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ADHERENCE TO COMMUNITY DIRECTED TREATMENT WITH IVERMECTIN FOR ONCHOCERCIASIS ELIMINATION IN ABEKWAI, TAIN DISTRICT, GHANA

BY

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DECLARATION

I, Jeffrey Gabriel Sumboh, do hereby declare that, except for references to other peoples work which has been duly cited in this dissertation, the rest of the dissertation is as a result of my own work under the supervision of Dr. Francis Anto of the School of Public Health, University of Ghana and that neither in whole or part of this work has been presented anywhere.

SIGNATURE: ….....

DATE……

ACADEMIC SUPERVISOR: Dr. Francis Anto

SIGNATURE: ……...

DATE: ……

DEDICATION

To God be the glory.

I dedicate this work with all humility to my parents and my sister; Mr. and Mrs. Thomas Sumboh and Jemima Sumboh and to all community members of Abekwai, Tain District, Ghana

ACKNOWLEDGEMENT

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ABSTRACT

Introduction

Onchocerciasis is one of the debilitating neglected tropical diseases that manifests in blindness at later stages. Ivermectin has been proven to clear microfilariae and is therefore being distributed in endemic communities. Adherence to ivermectin treatment is a major challenge in the implementation of the community directed treatment strategy. Some individuals do not adhere to the bi-annual treatment accounting for the continuity of onchocerciasis transmission.

Objective

The objective of this study was therefore to determine the level of adherence to ivermectin treatment under the community directed treatment strategy in the Abekwai community in the Tain district.

Methods

A population-based cross-sectional study involving community members in Abekwai was conducted to determine the proportion of community members who swallowed ivermectin during the 2015 mass distribution treatment round. Two hundred and fifty one participants were selected randomly to take part in the study. Factors likely to influence adherence was elicited from the community members using a pre-tested structured questionnaire. Data were analyzed using Stata version 13. Chi square test was used to determine significance of the individual level factors against drug uptake.

Results

Out of the total of 251 participants (age range 18-75, mean age 37.6, SD 14.3), 94% (236/251) received ivermectin; while 86.9% (205/236) adhered by swallowed it. The most common reason for not receiving or swallowing the drug was that the CDD did not come to their houses 63% (29/46). Individual level factors found to be significantly associated with adherence to taking the drug included: knowledge of onchocerciasis as a disease, its vector and mode of transmission. Other factors were knowledge of the signs and symptoms of the disease, its seriousness and how common they perceived it to be in their community, their perceived level of risk and perceived importance of Community Directed Treatment with Ivermectin (CDTI) as well as whether they knew any Community Directed Distributor (CDD).

Conclusion

It has been established that 18.3% of the participants did not swallow ivermectin. Educational activities and mop-ups are therefore needed to be carried out on regular bases by the district health directorate to encourage regular uptake while implementation research be carried out for an overall improvement in uptake.

TABLE OF CONTENTS

CONTENT Page

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

APOC - African Program for Onchocerciasis Control

CDC - Center for Disease Control and Prevention

CDD - Community Directed Distributor

CDI - Community Directed Intervention

CDTI - Community Directed Treatment with Ivermectin

CHW - Community Health Workers

GHS - Ghana Health Service

ITN - Insecticide Treated Bed Nets

IVM - Ivermectin

LF - Lymphatic Filariasis

MDA - Mass Drug Administration

Mf - Microfilariae

Mf/mg - Microfilariae per milligram

NTDCP - Neglected Tropical Disease Control Program

NTD - Neglected Tropical Disease

OCP - Onchocerciasis Control Program

OEPA - Onchocerciasis Elimination Program for the Americas

SIZ - Special Intervention Zone(s)

WHO - World Health Organization`

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background to the study

Onchocerciasis, commonly known as river blindness is a parasitic disease caused by the filarial worm *Onchocerca volvulus*. It is transmitted by infected blackflies of the genus *Simulium* through repeated bites (Crump, Morel, & Omura, 2012). These blackflies breed in fast-flowing rivers and streams, mostly in remote areas. In the human body, the adult worms produce larvae known as microfilariae that migrate to the skin, eyes and other organs. When a female blackfly bites an infected person as it takes a blood meal, it also ingests microfilariae which develops further in the fly and are then transmitted to the next human host during subsequent bites (WHO, 1995) (Asfaw et al., 2005).

