referred to as LF “hotspot” districts. Bole District in Northern Ghana is one of these districts. The 2016 microfilariae prevalence in Bole District was 1.9% with some communities within the district having prevalence rate as high as 5.9%.

From the available literature, many issues affecting the MDA programs have been identified and need to be individually explored and addressed to improve the MDA process. Some of these issues include community availability and participation in the MDA, community/stakeholder engagement before and during the MDA [16, 17, 19] and other health system challenges such as inadequate supervision due to heavy workload [16], delays in releasing funds and logistics [16, 20], the minimal monetary incentive to drug distributors [16, 19, 21, 22] and community-specific contextual issues [16, 19, 20, 23].

Quality improvement interventions anchored on implementation research are necessary to understand how and why evidence-based interventions are not achieving the expected results. This will help in identifying performance gaps and addressing context-specific implementation challenges of existing interventions such as LF MDA.

Implementation of context-specific evidence-based quality improvement strategies using appropriate frameworks of implementation drivers will lead to more effective LF MDA. Hence, to ensure the implementation-relevance of LF MDA in communities with the persistent

transmission of LF, there is the need for better process evaluation of the MDA program using appropriate improvement tools to capture context-specific contextual implementation complexities. This will help design relevant improvement interventions for more effective MDA.

Achieving sustainable control and eliminating LF is an essential yet challenging target to pursue. It is also important to understand how specific contextual factors can impact access to and the effectiveness of the treatment, as well as how to increase and maintain targeted levels of treatment coverage and compliance need for elimination of the disease [24].

CHAPTER 2: LITERATURE REVIEW

“What gets measured gets managed”- Peter Drucker

2.01 Introduction

The purpose of this chapter is to summarise the literature on the factors contributing to the persistent transmission of lymphatic filariasis, developed and implemented quality improvement strategies towards the elimination of lymphatic filariasis in Ghana as presented in Chapter 1. This chapter begins with the historical time-line of lymphatic filariasis which outlines the events in the discovery of lymphatic filariasis from 2000BC to 1960 in section 2.12. Sections 2.13 to 2.30 summarises the literature on the epidemiology of lymphatic filariasis, the parasite, transmission and life cycle, clinical manifestation, treatment, global program for lymphatic filariasis elimination, mapping and baseline, control and treatment strategies, vector control, monitoring and evaluation, transmission assessment survey, validation and elimination of lymphatic filariasis, accelerate the elimination effort, implementation changes of the program, socio-economic consequences of lymphatic filariasis, and relevance of quality improvement. Sections 2.29 and 2.30 discussed the conceptual framework that linked the three phases of the study and definition of coverage indicators, respectively.

2.12 Historical time-lines

Table 1. Historical Timeline of Lymphatic Filariasis

Period	Lymphatic filariasis discovery events
2000 BC	Depicting of elephantiasis limbs of Pharaoh Mentuhotep II
500-200 BC	Depicting of elephantiasis limbs and hydrocele scrotal in art from Nigeria
500 AD	Artefacts from Nok civilization of West Africa and South America showing scrotal swelling.
10th and 13th centuries	Persian/medieval Accurate documentation of elephantiasis and hydrocele by European physicians
16th century	Documentation of elephantiasis in India by Jan Huyghen and van Linschoten during Goa exploration.

1849	First-time account of chyluria by William Prout
1862	Observation of microfilariae from hydroocele fluid by Jean-Nicolas Demarquay

Table 1 (Continued)

1866	Observation of microfilariae from a urine sample by Otto Henry Wucherer in Brazil
1872	Timothy Lewis observed microfilariae in both blood and urine, and associate his finding with elephantiasis for the first-time.
1876	Discovery of female adult <i>Wuchereria bancrofti</i> in an abscess on the arm of a butcher by Joseph Bancroft.
1877	The documentation of worm in mosquitoes indicating the life cycle of the parasite involving a vector by Patrick Manson.
1888	Observation of the adult male of <i>Wuchereria bancrofti</i> from a sample taken from a patient by Sibthorpe and Bourne.
1900	The discovery of microfilariae in the proboscis by George Carmichael Low confirms the lifecycle.
1905	The description of microfilariae in the Philippines by Ashburn and Craig.
1921	The adoption of the name of <i>Wuchereria bancrofti</i> from many confirmed samples from South America/China.
1927	The discovery of morphological differences in microfilariae from Indonesia by Lichtenstein and Brug.
1940	The description of <i>Filaria malayi</i> by Rao and Maplestone.
1958	The proposal of a new genus <i>Brugia</i> by Buckley while appreciating the work of Brug and re-named <i>F.malayi</i> as <i>Brugia malayi</i>
1960	Identification of a new filarial species in Portuguese Timor and it is named as <i>Microfilaria timori</i>

2.13 Epidemiology of lymphatic filariasis

Lymphatic Filariasis has been known clinically or parasitologically in 104 countries in the tropics and sub-tropics [25]. Microfilaria of *W. bancrofti* were first identified in 1866 by Wucherer. The worm was identified in a urine sample of a patient suffering from urinary schistosomiasis in Bahia, Brazil [25]. After six years, Lewis discovered *W. bancrofti* microfilaria a blood sample of an India patient [25]. The first adult *W. bancrofti* worm was identified in a Chinese patient in Brisbane, Australia, in 1876 [25]. Microfilaria of *Brugia malayi* was not labelled as distinctly different until Lichtenstein and Brug did so in 1927. Microfilaria of *Brugia timori* was not categorised until 1965 by David and Edeson [25]. Before establishing a clear difference between *W. bancrofti* and *Brugia* spp. in 1947, an estimated 189 million individuals have been infected with *W. bancrofti* worldwide [26].

Presently, due to indirect economic advancement, environmental changes, and deliberate efforts in treating and controlling the disease, the number of LF transmitting countries has been reduced to 72 [27]. Although LF is widespread, the focal distribution and intensity vary by region [28-31]. The pockets of transmission of the disease become progressively challenging to identify as prevalence declines. The disease is known to be linked with poverty [32-35], and transmission usually ensues in areas where there is a high threat for multiple infectious diseases, complicating the effect LF can have on the endemic community.

Exposure to LF is not limited to only rural or urban regions because the different mosquito species capable of transmitting filarial parasites can breed in both rural and urban environments. LF is known to be a significant contributor to disability worldwide. In 2016, LF was responsible for an estimated 1.19 million disability-adjusted life years (DALYs) [36].

The transmission of LF is influenced by different factors which include a number of infected individuals, microfilaria density in the blood of infected persons, and the density of mosquito vectors in the area. Filarial infection is known to be usually acquired in childhood. Studies have shown that babies born to microfilaremia mothers are more likely to be infected than those born to healthy women [37, 38]. Infection is, however, not acquired in the uterus because during pregnancy microfilaria worm rarely crosses the placental wall. Instead, frequent exposure of women predisposes their babies to LF infection [39, 40]. Prevalence of LF infection increases with age in endemic countries [41-44]. Studies have shown that many more people are infected than cases of clinical manifestation. This causes underestimation of clinical

diagnosis of the number of individuals affected by the disease. Short-term visitors pose minimal risk of acquiring infection since frequent exposure to the filarial parasites is a risk factor for LF infection [45, 46].

Due to the time required for the microfilaria worm to mature into adulthood, detection of infection is limited by the time needed for patent infection to appear. Antifilarial antibody responses are the earliest marker of disease and usually develop within a few months after exposure [47]. The circulating filarial antigen develops between 6 to 12 months after antibodies [47]. As the adult worms only produce microfilaria after mating, it is a lagging indicator. Microfilaria normally does not exist for 12-18 months after circulating filarial antigen [47].

Although LF is widespread, studies have shown that the characteristics of the parasites make its elimination achievable [25]. The *W. bancrofti* carries out its lifecycle in two hosts. Humans are the definitive host and mosquitos as the intermediate host. The adult worms mate within the human lymphatic system to reproduce in the human host [25]. Since the continuous transmission is reliant on both human host and mosquito vector, there is an opportunity to explore active treatment and reliable vector control approaches to interrupt the transmission of the disease. Hence International Task Force for Disease Eradication (ITFDE) in 1993 categorized LF as a disease that could be eliminated [48].

2.14 The parasite

In sub-Saharan Africa, *Wuchereria bancrofti* is the main species that cause LF in humans [49, 50]. The adult parasite is around 4-8cm long and lives in the lymphatic system. The parasite lives in a mutual symbiosis way with *Wolbachia endobacteria* which is important for larval production and sex determination. It is accountable for a key part of the inflammation resulting in symptoms [51]. An adult parasite can live for 5 to 8 years. The adult can produce millions of 100 to 150 μm long-sheathed microfilaria worms (L1 stage) into the blood and lymphatic system, at approximately 10,000 a day. The microfilaria worms can be found in the peripheral blood of an infected person, and the parasite density is at a peak from 9 pm to 4 am. Coincidentally, this is the most active feeding period of the local vector [24, 52, 53]. The infection of *W.bancrofti* is differentiated from that of other species through the nocturnal periodicity of the microfilaria [24, 54].

Filariasis

(*Wuchereria bancrofti*)

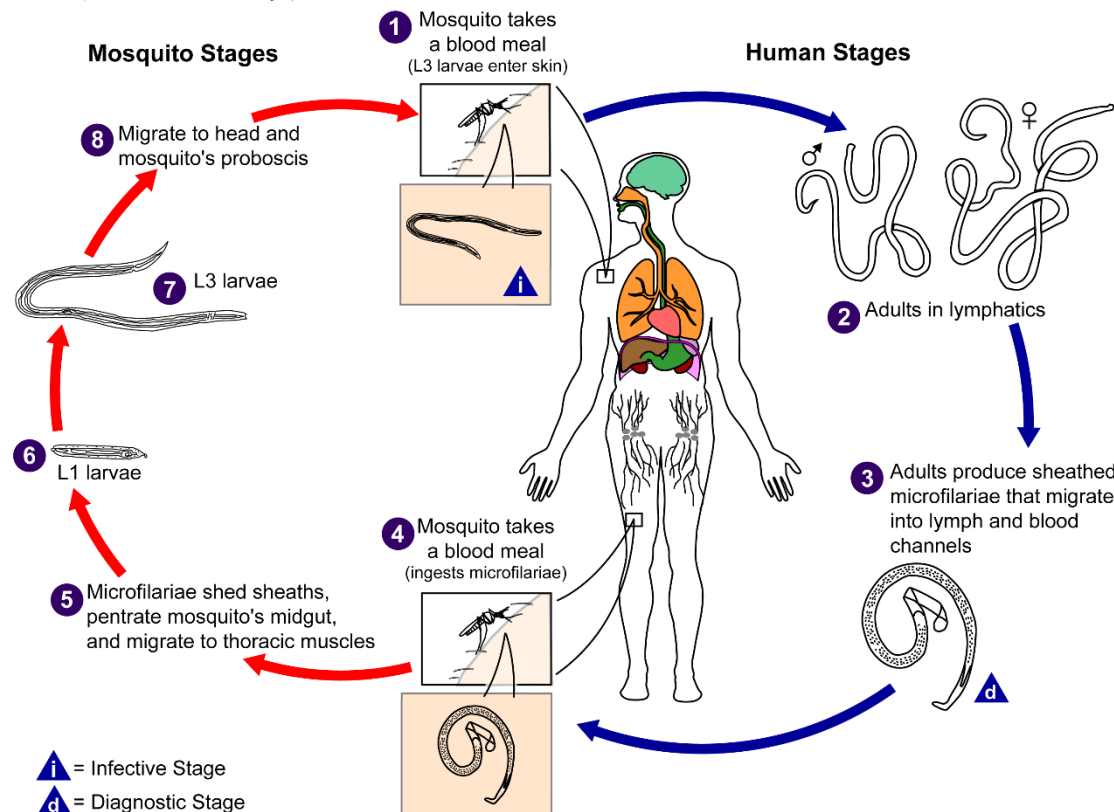


Figure 5: Life cycle of *Wuchereria bancrofti*

source: https://www.cdc.gov/parasites/lymphaticfilariasis/biology_w_bancrofti.html

2.15 Transmission and life cycle

During their lifetime, female worms bring millions of immature microfilariae into the blood after mating. Mosquitoes may engorge these microfilariae during a blood meal. The microfilaria develops in about 12 days into infective stage larvae (L3) as shown in Figure 5. The L3 are infective, and they penetrate bite wound into the human body during a blood meal of a mosquito [25].

In human, the microfilariae travel to the lymphatic and blood channels where they can then be engorged during a blood meal of a mosquito [25]. After the mosquito ingests microfilariae, they move via the midgut to the thoracic muscles. The microfilariae continue to develop into infective L3 stage. There is no reproduction of the parasite in the mosquito [25]. The complete life cycle of *W. bancrofti* is demonstrated in Figure 2. The infective L3-stage larvae move to the proboscis of the vector for onward transmission to the host during another blood meal. The

worms develop into adult (L5-stage) and the duration of development and longevity of the worm differ by species of the nematode [24, 54]. The microfilariae cannot develop into adult worms without going through the developing stages in the vector. The life span of microfilariae in the human body is estimated at 6-24 months [25]. It has been established that in the absence of re-infection, the microfilaremia can disappear from the host in five years in West Africa [24, 52].

2.16 Clinical manifestation.

Infection of filarial can result in a multiplicity of clinical manifestations. The commonest among the clinical sign of the disease is lymphedema of the limbs and hydrocele among adult males [6]. It has also been established that most infections are asymptomatic, and most infected individuals will never develop visible clinical signs [55]. Despite the nonexistence of ostensible clinical symptoms, almost all infected individuals have some amount of subclinical lymphatic destruction that can ultimately lead to permanent, chronic complications [55]. Nevertheless, this subclinical harm is potentially correctable in children if infections are treated timely [56-58].

With the use of more advanced diagnostic tools, filarial infection is known to be acquired in childhood—a period when the lymphatic system is damaged [57]. The common among these clinical manifestations in West Africa is (i) acute adenolymphangitis, (ii) lymphedema, (iii) elephantiasis and (iv) hydrocele. Other researchers also reported chyluria, lymphocele, scrotal lymphedema, tropical pulmonary eosinophilia, adenopathy, and hematuria as the manifestation of the disease but these are not of public health importance [4, 49, 59]. These signs and symptoms are known to cause physical, psychological, and social disabilities to the affected people [60, 61] and loss of livelihood and income [62]. The disease weakens the social and economic welfare of affected individuals and their societies.

2.16.1 Acute dermatolymphangioadenitis

Studies have shown that the destruction of the lymphatic vessel and lymphatic dysfunction as a result of filarial infection often predisposes affected individuals to recurrent bacterial infections [63-65]. These secondary infections cause an acute dermatolymphangioadenitis (ADLA), often known as acute attacks [6]. This is known to be a major acute complication among lymphedema and hydrocele patients. The incidence of ADLA is approximately 96 per

1000 per annum among patients older than ten years of age [32, 66]. Lymphedema patients are known to have more frequent episodes of ADLA compared to those with hydrocele [24]. These episodes play a critical part in the advancement of lymphedema [6]. Each ADLA episode can last in an average of 9 days, and more than 73% of individuals with an episode were debilitated and unable to perform their usual activities for approximately four days (Gasarasi et al. 2000). ADLA results in painful adenolymphangitis, cellulitis, the warmth of the affected part, the redness, and swelling of the limbs (Figure 6). Individuals with ADLA attack often experience fever, headache, and general malaise [67, 68]. These symptoms can be managed using analgesics and antipyretics to reduce the pain and to lessen the heat. First-line antibiotics are also recommended for the management of the symptoms [69, 70]. The occurrence of ADLA attacks can be reduced by ensuring proper hygiene that can be achieved by primary home care [9, 71-73].



Figure 6: Acute dermatolymphangioadenitis (ADLA)

2.16.2 Lymphedema

Infection in some individuals develops into lymphedema. This is due to the malfunctioning of the lymphatic system. In these persons, the adult worms cause lymphatic vessel dilatation causing lymphatic dysfunction, causing accumulation of fluid and swelling in the areas of

collection [50, 74]. The swelling is ordinarily gradual and occurs mainly in the lower limbs, as shown in Figure 7. The lymphedema develops mostly in the legs, but it can also occur in the arms and breasts [6, 75-77]. Although the swelling of the limbs usually is unilateral, there are bilateral occurrences. Swelling tends to be asymmetrical in such instances [69]. Lymphedema is also associated with thickened skin, knobs, mossy lesions, and folds in some infected individuals [78-80].

Lymphedema may also progress into elephantiasis in some individuals. This is an extreme inflammation and toughening of the skin. The process of development from filarial infection to lymphedema to elephantiasis is not well documented [69, 80]. It has also been established that people with lymphedema and elephantiasis do not usually have evidence of microfilariae in the blood [81-83]. WHO recommended lymphedema management includes; (a) simple hygiene, (b) prevention and treatment of skin lesions through, (c) exercises, (d) elevation of the affected limb(s), and (e) wearing of less tight shoes. Patients are generally trained to implement each component of the disease management package daily [24, 84, 85].

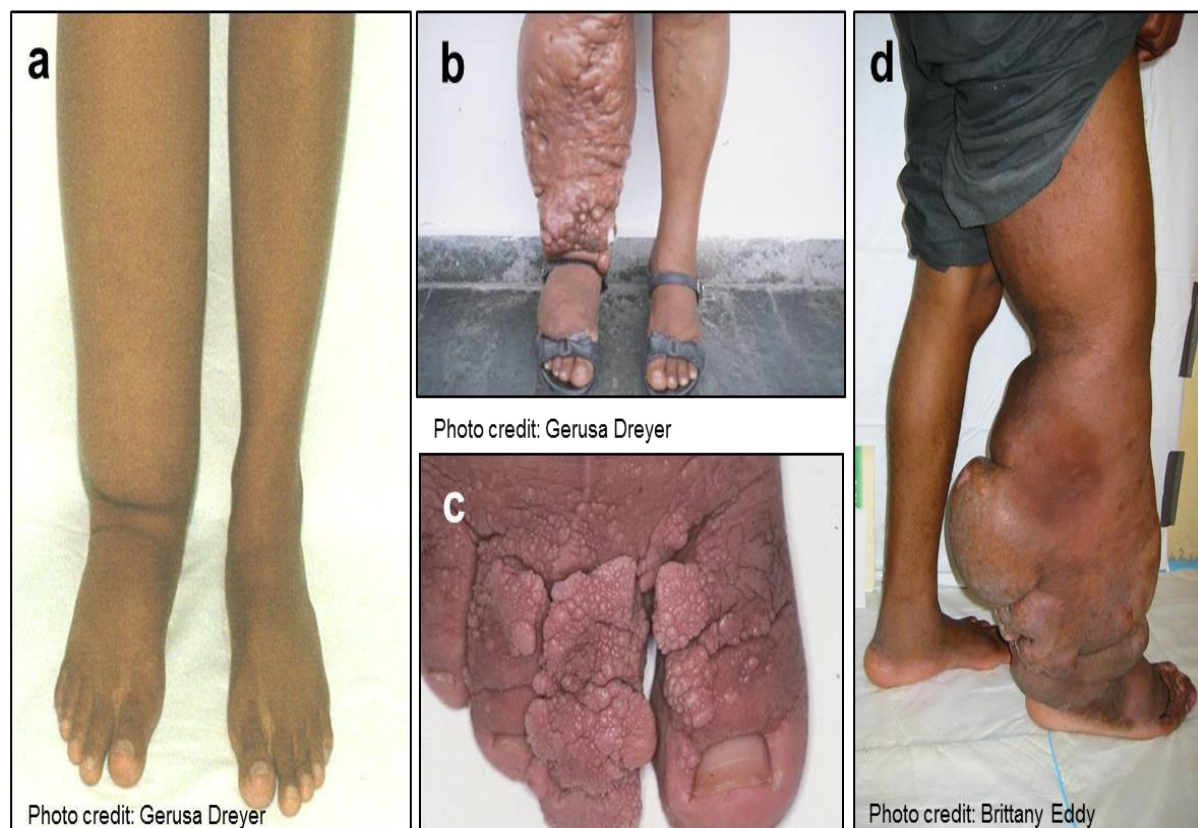


Figure 7: Lymphedema associated skin changes: (a) unilateral swelling (b) knobs (c) mossy lesions (d) folds.

2.16.3 Hydrocele

Although it is problematic to estimate the actual burden of clinical manifestation of the disease, surveys conducted in endemic areas indicated that hydrocele was the most common clinical manifestation of LF in adult males [24, 86-89].

Hydrocele (Figure 8) is as a result of the collection of fluid in the tunica vaginalis [74]. Swelling may vanish after early severe episodes [90, 91], but over a period, the scrotum enlarges and thickens due to excessive fluid around the testicles, and the hydrocele develops gradually bigger. Inception is mostly silent but may be preceded by an acute episode(s) of funiculitis [92, 93]. Research has revealed that adult males in endemic communities who have regular clinical assessments can have subclinical hydroceles [94]. A cephalocele may rarely form if lymphatic fluid from a ruptured lymphatic vessel moves into the hydrocele [74]. While treated hydroceles can have a substantial impact on the quality of life, a simple surgical operation can drain and repair hydroceles [6, 95]. People with hydrocele are ridiculed and isolated in communities; they find it challenging to find a life partner, and they have sexual dysfunction [24, 66, 96, 97].

Hydrocele can be managed through aspiration and sclerotherapy [98], eversion of the tunica vaginalis [99], and excision of the vaginalis [100]. Currently, the most conventional approach in hydrocele management in West Africa is the total tunical resection and closure of the wound without drainage [24, 101].



Photo credit: Tom Streit

Figure 8: Hydrocele

2.17 Treatment

There is currently no specific medication that can destroy the adult filarial worms. In 1947, Diethylcarbamazine (DEC) was developed as a derivative of the antiparasitic medicine, piperazine [102], as a preferred treatment. Although it is very successful in killing microfilaria [25, 103, 104], it is also known to have a limited macrofilaricidal impact [105, 106]. Though a standard 12 days treatment of DEC (6 mg/kg/day) was recommended historically, research established the efficacy of a single dose (6 mg/kg) in realizing a sustained decrease of microfilaria of up to one year [106-108]. Although DEC is comparatively well accepted, its side effects such as headache, fever, and general malaise are common [104, 109]. The rapid killing of the parasite in treated individuals sometimes results in localised reactions and pain [104].

In the early 1980s, Ivermectin, an avermectin derivative, was initially manufactured as veterinary medicine and later as a drug for human [110, 111]. A single dose of ivermectin (200 µg to 400 µg) is also effective at the speedy killing of microfilaria for a duration of up to 12 months but has nearly no effect on the adult worms [112, 113]. The drug is also used to treat common intestinal parasites and ectoparasites such as scabies and lice as an added benefit [114-117]. Both ivermectin and DEC treatments can result in the same reaction in individuals treated [109].

Albendazole, a benzimidazole, for human use, was first initiated in the early 1980s [118, 119]. A regular dose of 400 mg is known to be effective against many helminth infections, including LF [109, 120-122]. A single dose of albendazole is gradual in clearing the parasites over 6 to 12 months, unlike DEC and ivermectin [123]. The drug reactions to treatment of albendazole are comparable to the other antifilarial medicines [109]. Thus, the drugs have a limited effect on adult worms.

2.18 Global program for lymphatic filariasis elimination

At the 50th World Health Assembly (WHA) in 1997, a resolution was passed to stop the transmission of LF as a public health problem by 2020 (WHA resolution 50.29) [3]. After that, the Global Program to Eliminate Lymphatic Filariasis (GPELF) was organised in 2000 to help countries in attaining the aim of eliminating LF as a public health problem [124]. To achieve the objective of LF the elimination, the GPELF set out to treat people in endemic areas through

annual community-based mass drug administration (MDA) for a minimum of 5 years. At the beginning of the program, approximately 120 million people were infected, and an estimated 1.4 billion individuals were at danger for filarial infection [5]. Due to the MDA programs, currently, the number of individuals at risk of the disease has been reduced to 856.4 million [27]. By 2016, MDA had been carried out in 63 of 72 LF-endemic countries. Cumulatively, 6.7 billion individuals have been treated since the inauguration of GPELF [27].

The global LF elimination strategy aims to interrupt transmission through MDA and to ease suffering caused by the disease through morbidity management and disability prevention (MMDP). There are WHO established guidelines to accomplish these aims [13, 125], which is supposed to be followed by all LF elimination programs through the fundamental programmatic steps.

2.19 Mapping and baseline

To achieve the first goal of interrupting transmission of the disease, the programs conduct an initial mapping to ascertain the necessity of the intervention. There was a predisposition towards using MDA strategy to interrupt the transmission of the disease. Treatment was sometimes started based on historical confirmation and the incidence of clinical manifestation of the disease (i.e. lymphedema and hydrocele). District-Wide treatment decisions were usually based on evidence of parasitological assessments. This evidence is grounded on testing a sample of 50-100 people. The choice of MDA is activated when more than 1% of the sampled participants tested positive for microfilaria or CFA [13]. More thorough population-based assessments are recommended for mapping presently [126]. After mapping, before initiating MDA, some programs conduct baseline assessments of microfilaria or CFA. Though these surveys involve testing 300-500 individuals, they are usually based on testing a convenience sample of the population. They may not be an accurate picture of the entire area where MDA intervention is implemented.

2.20 Control and treatment strategies

The control of LF in Africa began in the 1940s with two major strategies: the use of DEC and mosquito control. The recommended MDA intervention strategy depends on the local context. WHO recommended co-administration of either DEC (6 mg/kg) and albendazole (400 mg) (DA) or ivermectin (200 µg/kg) plus albendazole (400 mg) (IA) at the start of the GPELF [127]. The double therapy was identified to be effective and safe at killing microfilaria compared to the monotherapy with any of the three medicines [109, 123]. Hence, the DA became the

acceptable combination in areas where LF and onchocerciasis were not co-endemic. Therefore, non-African countries preferred the DA due to the risk of severe drug reaction induced by DEC when administered to people infected with *Onchocerca volvulus* [128, 129]. The recommended medication combination in areas of co-endemicity was IA. Hence, IA is the default MDA regimen in most African countries. Due to the presence of *L. loa* in addition to *O. volvulus* and *W. bancrofti* in Central and West Africa, there is significant risk in treating loiasis with either DEC or ivermectin [130, 131]. Therefore, a monotherapy with albendazole is endorsed for LF MDA [125, 132]. The rapid increase in the scale and implementation of MDA was made possible by the donations of albendazole from GlaxoSmithKline and ivermectin from Merck and Company [124]. An additional donor of DEC, Eisai Co., Ltd., has contributed to the effort of supporting the global need for MDA drugs [133].

Because of the limited effect of these drugs on the adult filarial parasite, at least five annual rounds of double combination MDA are rounds recommended [125]. The effectiveness of MDA is subject to epidemiological coverage; an effective MDA round where more than 65% of the total population at risk taking the tablets [125]. Pregnant women and people who are seriously sick do not partake in the MDA. Due to logistical challenges in weighing people during MDA, age or height are often used as proxies to determine the dose of the medicine to administer. Children under two years of age are not given DEC, and ivermectin is not administered to people under 9 cm.

A safety and efficacy study showed that a single dose of a tripartite drug regime of ivermectin, DEC, and albendazole (IDA) is extremely effective in clearing microfilaria in infected individuals [134]. As a result, in November 2017, WHO recommended IDA for programmatic use [125] in areas eligible for DA MDA that have implemented fewer than four rounds MDA or have evidence of persistent transmission even after five rounds of MDA.

2.21 Vector control

It has been estimated that more than half of the LF burden in the world is transmitted by *Culex quinquefasciatus* and other human-biting mosquitoes of the *Culex pipiens* complex [135]. In the African region and Papuan sub-region, *W. bancrofti* is mostly transmitted by Anopheles mosquitoes (which is also the vector for malaria disease) in rural areas in 40 countries [136].

It has been shown that the incidence of filarial infection dependent on high rates of transmission to cause the occurrence of new infections and continued endemicity. It has been estimated that tens of thousands of bites by infective vector mosquitoes (between 2700 to 100,000) occur before a new case of filarial infection is established [135]. It has also been estimated that about 15,500 infective bites of *Culex quinquefasciatus* before the transmission of *W. bancrofti* can occur leading to obvious microfilaraemia [135].

Scientists have shown anxieties concerning the effectiveness of MDA strategy alone to interrupt transmission of LF without vector control strategies [135]. This is particularly relevant because vector control was once encouraged as the primary intervention to eliminate filariasis disease (66). The approach was practicable in some epidemiological settings, as showed by the elimination of Anopheles-transmitted filariasis from the Solomon Islands and Togo [135] by indoor spraying with *dichloro-diphenyltrichloroethane* (DDT).

While the GPELF depends mainly on MDA to stop transmission of LF, a combination of vector control programs and environmental sanitation activities are recommended but national LF elimination programs concentrated largely on MDA over the years [137].

In countries where LF and malaria are co-endemic and transmitted by the same vector, the vector control strategies mostly use residual indoor spraying and nationwide distribution of long-lasting insecticide-treated netting materials [137]. This integrated vector control program is believed to be an essential complementary component for the GPELF strategy to achieve the global elimination of LF [137].

In many areas, mosquito prevention and control can be attained through sustainable environmental management [138], improved sanitation, and biological control. Additional measures include screening houses and siting them away from mosquito genic habitats. Efforts were also made to minimize exposure of individuals to mosquito bites through the use of ITNs [139], covering the body at peak mosquito biting-periods of diurnally active mosquitoes, appropriate utilisation of effective mosquito repellents [140].

Mosquito larval control is expensive and difficult because of the wide range of different breeding environments which are too many to identify and deal with separately; hence, MDA offers the best prospect of elimination of LF.

2.22 Monitoring and evaluation

Key to guaranteeing high MDA treatment coverage, evaluations are needed to monitor the impact of MDA effectively. Because of resource constraints, large-scale surveys are not done regularly. Instead, treatment impact is regularly monitored through sentinel and spot-check sites during the MDA implementation period to provide data on trends of infection [13, 125]. Sentinel sites are identified before the first round of MDA treatment and are recommended to remain the same during the program implementation. Selection of sentinel sites is based on known or suspected level of endemicity. Preferably, sites have stable populations of not less than 500 individuals so that at least 300 people with age $\geq$ five years can be tested for microfilaria or CFA during each assessment. Although more sites are encouraged, due to resource constraints, a minimum of one sentinel site per 1 million population is a recommendation. Spot-check sites have similar features as sentinel sites other than the random selection of site locations. Spot-check sites are selected to control for the possible limitations introduced by repetitive surveys at sentinel sites.

Preferably, spot-check and sentinel site assessments should be conducted as regularly as possible. To evaluate the performance of the program and to decide if programmatic activities need to be altered in any way, a mid-term assessment is conducted after the third round of MDA. Currently, a pre-transmission assessment survey (pre-TAS) is needed as part of the benchmarks to decide eligibility for stopping MDA. The pre-TAS assessment is done after the fifth round of effective MDA. To qualify for the TAS, the prevalence of CFA in *W. bancrofti* areas or antifilarial antibody in *Brugia* spp. areas must be $<2\%$ or microfilaria prevalence $<1\%$ in sentinel and spot-check sites [13].

2.23 Transmission assessment survey

National LF elimination programs must be able to establish whether transmission of the disease is no longer sustainable even in the absence of treatment after multiple rounds of MDA based on WHO protocol [13]. It is estimated that after at least five rounds of MDA with coverage of greater than 65% and microfilaria prevalence less than 1% in spot-checks and sentinel sites and implementation unit is eligible for TAS [24, 53]. The verdict to stop MDA is based on a rigorous statistical survey designed by WHO to guide program managers determine whether the level of infection in the endemic area has been dropped below the threshold at which transmission is sustainable in the absence of MDA [13]. The recommended limit below which

transmission will no longer be self-sustaining is less than 2% CFA prevalence in areas where *Anopheles* spp., *Culex* spp. and *Mansonia* spp. are the leading vectors and less than 1% CFA prevalence in areas where *Aedes* spp. is the major transmission vector. Where there are no antigen detection tools appropriate for *Brugia* spp., the same thresholds are used for antifilarial antibody prevalence in *Brugia* areas [13].

The target people for TAS are individuals aged 6-7 years old because infection in this group is an indication of a relatively new infection. If the overall number of positive children identified in an evaluation unit (EU) is lower than the cutoff point, the EU “passes”, and MDA can be stopped. If the number of positives is above the cutoff point, then the EU “fails” and MDA is continued. The TAS sample size and critical cutoff points are powered so that the EU has a minimum of 75% chance of qualifying if the true infection prevalence is half the threshold, and not more than a 5% chance of eligibility if the actual prevalence is higher or equal to the limit [13]. After stopping MDA, TAS is conducted twice at 2-3 years’ period to settle that transmission of the disease is still below the critical threshold.

2.24 Validation of elimination of lymphatic filariasis

Endemic countries have to successfully meet all the requirements of the TAS before MMDP activities can start. Where necessary, the country has to meet the standards recommended by WHO for authentication of LF elimination. The WHO officially certified a standardised process for formally recognising the elimination of LF as a public health problem in 2015 [141]. As part of this procedure, national LF programs compile all information into a report for assessment. Currently, 11 countries (Cambodia, Cook Islands, Egypt, Maldives, Marshall Islands, Niue, Sri Lanka, Thailand, Togo, Tonga, and Vanuatu) have completed the current validation process is ongoing. WHO has recognised them for their successes in interrupting transmission of the disease [142-144]. Currently, there is no standardized protocol for post-validation surveillance activities. A diagram of the major stages of an LF elimination program is demonstrated in Figure 9.

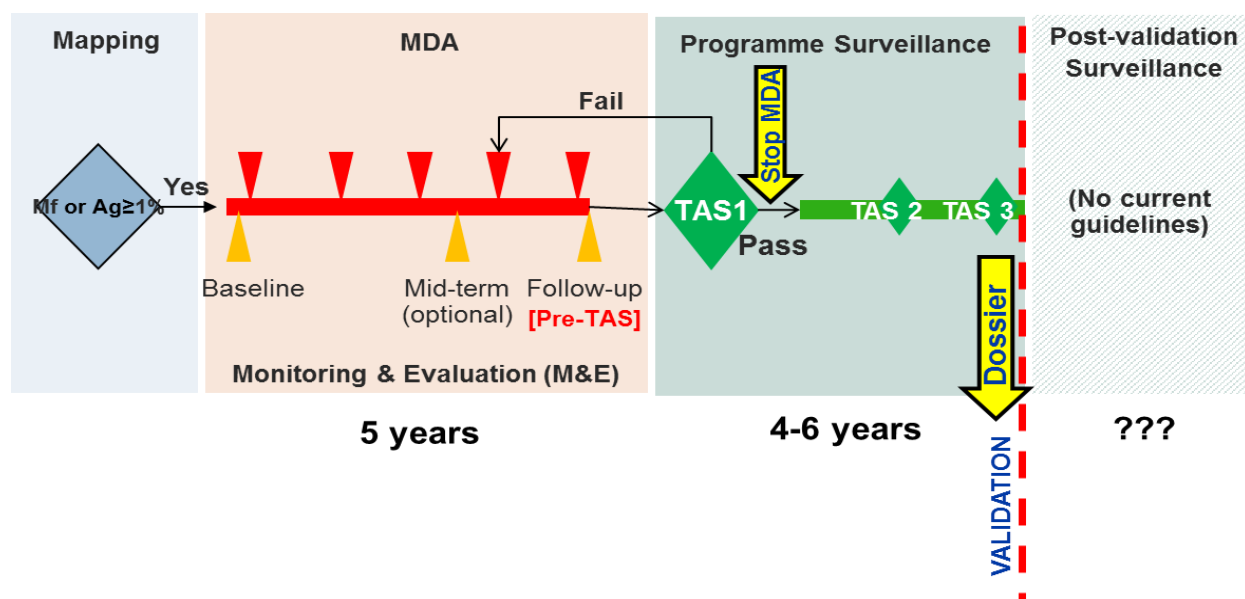


Figure 9: The life cycle of the LF elimination program

2.25 Accelerate the elimination effort

By 2016, nearly 1,100 TAS have been carried out worldwide with a total achievement rate of >90% [27]. Thus, a total of 500 million no longer need MDA. Although there has been substantial improvement since the commencement of GPELF, the target of elimination of LF as a public health problem by 2020 may not be achieved since an estimated 856 million individuals in 52 countries are still living in LF endemic areas that need MDA intervention [27]. Of these 52 countries where MDAs are required, 22 (42%) have not yet had 100% MDA geographic scaled-up [27]. Furthermore, after completing the recommended number of MDA rounds in many countries, the infection levels are still above the established thresholds for stopping MDA [145, 146]. These areas with the persistent transmission of LF after many rounds of MDA are known as hotspots [24]. At this crucial stage of the GPELF, it is essential to identify strategies to fast-track progress toward global elimination and to safeguard the improvements made to date.

2.26 Implementation challenges of the program

The LF elimination program, just like any public health intervention, has many problems [24]. Studies reported varying MDA coverage and compliance rates due to these bottlenecks [147-150]. A decrease in compliance rates after several rounds of MDA have been reported in a study [151]. As shown in Figure 10, challenges facing LF elimination programs relates to the MDA delivery system and characteristics of the endemic population. Other studies have shown that factors contributing to the MDA non-compliance include ignorance about the disease in

the study population, fear of adverse effects from treatment, mistrust of government programs and refusal to receive the medication [148, 150, 152].

Inadequate supervision of Community Drug Distributors (CDDs) by officers from the health service, insufficient training and insufficient motivation for the CDDs to continue providing voluntary services to endemic communities resulted in disparities between coverage rates reported by CDDs for MDA programs and other surveys [19, 153, 154].

Supervisors are expected to monitor the MDA process to ensure the CDDs are adhering to the protocols to achieve fidelity and to help resolve any challenges [21]. Still, due to the workload of supervisors and a minimal level of motivation, these supervisions are not done [16]. This means that quality control to ensure the fidelity of the MDA process may not take place in some areas. Funding issues have been identified to be a significant challenge of the MDA program. Delays in releasing funds by donors affect the MDA implementation schedule. And the program sometimes coincides with other public health programs hence some districts decide to complete other activities before executing the MDA since the other programs may give better motivations than the LF program [16, 20].

Difficulties with timely availability of medicines and publicity supplies were identified as explanations for low coverage in some endemic areas [150, 153, 155, 156]. Unsuitable MDA timing was sometimes cited for hurting MDA coverage [153, 157]. In other areas, inadequate time and personnel negatively affected coverage and compliance of LF MDA [153, 156, 158, 159].

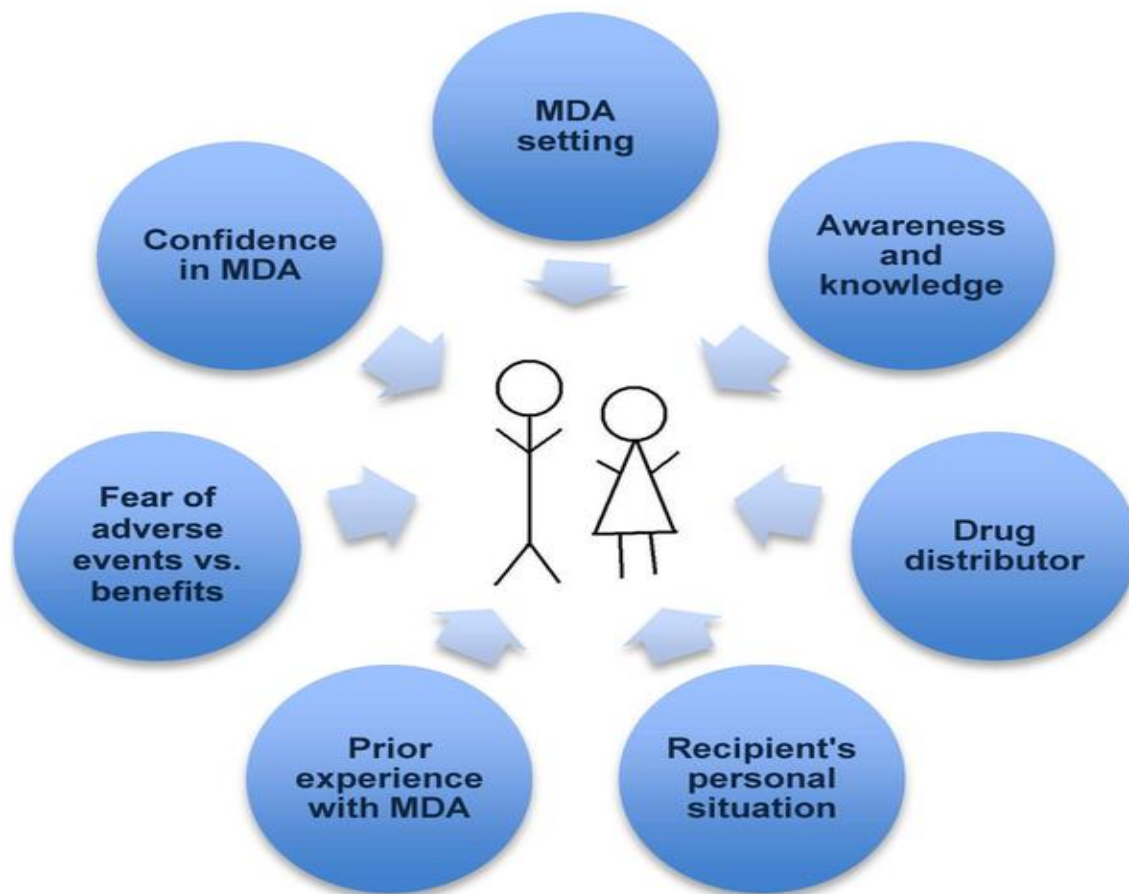


Figure 10: Factors affecting individual adherence to mass drug administration

Physical accessibility to some of the LF endemic communities by CDDs becomes difficult due to long distances between communities, and inaccessible roads during rainy seasons when rivers overflow their banks. Accessibility is also reported to be affected by the availability of vehicles and motorcycles to CDDs and supervisors at the community, sub-district and district levels [16]. At times when cars or motorbikes are available, there are no funds to fuel them [16]. This can also result in inadequate supervision and low treatment coverage of the MDAs.

Unavailability of eligible recipients of the medication during MDA because of the short or long-term relocation of community members poses challenges to coverage in some areas [155, 159, 160]. However, unavailability of eligible recipients during MDAs was also frequently reported as a significant cause for noncompliance by persons who were not migrants [155, 161, 162]. The time allocated for MDA activities was sometimes not sufficient to reach all eligible individuals in endemic areas at the time of drug distribution [158, 163, 164].

The difficulty of CDDs reaching community members within a given period due to economic activities in those endemic communities results in individuals and households not being reached during the day [16, 19]. The ideal times for MDA in the endemic communities are early mornings and evenings, which may not give sufficient time to reach the target population in some endemic areas. MDA at night may not be possible in some communities because they are not connected to the national electricity grid.

The interface between MDA programs and their target populations are the CDDs. Therefore, the characteristics of these frontline staffs were cited as crucial determinants to the success of the MDA [163, 165]. The low motivation for CDDs was cited as the reason for low compliance in the endemic area [166-168].

Giving a minimal monetary incentive to the CDDs and supervisors by LF MDA program compared to other public health programs is also reported to be a cause of the low levels of motivation for CDDs and supervisors. As a result, these frontline workers feel reluctant to participate in the LF MDA and in some cases opting out of the program which results in the fewer number of CDDs distributing the drugs making it difficult to reach the target population within the required time [16, 19, 21, 22]. Overloaded local health staff considered the MDA program to be an undesirable extra responsibility [163].

Literature has indicated that the level of adherence to the MDA process is a crucial determinant of the success of the MDA program [147, 169, 170]. Factors such as systematic refusal to ingest the drug and non-adherence to the MDA protocols present a severe programmatic obstacle for the success of the LF program [17, 169, 171-173]. Nonadherence to the DOT strategy where drugs were sometimes left at the house for eligible individuals [161] or left for family members to distribute without an adequate explanation [153, 155]. The quantity and size of pills to be swallowed were identified as reasons for refusal to participate in MDAs [156, 162, 163, 174, 175].

Available evidence shows that knowledge affecting MDAs can be categorised into the transmission of LF, the knowledge that MDA protects against LF, knowledge of lymphedema management procedures and knowing that LF is transmitted by mosquitoes [147, 167, 168, 174, 176, 177].

Inadequate knowledge about LF disease and the MDA among the endemic population and distrust for the government was found to be a significant challenge affecting the ingestion of the LF drug [171, 178]. Other studies have shown that factors that contribute to MDA noncompliance include the poor knowledge about the disease and the MDA among the endemic population, fear of adverse effects from treatment and distrust of government programs [148, 150, 152]. Lack of involvement of community organisations and other preexisting stakeholders in MDA process was reported to have a negative effect on MDA intervention [161, 179, 180].

2.27 Socio-economic Impact of Lymphatic Filariasis

Lymphatic filariasis is not a deadly disease, but it is known to bring significant social and economic difficulties to affected persons, their families, communities and the health system [32, 34, 181]. The treatment and management of lymphoedema and ADL episodes of secondary bacterial infection are expensive as the infection is life-long conditions. Hence, negatively affecting social activities and productivity. Surgical operation on hydrocele patients and management of other clinical manifestations of the disease are a high burden on health care systems in endemic countries [182]. It has been established that chronic physical disability; as a result, LF disease may have debilitating social and psychological effects on affected individuals. Patients with elephantiasis or hydrocele are often shunned and become isolated within their communities. They are ridiculed and suffer social stigma [180].

Hydrocele in older men can cause sexual and social dysfunction. Lymphoedema of the limbs or genitals can also result in the ostracism of women [68, 183]. The consequences of the disease can lead to dependency, as patients may be unable to engage effectively in economic activities, marry and participate in social activities. These situations support the isolation and result in a vicious circle of poverty [184]. Lymphatic Filariasis patients suffer intermittent pain with chronic manifestations as the main problem. When in pain, patients become incapacitated and liability on their households and family members. Finally, the devastating events of LF make the disease a significant source of psychosocial and economic burden to individual patients, and their immediate families.

2.28 Relevance of quality improvement

Due to the mixed results and challenges of implantation of evidence-based interventions (EBIs) such as the LF MDA from a different context, quality improvement has become critical in

ensuring implementation of EBIs to achieve the goal of better population health and Sustainable Development Goals (SDGs) [185, 186]. Quality improvement (QI) of EBIs is necessary for low and middle-income economies (where the implementation challenges are most significant) such as Ghana to identify implementation bottlenecks and performance gaps of existing EBIs. This is necessary to address implementation challenges at the local community, district, regional and national levels taking into account context-specific implementation complexities at each level [187]. The fundamental of QI in an ongoing EBIs is to understand not only what is and is not working, but how and why implementation of an intervention is going right or wrong and testing appropriate QI strategies to improve it [188]. An adequately designed QI with its all-important focus on context can help implementers foresee and anticipate implementation challenges [188].

From the available literature, methods used by these improvement interventions include process improvements (involving incremental, cyclically effected changes relevant to the local context, to system-level interventions and policies) to improve and sustain the quality of EBIs [187]. Regardless of the focus of improvement efforts and methods used, the impact and spread of QI has often fallen short [187]. Causes of these lost opportunities include decision-making process about QI, the methodology for assessing the effectiveness of the intervention, type of data generated and how the evidence on both the EBI and the QI is communicated to drive scale-up and knowledge translation [189, 190].

Essential aspects of designing a QI intervention which helps to sustain effectiveness include an initial assessment of the existing EBI to recognize and accept the current systems. Appreciating the implementation procedures as a sequence of separate but nonlinear stages (with the continuous, interactive process, involving “agents” working within a context to facilitate improvement), recognize implementation outcomes as fundamentals for treatment outcomes, and analyze implementation difficulties through appropriate frameworks of implementation drivers. In more multifaceted settings, how EBIs are executed may be necessary than their specific content, and how EBIs align and adapt to local context may determine their continual usefulness [187]. In ensure the implementation-relevance of LF MDA, there is a need for better process evaluation of the program. But not to depend on experimental approaches that do not incorporate specific contextual implementation complexities.

Experts in the field of implementation science have emphasized the importance of a robust, theory-based method to choose improvement strategies that connect the implementation gaps of the EBI [191]. This study employed context-specific evidence-based quality improvement (CEQI) strategies to improve the implementation of the LF MDA program. The current study used evidence-based intervention mapping (IM) approach to select a QI intervention as described in the methods.

The QI strategies used in this study are based on the concept of the GPELF [169] and the aim of the Ghana Filariasis Elimination Program [17]. The GPELF is a combination of public and private partnership for health system improvement. The choice of the QI approaches in this study was also based on evidence from other LF MDA studies such as improving service delivery of the MDA, active stakeholder engagement, and improving compliance in endemic areas [191] as described in the methods section.

2.29 Conceptual framework

This study was based on a modified conceptual model suggested by Ickovics and Meilser (1997), which described a multi-variable framework for HIV/AIDS care and medication adherence. They proposed a framework whereby factors affecting adherence in AIDS clinical trials can be classified as characteristics of the: (i) individual, (ii) treatment regimen, (iii) patient-provider relationship, (iv) clinical setting, and (v) disease [192].

The framework (Figure 11) is also based on a conceptual model of issues affecting MDA compliance by Njomo, 2008 and Plan-Do-Study-Act (PDSA) model for quality improvement in evidence-based interventions. Factors that influence treatment adherence are patient-related; provider-related; treatment-based. In this study, factors affecting the implementation of LF MDA were explored at community, health system, and community drug distributor and individual community member level at the pre-intervention stage.

A quality improvement strategy was designed, implemented and evaluated at the intervention and post-intervention stage using a single PDSA cycle. This framework was used to guide and assess perceived barriers and facilitators of implementation of lymphatic filariasis MDA and to design and test a context-specific evidence-based intervention to improve the implementation of the MDA in Bole District of Northern Ghana.

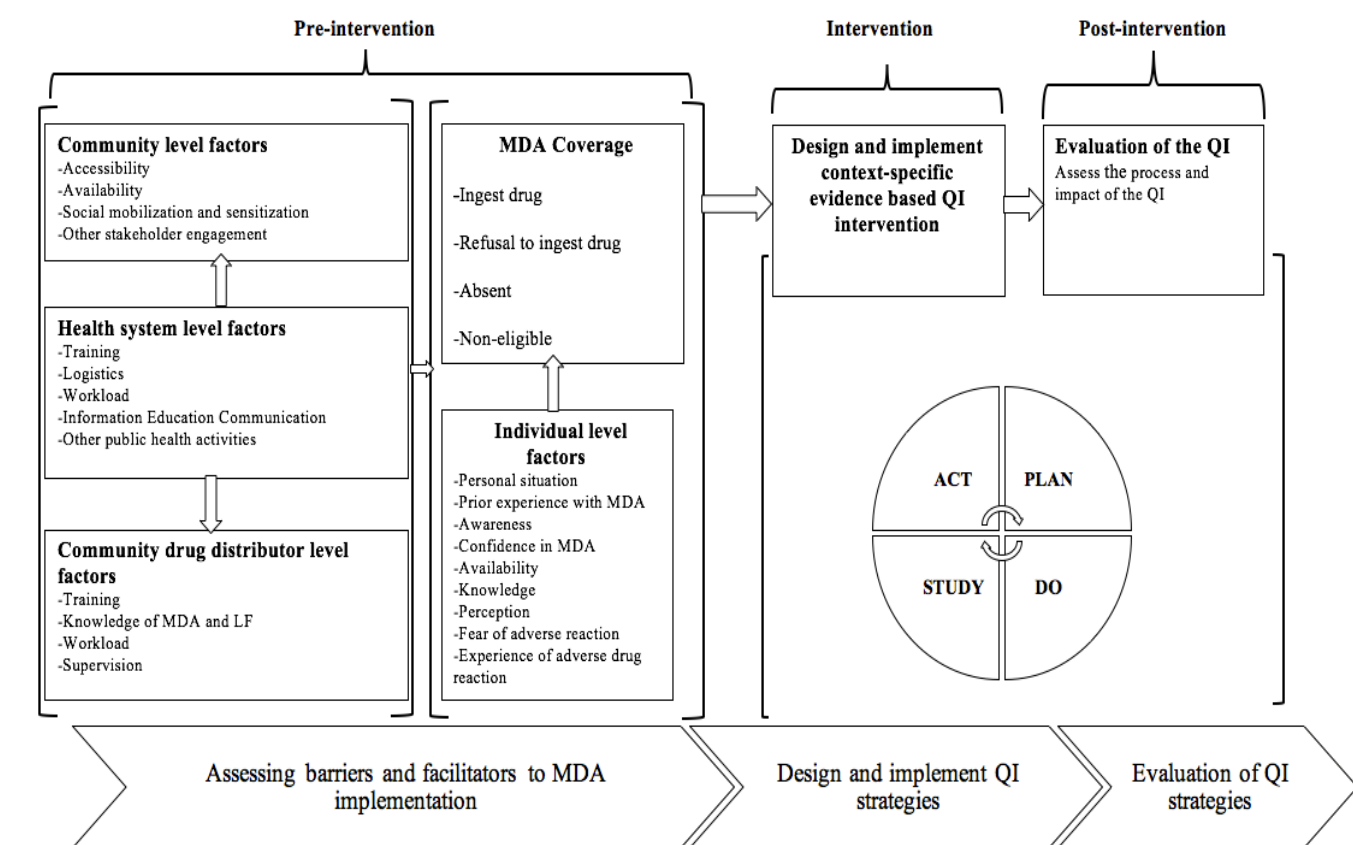


Figure 11: Conceptual framework showing the process of designing and implementing quality improvement intervention towards the improvement of lymphatic filariasis mass drug administration.

The PDSA cycle in the framework, as shown in Figure 11, is made up of the four-step process to test the evidence-based quality improvement strategies. These four steps of the PDSA cycle includes: (plan) the change to be tested or implemented, (do) conduct the test of change with thorough measurement, (study) the data before and after the implementing the change idea and reflect on the learnings obtained, and (act) plan the next test. PDSA cycles are used to test an idea or theory through a pilot, evaluating the impact, and making interventions based on these small tests.

The purpose of the PDSA method is to learn as fast as possible. And whether the quality improvement strategies work in the setting of the Bole District and to make changes appropriately to increase the chances of delivering and sustaining the desired improvement to elimination LF as a public health problem in Bole District of Northern Ghana as detailed in Figure 13 in the next chapter.

2.30 Definition of coverage indicators

For this study, coverage refers to the percentage of targeted persons who receive MDA tablets, and compliance denotes the percentage of a targeted population who ingested the medications. Unless otherwise stated, MDA refers to mass drug administration at the community level; and low or inadequate compliance is described as <65%. Table 2 presents details of terminologies used in this study.

Table 2. Definitions of coverage indicators for mass drug administration programs used in the study.

Term	Definition	Researcher's Remark
At-risk population	"Total population in the endemic implementation unit(s)." [13]	This number includes the population eligible and ineligible for MDA.
Directly observed treatment (DOT)	The only method to assure an individual swallowed a drug or a combination of drugs. [13, 193]	In situations where the drug is not administered by the DOT strategy, only self-reported compliance or surveyed coverage can be reported.
Drug coverage	"Proportion of individuals, expressed as a percentage, in a targeted population who swallowed a drug, or a combination of drugs." [13]	This study uses the GPELF definition for drug coverage as the definition of drug compliance.
Epidemiological drug coverage (program coverage)	"Proportion of individuals in the implementation unit who have ingested the MDA drugs of the total population in the implementation unit." [13]	Other authors use the GPELF definition for epidemiological drug coverage as epidemiological drug compliance [13, 194, 195]. This describes the proportion of individuals (%) in an at-risk population who swallowed a drug or a combination of drugs and is used for epidemiological modelling.
Geographical coverage	"Proportion of administrative units that are implementing MDA of all those that require MDA." [13]	The definition describes drug distribution independently from drug ingestion.
Ineligible population	"Group of individuals not qualified or entitled to receive anti-helminthic treatment in preventive chemotherapy interventions. Ineligibility is usually determined by exclusion criteria based on drug safety." [13]	Members of the ineligible population may be infected, and their parasites may be a reservoir for continued transmission.