The disease manifests mainly as an eye and skin problem with symptoms due mainly to the microfilariae, which migrate to all parts of the human body through the subcutaneous tissue and induce intense inflammatory responses, especially when they die. Infected people may show symptoms such as severe itching and various skin lesions (Bush, Simon; Ngorok, 2011). In most cases, nodules develop under the skin. Some infected people develop eye lesions which can lead to visual impairment and permanent blindness (Coffeng et al., 2013). The adult parasite has a life span of 8-15 years, during which time they release thousands of microfilariae every year.

Onchocerciasis is a tropical disease and among the neglected tropical diseases. About 37 million people have been infected, with 90 million people at risk worldwide (Hotez & Molyneux, 2007). More than 99% of the infected people live in 31 countries in sub-Saharan Africa including Ghana, Benin, Burkina Faso, Côte d'Ivoire, Mali, Niger, Nigeria and Togo ("http://www.who.int/mediacentre/factsheets/fs374/en/," n.d.). The WHO estimates that at least 17.7 million people are infected, with 500,000 of the people visually impaired and 270,000 already blind (Osei-Atweneboana, Eng, Boakye, Gyapong, & Prichard, 2007). In Ghana 1.5 million people have been infected, with 128,000 blind (Opoku, 2009)

The Onchocerciasis Control Programme in West Africa (OCP) was the first major programme developed to control the disease. It was launched in 1974 initially covering seven countries in West Africa but was later extended to cover 11 countries. The OCP used aerial larviciding as its main strategy to control the vectors, as there was no safe drug for mass treatment against the parasites at the time of initiating the programme (Fobi et al., 2015).

Efforts to control onchocerciasis evolved when in 1987 Merck & Co. Inc. decided to donate ivermectin, for as long as necessary, to all people affected by the disease (Bundy, Dhomun, Daney, Schultz, & Tembon, 2015). This drug kills the juvenile worms that cause the various symptoms associated with the disease (WHO Expert Committee on Onchocerciasis Control (1993 : Geneva & Organization, 1995). As a result of the donation, OCP instituted a new strategy of chemotherapy in combination with vector control. In the 11 countries covered by OCP, this two-prong approach led to the virtual

elimination of onchocerciasis as a public health problem and as an obstacle to socioeconomic development.

After successfully meeting the target of the OCP and coming to the realization that ivermectin was highly efficacious, it officially ended paving the way for the setting up of the African Program for Onchocerciasis Control (APOC) in 1995 to handle the distribution of ivermectin to the rest of Africa. They were initially challenged with the method of distribution but after working together with African Scientist, an effective method that is a community directed treatment system was adopted. It proved to be efficient and up till today, it is the sole method of ivermectin distribution. By the year 2006, 46.2 million people in endemic countries were treated by trained Community Drug Distributors (CDD) selected by communities from among their own ranks (APOC, 2007).

While reports of population coverage of ivermectin distribution are encouraging, it is of concern the levels of uptake in communities because there may be individuals or groups who systematically have not adhered over the years and thus provide a continuous focus for disease transmission. Adherence according to Brieger et al. is defined as "the extent to which a patient acts in accordance with the prescribed interval and dose of and dosing regime" (Brieger et al., 2011). The level of adherence to ivermectin is of worry and still persists after 15 years of administration. It is therefore imperative to account for the reasons of non-adherence and find means and ways to remedy the situation. Given that ivermectin treatment will be around for an appreciable number of years until onchocerciasis is eliminated, it is imperative to find solutions to influence adherence positively to the maximum limit possible in anticipation of eliminating it totally. Studies

in Nigeria and Cameroon indicate low adherence to ivermectin and have therefore put forth a system of continues education, monitoring and research to encourage high level adherence (Brieger et al., 2011).