Table 2 (Continued)

Term	Definition	Researcher's Remark
Ineligible population	“Group of individuals not qualified or entitled to receive anti-helminthic treatment in preventive chemotherapy interventions. Ineligibility is usually determined by exclusion criteria based on drug safety.” [13]	Members of the ineligible population may be infected, and their parasites may be a reservoir for continued transmission.
National coverage	“Proportion of individuals in an endemic country requiring MDA for LF who have ingested the appropriate drugs.” [13]	This is a theoretical definition because programs normally report doses delivered rather than doses ingested unfortunately. Again, programs with high national coverage may have low epidemiological coverage if ineligible populations are large.
Reported coverage	“Intervention coverage calculated from data reported by all drug distributors.” [13]	This number is often much larger than drug coverage or surveyed coverage.
Surveyed coverage	“A method used to verify reported coverage through the use of population-based cluster survey methods. It is calculated as the total number of individuals identified by the household survey as having ingested the drugs of the total number of individuals residing in all the surveyed households about whom information on drug ingestion could be elicited.” [13]	Coverage surveys depend on self-reporting by individuals in the endemic community. Results may be affected by social desirability and or recall biases.
The target population for MDA	The population in an implementation unit that is targeted for treatment. This includes those who are eligible to receive drugs based on safety criteria. [13]	The target population plus the ineligible population form the total at-risk population in an endemic area.

CHAPTER 3: METHODS

“No army can withstand the strength of an idea whose time has come”- Victor Hugo

3.1 Introduction

The PhD used a mixed-methods approach to explore factors contributing to the persistent transmission of lymphatic filariasis. It developed and implemented quality improvement strategies towards the elimination of lymphatic filariasis. The mixed-methods approach provides the opportunity to build on and complement the strengths of the community survey, the larger sample size of quantitative program data and the rich narratives of qualitative methods in exploring implementation complexities of the lymphatic filariasis elimination program.

This chapter describes the methodological approach for the three inter-linked phases of the PhD study. Sections 3.2 to 3.9 describes the study setting, study design, the study population, sample size and sampling procedure and the ethical considerations of the study. Section 3.10 describes the limitations of the research and how these were addressed.

3.2 Study setting

This study was conducted in the Bole and Central Gonja Districts of Ghana, as shown in Figure 12. The criteria for selection of the districts are the LF prevalence rate and interruption of LF transmission. These two districts were the study sites for the pre-intervention phase of the study. The Bole District has an average LF prevalence rate of 1.9%, but some communities in the district have a prevalence rate as high as 5.9%.

The Bole District is one of the twenty (20) districts in the Northern Region of Ghana with a total land size area of 6,169.2 square kilometres, and the district capital is Bole. Bole District lies between latitude 8°10.5'N and 09°N and longitude 1.5°E' and 2.45°W and is located on the extreme western part of the northern region of Ghana [196]. The district is bordered to the north by Sawla-Tuna-Kalba District, to the west by the Republic of Ivory Coast. The Black Volta is the boundary between the two West African neighbouring countries. Bole is bordered on the east by West Gonja District and on the south-west by the Wenchi and Kintampo Municipals of Brong-Ahafo Regions of Ghana. The district stretches from Bodi in the north to Bamboi in the south [196].

According to the 2010 Ghana Population and Housing Census (PHC), the population of Bole District is 61,593 representing 2.5 per cent of the region's total population living in 10,160 households. The dominant tribe is Gonja, and other tribal groups are Vagla, Brifor, Safalba, Mo, Dagaaba, Grunshie and the Pantras. The average household size in the district is 4.5 persons per household. Males represent 51.4 per cent of the population, and 79 per cent of the population lives in rural areas. The literacy rate is 41.8 per cent and the majority, (59%) of the populace are employed in agricultural sectors of the economy [196].

A district hospital is in Bole, and the health services are divided into four sub-districts (Bole, Tinga, Jama and Bamboi), each sub-district being served by a health facility. Also, the Catholic Church runs a primary health care programme in Bole township. There are six operational CHIPS compounds located in Mankuma, Kakiase, Gbemfu, Maluwe, Banda Nkwanta and Chibrinyoai [196].

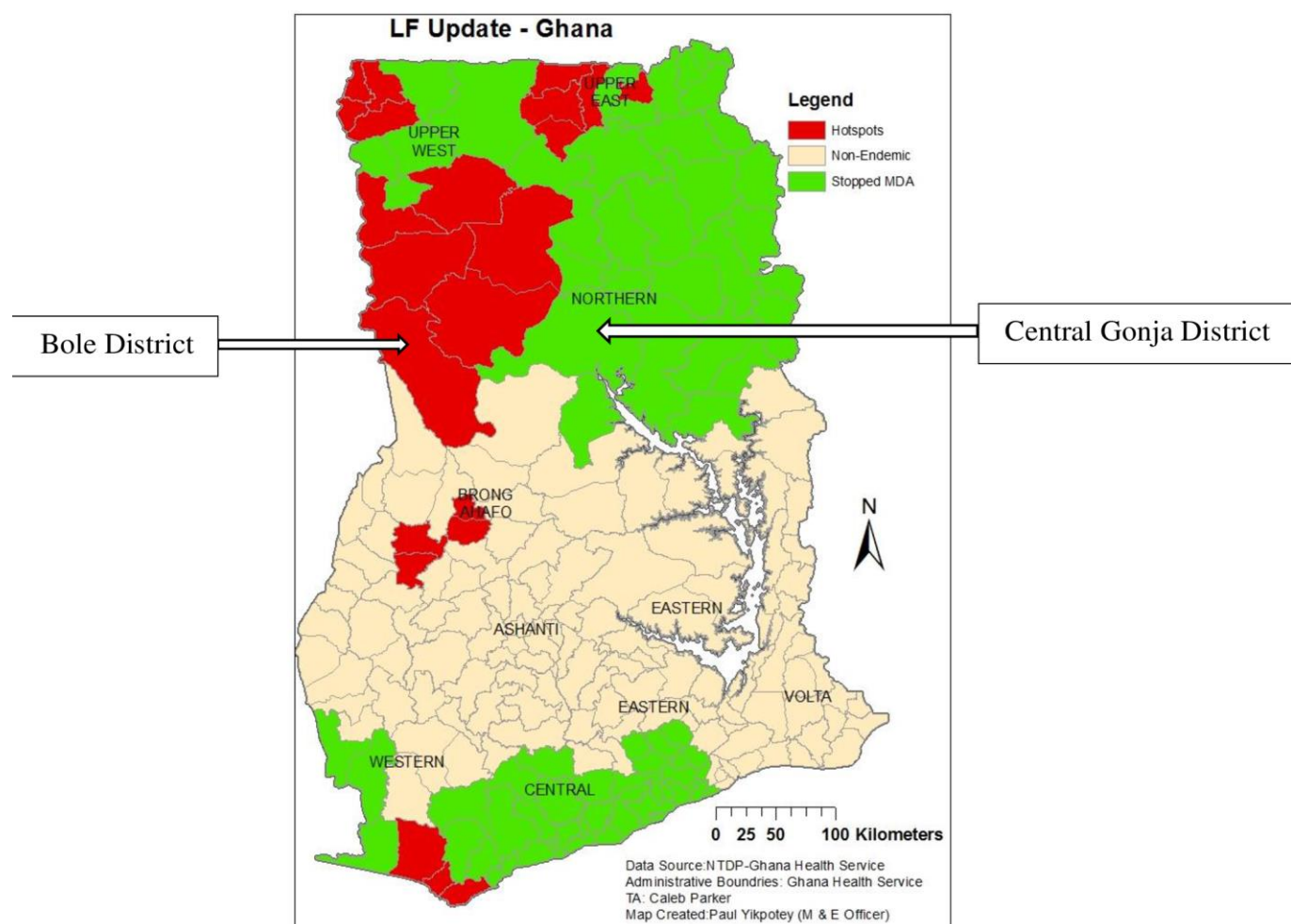


Figure 12: Location of areas with the persistent transmission of LF (hotspots) in Ghana [196]

The Central Gonja District lies within longitude 1°5' and 2° 58' west and latitude 8°32' and 10°2' north and has a total population of 87,877 according to the 2010 PHC. This represents 3.5 per cent of the total population of the northern region of Ghana. The average household size is 7.6 persons per household, and about 71 per cent of the people are illiterate. Most of the populace (78 per cent) are engaged as agricultural, forestry and fishery workers [197].

The highest level of a health care facility in the District is a District Hospital supported by Health Centres at Langbonto, Laribanga, Achubunyo, Mole and Busunu. The Tamale Teaching Hospital serves as a referral centre for medical conditions. Trained Traditional Birth Attendants (TBAs), Village health workers and Guinea-worm volunteers help in providing health care services to the population. There is a Health Assistance Training School in the district which trains professionals for the health sector [197].

3.3 Study design

The study was a cross-sectional quality improvement study involving the collection of both quantitative and qualitative data. Data collection was done in three phases: pre-intervention, intervention and post-intervention.

The quantitative arm of the study is made up of secondary data of all residents of Bole and Central Gonja districts of Northern Ghana who took part in the 2016 and 2014 MDA respectively and primary survey data collected from randomly selected community members in the two study districts in 2017.

3.4 Study population

The population of interest was District Directors of Health Service, Sub-district Heads of Health Service, Disease Control Officers, Community Drug Distributors, Community Members, Chiefs/Opinion Leaders,

3.5 Sample size and sampling procedure

The minimum sample size (n) for the primary data was determined using the formula: $n = (Z_{\alpha/2})^2 * (p*q) / d^2$ adopted from World Health Organisation's practical manual for sample size determination in health studies [198]. This formula was also used in a similar LF compliance study conducted in Ghana [19]. The sample size calculation was based on the assumption that

65% [19] of the population was aware of the MDA program and ingested the drugs, $Z_{\alpha/2}$ is the confidence level at 95% = 1.96, p is the coverage, q is (1-p) and d is the level of precision. Here p = 65% and d = 5%. The sample size was increased by 30% to compensate for nonresponse and missing information.

$$\begin{aligned}\text{Therefore, } n &= (1.96)^2 * (0.65 * 0.35) / (0.05)^2 \\ &= 349.58 \text{ People.}\end{aligned}$$

$$\begin{aligned}\text{A further 30\%} &= 349.58 * 0.3 \\ &= 104.88\end{aligned}$$

$$\begin{aligned}\text{Hence, the actual sample size} &= 349.58 + 104.88 \\ &= 454 \text{ people.}\end{aligned}$$

However, 8 participants do not have complete information; hence 446 participants were included in the analysis, as shown in Table 3. This is made up of 222 and 224 participants from Bole and Central Gonja Districts, respectively.

The individual participants were randomly selected from the LF MDA community register using a simple random sampling strategy. A random number generator was used to select the desired number of participants using the LF community registers as a sampling frame. The selected participants were identified using the community and house names and through the help of community leaders and community health workers.

Table 3 presents sources of data and the breakdown of the number of participants included in each arm of the study.

Secondary quantitative MDA data for 2016 and 2014 of all residents of Bole and Central Gonja districts respectively were included in the study. In addition, 2017 secondary MDA data for residents of Bole district was also extracted and included. The secondary MDA data was extracted from the Districts Health Administration (DHA) databases of the two participating districts.

Qualitative data collection strategies were employed to gain a deeper understanding of the factors affecting the quality of implementation of the LF MDA strategy. Twelve (12) out of 96 communities from 4 sub-districts which had MDA coverage below 80% were purposively selected in the Bole District. This was done to explore factors affecting the implementation of the MDA. Four (4) out of 84 communities from 4 sub-districts with MDA coverage above 80% were also purposively selected from the Central Gonja District to explore factors that contributed to the interruption of transmission of the disease.

Selection of participants into the qualitative arm of the study was purposive; based on their level of participation in the implementation process of the MDA and role in community activities in the study area.

In-depth interviews (IDIs) were conducted with health workers made up of District Directors of Health Service (DDHS), Sub-district Heads of Health Service (SHHS), and Disease Control Officers (DCOs). The IDIs were also conducted with CDDs to understand the perspective of health and frontline workers regarding factors affecting the quality of implementation of MDA in the study area. Besides, key informant interviews (KIIs) were conducted with opinion leaders and noncompliant community members in both districts, as shown in Table 3.

The CDDs are community selected individuals who were trained on the enumeration of households, LF treatment eligibility, exclusion criteria for treatment, drug storage and safety. The drug distributors were also trained to treat minor side effects, referrals of severe adverse drug effects, and record keeping. The CDDs are retrained every year before the commencement of the drug distribution [24].

The interviews were conducted in venues chosen by participants. This was generally in their offices and homes. The interviews took between 60 and 90 minutes.

The sub-districts were accessed through the DDHS and District DCO after an explanation of the purpose of the study. Graduate research assistants were recruited and trained to collect the data in March - April 2017 and April 2018.

The research assistants accessed each community with the help of contact people (the sub-district heads of health service or DCOs). The purpose of the study was explained to the contact people who assisted the research assistants to identify the CDDs in the communities and opinions leaders. The non-compliant community members were identified from the LF registers kept in the health facilities at the sub-district level. All noncompliant in the selected study communities who were present at the time of data collection and willing to participate in the study were interviewed.

Semi-structured interview guides were used for the data collection. They were translated from English to the local language before the fieldwork began. Back-to-back translation strategy

was used to ensure that the versions in English were the same as those in the local languages. The guides covered broad areas of knowledge of causes and transmission of LF; perception of LF drug; knowledge and awareness of MDA; Implementation process of MDA; Community understanding and perception of MDA as shown in appendix 6.

All interviews were recorded using a digital voice recorder and translated and transcribed verbatim.

Permission was sought from the research participants for their participation and to record the IDIs and KIIs using digital voice recorders. Field notes were also taken, which were turned into data documents for analysis.

The IDIs and KIIs with CDDs, Chiefs/Opinion leaders and non-compliant community members were conducted in the local language and translated into English by two independent language experts during transcription.

Table 3. Study participants and sources of data in Central Gonja and Bole Districts

	Central Gonja District		Bole District	
Pre-intervention	Qualitative	Quantitative	Qualitative	Quantitative
District Directors of Health Service	1	-	1	-
Sub-district Heads of Health Service	3	-	2	-
Disease Control Officers	2	-	2	-
Community Drug Distributors	5	-	4	-
Non-compliant Community Members	-	5	-	3
Chiefs/Opinion Leaders	4		4	-
Pre-intervention secondary MDA*		106266		70591
Community members in a survey	-	224	-	222
Post-intervention				
District Directors of Health Service	-	-	1	-
Community Drug Distributors	-	-	15	-
Chiefs/Opinion Leaders	-	-	10	-
Health Workers**	-	-	16	-
Post-intervention secondary MDA*	-	-	-	79894
District Directors of Health Service	-	-	1	-
Community Drug Distributors	-	-	15	-
Chiefs/Opinion Leaders	-	-	10	-

Health Workers**	-	-	16	-
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**Individual MDA data extracted from the LF program at the district level, *Individual MDA data extracted from the LF program at the district level. **The health workers include: health information officers, disease control officers, sub-district heads of health services*

3.6 Data collection and analysis

Table 4 provides an overview of the data collection and analysis methods used in each of the three phases of the study. Data were collected through semi-structured in-depth and key informant interviews, structured questionnaire interviews and extraction of secondary MDA data.

Table 4. Overview of measurement and analysis methods used in the study

	Phase 1 (Pre-intervention)	Phase 2 (Intervention)	Phase 3 (Post-intervention)
Study Design	A concurrent mixed methods approach. This involves a separate collection and analysis of quantitative and qualitative data.	Quality improvement intervention.	A mixed-methods approach. This involves a separate collection and analysis of quantitative and qualitative data.
Issues analysed	Assessed the level of MDA coverage, explored factors that contributed to the interruption of the transmission of LF in Central Gonja District and the persistent transmission of LF in the Bole District.	Steep-by-steep description of the intervention mapping process and use of a single PDSA cycle to selecting, implementation and evaluation of the process and impact of the quality improvement strategies	Assessing the process and effect of the context-specific evidence-based intervention on the level of MDA coverage, knowledge and understanding about the LF and the MDA activities.
Data sources	Secondary quantitative MDA data, Structured questionnaire interviews with randomly selected community members. Semi-structured in-depth interviews with Community Drug Distributors, District Directors of Health Service, Sub-district Heads of Health Service, and Disease Control Officers. Semi-structured, key informant interviews with opinion leaders and non-compliant community members.	-Results from the pre-intervention phase -Stakeholder engagement and brainstorming sessions, -Adapted implementation specifying the model	Semi-structured in-depth interviews, with Community Drug Distributors, Health Workers, Chiefs and Community Opinion Leaders. Secondary quantitative MDA data, training attendance records and weekly written reports.
Analytical approach	The framework, thematic, and descriptive analysis with t-test was used.	Intervention mapping, PDSA cycle, stakeholder engagement and brainstorming sessions, adapted implementation specifying the model and descriptive analysis with a t-test	A single PDSA cycle, REM-AIM framework, thematic, and descriptive analysis with t-test.
Software used	Stata version 14.2, NVivo Version 10 and Quantum Geographic Information System (QGIS).	Stata version 14.2, NVivo Version 10 and WhatsApp platform.	Stata version 14.2, NVivo Version 10 and Quantum Geographic Information System (QGIS).

3.7 Measurement of key variables and analysis approach

The key variables presented in Table 5 were measured to assess the level of MDA coverage, factors contributing to persistent and interruption of transmission of lymphatic filariasis. The pre-intervention phase of the study presents the detail methods and analysis of levels of MDA coverage and factors that characterised the persistent transmission of LF in Bole and interruption of the disease transmission and central Gonja District. A detailed step-by-step intervention mapping process to design and implement a quality improvement strategy through an initial needs assessment is detailed in the intervention phase. The post-intervention phase described the process and impact of the quality improvement strategies on the level of MDA coverage and compliance to lymphatic filariasis MDA in the Bole District.

Table 5. Key variables measured to assess the level of MDA coverage, factors contributing to persistent and interruption of transmission of lymphatic filariasis.

Objectives	Key variables, definitions and approach to analysis
Pre-intervention objectives	
To assess the level of coverage and compliance to the lymphatic filariasis mass drug administration in Bole and Central Gonja Districts of Northern Ghana.	MDA compliant: Individuals who ingested the LF drug. Non-compliant: People who refused to ingest the drug and those absent at the time of the MDA. Non-eligible: Pregnant, breastfeeding mothers, seriously sick, under-height children. Adverse drug reaction: Self-reported adverse drug reaction after ingesting the LF medication.
To investigate factors that contributed to the interruption of transmission of lymphatic filariasis in Central Gonja District in Ghana.	Descriptive analysis was carried out, and results were presented in tables and density maps.
To investigate factors contributing to the persistent transmission of lymphatic filariasis in Bole District of Ghana.	
Intervention Objective	
To design and implement a quality improvement strategy based on findings of objectives 2 and 3 to improve coverage and compliance of lymphatic filariasis mass drug administration in Bole District of Ghana.	Intervention mapping (IM) approach was used to design the quality improvement intervention. IM is a systematic process involving six key steps. The six levels of IM process consist of 1) initial needs assessment, 2) developing program objectives, 3) selection of intervention methods and practical strategies, 4) producing program components and materials, 5) plan for adoption and implementation and, 6) designing an evaluation plan.
Post-intervention objective	
To evaluate the quality improvement strategy on the level of coverage and compliance to lymphatic filariasis mass drug administration in the Bole District of Ghana.	MDA compliant: Individual who ingested the LF drug. Non-compliant: People who refused to ingest the drug and those absent at the time of the MDA. Non-eligible: Pregnant, breastfeeding mothers, seriously sick, under-height children. Adverse drug reaction: Self-reported adverse drug reaction after ingesting the LF medication. Descriptive analysis was carried out, and results were presented in tables and density maps.

	The interview guides covered broad areas of knowledge and understanding of LF, knowledge and understanding of the MDA process and implementation challenges of the LF MDA, as shown in the semi-structured interview guides in the appendix 6A-6G. Framework analysis involved six iterative steps were used: familiarisation, identification of thematic framework, indexing, charting, mapping and interpretation. The results were summarised based on the themes that emerged from the data with key quotes from participants
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3.8 Application of Plan-Do-Study-Act and RE-AIM frameworks

The study used the Plan-Do-Study-Act and the RE-AIM framework for the intervention and post-intervention phases.

3.8.1 The Plan-Do-Study-Act framework

Generally, the Plan-Do-Study-Act (PDSA) method follows a prescribed four-stage cyclic learning approach to adapt changes aimed at improvement. In the ‘Plan’ stage an amendment aimed at improvement is identified, the ‘Do’ stage sees these change ideas tested, the ‘Study’ stage examines the outcome of the change, and the ‘Act’ stage identifies adaptations and next steps to inform the next cycle.

Specifically, the ‘Plan’ phase indicate the four quality improvement strategies implemented in this study, as shown in Figure 13 and are described in details in paper two in the next chapter. The ‘Do’ record the results and observations during and after the implementation of the quality improvement strategies. The ‘Study’ stage was used to find out what the data is saying to make a sound decision under the “Act”. Finally, the ‘Act’ phase was used to recommend what the next line of action based, as shown in Figure 13. The PDSA framework used in this is also made up of an aim, change ideas, measures (process and outcome) and prediction which guide the intervention and post-intervention phases of the study.

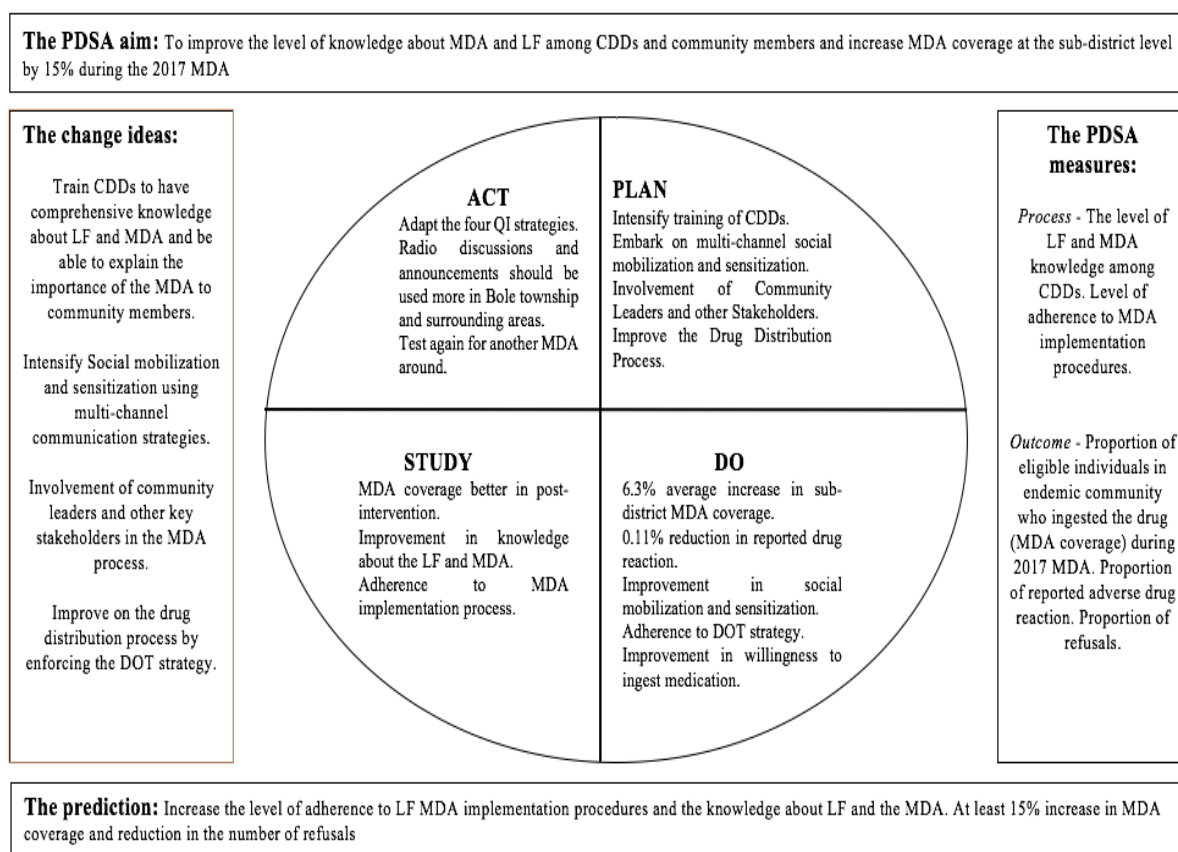


Figure 13: Details of single Plan-Do-Study-Act cycle for the intervention and post-intervention

The pragmatic principles of PDSA cycles encourage the use of a small-scale, iterative method to implement interventions, as this allows quick evaluation and offers flexibility to adapt the change based on feedback to ensure evidence-based solutions are developed [201]. Starting with small-scale implementation provides researchers/practitioners with the flexibility to act and learn while upholding all ethical principles, providing the opportunity to develop evidence for change and involve stakeholders as partners in the quality improvement intervention process.

Following investigational scientific methods, the PDSA cycle encourages prediction of the outcome of a test of change and measurement of the result (quantitatively or qualitatively) over time to assess the process and impact of an intervention on the outcomes of interest.

Working in a complex pragmatic setting like LF MDA with inherent contextual complexities and variabilities, measurement of data over time helps understand variation in the program implementation, increase awareness and knowledge of other factors influencing processes or outcomes, and understanding of the impact of an evidence-based intervention.

As with all scientific approaches, recording of each stage of the PDSA cycle is vital to the backing of the quality scientific process, local learning and capacity building to ensure knowledge is captured to support institutional memory and transferability of knowledge to other similar programs in different settings.

While PDSA activities are often implemented as multiple small cycles to test a change, this study conduct and report on only a single PDSA cycle. This is because the MDA is carried out once a year, and the resources (time and finance) available did not allow for multiple PDSA cycles. The application of a single PDSA cycle in the LF MDA program as determined by crucial principle features of PDSA technique described in Figure 13.

3.8.2 The RE-AIM framework

Reach, Effectiveness, Adoption, Implementation, Maintenance (RE-AIM) framework was used to guide the evaluation of the post-intervention phase of the study. The RE-AIM framework was developed to assess the effects of public health interventions [202].

Reach is defined as the proportion of eligible individuals in the aimed population who partook in an intervention program and the extent to which those individuals represent the target population. *Effectiveness* is the degree to which the intervention program has a positive effect on an outcome(s) of interest. *Adoption* is a measure of the total number of program providers who implement an intervention and the extent to which they represent all potential program providers. *Implementation* is an organisational measure of the quality of the intervention's delivery and its adherence to the essential elements of the research program. *Implementation* is sometimes referred to as *treatment fidelity*. *Maintenance* is the measure of the program's effectiveness in attaining the expected outcome for an extended time. It is a measure of the sustainability of the intervention and indicates whether the intervention is likely to become an institutional culture [202, 203].

The RE-AIM has been useful in evaluating intervention in diverse fields including behavioural change interventions [204, 205], weight loss studies [206, 207], nutrition projects [208], studies on injury prevention [209, 210] and studies on manual activity [208, 211]. The RE-AIM framework has been applied to assess the effectiveness of a single intervention at employee, community, and patient levels [212]. The framework has also been useful in studying the impact of evidence-based interventions with fidelity and interventions that focus on improving organizational culture and adherence to clinical guideline [213]. It has also been used to assess

the impact of single intervention within a context of a broader project [214] and recently to evaluate more extensive multidimensional interventions [203].

Qualitative, quantitative, and the mixed methods approach to the application of the RE-AIM framework has been demonstrated in evaluating interventions [215]. With awareness of these various options of application of the RE-AIM framework, the primary purpose of this paper is to use the RE-AIM framework to evaluate the effect of CEQI intervention on implementation of LF MDA in the Bole District of Northern Ghana.

3.9 Ethical considerations

The study was reviewed and approved by Human Research Ethics Committee (Medical) of the University of the Witwatersrand, Johannesburg, South Africa (Clearance Certificate No. M170219) and Ghana Health Service Ethics Review Committee (Clearance Certificate No. GHS-ERC: 04/02/2017). Permission was obtained from the Neglected Tropical Diseases (NTDs) program of the Ghana Health Services and the District Health Administration of Bole and Central Gonja Districts for the extraction and use of the secondary LF data. All study participants were adults. All participants in the study provided informed consent. All participants consented to have de-identified quotes used in a publication in the consent form. All ethical principles were upheld.

3.10 Addressing study limitations

3.10.1 Scope of the study

Resource constraints and limited logistics prevented us from adding more LF transmission districts. However, this is significant implementation research. The scope and scale of the study met the standard requirement of a doctoral degree. Inclusion of Central Gonja district allowed for the understanding of factors that contributed to the elimination of transmission of the disease which informed the formulation of strategies for the intervention phase of the study.

3.10.2 Cross-sectional nature of the study

The cross-sectional nature of the study, which aimed at exploring factors contributing to the persistent transmission of lymphatic filariasis developed and implemented quality improvement strategies towards the elimination of lymphatic filariasis in Ghana has many merits. Compared to other study designs such as cohort studies, hybrid designs, cross-sectional

studies are relatively cheaper, quick to administer and provide a details description of contextual issues at a particular point in time [216, 217]. Nevertheless, the short duration nature of cross-sectional studies makes it difficult to establish causal relationships between different exposures and outcomes [216].

3.10.3 Pre-intervention Phase

The combination of quantitative and qualitative methods employed in this study ensured a deeper understanding of the relevant factors affecting the quality of implementation of the LF MDA in the study. The results from each component of the study helped shed light, especially the qualitative arm, which assisted in elucidating the findings of the quantitative arm using key quotes. However, the following should be noted:

- The participants were interviewed a few months after the last MDA activities. Thus there are high chances of forgetting all the details of the activities before, and during the previous MDAs, therefore, recall bias cannot be eliminated in this study.
- The health system-level factors we not fully explored in the study.
- The findings may not be generalisable to all LF endemic districts given the peculiarities and specific contextual factors of the study districts.
- Due to the use of already collected program data, the study was not able to verify the accuracy of MDA coverages.

3.10.4 Intervention Phase

Although the insight provided by the intervention phase of the study will be valuable to other low-resource settings seeking to use evidence-based QI strategies to improve the quality of the lymphatic filariasis mass drug administration towards the elimination of the disease as a public health problem, it is important to note that, the QI strategies could not incorporate other issues such as incentives/motivation (monetary rewards) for CDDs, transportation-related challenges and the timing of the MDA. These were part of the problems identified during the initial needs assessment. However, these were decisions that could only be made at regional and national levels of neglected tropical diseases program due to the cost implications.

The use of radio stations, information vans and posters for social mobilisation and sensitisation could have been more effective in peri-urban and urban communities as shown by other studies [17, 218, 219]. Due to the financial implications, these methods of social mobilisation

sensitisation (which the funding of this study could not support) were not included in the consolidated intervention package implemented.

3.10.5 Post-intervention phase

The post-intervention phase of the study also has some limitations. Social desirability bias could be a limitation to this phase of the study, as some study participants might have withheld what they thought to be contrary practices during the implementation of the CEQI from the researchers. The duration of the intervention (one round of implementation) does not provide knowledge of the long-term effect and difficulties within the setting and with participants to be fully studied. Adding more quantitative data and using robust statistical techniques could have contributed more value to the evidence. The CEQI intervention has been implemented for one round of MDA and was also limited to one district in the Northern Region of Ghana; hence, limits the generalizability of the findings.

CHAPTER 4: PRE-INTERVENTION ASSESSMENT

“In God we trust, all others bring data” - Hastie et al. 2009, The Element of Statistical Learning.

4.10 Introduction

This chapter presents the results covering objectives 1-3 of the study. The results highlight the level of MDA coverage using secondary program data, explored factors that contributed to interruption of LF in Central Gonja district and factors contributing to the persistent transmission of LF in Bole district of Ghana using primary quantitative and qualitative data. The chapter is presented in 13 sections. The next section 4.11 describes the mass drug administration coverage followed by a description of socio-demographic characteristics of survey participants in section 4.12. Knowledge of lymphatic filariasis is highlighted in section 4.13. This is followed by preventive treatment measures in section 4.14. The next section 4.15 describes perceptions of LF on livelihood and stigma. The reason why this disease still exists is presented in section 4.16, while section 4.17 described knowledge about the mass drug administration exercise. Activities during the MDA is presented in section 4.18. Section 4.19 describes adherence to the directly observed treatment strategy. Section 4.20 outlined perceptions and side effects of the drug. Section 4.21 highlights challenges faced by CDDs and health workers. Sections 4.22 and 4.23 describes the reasons for refusals and suggestions on how to reach community members to improve MDA, respectively.

4.11 Mass drug administration coverage

This result is based on secondary MDA data. As shown in Table 6, the MDA coverage in Central Gonja and Bole Districts were 84.2% and 82.0% respectively. In Central Gonja District, 84.7% and 83.6% of the male and female population respectively received the drug in the last MDA (2014), while in the Bole District 80.4% and 83.9% of the male and female population respectively received the drug. The noncompliance rates in Central Gonja and Bole Districts were 0.9% and 2.5% respectively.

In terms of community members being absent at the time of the drug distribution, there were 5.8% and 7.1% in Central Gonja and Bole Districts respectively. While 9.1% of the population were non-eligible to ingest the drug in Central Gonja, 8.4% of the population in Bole District were non-eligible to take the LF medication during the last drug distribution as indicated in Table 6.

Table 6: Mass drug administration coverage by sex in Central Gonja and Bole Districts

Central Gonja District					
Characteristics	Compliance* (%)	Noncompliance** (%)	Absent (%)	Non-eligible*** (%)	Total (%)
Sex					
Male	45369 (84.68)	570 (1.06)	4706 (8.78)	2931 (5.47)	53576 (100)
Female	44063 (83.63)	417 (0.79)	1502 (2.85)	6708 (12.74)	52690 (100)
Total	89432 (84.16)	987 (0.93)	6208 (5.84)	9639 (9.07)	106266 (100)
Adverse Reaction	9 (0.01) †				
Bole District					
Sex					
Male	30273 (80.40)	1006 (2.67)	4012 (10.65)	2364 (6.27)	37655 (100)
Female	27635 (83.91)	742 (2.25)	997 (3.03)	3562 (10.81)	32936 (100)
Total	57908 (82.03)	1748 (2.48)	5009 (7.10)	5926 (8.39)	70591 (100)
Adverse Reaction	180 (0.31) †				

*Compliance means those who ingested the drug. **Noncompliance comprises those who refused to ingest the drug. ***Non-eligible is made up of pregnant, breastfeeding mothers, as well as seriously sick and under-height children (details can be found in S1 Table). †These are the numbers per person who ingested the drug.

As shown in Figure 14, all sub-districts in Central Gonja had an MDA coverage of above 79%, while some sub-districts in Bole District recorded MDA coverages below 70%. More specifically, in Bole District, Bamboi and Jama sub-districts had coverages of above 95%. From Figure 14, MDA coverages are; Mandari (70%), Tinga (70.4%), and Mankuma (68%). Although the overall MDA coverage in Bole District is high (82.0%), there were some communities with coverages as low as 47.5% as summarised in Table 7.

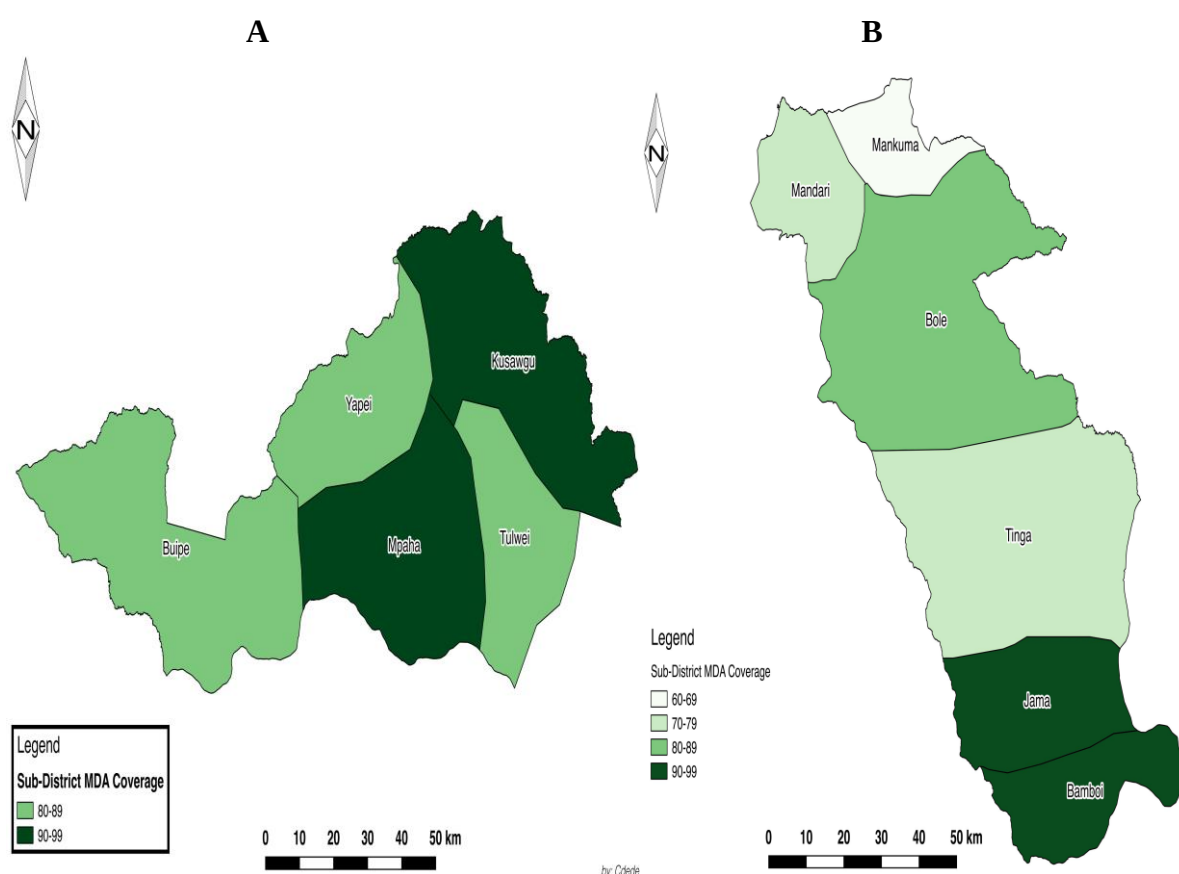


Figure 14: Patterns of Sub-district Mass Drug Administration Coverage in Central Gonja (A) and Bole (B) Districts.

Table 7: Summary statistics of MDA coverage in Bole and Central Gonja Districts

Summary Statistics	Central Gonja District		Bole District	
	Community Coverage	Sub-district Coverage	Community Coverage	Sub-district Coverage
Mean	87.7	89.3	82.7	81.3
Standard Deviation	6.8	0.7	12.2	14.0
Range	70.9 - 100	88.4 – 90.2	47.5 - 100	70.0 – 98.9

4.12 Socio-demographic characteristics of survey participants

This result is based on the primary survey. A total of 446 individuals participated in the survey representing a response rate of 98%.

Except for educational level and occupation, there are no significant differences in the socio-demographic characteristics of the study participants in the two districts, as shown in Table 8. More than half (50.5%) of the survey participants from the Central Gonja District were females.

The mean age of the participants from Central Gonja is 40.5 years (13.5 standard deviations). Whereas in Bole District there were 52.3% female participants with an average age of 43.9 years (25-64 range) as shown in Table 8.

Table 8. Socio-demographic information of survey participants

	Central Gonja District (n=224)		Bole District (n=222)		P-Value *
Variables	Frequency	Percentage	Frequency	Percentage	
Sex					0.703
Male	111	49.6	106	47.8	
Female	113	50.5	116	52.3	
Mean Age (Range)	40.5 (28-59)		43.9 (25-64)		
Marital status					0.692
Married	178	79.5	173	77.9	
Not married	46	20.5	49	22.1	
Occupation					0.008
Farmer	170	75.9	158	71.2	
Trader	32	14.3	27	12.2	
Public servant	11	4.9	5	2.3	
Unemployed	6	2.7	15	6.7	
Artisans	5	2.2	17	7.7	
Religion					0.631
Christian	89	39.7	98	44.1	
Moslem	110	49.1	100	45.1	
Traditional	25	11.2	24	10.8	
Level of education					<0.001
No formal Education	110	49.1	158	71.17	
Primary	90	40.2	23	10.4	
Junior High Sch.	9	4.0	27	12.2	
Senior High Sch. and tertiary	15	6.7	14	6.3	

***P-values of a t-test**

4.13 Knowledge on lymphatic filariasis

The survey result presented in Table 9 shows that there is a significant difference in knowledge about lymphatic filariasis among the study participants in the two study districts. The comprehensive knowledge of LF among the participants in Central Gonja District is higher compared to that of Bole District.

Table 9. Knowledge about lymphatic filariasis in Central Gonja and Bole Districts

	Central Gonja District (n=224)		Bole District (n=222)		
Variables	Frequency	Percentage	Frequency	Percentage	P-Value*
Have correct knowledge of how LF is acquired					<0.001
Have correct knowledge	200	89.2	75	33.9	
Do not have correct knowledge	24	10.8	147	66.1	
Have correct knowledge of signs associated with LF					<0.001
Have correct knowledge	217	96.9	127	57.1	
Do not have correct knowledge	7	3.2	95	42.9	
Have correct knowledge of LF prevention					<0.001
Have correct knowledge	146	65.3	82	37.1	
Do not have correct knowledge	78	34.7	140	63.0	
Misconception about how LF is acquired					<0.001
Have misconception	35	15.5	131	59.2	
Do not have misconception	189	84.5	91	40.8	
Comprehensive knowledge of LF					<0.001
Have comprehensive knowledge	178	79.7	70	31.5	
Do not have comprehensive knowledge	46	20.3	152	68.5	

***P-values of a t-test**

The quantitative is similar to the qualitative results where some of the CDDs who participated in the IDIs in Bole District were not knowledgeable about the causes of LF. Besides, none of the participants in the noncompliance IDIs knew the causes of LF due to a lot of misconceptions about how the disease is contracted in their communities. Some respondents were superstitious about LF by attributing it to curses for stealing and doing something evil against someone. This is indicated by the following comments:

“It is a result of the curse ... so if a person steals something, they are cursed with the disease.” (Non-compliant, Bole District).

“There is a hole in this community when you step in it; you get LF” (Opinion leader, Bole District).

Some of the CDDs who participated in the IDI in Bole District were not knowledgeable about the specific cause of LF, as shown in the quote:

“I don’t know anything about it; I only see the leg swell big and when I ask they say is ‘kiapeni’ (LF), and I didn’t ask what causes it” (CDD, Bole District).

4.14 Prevention and treatment measures

The respondents indicated that the disease could be prevented by sleeping under treated bed nets, keeping clean environments, going for regular check-ups, and taking the LF drug amongst other measures.

Although some respondents thought the disease could be prevented by eating hot food, others were also of the view that taking the drugs would automatically prevent them from getting the disease. These were the comments following the question about prevention:

“By taking the LF drugs, we have been receiving ... So those that refuse to take the drug wouldn’t be able to prevent the disease, but we those that take the drug automatically prevents our system from getting LF” (CDD, Bole District).

“The disease can be prevented by sleeping under a mosquito net, intake of LF drugs, and regular check-up in the hospital can all prevent LF infections.” (CDD, Central Gonja District).

4.15 Perceptions of LF on livelihood and stigma

The respondents perceived LF as an awful and dangerous disease. Hence they found it challenging to buy food from people who have clinical manifestations of the disease and sell food. This results in affected people becoming jobless. It is also clear from the comments that people affected by the disease live in isolation and tend to be lonely. No one wants to associate with them, and they are mostly abandoned by their communities, as shown in the key quotes:

“They see it as a dirty disease ... if someone is suffering from it and sells food they won’t buy the food ... people with LF stay away from people ... they don’t want to associate themselves with people.” (Non-compliant, Bole District).

“The disease makes life very difficult for people ... they can’t work or even do anything again ... and your friends will not come close to you again.” (Opinion Leader, Central Gonja).

“It is a very bad thing ... the people who have it are always lonely and isolated.” (Health worker, Bole District).

4.16 Reasons why this disease still exists

Health workers, the non-compliant and CDDs stated that why the disease still exists in the communities was because community members refused to take the LF medication. This illustrated by the following quotes:

“I think those suffering from the disease don’t take the drug, that is why ... if they were to be taking the drugs by now they would have been treated.” (Noncompliant, Bole District).

“Well, a lot of people believe that the disease can be acquired when a healthy person comes into contact with someone with the disease, so they don’t like taking the drug.” (Health worker, Bole District).

“A lot of people in the community give excuses when we are distributing the drug ... they don’t want to take the drug ... I think that is why people still have the disease.” (CDD, Bole District).

4.17 Knowledge about the mass drug administration exercise

The results in Table 10 show that there is a significant difference in the level of knowledge about the mass drug administration exercise among the study participants from the two study districts. Participants from Central Gonja District showed a high level of knowledge and participation in the MDA exercise compared to those from Bole District. While adherence to the DOT strategy is significantly higher in Central Gonja District than in Bole Districts, the

fear of side effects of the drug as the reason for the refusal to ingest the medicine was higher in Bole District compared to Central Gonja District.

Table 10: Knowledge of lymphatic filariasis mass drug administration in Central Gonja and Bole Districts

	Central Gonja District (n=224)		Bole District (n=222)		P-value*
Variables	Frequency	Percentage	Frequency	Percentage	
Awareness of LF MDA					<0.001
Yes	173	77.2	102	46.0	
No	51	22.8	120	54.1	
Source of MDA information					<0.001
Radio	2	1.3	2	2.3	
Health workers	58	33.5	6	5.4	
Posters	12	6.7	0	0.00	
Family members	2	0.9	7	6.7	
Church/mosque	23	13.4	18	18.0	
Community volunteers	39	22.3	37	36.5	
Gong-gong	35	20.5	14	13.5	
Neighbors/friends	2	1.3	18	17.6	
Was there any public education before MDA					<0.001
Yes	154	89.0	40	39.6	
No	18	10.4	51	50.0	
Don't know	1	0.6	11	10.4	
Have you ever taken the LF drug					<0.001
Yes	210	93.8	98	44.1	
No	10	4.5	82	36.9	
Can't remember	4	1.8	42	18.9	
How was the drug administered					<0.001
Direct observation treatment	221	98.7	140	63.1	
Given to beneficiary to take at his/her convenience	3	1.3	82	36.9	

***P-values of a t-test**

Table 10: (Continued)

Why some community members' refused to ingest drug					<0.001
Fear of side effects	140	62.5	143	64.4	
Level of knowledge of the disease	10	4.5	20	9.0	
Don't think they will get the disease	9	4.0	17	7.7	
Think only sick people should take the drugs	6	2.7	15	6.8	
Too many drugs	16	7.1	18	8.1	
Religious beliefs/superstition that oppose medication	3	1.3	6	2.7	
Taking other medication	19	8.5	2	0.9	
Have taken the drugs far too many times	21	9.4	1	0.5	

***P-values of a t-test**

In the qualitative study, participants generally exhibited good knowledge of the MDA exercise. In the IDIs, the noncompliance community members and health workers knew the purpose of the MDA exercise by indicating that the activity was carried out to prevent LF. Both health workers and the CDDs interviewed were able to outline the time the program commenced. According to them, the MDA is a yearly program that is undertaken between April and July (the beginning of the wet season). However, they say this is not favourable because this coincides with the planting season, which then becomes a significant challenge in terms of availability of community members carry out the program. This is expressed in the quotes:

"The last distribution that we did occurs during the rainy season, which is not the best as most people go to the farm." (CDD, Bole District).

"The exercise is done at the beginning of the farming season... the kind of work (farming) the people do here is a challenge as most of them sleep at their farms during the farming season ..." (Health worker, Bole District).

According to the respondents, before the MDA exercise, certain activities need to take place. Amongst them are cascade training, announcements to community members about the day of the exercise and registering various household members as reported in the following comments:

“Before the distribution of the drugs, I announce the Mosque, and at information centres to inform the people about the date the medicine will be distributed.” (CDD, Bole District).

“Before the MDA exercise, we were trained at Bole, and we also trained the volunteers here in Tinga. The drugs and other materials were sent to us after the training.” (CDD, Bole District).

According to respondents, the training took the form of illustrations and presentations. They were shown photos of LF, the drugs were introduced, and they were taught how to distribute them during the exercise. They were taught how to measure the height of people, administer medicines, and register pregnant women, all births and deaths and the recording of possible causes of death.

IDIs with drug CDDs in Bole District showed that the CDDs made announcements in mosques, churches, information centres and by using the ‘gong gong’ (a traditional means of giving information to the community) before the drug distribution. The following quote explains this:

“Most often, it is the hospital that informs me as a volunteer, and I will also let them make announcements through gong-gong beating. Also, it is me the volunteer who will move from house-to-house to inform the people again about the drug and its purpose before they will accept and take the drugs.” (CDD, Bole District).

The qualitative results show that the announcements before the MDA only informed the community about the date of the drug distribution but did not focus on: educating the community about the importance of the MDA, elimination of LF, adverse drug reaction and management, the importance of direct observation treatment (DOT), and why all eligible community members must take part.

Community engagement and involvement in the planning of the MDA was also not mentioned in any of the responses.

In Bole District, announcements about the MDA programs were made by CDDs, whereas in the Central Gonja District, the announcements and education were done by the health workers as shown in the following quotes:

“Before the distribution of the drugs, the CDDs announce the at the Mosque, and information centres to inform the people about the date the medicine will be distributed.” (Health worker, Bole District).

“We first go for training at the district level then we come to train at the sub-district level ...then to the community to give health information to community members before the actual day of distribution.” (Health worker, Central Gonja District).

4.18 Activities during the MDA

Activities during the MDA exercise include: identification of homes, counting of individuals, height measurements were taken, and establishing other inclusion criteria (pregnant women, severely sick people and under-height children were excluded from taking the drug).

With the drug administration process, respondents pointed out that people access the drug from door to door distribution and not at a central point. Thus, the CDDs move from house to house to deliver the drugs to the community members. The following comments were reported:

“I start by planning my movement and how to identify homes that have not been completely administered and those that are completed. I do this by numbering the various homes before entering and circle it if completely administered. Still, I leave it open if I have some household members missing or absent and I have to return to that house to attend to them. I also decide on what time is best and appropriate to get the people at home to reduce the amount of movement to and fro for absent people. After taking their heights and giving them the drug. I also get myself some indelible ink which I put on a finger of those who have taken the drug to prevent overdose.” (CDD, Bole District).

“We do not give the drug to children who are under-height, pregnant women and seriously sick persons ... but aside these groups of persons, every other person takes it.” (CDD, Bole District).

4.19 Adherence to the directly observed treatment strategy

Some of the CDDs interviewed in Bole District interviewed leave the drug for absent household members and people who insist on ingesting the medicine at their convenience. On the other hand, CDDs in Central Gonja District adhered to the DOT strategy by ensuring that all eligible household members ingest the medicine in their presence as indicated by the following:

“Most of them collect the drug from you telling you that they will take it at their convenience, but it was later revealed that most of these people do not take the drug after all.” (CDD, Bole District).

“Since everybody in the community needs the drug and I know most of the people if someone is not at home at the time of the distribution I normally leave his own[drug] with someone in the house for him.” (CDD, Bole District).

“I explain the purpose of the MDA to every household member, and I make sure every eligible household member swallows the drug with water in front of me before I leave the house.” (CDD, Central Gonja District).

4.20 Perceptions and side effects of the drug

According to the CDDs, community members have the belief that the drug has some side effects. Some of the adverse drug reactions reported include vomiting, dizziness, swollen testicles and body itches as reported:

“People complained about swollen testicles, and some people say when they take it [the drug], they have some itches in their body [...] some people also say they have bodily pain when they ingest the drug ...” (CDD, Bole District).

“They say they were vomiting, and feeling dizzy, but sometimes most of them don’t eat before taking the drug. But we have not recorded any serious side effects that should scare somebody enough not to take the drug.” (Health worker, Bole District).

4.21 Challenges faced by CDDs and health workers

The challenges encountered by the health workers and drug distributors were lack of transport to cover the communities, frequent breakdowns and sometimes no fuel for motorbikes. They also struggled with bad road networks due to potholes and flooding and a lack of motivation

and incentives. Some CDDs said they were attacked by community members who experienced some form of reaction to the drug. This is revealed in the following comments:

“We don’t have motorbikes; fuel is number two ... flooding of roads to some communities is also a big problem here.” (CDD, Bole District).

“They usually complain and sometimes attack me ... because of the reactions or side effects they have after taking the drug ... I try to explain or convince them, but at times it doesn’t work.” (CDD, Bole District).

4.22 Reasons for refusals

The qualitative result shows the refusals of the community members refused to ingest the drugs due to misconceptions of the drug were, such as the drug was a method for family planning, the side effects of the drug, the perception that it kills people, and others superstitions and traditional inclinations.

It is worth noting that the involvement of opinion leaders in the MDA process that helped people to refrain ingesting the drug in Central Gonja District and presented in the quotes:

“Some people say it is a disguised family planning drug.” (Health worker, Bole District).

“The last time I took medicine, I had lots of side effects ... I was vomiting, itching and had rashes on my body, so I stopped taking it. Due to this problem and I know many people who do not want to take it due to the same problem.” (Noncompliant, Bole District).

“Yes, at times, some people refuse to take the drug for fear of side effects and some other reasons but when I bring in the assemblyman, and we explain to them there agree to participate.” (CDD, Central Gonja District).

4.23 Suggestions on how to reach community members and improve MDA

The respondents suggested that to reach more people, education and awareness creation about the MDA should be intensified. Also, there should be adequate transport, increased motivation,

the involvement of community leaders and a strategy to involve males who drink alcohol needs to be devised. This is shown in the following responses:

“I think, there is the need to intensify sensitisation to educate the people more about the safety and possible side effects of the drugs ... the community need to understand that the side effects are normal and will not harm them ... they should also be made to understand the importance of taking the drugs.” (Health worker, Bole District).

“The involvement of the community leaders during the MDA is essential. Their involvement makes our work very easy.” (CDD, Central Gonja District).

According to the respondents, the MDA can also be improved through education and sensitisation on the safety of the drug and side effects to allay the fears of community members and the involvement of community leaders. Some respondents also indicate the need to reduce the quantity of the drugs and use bed nets to be used to lure community members into taking the pills. This is shown in the quotes:

“They should distribute bed nets when they are coming to distribute drugs, and it will encourage people to take drugs ... people in this community find it difficult to believe issues so if they could find time to have meetings and educate them; it will help” (Noncompliant, Bole District).

“More education should be done before the distribution so that people can take it [the drug] without any fear.” (CDD, Bole District).

“They should reduce the number of drugs they give; they give plenty and ask you to take all” (Noncompliant, Bole District).

CHAPTER 5: SELECTION AND IMPLEMENTATION OF QUALITY IMPROVEMENT STRATEGIES IN INTERVENTION PHASE

“We like to test things... no matter how good an idea sounds, test it first”- Henry Block

5.10 Introduction

This chapter describes the process of selecting and implementing strategies in the intervention phase of the study. The intervention phase of the PhD aimed to design and implement a quality improvement strategy based on findings of objectives 2 and 3 to improve coverage and compliance of lymphatic filariasis mass drug administration in Bole District of Ghana. The designed QI intervention described in this chapter was implemented in five (5) sub-districts of the Bole District. The process and impact evaluation of the implemented QI intervention is presented in the next chapter. This chapter demonstrates the feasibility of using implementation research tools to develop and implement a context-specific quality improvement strategy for an existing evidence-based intervention (LF MDA) towards the elimination of lymphatic filariasis as a public health challenge in Bole District of Northern Ghana. This phase of the study implement one PDSA cycle, and the intervention process has been published elsewhere [191]. The next section 5.11 describes developing the quality improvement strategies followed by the intervention mapping process in section 5.12. Section 5.13 highlights the domains while monitoring of the intervention is presented in section 5.14 to answer objective 4.

5.11 Developing quality improvement strategies

Results from initial needs assessment (as shown in Chapter 4) were used to identify the possible areas of intervention.

The QI strategies are based on the concept of the GPELF [169] and the aim of the Ghana Filariasis Elimination Program [17]. The GPELF is an innovative, public-private partnership for health improvement. The selection of the QI strategies in this phase of the study was also grounded on evidence from other LF MDA studies such as improving service delivery strategies of the MDA, active stakeholder engagement, and improving compliance at the level of the community and the individual level [17, 169, 220].

The success of LF MDA is shown to be backed by community sensitisation and mobilisation through evidence-based, multi-channel communication approaches with key messages on treatment and side effects combined with high visibility if the MDA should be pioneered [19, 169, 172, 220-223]. As evident in a study in Nepal by Adhikari et al., awareness of MDA campaigns had significantly increased the level of compliance among participants. Individuals who knew side effects during MDA campaigns had a lower prevalence of non-compliance [224].

Community leaders were involved, based on the World Health Organization's recommendation that community involvement in health programs will not only help to remove the burden of dependency that characterises health development work but also creates general awareness among local people about the need for their involvement in all forms of health development [225].

Evidence elsewhere shows that the involvement of local leaders, religious and political authorities in the MDA activities enhance the participation, coverage and compliance of MDAs [169, 172, 221, 226].