1.2 Problem statement

Ivermectin is known to be an efficacious drug in the control of onchocerciasis which kills up to 99% of microfilariae with a single treatment (APOC, 2010). It clears the microfilariae from the blood and inhibits microfilarial release by adult female worms (Osei-Atweneboana et al., 2011) indicating an effective and constant use of ivermectin will clear microfilariae from the blood and interrupt transmission. It is therefore expected that after annual mass distribution for 20 years, that is the maximum presumed lifespan of an adult *Onchocerca volvulus* in man (Richards, Boatin, Sauerbrey, & Sékétéli, 2001), the prevalence of microfilariae will reduce to levels below which transmission will no more occur.

Mass administration with ivermectin has been ongoing under the Community Directed Treatment with Ivermectin (CDTI) strategy in Ghana since 1995. Emphasis was laid on communities around the Black Volta Basin to minimize transmission. The Tain district in the Brong-Ahafo region for the past 20 years (1995 to 2015) has been part of this treatment schedule in consonance with the African Program for Onchocerciasis Control (APOC) and the Ghana Neglected Tropical Disease Program (NTD). This has led to a significant reduction in morbidity necessitating the change in its goal from control to total elimination (Kim et al., 2015). In some communities in the district (Abekwai) however, prevalence continuous to be high (11.8%), despite the fact that the district is currently

undertaking a biannual ivermectin mass distribution and has a high reported geographical coverage of 80% and above (NTD Ghana, unpublished 2015).

The level of adherence to ivermectin by community members has been implicated in accounting for therapeutic coverage and continues prevalence of the infection (Endale, Erko, Weldegebreal, & Legesse, 2015). It is against this backdrop that the current study sought to determine the level of adherence to ivermectin mass administration for Onchocerciasis Elimination in Abekwai in the Tain district.

1.3 Justification of the study

Adherence to a drug refers to when a patient or an at risk person drinks or swallows his/her medication as prescribed by a qualified person. Ho and others (2009) defines adherence as "active, voluntary and collaborative involvement of a patient in a mutually acceptable course of behavior to produce a therapeutic result." (Ho, Bryson, & Rumsfeld, 2009). It therefore indicates that the only way for a medication to achieve maximum results is to strictly adhere to it. Non-adherence to medications progressively is becoming a concern to health care providers and stakeholders because it prolongs treatment time and waste resources (Jimmy & Jose, 2011).

The discovery of ivermectin and approval of use by the World Health Organization for onchocerciasis control makes strict adherence to it very important since it is the only drug for onchocerciasis control today. According to Brown and Bussell (2011), approximately 50% of patients do not take their medication. It therefore influences an increased morbidity and death incurring an estimated cost of 100 billion dollars per year (Brown & Bussell, 2011).

A continues mass drug administration will have an implication on cost especially now that a graduation has been made from annual to biannual treatment. Though ivermectin is distributed for free, the cost encompasses transportation from the port all the way to the community level. Training of volunteers, reporting and surveillance and administrative cost is taken into consideration (Turner et al., 2013). It is therefore imperative that a strict adherence to ivermectin is practiced to reduce as much as possible the disease transmission and to reduce cost of operations as well.

In view of these, it is imperative that adherence to ivermectin in the Tain District is achieved optimally. Being designated as a hyper-endemic district adding to the situation where ivermectin treatment is carried out twice a year, accounting for the level of adherence will influence programs and better interventions to encourage drug uptake, to eliminate onchocerciasis and to promote a health society.

1.4 Research objective

To determine the level of adherence to ivermectin mass administration under the Community Directed Treatment approach for onchocerciasis elimination in Abekwai in the Tain District of Ghana.

1.4.1 Specific objectives

1. To determine the proportion of the eligible population who received ivermectin during the 2015 programme period.
2. To determine the proportion of eligible people who swallowed ivermectin during the 2015 programme period.

3. To determine individual level factors that affect swallowing of ivermectin in the Abekwai community.

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Onchocerca volvulus Infection.

Onchocerca volvulus, is known to be one of the nine worldwide filarial nematode parasites which infect humans. It is known to cause human onchocerciasis otherwise known as River Blindness. It affects mainly the eye and the skin. Female blackflies *Simulium damnosun*, are day biters, and are mostly found near fast running rivers and streams (Adeleke, Olaoye, & Ayanwale, 2013).