A study conducted in 2017 in Southern Ghana shows that knowledge, attitude and practices relating to LF and the MDA improved after a health education intervention [17]. It has been suggested by Njomo et al. [174] that for the LF elimination program to succeed, there is a need for aggressive community sensitisation towards the disease and elaborate social mobilisation [221]. Thus, bridging the knowledge gap with appropriate educational intervention is cardinal to change perceptions and popularly held-beliefs which have no scientific basis.

The selection of the QI strategies also combined several complementary theories such as the health belief model, social cognitive theory, the community empowerment model and the social networks and social support model. These theories were used as a guide in developing the interventions package. This is because the desired change is at both the provider and the individual levels. Hence, there is the need for convincing providers and the endemic community to consider the LF drug as a viable intervention option to stop transmission of LF. These theories have been applied to similar public health interventions [227-230]. A practical

description of the evidence-based strategies for this QI intervention was based on a model adopted by Proctor et al. 2013 [231].

5.12 Intervention mapping process

The intervention phase of the study adopted intervention mapping strategy to come up with QI approaches for implementation in the existing evidence-based LF-MDA program. An initial stakeholder engagement meeting involving officials of the NTDs program at National, Regional and District levels was organised during the formative stages (pre-intervention phase) of the study. The intervention mapping process comprised dissemination of the findings of the pre-intervention phase (initial needs assessment) and stakeholder engagement discussions in a systematic process.

The initial needs assessment (as indicated in Chapter 4) shows that the persistent transmission of lymphatic filariasis in the Bole District is characterised by 1. refusal to ingest the drug due to the fear of adverse drug reactions, 2. poor knowledge and misconceptions of the disease, 3. reported adverse drug reactions, 4. poor community mobilisation and sensitisation, 5. non-adherence to the directly observed treatment strategy, and 6. poor adherence to the MDA protocol. The barriers and needs identified in the Pre-intervention phase are summarised in Table 11.

Table 11: Key Barriers to the Lymphatic Filariasis Mass Drug Administration in the Bole District of Ghana

	Issues/Concerns	Barriers
1	Knowledge of LF and MDA among Drug Distributors	• Drug distributors do not have enough knowledge of the Disease and the purpose of the MDA. • Drug distributors do not understand the MDA inclusion criteria. • Drug distributors are unable to explain the importance of the MDA and the need for all to participate in the endemic communities.
2	Social mobilisation and sensitization	• The endemic communities have little or inadequate information about the disease and the MDA. • No mobilisation and sensitisation are done in some endemic communities.
3	Drug distribution process	• The duration of the MDA process is not enough to cover temporarily absent people. • There is not enough time to prepare for the MDA.
4	Adverse drug reactions	• Community members do not know the drug reactions and what to do when they experience adverse drug reactions. • Due to the low knowledge of and understanding of possible drug reactions, some community members refuse to take the drugs

5	Non-complaint community members	• Refusal to ingest the drug by some community people. • Misconceptions about the disease among community members.
6	Non-adherence to the DOT strategy	• Some drug distributors do not adhere to the directly observed treatment (DOT) strategy.
7	Non-involvement of community leaders and other stakeholders	• Community leaders such as assemblymen and women, opinion leaders and traditional leaders are not involved in the MDA exercise.

The key issues from the stakeholder meeting (based on the results of the pre-intervention phase) are presented in Table 12. The seven stakeholder groups suggested solutions to the barriers in Table 11 ranging from the training of CDDs, community education, proper supervision, health education and community feedback, to the involvement of opinion/religious and community leaders. The selection of the final consolidated QI strategies was based on available evidence from the literature, as shown under the justification domain in Table 13.

The stakeholder engagement meeting for the dissemination of baseline results and intervention mapping towards the intervention phase of the study was held in the district capital of Bole District. The purpose of the stakeholders' engagement was to disseminate the findings of the baseline study and to map out tailored, discrete, need-based implementation strategies to address the specific contextual bottlenecks identified in the preliminary study to improve the fidelity of the MDA and its coverage.

Table 13 presents the consolidated QI strategies that were implemented. The researchers, together with the stakeholders, came up with the final cost-effective and evidence-based QI strategies based on the model adopted from Proctor et al. (2013) [231]. The concept informed these strategies of the GPELF [169] and evidence from other related studies [19, 169, 172, 220-223, 226]. The components of the implemented strategies include training of CDDs, social mobilisation and sensitisation, the involvement of community leaders and other stakeholders and the drug distribution process. Each of these strategies has seven (7) domains namely; actors, actions, a target of action, temporality, dose, implementation outcome effects and justification.

Table 12: Challenges and suggested solutions from stakeholder brainstorming sessions

Issues/Concerns	Challenges	Suggested solutions by District Health Management Team	Suggested solutions by Tinga sub-district	Suggested solutions by the assembly (local government) participants	Suggested solutions by Bamboi sub-district	Suggested solutions by Mandari sub-district	Suggested solutions by Bole sub-district	Suggested solutions by Mankuma sub-district
1. Training of drug distributors	• Drug distributors do not have enough knowledge of the disease and the purpose of the MDA. • Drug distributors do not understand the MDA inclusion criteria. • Drug distributors are not able to explain the importance of the MDA and the need for all to participate.	• Distributors should be trained on: causes of disease, its mode of transmission, signs and symptoms and ways of prevention. • Exclusion criteria (pregnant women, breastfeeding mothers, seriously sick people and under height people) should be made known to distributors.	• CDDs should be given educated in MDA and the disease. • Adequate education of the exclusion criteria should be given to CDDs. • CDDs should be well trained on the importance of the MDA to ensure community people participate. • CDDs should be trained in each community.	• In-service training should be organized for drug distributors in the district.	• Proper education about the disease which includes the causes, signs and symptoms, mode of transmission and preventive measures. • Educate the drug distributor on eligibility and non-eligibility by listing the criteria and providing hard copies for the CDDs to refer to when in the field. • CDDs should be educated on the importance and benefits of taking the drugs.	• Adequate training of drug distributors (all inclusive). • Hold training sessions for drug distributors at different locations • CDDs should be literate people. • Training should include practicals.	• Days for training should be increased to two days. • Training decentralization. • Increase the number of CDDs.	• Drug distributors should be educated on the disease and the purpose of the MDA. • Education on the MDA inclusion criteria. • Selected CDDs should be trusted and also have the knowledge and the capability to convince the community of the MDA program.
2. Social mobilization and sensitization	• The endemic communities have little or inadequate information on the disease and the MDA. • No mobilization and sensitization are carried out in some endemic communities.	• Include stakeholders (Chiefs, assembly members, etc.) in the MDA exercise. • Organize community durbars and meet social groups to explain MDA relevance. • Make announcements in churches, mosques, schools, etc.	• CDDs should be trained to deliver messages to the community people through regular gatherings. • Health education should be carried out at CWC, OPD and ANC levels before and after the MDA.	• Community durbars should be organized in the endemic communities to educate the people before administering the drugs.	• Hold meetings with stakeholders, e.g. chiefs, Imams, Pastors, elders, etc. to educate them on the disease, the MDA activities, and when it would begin. • Dissemination of information to the community members by the door to door education, holding durbars/ outreach sessions at market squares, churches, mosques, community groups, school health programs and during ante-natal and post-natal sessions.	• Intensify social mobilization through home visits, outreaches, durbars, school health programs, statics (OPD, CWC, ANC)	• Home visits • School health service • Outreach service • Durbars • OPD level service	• Organize durbars to include major stakeholders (Chiefs, assembly members, religious leaders, etc.) • Mobilization and sensitization should be done through gong-gong beating, church services, mosque sessions, youth meeting and groups (JAKSALLY Group) OPD, outreach.

Table 12: (Continued)

3. Drug distribution process	• The duration of the MDA process is not sufficient to account for temporarily absent people. • There is inadequate time to prepare for the MDA.	• 3 weeks of preparation before the distribution of drugs are required. • One month period is required for re-visits before submitting reports to the region.	• Duration of MDA should be extended in order to accommodate revisits and reduce absenteeism. • MDA period should be changed from the rainy season to the dry season.	• A follow up visit should be carried out after the mass distribution.	• Appeal for extension of MDA period to meet the demands of the people. • Appeal for the MDA activities to be carried out during the dry season. • Group proposed early notification for proper preparation.	• Maintain a yearly calendar on MDA. • The training of drug distributors should be in the dry season.	• Extend the duration of the MDA exercise. • Follow up visits. • Provide a second opportunity for MDA.	• Duration of MDA should be extended to cater for absent people. • Revisits by CDDs to places where there were absent people, located by marking • Pre-information should be given to communities in order to make time for the MDA.
4. Adverse drug reactions	• Community members have no knowledge of possible drug reactions and what to do if they experience adverse drug reactions. • Due to the limited knowledge of possible drug reactions, some community members refuse to take the drugs.	• Sensitize community members on the adverse effects of the drug • Inform participants on where and when to go for help if they experience any reactions. • Let participants know that the treatment of reactions would be catered for by the health system.	• CDDs should be trained to explain the side effects of the drug to the people and also to inform them to report to the nearest health facility in the case of any adverse reactions to the drug.	• Drug distributors should educate community members on some of the reactions and what to do in the case of such reactions.	• Educate people on the adverse effects of the drug. • Advise them to report to the nearest Health Facility when experiencing any reactions from the drugs. • Conduct follow up visits.	• Education of drug distributors on some of the perceived drug reactions and how to address them. • Education of drug distributors on the side effects and what to do.	• Health education on early identification and early reporting of drug reactions. • Health education on side effects.	• Community members should be well informed about the adverse effects of the drug and report to the nearest health facility or the CDD in the case of any reactions. • Community members should be well informed about the importance of the drugs and be assured of the availability of the health staff's support.
5. Non-complaint community members	• Refusal to ingest the drug by some individuals. • Misconceptions about the disease by community members.	• Educate community members on the importance of taking the drugs • Educate them on the myths and known misconceptions held by the community.	• Stakeholders should be involved during the MDA in order to explain the merits of the drug. • Interpersonal relationships during the MDA.	• Community members should be educated on the importance of taking the drug.	• Health education on the side effects of the drug and its management. • Awareness creation during social mobilization through durbars, at churches, mosques, etc.	• Proper education of community members on the benefits of the drugs and the dangers of not taking them. • Educate and encourage some community members to be part of the sensitization process.	• Health education on the importance of the drugs and possible side effects. • Good interpersonal relationships.	• CDDs should observe the intake of the drug by community members during the MDA. • They should be educated about the causative agent of the disease, and that it is not caused by witchcraft, in-take of oily foods and neither is it hereditary.

Table 12: (Continued)

6.Feedback to communities	• No feedback is given to the endemic community on the MDA and the status of the disease prevalence.	• Feedback would be provided to the stakeholders (Chiefs, Imams, pastors, assembly members, health staff, teachers, etc.).	• Feedback should be given to stakeholders after the MDA.	• There should be feedback to the endemic communities in the form of ranking.	• Organize durbars, school health programs and group meetings to disseminate the feedback of the disease prevalence to the community members.	• Organize durbars, school health and community outreaches with key messages on Challenges, successes, support and importance of the MDA.	• Durbars • Review meetings • During MDA exercise.	• CDDs and supervisors should be educated on giving feedback to the communities and the importance of this feedback.
7.Non-adherence to the DOT strategy	• Some drug distributors do not adhere to the DOT strategy.	• Explain the essence of DOTs to the CDDs and encourage them to be patient with community members.	• CDDs should ensure that drugs are taken in their presence. • Supervision of CDDs during MDA.	• Drug distributors must adhere to the DOT strategy and encourage community members to comply.	• We are educating the volunteers on the DOT strategy during the training of CDDs.	• Drug distributors should be well educated on DOT and strictly comply with the requirements. • Drugs should not be given to a third party.	• Supervision of CDDs.	• CDDs should be made to understand that most people do not take the drugs, hence the need to observe the community members taking the medication. • CDDs should desist from the I don't care attitude.
8.Non-involvement of community leaders and other stakeholders	• Community leaders such as assembly men and women, opinion leaders and traditional leaders are not involved in the MDA exercise.	All stakeholders would be involved before, during and after the exercise.	• Stakeholders should be involved in the MDA exercise.	• Opinion leaders in the communities should be actively involved in the MDA exercise.	• Hold stakeholders meeting with the chiefs, elders, religious leaders, traditional rulers, etc. focusing on the MDA exercise.	• Proper community entry – To hold meetings with key stakeholders and community leaders to explain the purpose of the exercise and seek their approval and support. • Community leaders should be made to understand that they are part of the successes and challenges. • Always plan with the community.	• Involve leaders and other stakeholders in the MDA training	• Community leaders and stakeholders should be actively involved in the organization of the MDA exercise.

Table 13: Description of the consolidated implementation package

Domain*	Strategy: Training of Community Drug Distributors (CDDs)	Strategy: Social Mobilization and Sensitization	Strategy: Involvement of Community Leaders and other Stakeholders	Strategy: Drug Distribution Process
Actor(s)	District Director, Sub-district NTD focal persons, disease control officers and implementation/QI team (District and sub-district NTDs focal persons and heads, DCO, HPO, Assemblymen/women and PI) who have been trained.	Intervention implementation/QI team (District and sub-district NTDs focal persons, opinion, religious and traditional leaders and PI).	Intervention implementation/QI team.	Intervention implementation/QI team and CDDs
Action(s)	- Train drug distributors to have good knowledge and to be able to explain the importance of the MDA exercise to community members. - Train drug distributors to be able to convince every qualified person in the endemic area to participate in the MDA exercise. - Train drug distributors to know the inclusion and exclusion criteria of the MDA. - Train drug distributors to know the possible adverse drug reactions and explain them to the community members. - The drug distributors should be taught the skills of communication and interaction and the importance of being patient and tolerant with difficult community members. - Vigorous enforcement of the MDA procedures, in particular, DOT policy during training and supervision.	- An evidence-based, multi-channel communication strategy to result in high levels of awareness among community members, (radio discussions and announcements, announcements in churches, mosques, schools, etc., community durbars and meetings with social groups to explain MDA relevance and public/community announcements). - Focus key messages on cause and mode of transmission of the disease, importance of the MDA, and how to identify, what to do and minimise adverse drug reactions.	Community/Opinion leaders such as Chiefs, Assemblymen/women, religious and traditional leaders should be involved in the MDA exercise.	- An adequate number of days should be dedicated to the distribution exercise (not less than 1week) - The distribution should reach people in institutions, markets, places, offices and homes. - People with higher-level qualifications and a good knowledge of the MDA should be sent to institutions and offices to distribute the drug. - Enough days should be assigned to the MDA activities. - Strong enforcement of the DOT policy.
Target (s) of the action	Drug distributors in the endemic communities.	People in the endemic communities.	Community leaders.	People in the endemic communities.
Temporality	The drug distribution should start within one week after the training of drug distributors.	Social mobilisation and sensitisation should start two weeks before and should continue during the MDA.	Before, during and after MDA exercise.	During the drug distribution

Note CDD: Community Drug Distributors, DCO: Disease Control Officer, HPO: Health Promotion Officer, QI: Quality Improvement, DOT: Direct Observed Treatment MDA: Mass Drug Administration. *Model adopted from Proctor et al. 2013

Table 13: (Continued)

Dose	• The training of the CCDs should be detailed enough to equip them well for the MDA task, and the training period should not be more than one day to enhance their active participation in the training.	• Each endemic community should have at least two social mobilisation and sensitisation exercises (community durbar, school education, information centre announcement, education at church and mosque, and or radio talk shows etc.) for the start of MDA and at least one during MDA.	• Every endemic community must have a community leader representing it.	• The distribution exercise should not be less than 1 week in the endemic district. • Over 80% of the people in the endemic communities must be covered.
Implementation outcome (s) and effect	• Increase the level of adherence to LF MDA implementation procedures and participants' responsiveness.	• At least 15% increase in MDA coverage and reduction in the number of refusals (increased participant responsiveness).	• At least 15% increase in MDA coverage and reduction in the number of refusals (increased participant responsiveness).	• At least 15% increase in MDA coverage and reduction in the number of refusals (increased participant responsiveness).
Justification	• Researchers suggest that drug distributors are the interface between MDA programs and their targeted population; hence their adequate training is crucial to the success of the MDA [166, 167, 169, 172].	• It has been shown that evidence-based, context-specific and multi-channel social mobilisation and sensitisation is required for the LF elimination program to succeed [17, 172, 221].	• Stakeholder engagement and involvement in LF MDA cannot be overemphasised [17, 169, 172].	• The MDA implementation process is very important for participants' responsiveness to the program [17, 172].

Note CDD: Community Drug Distributors, DCO: Disease Control Officer, HPO: Health Promotion Officer, QI: Quality Improvement, DOT: Direct Observed Treatment MDA: Mass Drug Administration. *Model adopted from Proctor et al. 2013

5.13 The domains

1. The actor

The actors used in this context are stakeholders who will deliver the QI strategies. The actors for this study include District and Sub-districts NTD focal persons, disease control officers, health promotion officers, local government representatives (assemblymen/women) and the Principal Investigator (PI).

2. The action

The actions are the specific processes or steps and activities to be undertaken in a specified sequence. For the study, the actions for each of the four strategies are specified in Table 13. These actions include training activities, multi-channel communication strategies, the involvement of community leaders and increase in the duration of MDA activities for wider coverage of the eligible population.

3. Targets of actions.

An implementation strategy is a function of where it is directed to have an impact. Hence, it is important to specify the target because it helps focus on the strategy and suggests where and how an outcome of interest should be measured. The targets of actions in this study were community drug distributors, people in the endemic district and community and opinion leaders. A total of 162 community drug distributors were trained.

4. Temporality

The order or sequence in which a QI strategy is implemented is very important in the execution process of the strategy. This study specified when each strategy should be used, as shown in Table 13.

5. Dose

These are details about the intensity of the implementation strategies required to have the needed effect. This ranges from the number and duration of training sessions, number of social mobilisation and sensitisation activities per community for the period of the drug distribution exercise. The training was for one day, but the number of social mobilisation and sensitisation activities varies from community to community.

6. Implementation outcomes and effect

Implementation outcomes are purposive and deliberate actions or activities to implement new strategies or practices. Implementation outcomes serve as indicators of the implementation success, act as proximal indicators of implementation processes and key intermediate outcomes [232]. Implementation outcomes, therefore, serve as necessary preconditions for achieving desired changes or results [233]. The implementation outcome in this study is increasing adherence to the LF MDA implementation process and involvement of the endemic community, resulting in increasing the MDA coverage by 15% and reducing the number of refusals, as shown in Table 13.

7. Justification

The selection of the implementation strategies in this study is based on a proactive needs assessment of barriers or factors affecting the implementation of the LF MDA in the study district. The strategies are also supported by current literature, as shown in Table 13 and programmatic rationale through stakeholder engagement in the brainstorming exercise, which is deemed appropriate to address the specific bottleneck posed by the implementation context.

5.14 Implementation and monitoring of the consolidated quality improvement intervention

The quality improvement strategies described in Table 13 were implemented in all the five subdistricts in Bole District of Ghana. The intervention was implemented in one round of MDA representing one PDSA cycle across all five sub-districts concurrently. The Sub-district Head of Health Services led the implementation of the strategies in each sub-district.

The implementation process of the intervention was closely monitored. The monitoring allows for continuous sympathetic assessment of the implementation process of the intervention and whether changes needed to be made during the implementation [234, 235]. The monitoring was also done to assess the activities during the implementation of the QI strategies based on the planned consolidated QI implementation package. As part of the monitoring and to ensure successful implementation of the QI strategies, a trained QI implementation team was formed. The QI team was made up of District Director, Sub-districts heads, Sub-district NTD Focal Persons, Disease Control Officers, Local Government Representatives (Assemblymen/women) and the Principal Investigator (PI). The general responsibility of the QI team was to ensure the smooth execution and sustainability of the QI strategies.

A WhatsApp group was created to link members of the QI team. This social media platform was used to facilitate the sharing of ideas and challenges encountered during the implementation of the QI strategies. The WhatsApp platform also allowed the PI to review progress, troubleshoot problems and reinforce compliance to the QI strategies during the implementation process. During the implementation, sub-districts heads of health services were tasked to submit a weekly written implementation report to the Bole District Director of Health Services and the PI.

CHAPTER 6: POST INTERVENTION ASSESSMENT

“Every system is perfectly designed to achieve the result it gets”- Edwards Deming

6.10 Introduction

This chapter presents the results of the past intervention phase, which aimed to evaluate the quality improvement strategies (described in Chapter 5) on the level of coverage and compliance to lymphatic filariasis mass drug administration in the Bole District of Ghana. The next section 6.11 highlights the mass drug administration coverage. Sections 6.12 – 6.15 outlined the application of the RE-AIM (Reach, Effectiveness, Adoption, Implementation, and Maintenance) framework based on a mixed-methods approach to evaluate a context-specific evidence-based quality improvement intervention on the lymphatic filariasis mass drug administration in Bole District.

The findings provided the groundwork for future application of the RE-AIM framework to evaluate QI interventions to improve LF MDAs towards the elimination of LF as a public health problem. Central Gonja District interrupted transmission of LF hence stopped LF MDA activities in 2016; hence the intervention phase of the study was only implemented in Bole District, which is the main focus of the study.

6.11 Mass drug administration coverage

Result of the post-intervention phase shows an increase in the overall MDA coverage at a sub-district level during the post-intervention. This represents 8,715 more individuals who ingested the drug after the implementation of a QI strategy in 2017. Although there is a reduction of 3.2% in MDA coverage in Bole sub-district after the intervention in Table 14, all other sub-districts recorded an increase in coverage ranging from 0.1 to 12.3% after the implementation of the QI intervention.

Table 14: Distribution of pre and post intervention MDA coverage

Sub-districts	2016 Coverage % (Pre-intervention) N=57908	2017 Coverage % (Post intervention) N=66623	Difference (2017-2016) Coverage %
Mandari	70.0	79.8	9.8
Tinga	70.4	82.7	12.3
Bole	83.7	80.5	-3.2
Mankuma	68.0	86.0	18.0
Bamboi	98.9	99.0	0.1
Jama	96.9	98.8	1.9

Overall district coverage	82.0	83.4	
Self-reported adverse drug reaction*	0.13	0.02	

* This is per the number of people who ingested the drug.

While the average community and sub-district MDA coverage in the pre-intervention is 82.7 (12.2sd) and 81.3 (14sd) respectively, that of post-intervention is 81.5(11sd) and 87 (8.9sd) respectively as shown in Table 15.

Table 15: Summary statistics of MDA coverage in Bole 2016 -2017

Summary Statistics	Pre-intervention Community Coverage	Post-intervention community Coverage	Pre-intervention Sub-district Coverage	Post-intervention Sub-district Coverage
Mean	82.7	81.5	81.3	87.8
Standard Deviation (sd)	12.2	11.0	14.0	8.9
Range	47.5 - 100	58.5-100	70.0-98.9	79.8-99.0
P-value *	0.2520		0.2032	

* P-values for independent samples T-test

6.12 Reach

Before the commencement of the 2017 MDA, respondents said that training, which usually lasts between one and three days, were held for CDDs. According to them, training focused on teaching CDDs how to administer and handle the MDA drugs, how to fill the forms after administering the medications, how to sensitise community members and get hesitant people to ingest the drugs. Respondents also indicated they were taken through identifying the category of people drug should be given, and ensure houses are visited during the exercise. The participants stated the training was practical because they were given books and pictures of the disease to show to community members. These, they said, facilitated their work.

“We were trained for three days, and the training was very good. We were thought a lot about LF and the drug distribution. We were also taught how to sensitise our community members to participate in the drug administration” (CDD, Tinga).

District level: The district director of health service, district disease control officer, district public health officer, and district public health nurse participated in the training sessions. This participation represents 100% reach for the district level officials who superintends the MDAs in the district.

Sub-district level: The heads of each of the five (5) sub-districts and their disease control officers participated in the training. Thus 10 (100%) representation of the sub-districts officials who oversee the implementation of the MDA at the sub-district level. Besides, five (5) nurses from the sub-districts also participated in the training to help with supervision of the CDDs during the MDA.

Community drug distributor level: A total of 152 CDDs were trained representing 98% of the total CDDs identified for the MDA in the study district. Three (3) were absent due to ill health the time of the training, but an arrangement was made for them to be trained at the sub-district level before the commencement of the 2017 MDA.

Community leader level: Two (2) key community leaders from each sub-district (a total of 10) participated in the CDD's training. The community leaders were also involved in the social mobilisation and sensitisation activities in their various communities in the sub-districts.

Individual community member level: A total of 66623 eligible individual community members received the LF medication in the study district during the 2017 MDA as compared to 57908 in 2016.

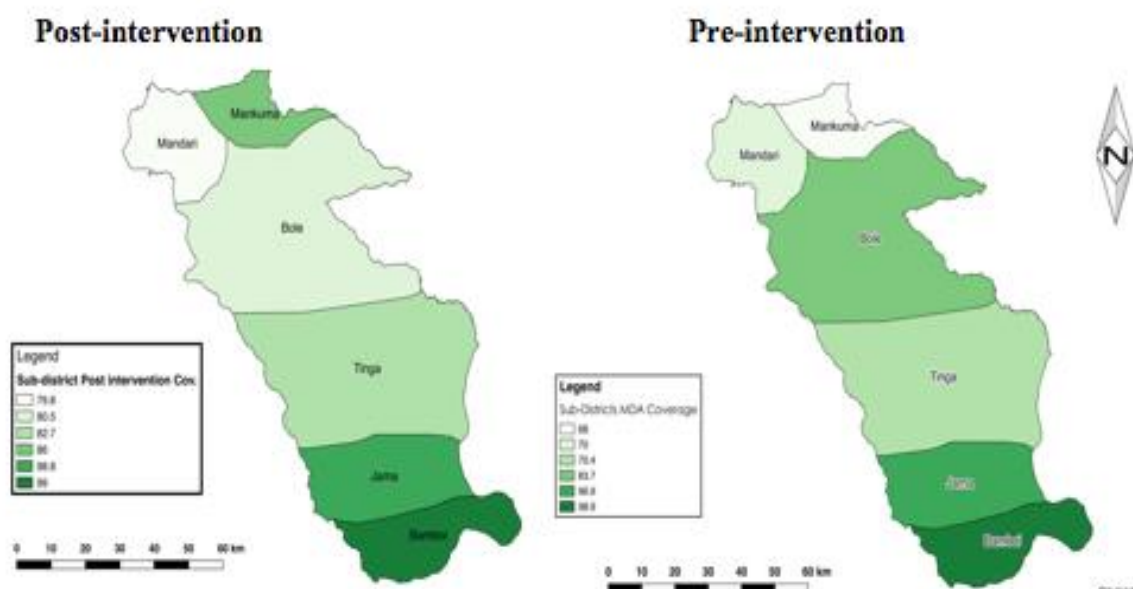


Figure 15: Pre and Post MDA Coverage in Bole District, 2016-2017

The three sub-districts (Mankuma, Mandari and Tinga) which had MDA coverage below 80% in the pre-intervention, during the post-intervention, they had a coverage of 80% and above as shown in Figure15.

6.13 Effectiveness

6.13.1 Knowledge of lymphatic filariasis

Most of the respondents were able to describe lymphatic filariasis (LF) based on the signs and symptoms exhibited by patients. Others also relied on the causes of the disease in explaining what the disease is. The following are some responses to the question of what LF is:

“...it is a disease that affects the human body and allows some fungi to grow on the affected part, and at a point, you will see the affected area growing to an abnormal position. Sometimes if it is the foot, you will see that foot is extraordinary fatter than the other foot, if it is the hand too, the same thing. But most people I have seen being affected by this disease have it on foot and hardly have I seen somebody being affected by the arm” (Community leader, Mankuma).

“It is a disease that when a mosquito bites a person who is not immunised and comes to bite you, then you also become infected” (CDD, Manderi).

“...it is a disease that affects the lymph system, which is mostly caused by mosquito. Mostly when it does happen, it is characterised by swelling, and the body parts it affects are the extremities and the scrotum and other parts of the body” (Health worker, Tinga).

On what causes LF, almost all other respondents mentioned bites of mosquitoes as the cause of the disease. Two respondents (a drug distributor and community leader) however said they had no idea about what causes the disease. One respondent, however, disclosed speculations that witches cause the disease.

“I don’t know what causes the disease, but some said it is caused by witches” (Community leader, Jama).

With regards to preventive methods available for treating LF, most of the respondents said that taking the MDA drugs help in preventing the disease.

“...health staffs have made us aware that if you take the drugs consistently, then you can prevent it” (CDD, Jama).

“...the only thing is to be taking the drugs always” (CDD, Manderi).

“...if you know you don’t have elephantiasis, and they are sharing the medicine, and you refuse to take them, it can’t prevent it unless you have taken the drug” Community leader, Bole).

The study participants were knowledgeable about the signs and symptoms of the disease. The most frequent sign mentioned by respondents was swollen limbs or legs. Others were itchiness, rashes, headaches, persistent diarrhoea, dizziness, fever, fear of light, enlargement of the testes, reddish eyes, body pains and weakness in the body.

“...you see one of the legs bigger than the other or very big testicles” (CDD, Jama).

“...sometimes I see the fellow having reddish eye and itchy body” (Community leader, Mankuma).

6.13.2 Broad understanding of the MDA

According to respondents, the MDA is the distribution or administration of drugs to all community members (both LF patients and non-patients), to prevent and eradicate lymphatic filariasis. This is usually done using volunteers from the communities with supervision and monitoring from health workers.

“We do the exercise because we don’t want anyone to get the disease in addition to those who already have it. It is an attempt to eradicate the disease” (CDD, Bamboi).

“...it has to do with we giving people drugs in our communities so that they are protected from getting the disease... mostly it happens once in a year... we go around to distribute the drugs... mostly we use the volunteers then the health workers do the monitoring and supervision” (Health worker, Tinga).

Although all the respondents agreed that drugs given during the MDA are to prevent LF, some CDDs were also of the view that the drugs are capable of curing blindness and other diseases.

It is worth noting that some community members were usually eager to ingest the drug because the drug enhances their sexual performance.

“The medicine makes you active in whatever you are doing. Some community member said they could have sex with their wives and husbands very well” (CDD, Manderi).

6.14 Adoption and implementation

According to the respondents, other activities undertaken before the 2017 MDA included informing the communities about the MDA via a town criers, sensitisation in churches, mosques, community information centres and sometimes on local radio stations. On a few occasions, durbars were held to educate community members on the LF disease and the importance of MDA. The endemic communities were also educated on reasons for the MDA and possible side effects of the drugs. Some respondents also reported that they used door to door approach to announce dates and to sensitise households. The reasons given for the announcement by drug distributors were to ensure that people make themselves available on distribution days as most communities’ members were farmers who sometimes spent nights on their farms.

“...we pre-inform the people. This is because sometimes, some people go to spend the whole day and nights on the farm. Sometimes we even go to churches to make announcements with regards to the exercise so that the people are overly aware of the exercise” (CDD, Jama).

It is important to note that most drug distributors disclosed that the focus is usually on announcements of dates and not on sensitisation. Very few of them mentioned sensitisation on the disease, possible side effects, and how to handle such as activities they undertook before the commencement of the MDA. Health workers who participated in the study, on the other hand, emphasised community mobilisation through durbars and meetings with stakeholders for sensitisation as one of the primary activities undertaken before the MDA began. This clearly shows that social mobilisation and sensitisation before and during the MDA is the responsibility of the health workers. There is an indication that community leaders were involved in the last MDA exercise, as shown in the quotes.

“We do what we call social mobilisation, and we get the stakeholders to involve. We have a meeting with the stakeholders, and we discuss what we about to do. We let them know the reason for carrying the exercise because without the stakeholders we can’t get the community to participate in the exercise we have the volunteers involved in the

meeting and we orientate them... we then send the information across to enforce the community sensitisation after the meeting” (Health worker, Tinga).

“The last time we were informed about the exercise, we beat the ‘gong-gong’ in the community to tell everyone about the exercise, and when it will take place. We then advise them to make sure they avail themselves to take the medication. We also recommend and encourage them to stay away from alcohol on the day of the exercise to avoid any complications” (Community leader, Mankuma).

According to the participants, the drug distribution lasted between one and two weeks. Alcoholics, pregnant women, under-heights, lactating mothers, and people who were seriously sick were excluded from the exercise. In cases where household members were unavailable to take the drugs or were unable to ingest the drug for one reason or the other (sometimes because they had imbibed alcohol), the house or structure was noted and revisited. Height of household members is measured to determine the dosage of medicine to be given.

“...we have the measuring stick we use to check their height so when we establish that the person can take the drug, we make sure the person takes the drug in our presence...we don’t give it to you to take later” (CDD, Tinga).

There is a strong indication that the Directly Observe Treatment (DOT) strategy has been adhered to by the CDDs, as indicated in the following quotes:

“...for some of them I fetch water, and they swallow the medicine there... especially those who didn’t take for the previous years... so they take it on the spot before I leave the house” (CDD, Tinga).

“...we make sure they take medicine in front of us so that they don’t go and throw the drugs away” (CDD, Bole).

The participants revealed that there were many differences which made the most recent exercise more effective compared to previous ones. Some of the differences mentioned include detailed training for CDDs, increase in incentive for CDDs, supportive supervision, assurance of free treatment of adverse drug effects by health service, a higher level of participation and community sensitisation.

The respondents indicated that a lot of community members agreed to ingest the medication in the most recent (2017) MDA exercise compared to previous ones. They disclosed that whereas in previous exercises, they had to chase and convince community members to ingest the drugs, the reverse was the case in the most recent MDA program. Some disclosed that in some occasions, community members went to the homes of the drug distributors or asked about the drugs even before the commencement of the MDA program. Some drug distributors also said they faced a very little challenge in getting community members to comply on distribution day as they were eager and ready to participate in the MDA exercise.

“Formerly they will say they don’t know you, but now they say you have not come to my house to give me the medicine” (CDD, Mandari).

“One major improvement is that we were given the assurance that if anyone faces any adverse effect after taking the drugs, they can report at the health facility, and they would be treated for free, and this boosted the confidence of the people in the drugs” (Bole, Tinga).

“Previously, people used to reject the drug and will never take it no matter what you say or do... but during the last distribution, people were in their houses waiting for me to bring the drug” (CDD, Mankuma).

“As I said earlier, the willingness of community members to ingest the medicine was very high in the last exercise...those who used to complain of drug reactions have now seen the benefits because we always convince them that the drug reactions they experience are because the organisms that cause the disease is already in their body, and so the drug is working on it, and so they need to continue taking the drugs to kill the organisms completely...previously, people used to reject the drug and will never take it no matter what you say or do” (CDD Tinga).

The higher level of compliance in the recent exercise, according to some CDDs was due to the claims that the MDA drugs make one more physically active and enhance sexual performance. There was also an indication that community members understood the importance of MDA exercise and so were willing to participate in the exercise, which made work easy for CDDs. Pictorial evidence was shown to community members on the signs and symptoms of LF also

influenced compliance as it induced some fear and insight about the reality of the disease into community members who were likely to reject the drugs.

“they say when you take it (the medicine), it makes you active in whatever you are doing and some also say they can sleep with their wives and husbands very well” (CDD, Mandari).

“The compliance was better now because they understood the exercise and so they were willing to swallow the drugs... sometimes those who were absent even trace me to come for theirs when they return” (CDD, Bamboi).

“During the previous drug distribution they were not willing to swallow, but last year they were willing due to the photos that we were holding” (CDD, Tinga).

Another difference between the recent MDA and previous ones was the intense training volunteers received before the distribution exercise. Because of this training, respondents said they were able to engage community members better. In instances where refusals were imminent, they were able to convince community members to take the drugs.

“...now what we do is that when the fellow wants to refuse to take the drugs, we explain the benefit of the drugs to them. But formerly, if the person doesn’t want to take the drug, we leave” (CDD, Mandari).

“...but now because of the intensive training, we take our time to explain to them, so most of them agreed” (CDD, Tinga).

Even though respondents said, they used different channels (religious centres, gong-gong beating, door-to-door approach) to sensitise community members and announce distribution dates, the introduction of some modern channels such as the use of community information centres and radios were new additions. These new additions were able to reach a wider population compared with the traditional method of the house-to-house announcement and gong-gong beating. A CDD has this to say:

“We used to go from house to house to inform people, but now there are information centres around that we were encouraged to use... you can just go there and make the announcements and people hear it from their homes” (CDD, Jama).

Also, respondents said unlike in previous exercises where drugs were just administered without measures put in place for treating adverse side effects, provisions were made in the recent exercise for free treatment of adverse reactions. Community members were informed on where to seek free health care should they have any adverse drug reaction. This, they say motivated community members to ingest the drugs as shown in the quote.

“One other improvement is that we were given the assurance that if anyone faces any adverse effect after taking the drugs, they can report at the health facility, and they would be treated for free, and that boosted the confidence of the people in the drugs” (CDD, Jama).

Respondents also mentioned an increase in allowances for volunteers and supervision in the most recent exercise compared to previous MDA exercises. These motivated drug distributors to give their best.

“...well, the money we were given in the last MDA exercise was an increment from the previous ones” (CDD, Bamboi).

“In fact, before God and man, there was a slight increment in the allowances that are given to the volunteers in this last MDA exercise, and this encouraged us to work harder” (CDD, Tinga).

“During the last exercise, the MDA officers were around to supervise us, so when you are going astray, they will correct you this helped us a lot” (CDD, Mandari).

Some distributors revealed that coverage in some communities in the recent MDA program was affected by the migration of community members to other parts of the country and so were not accessible. The results also show that the timing of the MDA being Islamic fasting period also contributed to the low participation in some communities.

“I realised that the number of people covered in the previous drug distribution was more than in the recent exercise because many of the people who had written their names in some of the houses were nowhere to be found because most of them had either moved out or travelled” (CDD, Bole).

“...you know Bole is a Muslim community, and the drug was distributed at the time of Ramadan so the people fasting could not take part” (Health Worker, Bole).

The fight against ‘galamsey’ (Illegal mining of gold) caused a lot of out-migration in some communities hence resulting in absenteeism in those communities.

“For my community, the coverage was low because previously, there were a lot of galamsey workers around and so the number of people was very high. But now that the galamsey has been stopped, all those people have moved away, and so it has caused a decrease in the number of people” (CDD, Bole).

“One challenge is that, since this is a galamsey area, you go and register a lot of people, but during the drug distribution they tell you they have moved out” (Health worker, Bole).

Some CDDs reported that they were unable to complete or cover the areas assigned to them within the stipulated time of the MDA. This was partly because of the increase in compliance or acceptance, which meant more people to attend. Some of the areas within the district had seen some development and population increase. Thus, some households were left out of the exercise.

Other community members rejected MDA drugs due to misconception, fear of side effects and the unwillingness of some health facilities to treat such cases for free. The distance to the nearest health facility to report adverse drug reaction was also assigned as reasons for refusal of the drug. CDDs outlined these as challenges encountered during the last MDA exercise.

“Because a lot of people including some visitors were ready to take the drug, I spent more time attending to people in some houses, and I was not able to visit all the houses in my area.” (CDD, Mankuma).

“...some of the community people said when they ingest the drug, their legs become swollen and I tell them if it has swollen they should come to the health centre, and they will give them drugs and they said when they go to the health facility, the nurses will not attend to them” (CDD, Tinga).

Some community members refused the drugs because they did not trust the volunteers, accusing volunteers of accepting bribes to administer deadly medicines to them.

“There were even people who would refuse to take the drugs and then ask you to leave their house... they say you have been given money to come and give them drugs for which they may even die after taking” (CDD, Mankuma).

Lack of logistics such as transportation and wellington boots to enable drug distributor access remote areas were among the challenges encountered.

“One thing they can do to help us is provided wellington boots and raincoats for us to be able to reach the communities that have muddy access and when it rains on the way” (CDD, Bamboi).

Community members also had unrealistic demands, demanded incentives such as mosquito nets which were not part of the program.

“Everywhere we go they talk about mosquito nets. They said we always talk about LF and oncho, but we don’t give them mosquito nets so they will not take the drugs” (CDD, Tinga).

6.15 Maintenance

Due to the short duration of the CEQI intervention, detailed evaluation of maintenance was difficult to assess and to determine the sustainability of the intervention. However, we reviewed barriers and possible solutions to enable successful implementation and sustainability of the intervention from the perspective of the study participants.

Because of the challenges encountered during the last MDA exercise, respondents suggested that the MDA exercise should be conducted during the dry season when there will be no farming activities as that will ensure accessibility to communities and availability of individual household members. The interval between MDA exercises was reported to be too long, and some CDDs suggested that the interval should be shortened.

“My suggestion is the interval between the MDAs is too long because people continue asking when is the tablet coming” (CDD, Jama).

To ensure the sustainability of the intervention, the CCDs suggested that more knowledgeable people (health worker) should accompany them during to authenticate their credibility during the drug distribution. According to some CDDs, community members knowing volunteers are

not medical personnel hence disregard information they give and consider it as inaccurate and incredible.

“We need more help to encourage us to do the job because if it only we the volunteers when we are talking to them, they won’t listen to us. They will say you have never been to school, and you are coming to give medicine to us” (CDD, Bole).

CDDs also recommended better remuneration, provision of incentives and motivation for community members.

“I think providing us with bicycles and increasing the allowance will help us reach the very far communities easily... and distributing bed-nets to the community members will also help” (CDD, Bamboi).

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“Everywhere we go they talk about mosquito nets. They said we always talk about LF and oncho, but we don’t give them mosquito nets so they will not take the drugs” (CDD, Tinga).

One major threat to the sustainability of the CEQI intervention observed is the frequent transfer of health staff within the district. Between 2017 to December 2018, key health worker (three senior disease control officers, two sub-district heads and a district director) has been transferred. These health workers were key members of the CEQI implementation team and management members, the sub-district and district health administration.

CHAPTER 7: DISCUSSION

“People don’t resist change. They resist being changed” - Peter Senge

7.1 Introduction

This study aimed to develop and test quality improvement strategies to effectively eliminate lymphatic filariasis disease as a public health problem in the Bole District of Ghana.

The study was in three phases and guided by a conceptual framework that connected the phases. The Pre-intervention phase explored barriers and facilitators to MDA implementation; the intervention phase was used to design and implement quality improvement strategies for more effective MDA, and the post-intervention phase was used to evaluate the implementation process and the impact of the quality improvement strategies.

The study used a mixed-methods cross-sectional design to answer the research objectives. The quantitative component of the study consisted of the use of secondary MDA data and community survey. The qualitative component of the study consisted of the IDIs and KIIs with health workers, community, drug distributors, community leaders and non-compliant community members.

The findings of objectives 1-3 (pre-intervention phase) are discussed under section 7.2, designing and implementation of the intervention (intervention phase covering objective 4) are discussed under section 7.3, and section 7.4 discussed the results of objective 5 (post-intervention phase)

This chapter brings together discussions of the findings of the three phases of the study covering the research questions and study objectives. The chapter also highlights the scholarly contribution of the PhD, outlines the limitations, conclusions and recommendations that flow from the study findings.

7.2 Pre-intervention

7.2.1 Mass drug administration coverage

The two study districts recorded MDA coverage above the recommended 65% coverage needed for interruption of transmission of the disease. This high MDA coverage reported in

the current study is consistent with the findings by other Ghanaian studies which reported MDA coverage rates above 65% in other settings [236, 237].

High MDA coverage, which does not translate into interruption of transmission of the disease after more than 4-6 rounds of MDA, was found in other settings to be associated with recording errors as reported by other researchers [19]. It has also been shown that for programs where the DOT strategy is not strictly followed, distributed drugs may not necessarily be consumed [220, 238, 239]. Due to the evidence of nonadherence to the DOT strategy by some CDDs in Bole District, the reported MDA coverage may not reflect accurate MDA coverage in the district, meaning, all distributed drug may not necessarily be ingested. This could explain why the MDA coverage is high (above 65%) in Bole District, but the transmission of the disease persists. The reported coverage in this situation will reflect distributed drugs as opposed to ingested drugs because the DOT strategy was not strictly being adhered to by CCDs. This nonadherence to the DOT strategy could also be contributing factor to the persistent presence of carriers of LF infection in Bole District; hence the persistent transmission of the disease in the area.

The MDA coverage for all sub-districts and communities in the Central Gonja District was very high compared to communities and sub-districts in the Bole District. This could also be another explanation for the persistent transmission of the disease after many rounds of MDA in the Bole District. This is consistent with existing evidence that low treatment-coverage rates in MDAs place the success of elimination programs at risk [1] and have been linked to failure in drug distribution, lack of perceived treatment benefit by the endemic population and fear of adverse drug reaction [148, 166, 167, 240]. This finding is also in line with the GPELF, which advocates for the treatment of entire endemic communities to achieve its elimination targets [124]. The low MDA coverage in the Bole District compared to Central Gonja District could also be due to refusal to ingest the drug, as confirmed by the qualitative results hence the persistent transmission of disease in Bole District.

7.2.2 Refusals and adverse drug reaction

The refusal of some community members to ingest the LF medicine in Bole District was explained in the qualitative study as due to Misconceptions about the cause and treatment of

the disease, fear of adverse drug reaction, poor knowledge about the disease, and religious beliefs.

The refusal to participate in MDA by eligible people in Bole District as compared to Central Gonja could also be a contributing factor to the low coverage in some sub-districts and communities. Such continuous refusal to ingest the drug could lead to a perpetual transmission of the disease to the nearby communities. Previous research in India has associated the continuous transmission of LF with systematic noncompliance and refusal to ingest the drug [241]. The noncompliance has perpetuated infection of microfilariae in certain communities in Haiti and Nepal [173, 224, 242]. This probably explains why the LF infection is still being transmitted in the Bole District after more than six years of MDA.

A systematic review by previous researchers in 2013 showed that when communities did not receive correct and adequate information about adverse drug reactions, the consequences were detrimental to the success of the MDA [169]. Studies from India have also demonstrated that insufficient information about the MDA [159, 243] and rumours about adverse drug reactions, when not addressed, persisted and negatively affected the MDA in neighbouring areas [155, 244]. It has, therefore, been suggested that side effects of MDA need to be communicated and reiterated at the time of the pre-MDA mobilisation as well as during the drug distribution [169]. The suggestion of this study is consistent with the finding of the current study. The occurrence of adverse drug reactions and its rumours in Bole has possibly contributed to the low MDA coverages as it could affect people's willingness to ingest the drug as shown in Sri Lanka, India, The Philippines, Papua New Guineas and Indonesia [147, 150, 156, 158, 166, 170, 175, 240, 245-250]. The fear of adverse drug reaction in Bole is also an indication of inadequate information about MDA treatment and failure to understand that such severities are rare in LF MDA [169].

However, it should be emphasized that the self-reported adverse drug reaction in the Bole District could be an indication of the high levels of the disease and parasites, which means that people with higher levels of the filarial parasite tend to have adverse drug reactions due to the drugs killing the circulating parasites [17, 251]. In effect, the degrees and severity of adverse events following ingestion of the LF drug increases with increasing microfilaria loads and increased microfilaricidal efficacy [252]. Conspicuously, therefore, this adverse drug reaction in Bole District could also confirm the high levels of transmission of the infection.

7.2.3 Non-eligibility and absenteeism

In this study, non-eligible participants in the MDA were under-height, pregnant or lactating mothers. The non-eligible population is higher in Bole District compared to Central Gonja District. A community-based study associated continuing transmission of lymphatic filariasis in Haiti with high LF infection rates among young children, most of whom were under-height and did not meet the inclusion criteria for the district's MDA [242]. Besides, although not WHO criteria, all breastfeeding mothers were considered ineligible for treatment. As shown elsewhere (Egypt, Haiti, Indonesia) this exclusion of lactating mothers from the MDA might have contributed to the large numbers of ineligible persons who remained carriers of infection [220, 238, 239].

The result shows both Ghanaian districts studied; some people met the eligibility criteria but did not take the drug due to being absent at the time of the drug distribution. One explanation given in the qualitative study is that the drug is usually distributed at the beginning of the busy farming season when most community members are absent. This finding confirms earlier studies which suggest that the time allocated for MDAs and its mopping-up activities was not sufficient to cater for people who were temporarily absent at the time of drug distribution [158, 163, 164]. It has also been shown in other studies that insufficient time adversely affects MDA coverage [153, 156, 158, 159]. The short time (one week) allocated for the MDA exercise makes it difficult for the drug to get to all eligible recipients in Bole District.

7.2.5 Knowledge of mass drug administration activities

The result revealed a significant difference in knowledge of mass drug administration activities among participants from the two study districts.

The health workers and the CDDs were able to outline the activities carried out before and during the MDA. They describe cascaded training for health workers and CDDs, community announcements, updating of LF registers and distribution of the drugs. However instead of the community sensitisation and education process prescribed by the MDA strategy, often only the date of commencement of the MDA is announced to the communities and, in some instances, it is not done by health workers. This no doubt creates a knowledge gap about the disease and would account for the prevailing attitude and perceptions of the MDA program in the Bole District. This finding is consistent with the results of studies conducted in Kenya, Ghana, India,

Indonesia and Haiti [19, 169, 172, 220-223]. Therefore, community sensitisation and mobilisation through evidence-based, multi-channel communication approaches with key messages on treatment and side effects combined with high visibility of the MDA activities is necessary for more effective MDA and elimination of LF in Bole District.

A review of factors influencing compliance of MDA for the elimination of LF by researchers found that ingestion of the pills is positively associated with advanced knowledge of MDA [169]. Hence, information about LF, the pills, and their distribution needs to be frequently available before the commencement of the MDA.

A study in Nepal showed that awareness of MDA campaigns had significantly increased the level of compliance among participants and that respondents who knew side effects during MDA campaigns had a lower prevalence of noncompliance [224]. Similarly, the current study shows that education and information on the importance of the program and the potential drug reactions were not properly communicated to the community members in Bole District. Also, the lack of education in the study area led to physical and verbal attacks on CDDs by individuals who had adverse drug reactions. These findings re-emphasized the recommendation by WHO that community involvement in health programs will not only help to remove the burden of dependency that characterises the health development work [225]. But the health system needs to create general awareness among local people about the need for their involvement in all forms of health development [225].

Besides, there was no mention of community engagement and involvement among the MDA activities listed by the health workers and the CDDs from Bole District. Yet results from Central Gonja District and evidence elsewhere shows that the involvement of local leaders, national institutions, religious and non-governmental organisations and political authorities in the MDA activities enhances the participation, coverage and compliance of the MDA [169, 172, 221, 226]. It is likely; therefore, non-involvement of some of these key stakeholders contributed to noncompliance and challenges encountered by volunteers during the program. The current study also revealed misconceptions amongst the noncomplying members of communities in Bole District. They are of the view that the drugs are supposed to be taken by people who have a chronic illness or clinical manifestations of the disease. The delusion about LF is an indication of shoddy education about the disease and the near-silent treatment of the MDA activities in the Bole District.

The uptake of the MDA programs in Bole District is being jeopardized by lack of health education. Bridging the knowledge gap with appropriate educational intervention is cardinal to changing perceptions and popularly held beliefs about the in Bole District. Therefore, the provision of clear information on potential drug reaction and its management in the LF endemic communities is crucial in restoring confidence in the MDA intervention in the district.

7.2.6 Knowledge of lymphatic filariasis

It is revealing to know that, there is a significant difference in the level of knowledge about the disease among the study participants in Bole and Central Gonja. There is a significantly higher level of knowledge about the mode of transmission of LF, signs associated with LF, and prevention methods of the disease in Central Gonja district than in Bole District. Comprehensive knowledge about the disease was significantly higher in Central Gonja district than in Bole District. All LF MDA non-compliant individuals interviewed in the Bole district did not know the exact cause of the LF disease. Also, some of the trained drug distributors were unable to indicate the precise cause of the disease which indicates the level of training in the area, the inadequate community sensitisation and social mobilisation, as well as insufficient information, education and communication (IEC) strategies. Studies had shown that social mobilisation and awareness campaigns to inform communities on the process before and during community-based interventions contributed to the success of such programs [172, 221]. Drug distributors at the interface, therefore, are key to the program's success with the targeted population through adequate training and appropriate knowledge of the LF disease [169, 172]. Inadequate training of CDDs and health workers results in non-adherence to the DOT strategy where pills were left in houses without adequate instructions for family members who were not present at the time of drug distribution [150, 153, 155].

7.2.7 Effect of misconception

This study found a significantly higher level of misconception about LF in Bole district as compared to Central Gonja district. Owing to the misconceptions about the disease, social stigmatisation and self-imposed restrictions associated with the disease in the Bole District, unemployed individuals are living with the disease as victims of the disease are considered invalids which other community members refuse to support by buying their goods or using their services. There are also perceptions and strongly held beliefs that people with the diseases have committed crimes, and therefore nobody wants to associate with them since they are

cursed. These misconceptions and firmly held beliefs about the disease are other indications of the inadequate distribution of information about the disease after many years of program implementation in Bole. The evidence of poor education, information and communication component of the LF MDA program in Bole is likely to have contributed to the noncompliance and persistent transmission of the infection in the district. This underscores the need for frontline staff (especially trusted healthcare workers) of the LF MDA program who educate the endemic community to have adequate training and the required knowledge about the disease and program. This evidence should motivate key educational messages that can be identified for pre-MDA stakeholder engagement, social mobilisation and community sensitisation campaigns to create awareness about the disease and the treatment.

7.2.8 Challenges faced and suggestions to improve MDA

The challenges faced by CDDs and health workers include transportation-related difficulties, community accessibility, poor knowledge of the MDA among community members, CDD motivation and non-availability of community members and non-adherence to the DOT strategy. Similar factors were identified in other community health intervention in Ghana [16, 17, 19] and elsewhere [169, 172].

The study participants suggested the need to revisit households that were missed by the drug distributor during the first visit. This is consistent with the finding of another study in Ghana which suggested that drug distributors not revisiting homes where members were absent during the first visit contributes to adherence to the DOT strategy and increase drug distribution coverage in the community [19]. As revisits, will depend on the workload of the CDD, human resources and the time allotted for such purposes, this also requires incentivising the health workers and the CDDs undertaking this task. Ultimately, it is in line with the fact that awareness must be created for the MDA and LF through better training of CDDs, massive education campaigns before the commencement of any drug distribution.

7.3 Intervention Phase

Based on the findings of the pre-intervention phase, a step-by-step procedure for selecting and tailoring QI strategies to an evidence-based intervention program was used. The QI strategies take into account local contextual needs through needs assessment and stakeholders' engagement [253]. The IM method used in this phase of the study galvanised stakeholders around common goals. It generated consensus regarding improving an ongoing evidence-based

intervention at a low-cost as shown in other studies [253, 254]. The process emphasises stakeholder contribution in coming up with a QI strategy [253, 255].

As suggested in other studies [253, 256], this phase of the study provides a clear description of the implementation strategies used as detailed in Table 13. In line with the article by Proctor et al. (2013) [231], this phase of the study designed and operationalises context-specific strategies in the Bole District. The strategies were specified according to features such as (1) the actor, (2) the action, (3) action target, (4) temporality, (5) dose, (6) implementation outcome [257] and (7) the empirical, theoretical, or pragmatic justification for the use of the strategy [231].

To show a clear link between the strategies and the bottlenecks that they are intended to address, an IM process and Proctor et al. (2013) implementation specifying model was used to clarify how and why carefully selected and tailored implementation strategy is proposed to work as suggested by other researchers [231, 253].

Improving the quality of evidence-based interventions to achieve expected results has proven to be a challenging task for most health system programs [258-266]. Studies [264-266] suggest that barriers and facilitators must be taken into consideration, and those different strategies may be required to overcome challenges associated with interventions, implementation contexts, and stages of implementation [253]. The intervention package used in the intervention phase of the study is in line with this suggestion. The processes presented in the intervention phase of the study have increased the rigour of selecting and tailoring an appropriate QI strategy, as demonstrated by Powell et al. (2015) [253].

This study provides a step-by-step procedure for selecting and tailoring QI strategies and for engaging key stakeholders who are very important in the success of the intervention. This is because implementing quality improvement strategies are usually multi-component and must be adapted to local contexts. The local contexts in which these interventions are implemented are themselves complex because of multiple interacting levels with wide variation from one setting to another [267, 268]. Hence, implementation research at the district level requires trans-disciplinary expertise which is not routinely part of the health system at the district level. The emerging implementation research provides a systematic set of principles, methods and expertise to improve the quality and effectiveness of evidence-based interventions within the health system [267].