Infections caused by *Onchocerca volvulus* has been estimated to be more than 37 million worldwide (Basáñez et al., 2006) and prevalent in 34 countries most of them in Africa. The level of endemicity stretches across the entire continent of Africa parallel to the equator and also extends into southwest Asia with some patches in Yemen and Oman in the Arabian Peninsula. Related countries where infection is prevalent includes Brazil, Venezuela, Mexico, Ecuador and Guatemala (Thylefors, 2004).

The World Health Organization Expert Committee on onchocerciasis estimated that over 120 million people live in endemic areas (WHO Expert Committee on Onchocerciasis Control (1993 : Geneva & Organization, 1995). It was estimated in 2001 that 500,000 people worldwide had visual impairments while 270,000 experienced blindness (WHO, 2012). Countries that recorded the highest prevalence of onchocerciasis included most of the West African countries such as Ghana, Nigeria, Liberia and Mali. These highly endemic areas saw infection rates to be as high as 80–100% among persons above age 20.

Clinical manifestations peaked at 40 – 50 years of age (WHO Expert Committee on Onchocerciasis Control (1993 : Geneva & Organization, 1995).

This infection often results in being an obstacle for socioeconomic development given that working adults are very much the ones infected and debilitated leaving the young to care for the rest of the family. It also affects the state of mental wellbeing, limits social acceptability, negatively affecting the quality of life and imposes a disproportionate disease burden on poor rural communities in Africa (Afolabi, 2014) (WHO, 2007).

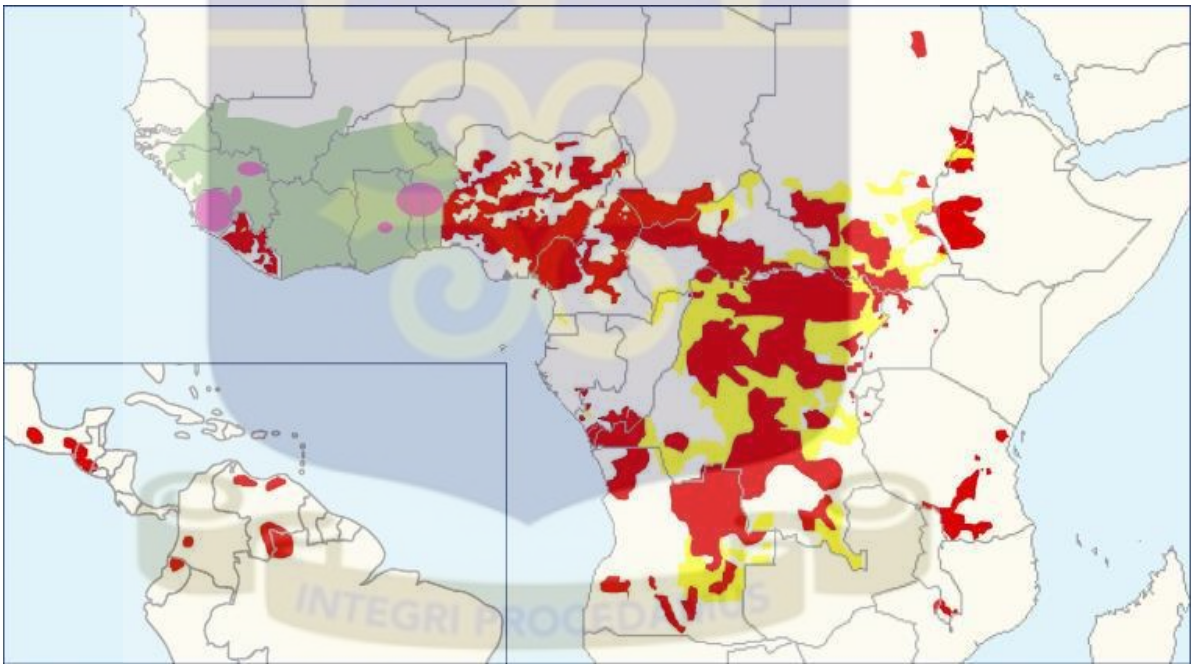


Figure 1: Global epidemiological distribution of *Onchocerca volvulus* infection. Source: (Basáñez et al., 2006)

(Red, yellow, green and pink shades denote areas receiving Ivermectin treatment, also indicates the cover region by OCP in West Africa and designated Special Intervention Zones respectively).

2.2 Life cycle of Onchocerca volvulus

Parasites that cause onchocerciasis are transmitted from one person to another through the bites of black fly vectors (http://www.who.int/apoc/onchocerciasis/lifecycle/en/). During a blood meal, an infected blackfly (genus *Simulium*) introduces third stage filarial larvae onto the skin of the human host where they penetrate into the bite wound. In the subcutaneous tissues, the larva develops into adult filaria which always resides in nodules in the subcutaneous connective tissues. Adults can live in the nodules for approximately 15 years. Some nodules may contain numerous male and female worms. Females measure 33 to 50 cm in length and 270 to 400 µm in diameter, while males measure 19 to 42 cm by 130 to 210 µm. In the subcutaneous nodules, the female worms are capable of producing microfilariae for approximately 9 years. The microfilariae, measuring 220 to 360 µm by 5 to 9 µm and unsheathed, have a life span that may reach 2 years. They are occasionally found in peripheral blood, urine, and sputum but are typically found in the skin and in the lymphatics of connective tissues. A blackfly ingests the microfilariae during a blood meal. After ingestion, the microfilariae migrate from the blackfly's midgut through the hemocoel to the thoracic muscles where it develops and subsequently into third stage infective larvae. The third-stage infective larvae migrate to the blackfly's proboscis and can infect another human when the fly takes a blood meal.