The systematic method for selecting and tailoring QI strategies of evidence-based interventions to contextual needs in collaboration with stakeholders provided an understanding of how, when, where, and why implementation strategies are effective in integrating evidence-based interventions and improving clinical outcomes in the health sector as shown in this study [269]. The move toward improving evidence-based health system programs with a more thoughtful and systematic application of implementation research will enhance the expansion and legitimacy of the field of implementation research. The scientific rigour of the QI intervention of this study and providing support for the LF MDA program in Bole district, strengthen the evidence-based intervention towards achieving the expected results.

The intervention phase of the study has demonstrated the feasibility of using IM to develop and implement a context-specific QI strategy for an existing evidence-based intervention (LF MDA) towards meeting the 2030 road map for elimination of lymphatic filariasis as a public health challenge in Bole District in Northern Ghana.

7.4 Post-intervention

This phase of the study aimed to assess the effect of implementing CEQI intervention on implementation of LF MDA in the Bole District of Northern Ghana using RE-AIM. The RE-AIM framework provided a structure to evaluate the effect of the CEQI towards the elimination of the LF as a public health problem in hotspot districts in Ghana.

The findings of the evaluation showed that there was an improvement in social mobilisation and sensitisation, knowledge about LF and MDA process, willingness to ingest the medication, and adherence to the DOT Strategy. There was a 6.3% increase in the district MDA coverage and a reduction in self-reported adverse drug reaction.

However, the interventions did not have the desired effects of increasing the MDA coverage in Bole sub-district. This was due to the timing of the MDA and peri-urban nature of the sub-district. Bole Sub-district being Muslim dominated population, administering drugs to the population around the Muslim fasting period made it difficult for most people to ingest the medicine, causing the decline in the MDA coverage. Secondly, social mobilisation and sensitisation strategy, which works well in rural areas did not work in Bole sub-district due to the semi-urban nature of the sub-district. Although these factors were foreseen during the initial

needs assessment stage, this study could not do otherwise because the timing of MDA and resource allocation for the social mobilisation are decided at the national level. This study reemphasised the need for context-specific strategies in dealing with LF hotspots in Ghana.

These observations reveal the contextual complexities of working in semi-urban/urban communities (as demonstrated in Bole sub-district), and that health workers at the local level understand their system and difficulties on the ground much better than the national level team. The evaluation revealed a substantial improvement in knowledge, risk perceptions and understanding of LF and the MDA. Comparable observations have been made elsewhere [17, 179, 270]. They reflect the need for the creation of awareness, through social mobilisation and sensitisation using evidence-based context-specific strategies. And the involvement of community leaders and other key stakeholders in deciding on the strategies and methods to be used to improve MDA activities towards LF control based on initial needs assessment [191, 221, 271].

Intensive training and motivation for CDDs was also an important factor that determines the success of the ongoing LF MDA in the study district, as shown elsewhere [17, 272].

The nature of contextual complexities and dynamics of populations in LF endemic areas may require that MDA activities are designed taking into consideration contextual factors based on WHO-recommended strategies [17, 191, 273]. The use of social mobilisation and sensitisation materials and strategies should focus on the local context, need-based, social and culture structures [17, 274]. This study also revealed that the involvement of community leaders, intensive training of CDDs, and employing context-specific evidence-based social mobilisation and sensitisation strategies. This led to an improvement in the knowledge, attitude and practices relating to the disease, reduction in misconception regarding LF and MDA activities and willingness to ingest the LF medicine in the study area.

The fear of adverse drug reaction associated with the LF medication was an essential factor that influenced the decision to take the MDA drugs and has been identified in several studies elsewhere [169, 275] and the study area [191]. The fear of adverse reactions improved after the implementation of QI intervention. This show that the fear of adverse drug reaction in control of LF can be eradicated through the implementation of context-specific educational strategies. Building confidence in the populace, outlining the reasons for the occurrence of drug reactions, and actions to take when they occur as indicated in the study. While misconception about the

drug (enhances sexual performance) still exist in some areas, continuous appropriate education and advocacy may help overcome this challenge to avoid abuse of the drug.

This study has reinforced the importance of application of the RE-AIM framework for evaluation of public health intervention using a mixed-methods approach.

The increasing advocate for public health studies to apply mixed methods in health services delivery research has been demonstrated in this study and studies elsewhere [276-280]. Guidance is scarce in the literature on how to apply qualitative methods in the RE-AIM framework [281]. Therefore, the inclusion of qualitative approaches in this study is a vital contribution to the full application of the RE-AIM model in assessing public health interventions [205, 282]. The combination of qualitative and quantitative methods helped to evaluate the CEQI intervention when very complex and unbiased quantitative data are not available or feasible [281].

Although the qualitative methods may not represent the entire study population, it added depth and meaning to facilitate understanding [281]. The methods in this phase of the study have also enriched the understanding and conclusion of the evaluation of the CEQI intervention. This approach can guard against the wrong assumption that an intervention or method did not work when it was an implementation failure [283, 284]. Finally, the approaches used in this phase of the study has offered insight into how to guard against implementation failures in the future application of the CEQI intervention. Mixed methods can both enhance and advance the effective application of the RE-AIM [281].

CHAPTER 8: CONCLUSION

“Never doubt that a small group of thoughtful, committed people can change the world. Indeed, it is the only thing that ever has”- Margaret Mead.

After 19 years of implementing LF MDA intervention in Ghana, the transmission of the infection persists in some districts in the country. Hence, Ghana missed the 2020 target of eliminating LF as a public health problem. The interplay of context-specific implementation complexities of the LF MDA intervention, lack of context-specific strategies, nonadherence to the WHO protocol, poor social mobilisation and sensitisation, and poor knowledge about the disease among others contributed the persistent transmission of the infection in Bole district as found in the pre-intervention phase of the study.

These implementation gaps may have arisen due to challenges in the health system, the endemic communities, implementation process and or at the level of individual community members.

As found in the intervention and post-intervention phases of the study, it is important to identify context-specific need-based QI strategies to deal with the implementation bottlenecks in partnership with key stakeholders to make the drug accessible to all eligible individuals in the LF endemic communities. This can be done through the application of appropriate implementation science tools (intervention mapping approach) to improve the implementation of LF MDA intervention.

The study has reinforced the significance of the application of RE-AIM framework for evaluation of public health intervention using mixed methods approach and contributed to scarce guidance in the literature on how to apply qualitative methods in RE-AIM framework in assessing public health interventions.

Hence, this study has demonstrated the feasibility of using IM to develop and implement a context-specific QI strategy for an existing evidence-based intervention (LF MDA) towards the elimination of lymphatic filariasis as a public health challenge in Bole District of Northern Ghana.

Based on findings in this research, the following strategies to improve the implementation of the LF MDA in hotspot district in Ghana towards the elimination of the disease as a public health challenge are recommended:

1. Implementation of context-specific quality improvement of strategies in all hotspot districts based on initial needs assessment.
2. Involvement of key stakeholders such as Non-Governmental Organisations (NGOs), local leaders and self-help groups and use of evidence-based multi-channel community education strategies.
3. Effective education with key communication messages on adverse drug reactions and the creation of awareness on the causes of the disease.
4. Since Ghana is at the elimination stage of LF, the planning, timing and implementation of the LF MDA should be based on the peculiar situation of implementing district and not based on a national calendar.
5. Duration of MDA should be increased from one week to two to allow a temporally absent individual to be cover.
6. Strong enforcement of the DOT strategy during MDA training and drug distribution.
7. Strengthen drug-driver process through adequate training, provision of incentives, effective supportive supervision, and mentoring before and during the MDA.

While these recommendations may help improve the implementation quality of the LF MDA, they cannot guarantee the elimination of the disease. Thus, context-specific evidence-based strategies which evolve with contextual dynamics and effective vector control programs are needed.

The findings in this study present only some of the challenges affecting the effective implementation of LF MDA in Ghana. Therefore, further research is needed to strengthen and complement inferences from this study towards the roadmap of the elimination of lymphatic filariasis by 2030.

This research also contributes to the debate around why public health evidence-based interventions work in one area but fail in another area. This research contributes to knowledge of the application of implementation research frameworks to evaluate public health interventions being implemented in a real-world setting. The thesis has demonstrated the role

of quality improvement in existing public health intervention, through the application of implementation science tools for effective delivery of public health interventions to provide quality, equitable, efficient and effective services to the underserved population.

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APPENDICES

Appendix 1: PhD ethics approval



R14/49 Mr Alfred Kwesi Manyeh

HUMAN RESEARCH ETHICS COMMITTEE (MEDICAL)

CLEARANCE CERTIFICATE NO. M170219

NAME: Mr Alfred Kwesi Manyeh
(Principal Investigator)
DEPARTMENT: Epidemiology and Biostatistics
Bole and Central Gonja Districts of Northern Ghana

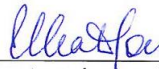
PROJECT TITLE: Toward Elimination of Lymphatic Filariasis Ghana:
Refining the Strategy Through Quality Improvement

DATE CONSIDERED: 24/02/2017

DECISION: Approved unconditionally

CONDITIONS:

SUPERVISOR: Prof T. Chirwa, Dr L. Ibisomi and Dr F. Baiden

APPROVED BY: 
Professor P. Cleaton-Jones, Chairperson, HREC (Medical)

DATE OF APPROVAL: 03/04/2017

This clearance certificate is valid for 5 years from date of approval. Extension may be applied for.

DECLARATION OF INVESTIGATORS

To be completed in duplicate and **ONE COPY** returned to the Research Office Secretary in Room 10004, 10th floor, Senate House/2nd floor, Phillip Tobias Building, Parktown, University of the Witwatersrand. I/We fully understand the conditions under which I am/we are authorised to carry out the above-mentioned research and I/we undertake to ensure compliance with these conditions. Should any departure be contemplated, from the research protocol as approved, I/we undertake to resubmit to the Committee. **I agree to submit a yearly progress report.** The date for annual re-certification will be one year after the date of convened meeting where the study was initially reviewed. In this case, the study was initially reviewed in February and will therefore be due in the month of February each year. Unreported changes to the application may invalidate the clearance given by the HREC (Medical).

Principal Investigator Signature _____

Date _____

PLEASE QUOTE THE PROTOCOL NUMBER IN ALL ENQUIRIES

Appendix 2: Ghana Health Service ethics approval

GHANA HEALTH SERVICE ETHICS REVIEW COMMITTEE

*In case of reply the
number and date of this
Letter should be quoted.*

*My Ref. GHS/RDD/ERC/Admin/App/17/
Your Ref. No.*



Research & Development Division
Ghana Health Service
P. O. Box MB 190
Accra
Tel: +233-302-681109
Fax + 233-302-685424
Email: ghserc@gmail.com

Alfred Kwesi Manyeh
University of the Witwatersrand
Johannesburg
Faculty of Health Sciences
School of Public Health
Private Bag 3 Wits, 2050

The Ghana Health Service Ethics Review Committee has reviewed and given approval for the implementation of your Study Protocol.

GHS-ERC Number	GHS-ERC: 04/02/2017
Project Title	Towards Elimination of Lymphatic Filariasis in Ghana: Refining the Strategy Through Quality Improvement
Approval Date	21 st March, 2017
Expiry Date	20 th March, 2018
GHS-ERC Decision	Approved

This approval requires the following from the Principal Investigator

- Submission of yearly progress report of the study to the Ethics Review Committee (ERC)
- Renewal of ethical approval if the study lasts for more than 12 months,
- Reporting of all serious adverse events related to this study to the ERC within three days verbally and seven days in writing.
- Submission of a final report **after completion** of the study
- Informing ERC if study cannot be implemented or is discontinued and reasons why
- Informing the ERC and your sponsor (where applicable) before any publication of the research findings.

Please note that any modification of the study without ERC approval of the amendment is invalid.

The ERC may observe or cause to be observed procedures and records of the study during and after implementation.

Kindly quote the protocol identification number in all future correspondence in relation to this approved protocol

SIGNED.....
DR. CYNTHIA BANNERMAN
(GHS-ERC CHAIRPERSON)

Cc: The Director, Research & Development Division, Ghana Health Service, Accra

Appendix 3: National NTD program, Ghana Health Service support letter

*In case of reply the
number and date of this
letter should be quoted.*

*My Ref. :
Your Ref. No.*



NTD Programme
Ghana Health Service
P. O. Box MB-190
Accra

Tel: +233-21- 670102
Fax + 233-21-226739

Email: nanakwadwo.biritwum@ghsmail.org

November 28, 2016

Dear Alfred,

RE: REQUEST FOR COLLABORATION ON RESEARCH WITH THE NTD PROGRAMME

I have received your request to work in collaboration with the NTD program of the Ghana Health Service on lymphatic filariasis. This research partnership with the Neglected Tropical Diseases (NTD) Program in Ghana will be conducted in fulfillment of the requirements for your PhD research project to be conducted in Northern Ghana (Bole and Central Gonja Districts) and will involve data collection, data sharing and joint publications.

I hereby approve your request on the following conditions:

1. The dataset will be used exclusively for the study.
2. The data must not be given to any third party for any other use without written permission from the NTD program.
3. All issues of confidentiality and anonymity must be adhered to.
4. You will give a presentation on your proposed study and findings to the national NTD Program and the District Health Administration in your study districts.
5. A copy of your report should be submitted to the National NTDs programs.

Yours Sincerely

Dr. Nana-Kwadwo Biritwum (MD, MPH, PhD)
Head: National NTD Program, Ghana Health Service
Email: nanakwadwo.biritwum@ghsmail.org

Appendix 4: Bole District permission letter



Faculty of Health Sciences
School of Public Health
Private Bag 3 Wits, 2050
Fax: 027117172119
Tel: 02711 7172076
Student No: 576824
10 October 2016

The District Chief Executive
Bole District Assembly

PERMISSION FOR DATA COLLECTION FOR A RESEARCH PROJECT IN THE CENTRAL GONJA AND BOLE DISTRICT OF GHANA

My name is Alfred ~~Kwesi~~ Manyeh, a student of Doctor of Philosophy in Epidemiology with the Faculty of health Science, School of Public Health, University of the Witwatersrand, Johannesburg, South Africa.

I write to inform you and to ask permission to conduct a health research project in your district. The research project entitled: "Towards Elimination of Lymphatic ~~Eilatiasis~~ (LF) in Ghana: Refining the Strategy Through Quality Improvement" in Central ~~Gonja~~ and Bole Districts of Ghana is purely for academic purposes and to contribute to the elimination of lymphatic ~~filariasis~~ (elephantiasis) in Ghana.

Trained research officers will be visiting selected households to collect data on LF mass drug administration in selected community in you district.

The research staff will comply with all norms in the study communities and ethical principles set out in all relevant guidelines.

Thank you.

Yours Sincerely,

A handwritten signature in black ink that reads "Alfred Kwesi Manyeh".

Alfred ~~Kwesi~~ Manyeh
WHO/TDR PhD Fellow

Appendix 5: Central Gonja District permission letter



Faculty of Health Sciences
School of Public Health
Private Bag 3 Wits, 2050
Fax: 027117172119
Tel: 02711 7172076
Student No: 576824
10 October 2016

The District Chief Executive
Central ~~Gonja~~ District Assembly
Post Office Box 1,
~~Buips~~.

PERMISSION FOR DATA COLLECTION FOR A RESEARCH PROJECT IN THE CENTRAL GONJA AND BOLE DISTRICT OF GHANA

My name is Alfred ~~Kwesi~~ Manyeh, a student of Doctor of Philosophy in Epidemiology with the Faculty of health Science, School of Public Health, University of the Witwatersrand, Johannesburg, South Africa.

I write to inform you and to ask permission to conduct a health research project in your district. The research project entitled: "Towards Elimination of Lymphatic ~~Eilariasis~~ (LF) in Ghana: Refining the Strategy Through Quality Improvement" in Central ~~Gonja~~ and Bole Districts of Ghana is purely for academic purposes and to contribute to the elimination of lymphatic ~~ilariasis~~ (elephantiasis) in Ghana.

Trained research officers will be visiting selected households to collect data on LF mass drug administration in selected community in you district.

The research staff will comply with all norms in the study communities and ethical principles set out in all relevant guidelines.

Thank you.

Yours Sincerely,

A handwritten signature in black ink, appearing to read 'A. Kwesi Manyeh'.

Alfred ~~Kwesi~~ Manyeh
WHO/TDR PhD Fellow

Appendix 6: Qualitative tool

Appendix 6A: IDIs for NTD focal person.

Towards Elimination of Lymphatic Filariasis in Ghana: Refining the Strategy Through Quality Improvement.

Introduction

My name is I am a student of University of Witwatersrand in Johannesburg, South Africa. We are conducting a study to gather information on Mass drug Distribution with Ivermectin and Albendazole programme in selected districts in Ghana. Note that I am referring to the distribution of the two drugs for which the heights of the people are measured before the drugs are given.

The purpose of this study is to gather information that will help us to know what happened with previous mass drug treatment exercise and to learn lessons that will help us to improve on future mass drug distribution exercises in urban areas such as yours.

We will try not to interrupt when you are speaking and also to allow you to say all you want to say. To capture all this information well, we would like to use a tape recorder during the discussion, however I assure you that all the information gathered will be put together at the end and what you say cannot be linked to you. The tape will be destroyed after we have taken all the information from it.

We are very interested in your opinions; everything you say is very interesting for us. I don't want to talk much; I want you to talk freely as much as you want. There are no 'correct' or 'wrong' answers. Please feel free to express your opinion on the issues to be discussed.

Background information

- Participant ID:
- Indicate gender:
- How old are you?
- What is your religion?
- What is your educational level?
- What is your position.
- How long have you been in this position?
- What are your main roles and responsibilities?
- How long have you lived in this community?

Topic 1: Knowledge and Understanding of Lymphatic Filariasis

1. What can you tell me about LF? (Probe for causes, prevention, signs and symptoms, health seeking behaviour, which category of people are at risk?)
2. What are some of the local beliefs about this condition?
3. What treatments are available for LF?
4. How is LF perceived in this community? Probe for how condition affects the lives of people with the disease.

Topic 2: Broad understanding of MDA

5. What do you know about the MDA exercise in your community?

- a. Probe for objective/purpose of the exercise
 - b. Probe for activities before MDA exercise (selection of drug distributors/training/duration of training/community engagement/ community involvement/ publicity)
 - c. Probe for attitude towards MDA (fatigue, refusal, beliefs/traditions/religion)
- 6. What happens during the MDAs?
 - a. Probe for steps involved in program delivery.
 - b. Probe for availability of logistics, community sensitization, timing of the exercise, recipients of the treatment, duration of treatment, challenges faced, how the drugs are delivered (directly observed or taken away)
 - c. Probe about supervision (how is done, who does it)
 - d. Probe about number of drug distributors and their motivation
- 7. How is the MDA program impacting on the status of LF in your area?
 - a. Probe: If there's no impact, why? If there is, to what extent?
- 8. Why does this disease still exist in your area?

Topic 3: Implementation of MDA

- 9. How are you involved in the MDA process/ activities? Probe for respondent's role.
- 10. What challenges do you or the district face in the implementation of the MDA activities?
 - a. Probe for factors associated with low coverage or noncompliance, community knowledge on MDA
 - b. Probe also for financial difficulties (cost in terms of transportation to beneficiaries), transport difficulties, motivation of service providers, reaching eligible population, migration issues, economic activities, shortage of drugs)
- 11. How have you managed these challenges?
 - a. Probe for actions taken to address challenges
- 12. What are your suggestions to improve the MDA in this community?

Thank you for your time

Towards Elimination of Lymphatic Filariasis in Ghana: Refining the Strategy Through Quality Improvement.

Introduction

My name is I am a student of University of Witwatersrand in Johannesburg, South Africa. We are conducting a study to gather information on Mass drug Distribution with Ivermectin and Albendazole programme in selected districts in Ghana. Note that I am referring to the distribution of the two drugs for which the heights of the people are measured before the drugs are given.

The purpose of this study is to gather information that will help us to know what happened with previous mass drug treatment exercise and to learn lessons that will help us to improve on future mass drug distribution exercises in urban areas such as yours.

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Background information

- Participant ID:
- Indicate Gender
- How old are you?
- What is your educational level?
- What is your occupation?
- How long have you been in this position?
- What are your main roles and responsibilities?

Topic 1: Broad understanding of health problems and interventions that exist in the community

1. What are some of the common diseases that affect community members? (Probe for LF if not mentioned, knowledge on the disease (causes, prevention, signs and symptoms, health seeking behaviour), what treatments are available for LF)
2. What health services are available?
 - a. Prompts: where do people seek care when they get sick?

Topic 2: Knowledge and understanding of MDA

3. What do you know about the MDA exercise in your community? (Probe for activities before and during MDA exercise, community involvement, community perception, timing and duration of exercise, objective/purpose of the exercise, attitude towards MDA (fatigue, refusal, beliefs/traditions/religion),
4. What are the challenges involved?
 - a. Probe for migration issues, community accessibility, shortage of drugs.
5. What happens during the MDAs?
 - a. probe for: what goes into the planning, availability of logistics, community sensitization, timing of the exercise, recipients of the treatment, duration of treatment, how the drugs are delivered (directly observed or taken away)
6. What is your understanding of the objectives of the intervention/MDA?
 - a. probe for knowledge of objectives, purpose of the exercise, reason for every activity that goes into the MDA processes)

Community participation and impact of MDA

7. How do you assess the participation of community members in the exercise?
 - a. Probe: what is the community perception about the exercise? why people take the drugs; why others do not; influence of drug side effects?
8. Tell us how the MDA program is impacting on the status of LF in your area.
 - a. Probe: If there's no impact, why? If there is, to what extent?
9. Why does this disease still exist in your area?
10. How are you involved in the MDA process/ activities?
11. What challenges do you or the district face in the implementation of the MDA activities?
 - a. probe for factors associated with low or noncompliance, community knowledge on MDA, financial difficulties (cost in terms of transportation to beneficiaries), transport difficulties, motivation of service providers, reaching eligible population, migration issues, economic activities, shortage of drugs)
12. How have you managed these challenges?
 - a. Probe for action taken to address challenges
13. What are your suggestions to improve the MDA that we conduct in this community?

Thank you for your time

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Please feel free to express your opinion on the issues to be discussed.

Background information for participant

- Indicate Gender
- How old are you?
- What is your religion?
- What is your educational level?
- What is your occupation?
- How long have you lived in the community?
- How does your household generate income?
- Do you have to travel for the income generation activities?
- How long have you been a community drug distributor?
- How many LF MDAs were you involved in?
- Have you participated in any other health interventions?

Topic 1: Understanding population livelihoods and population movement in the community

1. What are the main livelihood activities in the community?
 - a. Probe around how often people you have to travel with these activities
 - b. Probe: who are mostly involved in these activities? Is it men or women? Or are children involved?
2. How often do people leave the community [make sure that you clarify if this is men or women?
 - a. Probe around where they go?
 - b. What do they do when they are away?
 - c. How long they are away for?
3. How often do new people come into the community?

- a. Probe around where do they come from?
- b. How long do they stay?

Topic 2: Knowledge and Understanding of Lymphatic Filariasis

- 4. What are the common diseases that affect community members?
 - a. Probe for LF if not mentioned,
 - b. Probe: knowledge on the disease (causes, prevention, signs and symptoms, health seeking behaviour)
- 5. What treatments are available for LF?

Topic 3: Broad understanding of MDA

- 6. What do you know about the MDA exercise in your community?
 - a. Probe for activities before MDA exercise (community engagement/ community involvement/ communication)
 - b. Probe for attitude towards MDA (fatigue, refusal, beliefs/traditions/religion)
- 7. What happens during the MDAs?
 - a. Probe for how the drug administration is planned.
 - b. Probe for availability of logistics, community sensitization, timing of the exercise, recipients of the treatment, duration of treatment, challenges faced, how the drugs are delivered (either DOT or taken away)
- 8. What is your understanding of the purpose of the MDA?
 - a. Probe for knowledge of purpose of the exercise, MDA processes and activities
- 9. How do you assess the participation of community members in the exercise?
 - a. Probe: what is the community perception about the exercise?
- 10. Tell us how the MDA program is impacting on the status of LF in your area.
 - a. Probe: If there's no impact, why? If there is, to what extent?

- 11. Why does this disease still exist in your area?

Topic 4: Personal experiences of being involved in distributing drugs

- 12. How long have you been involved in the MDA process/ activities?
- 13. What are your responsibilities as a community volunteer?
 - a. Probe around how many days a year they are involved in these activities; how many people they have to deliver the drugs to?
 - b. Probe around who supervises these activities
- 14. How were you selected? (Probe for community acceptability of volunteers, willingness to cooperate with them)
- 15. Did you receive any training?
 - a. Probe for how training is done, objectives of the training, duration, what was taught, level of understanding of content of training.
- 16. Why do you do the work?
 - a. Probe for rewards(motivation) received for work done and perceptions about the adequacy or otherwise of it,
 - b. Probe for willingness to continue with tasks

17. How do you carry out the work?
 - a. (Probe for procedure for drug administration including who provides you with the programme information?)
 - b. Probe how the drugs are distributed either house-to-house or from a central location
18. How do the people want you to do the work?
 - a. Probe for expectations of community people i.e. do they want the drugs bought at a certain time? At a certain place?
19. What could be done to help you improve on the work you do?
20. What challenges do you face in the implementation of the MDA activities?
 - a. Probe around community support and knowledge of the programme
 - b. Probe for transport difficulties, motivation of service providers, reaching eligible population, migration issues, economic activities, shortage of drugs?
 - c. Probe around systematic noncompliance/refusals
 - d. Probe around supervision support
21. How do you manage these challenges?
22. Are there certain groups of people who you are unable to give the drug to?
 - a. Probe why they are hard to reach, probe for transportation and associated cost in reaching them.
 - b. Probe around who these groups e.g. are they men, women, young boys or younger girls
 - c. Probe around whether these groups are away?
23. Which groups of people are more likely to take the drugs?
 - a. Probe around age, sex and occupation
24. Which groups of people refuse to take the drug?
 - a. Probe around why they refuse? Is it related to side-effects? Knowledge of the programme?
 - b. Probe what do you do when people refuse the drugs?
25. What suggestions do you have so we can reach more people in your area?
26. What are your suggestions to improve the MDA in this community?
 - a. Probe before and during MDA.

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Please feel free to express your opinion on the issues to be discussed.

Background information for participant

- Participant ID:
- Indicate Gender
- How old are you?
- What is your religion?
- What is your occupation?
- What is your educational level?
- How does your household generate income?
- Do you have to travel for the income generation activities?
- How long have you lived in the community (if they recently came to the community where did they come from?)

Topic 1: Broad understanding of health problems in the community

1. What do you view as health problems in the community?
 - a. Probe for common diseases. Probe for LF if not mentioned.

Topic 2: Knowledge and understanding of Lymphatic Filariasis

2. What can you tell me about LF?
 - a. Probe for causes, prevention, signs and symptoms, health seeking behaviour, who is at risk?
3. What are some of the local beliefs about this condition?
4. What treatments are available for LF?
 - a. Probe for orthodox and traditional/herbal/ spiritual treatments.
5. Why does this disease still exist in your area?
6. How is LF perceived in this community?

- a. Probe for how condition affects the lives of people with the disease, probe; social economic, stigma

Topic 3: Experiences of MDA

- 7. What do you know about the MDA exercise in your community?
 - a. Probe for objective/purpose of the exercise
 - b. Probe for activities before and during MDA exercise (community engagement/ community involvement/ publicity)
 - c. Probe around when the drug distribution takes place and for how long
 - d. Ask who is targeted to receive the drug
 - e. How people access the drug e.g. is it door to door or from a central location
 - f. How the drug is administered whether DOT or it is taken home
- 8. What are the challenges involved in reaching people with the drugs? (Probe for migration issues, community accessibility, shortage of drugs, influence of drug side effects)
- 9. What are some reasons why community members agree to take the drugs?
 - a. Probe: share with us your personal experience with taking the drug
 - b. What are respondent's reasons for taking the drug?
 - c. Why do others refuse to take the drug?
- 10. What suggestions for how MDA should be delivered?

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- How old are you?
- What is your religion?
- What is your educational level?
- What is your occupation?
- How does your household generate income?
- Do you have to travel for the income generation activities?
- How long have you lived in the community (if they recently came to the community where did they come from?)
- Have you participated in any health intervention?

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Topic 2: Knowledge and understanding of Lymphatic Filariasis

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 - b. Probe for activities before and during MDA exercise (community engagement/ community involvement/ publicity)
 - c. Probe around when the drug distribution takes place and for how long
 - d. Ask who is targeted to receive the drug
 - e. Probe around how people access the drug e.g. is it door to door or from a central location
 - f. Probe around how the drug is administered whether DOT or it is taken home.
- 8. What are the challenges involved in reaching people with the drugs? (Probe for migration issues, community accessibility, shortage of drugs, influence of drug side effects)
- 9. What are some reasons why community members do not agree to take the drugs?
 - a. Probe: share with us your personal experience when you do not take the drugs?
 - b. Why are respondent's reasons for not taking the drugs?
- 10. What suggestions for how MDA should be delivered?

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Background information for participant

- Participant ID:
- Indicate gender
- How old are you?
- What is your educational level?
- What is your religion?
- What is your occupation?
- How long have you lived in the community (if they recently came to the community where did they come from?)
- What is your position within the community?
- How does your household generate income?
- Do you have to travel for the income generation activities?
- How many MDA programmes have you been involved with?

Topic 1: Understanding population livelihoods and population movement in the community

1. How often do people travel out of the community?
 - a. Probe around where they go?
 - b. What do they do when they are away? What is the purpose of their travel?
 - c. For how long they are away?
 - d. What period of the year do people usually travel?
 - e. Where do they usually stay while they are away?
2. What are the main livelihood activities in the community?
 - a. Probe: who are mostly involved in these activities? Is it men or women? Or are children involved?

- b. What periods of the year do these activities go on? Probe for each activity mentioned
- 3. How often do new people come into the community?
 - a. Probe around where they come from?
 - b. What do they do when they are here? What is the purpose of their travel?
 - c. For how long they are here?
 - d. What period of the year do people usually come in?
 - e. Where do they usually stay while they are here?

Topic 2: Perceived health problems in the community

- 4. What are the common health problems in this community?
 - a. Probe for LF if not mentioned. Ask for local term/name.
 - b. What are the causes of these health problems?
- 5. What health services are available?
 - a. Prompts: where do people seek care when they get sick?

Topic 3: Knowledge and Understanding of Lymphatic Filariasis

- 6. What do you know about LF disease [using the term provided by participants]
 - a. Probe: for how the disease is acquired;
 - b. Probe: for how can it be prevented
 - i. Probe for information regarding the use of bed nets to prevent LF
 - ii. Tell me about the ownership of bed nets in this community? Probe for usage: Gender, Age group
 - iii. Perceptions on the use of bed nets
 - iv. The need of clean environments in preventing LF.
- 7. What are the signs and symptoms of LF?
- 8. What are the beliefs about this condition within your community?
- 9. Which category of persons do you think are most at risk of getting this disease?
 - a. Probe for category of persons: gender, age group, occupation
 - b. Why?
- 10. What treatments are available for LF?
 - a. Probe for orthodox and traditional/herbal/ spiritual treatments
 - b. Which do people usually prefer?
 - c. Why?

Topic 4: Broad understanding of MDA

- 11. What do you know about the MDA exercise in your community?
 - a. Probe for purpose of the intervention/MDA?
 - b. Probe for activities **before** - planning, availability of logistics, community sensitization (method of publicity), timing of the exercise,

- c. Probe for activities **during** - recipients of the treatment, duration of treatment, how the drugs are delivered (directly observed or taken away)
 - d. Probe also for level of community involvement, community perception, timing and duration of exercise
 - e. Probe for attitude towards MDA (fatigue, refusal, beliefs/traditions/religion)
12. Are there people in the community who cannot take the drugs administered during the MDA?
- a. Which people cannot take the drug? Probe for side effects and probe for the influence of side effects. Probe for people who are not eligible (Height, age, pregnancy, lactating mothers and people seriously sick).
 - b. Probe for those who do not want to take the drug.
 - c. Probe for how does the inability to take the drug affect the exercise?
 - d. Which people do not take it?
 - e. Probe for access and why?
13. How do you think the MDA program is impacting on the status of LF in your area?
- a. Probe: If there's no impact, why? If there is, to what extent?
14. What do you think is the cause of persistent LF transmission in the community?

Topic 5: Personal experiences of MDA

15. How are you involved in the MDA process/ activities?
- a. Probe for role of the respondent
16. What challenges do you or the district face in the implementation of the MDA activities?
- a. probe for factors associated with low coverage or noncompliance, publicity, community knowledge on MDA
 - b. Probe also for financial difficulties (cost in terms of transportation to beneficiaries), transport difficulties, motivation of service providers, reaching eligible population, migration issues, economic activities, shortage of drugs)
17. How have you managed these challenges? Probe for action taken to address challenges.
18. What are your suggestions to improve the MDA that we conduct in this community?

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Topic 1: Understanding population livelihoods and population movement in the community

19. How often do people travel out of the community [make sure that you clarify if this is men or women]?
 - a. Probe around where they go?
 - b. What do they do when they are away? What is the purpose of their travel?
 - c. For how long they are away?
 - d. What period of the year do people usually travel?
 - e. Where do they usually stay while they are away?
20. What are the main livelihood activities in the community?
 - a. Probe: who are mostly involved in these activities? Is it men or women? Or are children involved?
 - b. What periods of the year do these activities go on? Probe for each activity mentioned.
21. How often do new people come into the community?
 - a. Probe around where they come from?
 - b. What do they do when they are here? What is the purpose of their travel?
 - c. For how long they are here?
 - d. What period of the year do people usually come in?
 - e. Where do they usually stay while they are here?

Topic 2: Perceived health problems in the community

22. What are the common health problems in this community?
 - a. Probe for LF if not mentioned. Ask for local term/name.

- b. What are the causes of these health problems?
- 23. What health services are available?
 - a. Probe; where do people seek care when they get sick?

Topic 3: Knowledge and understanding of lymphatic filariasis

- 24. What do you know about LF disease [using the term provided by participants]
 - a. Probe: for how the disease is acquired;
 - b. Probe: for how can it be prevented
 - i. Probe for information regarding the use of bed nets to prevent LF
 - ii. Tell me about the ownership of bed nets in this community? Probe for usage: Gender, Age group
 - iii. Perceptions on the use of bed nets
 - iv. The need of clean environments in preventing LF
- 25. What are the signs and symptoms of LF?
- 26. What are the beliefs about this condition within your community?
- 27. Which category of persons do you think are most at risk of getting this disease?
 - a. (Probe for category of persons: gender, age group, occupation)
 - b. Why?
- 28. What treatments are available for LF?
 - a. Probe for orthodox and traditional/herbal/ spiritual treatments
 - b. Which do people usually prefer?
 - c. Why?

Topic 4: Mass Drug Administration for LF in the community

- 29. What do you know about the MDA that happens in this community?
 - a. What is the purpose of the exercise;
 - b. Probe: How did you know about the drug distribution?
 - c. Probe: for activities before and during MDA exercise (public education and sensitization)
 - d. How long has this exercise been going on;
 - e. How did you find the last MDA programme? How would you compare it to previous 2 to 3 years?
 - f. how is the community involved
 - g. how is the drug administered? (Central point, House to house, DOT, take home)
- 30. Are there people in the community who cannot take the drugs administered during the MDA?
 - a. Which people cannot take the drug? Probe for side effects and probe for the influence of side effects. Probe for people who are not eligible (Height and pregnancy, lactating mothers and people serious sick).
 - b. Probe for those who do not want to take the drug. How does the inability to take the drug affect the exercise?
 - c. Which people do not take it? Probe for access and why?
- 31. What do you think is the cause of persistent LF transmission in the community?

32. How does the community view MDA?

- a. Probe: timing
- b. Probe for venue and duration of exercise, opinions about personnel involved; attitude towards MDA (fatigue, refusal, beliefs/traditions/religion)
- c. Do community people like it and if so why? What do they not like about it and why?

33. How can the MDA be improved in general?

Probe: Timing of distributions, drug administrators, distribution and intake of the drugs, any issues with the MDA

Thank you for the time.

**UNIVERSITY OF THE WITWATERSRAND
FACULTY OF HEALTH SCIENCES, SCHOOL OF PUBLIC HEALTH**

**TOWARDS ELIMINATION OF LYMPHATIC FILARIASIS IN GHANA: REFINING
THE STRATEGY THROUGH QUALITY IMPROVEMENT.**

Household interview questionnaire

INFORMATION PANEL	
Sub-districts: 1. Bole 2. Bamboi 3. Jama 4. Tinga	
Community name:	Household code:
Name of Interviewer _____	Date of interview: ____ / ____ / _____

My name is and I am student of University of the Witwatersrand in Johannesburg, South Africa and want to ask some questions about the drug distribution for which the height of people were measured before the drugs were given. The purpose of this interview is to gather information that will help us to know what to do to reach all target population for effective elimination of LF in Ghana.

Seek consent

QUESTIONNAIRE

Section A: Socio-Demographic Information			
No	Questions	Coding Categories	Skip
1	Age	Age (Completed Years).....	
2	Sex	Male.....1 Female.....2	
3	Marital Status	Married.....1 Divorced.....2 Separated.....3 Single.....4 Widowed.....5 Co-Habiting6	
4	Number of people in this household		
5	Occupation	Farmer.....1 Fisherman.....2 Artisan.....3 Trader.....4 Public Servant.....5 Unemployed.....6 Other Specify.....7	

6	Religion	Christian.....1 Moslem.....2 Traditional3 None.....4 Other (specify).....5	
7	Highest level of education completed	Primary.....1 JHS/Middle/JSS.....2 Commercial/Vocational/Technical.....3 A Level /SHS/Secondary.....4 Tertiary.....5 None.....6 Other (specify).....7	

Section B: Knowledge about the Disease			
8	Have you heard about the disease Elephantiasis? (show a picture)	Yes.....1 No.....2	If No Skip to Q21
9	How did you hear about the disease?	Disease control officer.....1 Community health nurses2 Public announcement3 Media (TV, radio, newspapers, internet, etc.).....4 Friend(s).....5 Relatives6 Community Volunteers.....7 Other (specify)8 NA.....88	
10	Do you know anyone with elephantiasis	Yes.....1 No.....2 NA.....88	
11	Is there anyone in this household with elephantiasis?	Yes.....1 No.....2 NA.....88 Don't Know.....99	
12	How is this disease acquired? (MULTIPLE RESPONSES)	Through the bite of a mosquito.....1 Breathing in germs.....2 Eating contaminated food.....3 Drinking contaminated water.....4 Juju/Witchcraft/Spell.....5 Hereditary.....6 Rain/ Stagnant water7 Oily food8 Poor hygiene9 Other Specify.....10 NA.....88 Don't know.....99	

Section B: Knowledge about the Disease			
13	Which of the following would you associate with the disease? (Tick all answers given by respondent)	High body temperature (fever)1 Swollen scrotum2 Swollen breasts3 Swollen legs4 Contact with infected person5 Mosquitoes6 Sores on the body7 Dirty environment8 Others (specify)9 NA.....88 Don't know99	
14	Do you think you are at risk of getting this disease?	Yes.....1 No.....2 NA88 Don't Know.....99	Skip to 16 if Yes
15	Why do you think you are not at risk? (MULTIPLE RESPONSES)	I sleep under mosquito net.....1 My environment is clean2 I take good care of myself.....3 I don't drink contaminated water.....4 The disease is not in my family (Hereditary).....5 I don't believe I can get it.....6 Other specify7 NA.....88 Don't know.....99	
16	Why do you think you are at risk? (MULTIPLE RESPONSES)	Anyone can get it.....1 Mosquitoes bite2 Dirty environment.....3 Drinking contaminated water.....4 Other specify.....5 NA.....88	
17	Is there any treatment available to people with elephantiasis in this community?	Yes.....1 No.....2 NA.....88 Don't know.....99	
18	Where do elephantiasis patients in this community go for treatment? (MULTIPLE RESPONSES)	Hospital1 Clinic.....2 CHPS.....3 Pharmacy/drug store.....4 Traditional healer/Herbalist5 Spiritual healer.....6 prayer camp.....7 Other (specify)8 NA.....88 Don't know99	
19	What help or treatment does the health service have for people with elephantiasis? (MULTIPLE RESPONSES ALLOWED)	Organize clean up campaigns..... 1 Give drugs to the community.....2 Distribute bed nets.....3 Treat those with the disease.....4 Other (specify).....5 NA.....88 Don't know99	

Section B: Knowledge about the Disease			
20	How is elephantiasis disease prevented? (MULTIPLE RESPONSES ALLOWED)	By taking drugs.....1 Mass Drug Administration2 Sleeping in treated mosquito nets.....3 Keeping a clean environment.....4 Insecticide spray/ Mosquito coil5 Other (specify).....6 NA.....88 Don't know99	

Section C: Knowledge about the LF Mass Drug Administration			
21	Are you aware of any drug distribution in this community for which people's heights were measured?	Yes.....1 No.....2 NA.....88 Don't know.....99	If No, skip to Q49
22	How is the community informed about this distribution programme? (MULTIPLE RESPONSES ALLOWED)	Radio.....1 Television.....2 Health workers.....3 Posters.....4 Family members.....5 Church/mosque.....6 Community volunteers.....7 Gong gong.....8 Neighbours/ friends.....9 Information van.....10 Other, specify.....11 NA.....88	
23	How else would you want the information to reach you? (MULTIPLE RESPONSES ALLOWED)	Information through media.....1 Information in churches/mosques.....2 Information in schools.....3 Information at market place/public centre.....4 Information by health workers at hospitals.....5 Door -to-door6 Other, specify7 NA88	
24	What is the purpose of the drug distribution exercise? (MULTIPLE RESPONSES ALLOWED)	To prevent/treat elephantiasis.....1 To prevent/treat hydrocele.....2 To prevent/treat onchocerciasis.....3 To prevent/ kill filarial worms.....4 To reduce the incidence of LF.....5 Other specify.....6 NA88 Don't know99	
25	Was there public education before the distribution exercise?	Yes.....1 No.....2 NA.....88 Don't know.....99	
26	What would you want to know about the drug distribution? (MULTIPLE RESPONSES)	Drug safety and effectiveness.....1 Education about the disease.....2 Why the drug is not distributed in health facility3 Other specify.....4 NA.....88 Don't know.....99	
27	Where is the drug distribution done?	Home to home1	

	(MULTIPLE RESPONSES ALLOWED)	Community center2 At school.....3 At marketplace.....4 Chief's palace5 At church.....6 Other (specify).....7 NA.....88 Don't know99	
28	How do they (Volunteers) do the drug distribution? (MULTIPLE RESPONSES ALLOWED)	Measure height before drugs are given.....1 Ask about health status.....2 Ask about alcohol intake3 Ask about age.....4 Directly observe treatment.....5 Ask whether one has eaten.....6 Explain the reasons for the treatment.....7 Other specify8 NA88 Don't know99	
29	What categories of people are not given the drugs? (MULTIPLE RESPONSES ALLOWED)	Children less than a certain height/age.....1 Pregnant women.....2 Breast feeding mothers3 Sick people.....4 If you have not eaten.....5 Others specify...6 NA.....88 Don't know99	
30	Have you ever participated?	Yes.....1 No2	
31	If "yes" to Ques. 30, how many times have you participated?	Once1 Twice2 Three times3 Four times.....4 Five times.....5 Six times.....6 Other (specify)7 Don't remember.....8	
32	Did you take the drug when it was distributed last time	Yes.....1 No.....2 Don't remember.....3 NA.....88	If yes skip to Q34
33	IF no, why not? (MULTIPLE RESPONSES)	I forgot1 I react to the drugs.....2 I do not find it necessary to take the drugs.....3 Less than approved height4 Have been busy during time of administration.....5 Religious belief.....6 Travelled.....7 Pregnant.....8 Breast feeding.....9 I was not around during time of administration.....10 I dislike the drugs11 Other (specify)12 NA.....88 Don't know.....99	

34	Apart from you, did anybody in your household take the drugs?	Yes.....1 No.....2 NA88 Don't know99	
35	How is the drug delivered	Direct observation treatment.....1 Given to the beneficiary to take at their convenient...2 Other (specify).....3	
36	Why do some miss the treatment? (MULTIPLE RESPONSES)	Absent.....1 Under height.....2 Pregnant.....3 Lactating mothers.....4 Seriously sick.....5 Other specify.....6 NA.....88 Don't know.....99	
37	Do some members of your household migrate to other places during certain times of the year?	Yes1 No2 Don't know.....99	If no skip to Q39
38	If yes, what are the reasons for their movement? (MULTIPLE RESPONSES)	To look for jobs.....1 To attend funeral ceremonies.....2 To go do farming3 Other, specify.....4 NA.....88 Don't know99	
39	What reasons do people give for refusing to take the drugs? (MULTIPLE RESPONSES ALLOWED)	Fear of side effects.....1 Lack of education on the disease.....2 Don't think will get the disease.....3 Think only sick people should take.....4 Too many drugs.....5 Religious beliefs/superstition.....6 Taking other medication.....7 Have taken the drugs for too many times.....8 Other (specify).....9 NA.....88 Don't know99	
40	Are you aware of any side effects of taking these drugs?	Yes.....1 No.....2 NA.....88 Don't know99	If No, skip to Q42
41	What are some of the side effects of taking these drugs? (MULTIPLE RESPONSES ALLOWED)	Itching.....1 Rashes.....2 Swelling of parts of the body.....3 Headache.....4 Fever.....5 Chills.....6 General muscle/bodily pains.....7 Fainting.....8 Vomiting.....9 Diarrhoea.....10 Other specify.....11 NA.....88	

42	How many times do you remember these drugs have been distributed in this community	Number.....[] NA.....88 Don't remember.....99	
43	Have you ever taken these drugs before?	Yes.....1 No.....2 NA.....88	If No, skip to 45
44	How many times have you taken these drugs yourself?	Number.....[] [] Can't tell.....1 NA.....88	
45	If the drugs were given again, would you want it to be distributed the same way?	Yes.....1 No.....2 NA.....88 Don't know99	
46	What motivates you to continue to take the drug	It prevents elephantiasis.....1 It prevents onchocerciasis.....2 It makes me healthy.....3 It is free.....4 Other, specify5 NA88	
47	Do you consider the treatment important?	Yes1 No2 Don't know99	
48	Why?		
49	What makes it difficult for some community people to get the drugs during the MDA? (Multiple response)	Migration of some community members to other areas for economic activities1 Travel for festival and funeral activities.....2 Shortage of drugs.....3 Negative attitude of volunteers.....4 Inadequate sensitization of community.....5 Timing of the drug administration.....6 Short duration of treatment period.....7 Other specify.....8 N/A.....88 Don't know99	
50	What suggestions do you have for improving future mass drug distribution exercises? (MULTIPLE RESPONSES ALLOWED)	Create awareness.....1 Health workers should distribute.....2 Volunteers should come from the community.....3 Distribute during the dry season.....4 Distribute during the rainy season.....5 Extend the distribution period.....6 Provide food with the drugs.....7 Distribute at work places.....8 Distribute at hospitals.....9 Train volunteers well.....10 Distribute the drugs at vantage points.....11 Distribute on weekends/ morning/ evening12 Distribute in churches/mosques.....13 Other, specify.....14 Don't know99	

Appendix 7: Information Form



UNIVERSITY OF THE WITWATERSRAND

FACULTY OF HEALTH SCIENCES, SCHOOL OF PUBLIC HEALTH

Community.....

Date.....

Category of group.....

Participant No.....

Information Sheet for the group/individuals participating in the study entitle: Towards Elimination of Lymphatic Filariasis in Ghana: Refining the Strategy Through Quality Improvement.

My name is **Alfred Kwesi Manyeh**. I am a student at the University of Witwatersrand in Johannesburg, South Africa. Together with my assistants, we are trying to explore the factors contributing to the persistent of Lymphatic Filariasis transmission in Bole District of Ghana. We are also exploring factors that contributed to the interruption of transmission of the disease in Central Gonja District.

Lymphatic Filariasis

Lymphatic Filariasis (LF) is a significant health problem threatening 1.1 billion people in 55 countries worldwide. Over 120 million people have been infected and about 40 million people disfigured and incapacitated by the disease. The global strategy for the elimination of LF is based on mass drug administration (MDA) to interrupt the transmission of the disease as is being done in your community annually.

Purpose of the research

We are here today to discuss some of the factors that cause the continued existence of LF in your community. It is our aim to eliminate persistent transmission of LF in Ghana; this study will help us to identify the problems arising from the service providers, communities, and individuals that contribute to the persistent transmission of the LF in Ghana.

You have been selected because you are a health worker/an opinion leader/a community member/a community volunteer and your experience and opinions are crucial in this endeavour.

Procedures

If you are willing to be part of this study, we will ask you a few questions. You are required as a health worker/ opinion leader/community member/community volunteer to give us your opinion on the questions that we will pose based on your personal experiences and your experience within the community. You are free to speak your mind about how you think and feel about any topic that is raised here. There are no wrong or right answers. You are free to discontinue with the discussion or refuse to discuss any issue you feel uncomfortable to talk about and this will not affect you in anyway.

So that we do not lose any valuable information, we would like to tape record the discussion.

Risks and discomforts

There may be a slight chance that some questions will be personal. We do not expect this to happen. However, should that happen and you do not feel comfortable to share any personal or confidential information with us, you can refuse to respond to those questions. The discussion will take about an hour.

Benefits

The study may not benefit you directly, but your participation is likely to help us find out how we can eliminate lymphatic filariasis in Bole District and in Ghana.

Confidentiality

Whatever you say will be confidential, so feel at ease to express your opinion. When we get back to the office, we will transcribe all the information from the tape, and the tape will be destroyed. Your name will not be mentioned, and it will not be played on any radio station. All questionnaires will be anonymous and no personal identifying information will be collected. It is only for this study and when we have finished with it will destroy all data collection tools as I have already mentioned. If you wish to hear what you said during the after the discussion, we will play the tape back to you. Your participation in this study is voluntary.

Thank you.

Alfred Kwesi Manyeh (Principal Investigator)

University of the Witwatersrand, Johannesburg

Faculty of Health Science,

School of Public Health

+27631492694 / +233 243 660782

Hannah Frimpong (Ethics Administration)

Research and Development Division,

Ghana Health Services

Box 184, Accra-Ghana

+233 50 7041223

Appendix 8: Consent forms

Appendix 8A: Consent form for opinion leaders

The purpose of this study has been explained to me in my mother tongue and I understand that views of other people in the community will also be sought, and I have been told about the importance of my contribution in taking part.

Procedures

If I feel uncomfortable about any topic, I have the right to voice it out. I understand that the discussion will last for about an hour, and I will be tape recorded.

Confidentiality

I know that my name will not be mentioned, and this interview will not be played on any radio station. It is only for the purpose of this study and when the study is completed the tapes will be destroyed. If I wish to hear the interview, it will be played back to me.

Risks and Discomforts

I understand that there may be a slight chance that some questions may be personal and uncomfortable. However, should that happen, I can choose to not to speak or share any personal or confidential information.

Benefits

This discussion may not benefit me directly, but my participation is likely to help eliminate lymphatic filariasis in Bole District and in Ghana. I understand that my participation is voluntary.

The study has been explained to me, and I have the opportunity to ask questions. I consent to be part of this study voluntarily. If I have any questions I can contact:

Alfred Kwesi Manyeh (Principal Investigator).

University of the Witwatersrand, Johannesburg

Faculty of Health Science,

School of Public Health

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Hannah Frimpong (Ethics Admin)

Research and Development Division,

Ghana Health Services

Box 184, Accra-Ghana

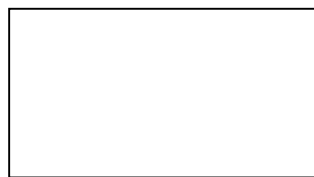
+233 50 7041223

Participants' signature:

Name of participant:

Signature:

Date:

Thumbprint:

Witness (Name & Signature)

Interviewer

I..... explained the purpose of this study to the research participant in his/her mother tongue and he/she willingly agreed to partake in the study.

Signature of interviewer.....

Alfred Kwesi Manyeh (Principal Investigator). Signature:**Appendix 8B: Consent form for opinion leaders**

The purpose of this study has been explained to me in my mother tongue and I understand that views of other people in the community will also be sought, and I have been told about the importance of my contribution in taking part.

Procedures

If I feel uncomfortable about any topic, I have the right to voice it out. I understand that the discussion will last for about an hour, and I will be tape recorded.

Confidentiality

I know that my name will not be mentioned, and this interview will not be played on any radio station. It is only for the purpose of this study and when the study is completed the tapes will be destroyed. If I wish to hear the interview, it will be played back to me.

Risks and Discomforts

I understand that there may be a slight chance that some questions may be personal and uncomfortable. However, should that happen, I can choose to not to speak or share any personal or confidential information.

Benefits

This discussion may not benefit me directly, but my participation is likely to likely to help eliminate lymphatic filariasis in Bole District and in Ghana. I understand that my participation is voluntary.

The study has been explained to me, and I have the opportunity to ask questions. I consent to be part of this study voluntarily. If I have any questions I can contact:

Alfred Kwesi Manyeh (Principal Investigator).

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Hannah Frimpong (Ethics Admin)

Research and Development Division,

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Box 184, Accra-Ghana

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Participants' signature:

Name of participant:

Signature:

Date:

Thumbprint:



Witness (Name & Signature)

Interviewer

I.....explained the purpose of this study to the research participant in his/her mother tongue and he/she willingly agreed to partake in the study.

Signature of interviewer.....

Alfred Kwesi Manyeh (Principal Investigator). Signature:

Appendix 8C: Consent form for Non-compliant

The purpose of this study has been explained to me in my mother tongue and I understand that views of other people in the community will also be sought, and I have been told about the importance of my contribution in taking part.

Procedures

If I feel uncomfortable about any topic, I have the right to voice it out. I understand that the discussion will last for about an hour, and I will be tape recorded.

Confidentiality

I know that my name will not be mentioned, and this interview will not be played on any radio station. It is only for the purpose of this study and when the study is completed the tapes will be destroyed. If I wish to hear the interview, it will be played back to me.

Risks and Discomforts

I understand that there may be a slight chance that some questions may be personal and uncomfortable. However, should that happen, I can choose to not to speak or share any personal or confidential information.

Benefits

This discussion may not benefit me directly, but my participation is likely to help eliminate lymphatic filariasis in Bole District and in Ghana. I understand that my participation is voluntary.

The study has been explained to me, and I have the opportunity to ask questions. I consent to be part of this study voluntarily. If I have any questions I can contact:

Alfred Kwesi Manyeh (Principal Investigator).

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Research and Development Division,

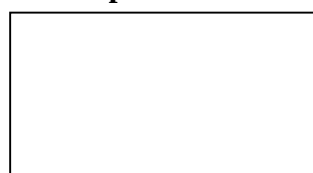
Ghana Health Services

Box 184, Accra-Ghana

+233 50 7041223

Participants' signature:

Thumbprint:



Name of participant:

Signature:

Date:

Witness (Name & Signature)

Interviewer

I..... explained the purpose of this study to the research participant in his/her mother tongue and he/she willingly agreed to partake in the study.

Signature of interviewer.....

Alfred Kwesi Manyeh (Principal Investigator). Signature:

Appendix 8D: Consent form for community volunteers

The purpose of this study has been explained to me in my mother tongue and I understand that views of other people in the community will also be sought, and I have been told about the importance of my contribution in taking part.

Procedures

If I feel uncomfortable about any topic, I have the right to voice it out. I understand that the discussion will last for about an hour, and I will be tape recorded.

Confidentiality

I know that my name will not be mentioned, and this interview will not be played on any radio station. It is only for the purpose of this study and when the study is completed the tapes will be destroyed. If I wish to hear the interview, it will be played back to me.

Risks and Discomforts

I understand that there may be a slight chance that some questions may be personal and uncomfortable. However, should that happen, I can choose to not to speak or share any personal or confidential information.

Benefits

This discussion may not benefit me directly, but my participation is likely to help eliminate lymphatic filariasis in Bole District and in Ghana. I understand that my participation is voluntary.

The study has been explained to me, and I have the opportunity to ask questions. I consent to be part of this study voluntarily. If I have any questions I can contact:

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Hannah Frimpong (Ethics Admin)

Research and Development Division,

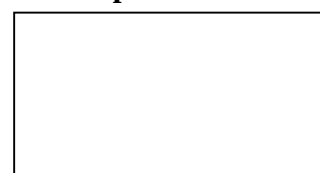
Ghana Health Services

Box 184, Accra-Ghana

+233 50 7041223

Participants' signature:

Thumbprint:



Name of participant:

Signature:

Date:

Witness (Name & Signature)

Interviewer

I..... explained the purpose of this study to the research participant in his/her mother tongue, and he/she willingly agreed to partake in the study.

Signature of interviewer.....

Alfred Kwesi Manyeh (Principal Investigator). Signature:

.....

Appendix 9: Turnitin Report

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