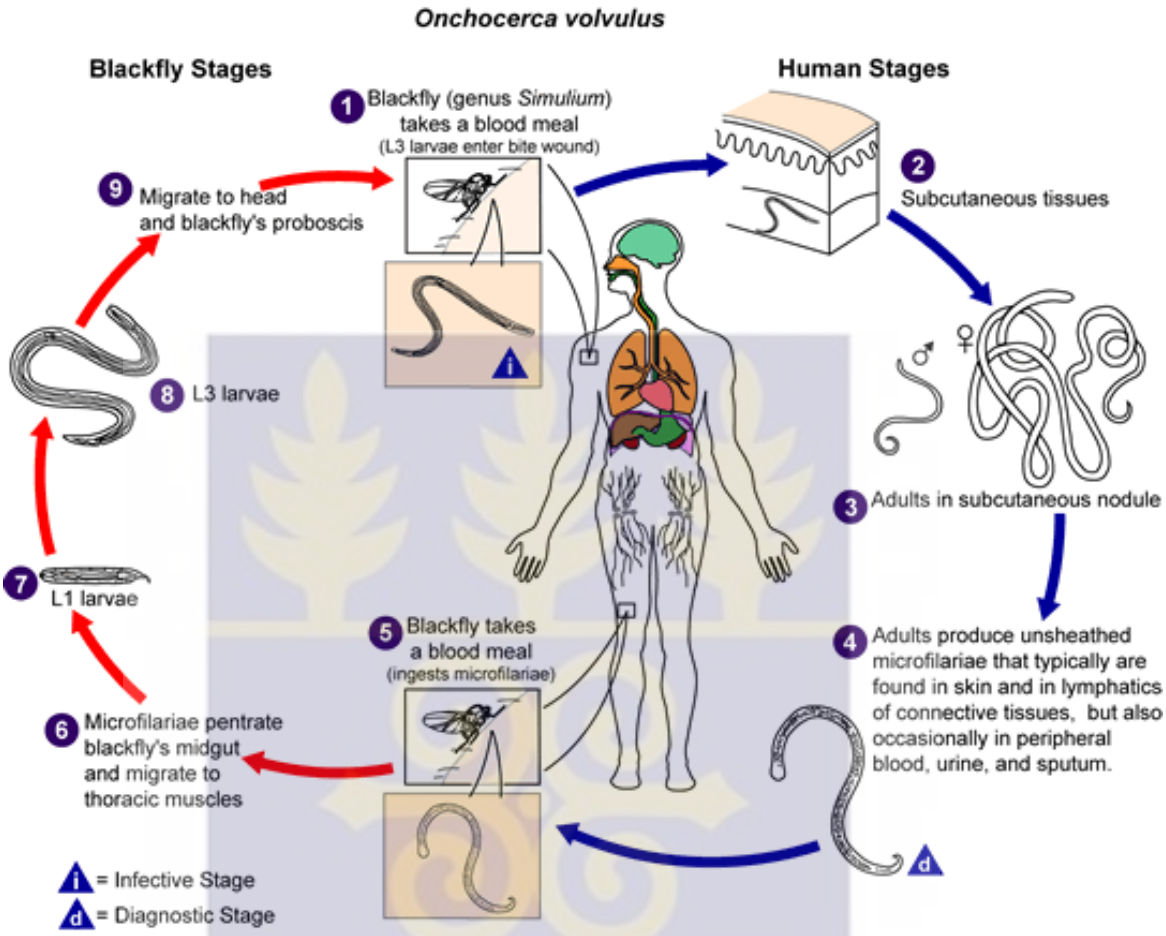


Figure 2: The life cycle of *Onchocera volvulus* represented in a diagram.

(Source: http://www.cdc.gov/dpdx/onchocerciasis/)

2.3 Control of Onchocerciasis globally

Onchocerciasis control initially was focused on the use of synthetic insecticides to control vectors in order to limit the number of infective bites per person per year given that the life cycle can be broken eventually at a point. This method was effectively used in Kenya for *Simulium neavei* where it was eliminated in an area of 40,000 square kilometers (Cupp, Sauerbrey, & Richards, 2011). Knowing this fact, the Onchocerciasis Control

Program (OCP) was established in 1974 in West Africa, one of the seriously affected regions. They adapted the larviciding strategy to stem the disease transmission and also to avoid more risk on the pollution (Paugy, Fermon, Abban, Diop, & Traoré, 1999). It was done on weekly bases. In 1987, ivermectin was discovered to be efficacious in killing microfilariae and reducing repopulation of adult females and was therefore registered for human use (Brieger, 2000). By the time the OCP was ending in 2002, onchocerciasis was no more a public health problem. Skin diseases associated with onchocerciasis was reduced significantly and more than 200,000 cases of blindness was prevented and a further decrease was recorded in *Onchocerca volvulus* populations (Cupp et al., 2011).

The Onchocerciasis Elimination program for the Americas (OEPA) was established in 1993 to eliminate morbidity in six major infected countries (Brazil, Columbia, Ecuador, Guatemala, Mexico and Venezuela) (Antwi-Berko, 2014) The distribution of ivermectin to all endemic communities twice a year and covering 85% and over has led to a reduction in transmission by 86% (Richards et al., 2001).

In 1995, the African Program for Onchocerciasis Control (APOC) was set up by the World Health Organization (WHO) to administer ivermectin to the rest of endemic Africa outside the OCP area. It adapted the Community Directed Treatment with Ivermectin (CDTI) strategy to administer the drugs (Brieger, 2000). Its goal was to put in place a sustainable drug distribution system and maintain a yearly population coverage of a minimum of 65% for at least 15 years which is required for an effective control of onchocerciasis (Brieger, et al., 2011).

The control of onchocerciasis today currently relies on mass administration with ivermectin based on a donation program by Merck & Co. To enhance the likelihood of achieving elimination status, the APOC is graduating from an annual administration to a biannual administration or even higher. Graduating treatment to a biannual basis will reduce the time for the remaining program by 40% while a further reduction to 60% will be achieved if ivermectin is administered every 3 months (Coffeng et al., 2014).

2.4 The Impact of Community Directed Interventions

The availability of interventions to reach people who need them the most is one of the greatest challenges to achieving maximum health. A lot of diseases could have been conveniently controlled if not eliminated if communities were involved holistically in the intervention process.

The Community Directed Intervention (CDI) is a strategy in which the communities themselves direct planning and implementation of the delivery of an intervention (Amazigo, 2010). Since the adaptation of the CDI by the APOC in the mid-1990's, it has helped in ivermectin treatment for over 75 million Africans many of whom live in rural areas (Amazigo, 2010). The success of CDI in onchocerciasis control brought up an interest in applying this strategy for interventions on other health problems by the World Health Organization (WHO). It was applied in Asia-Pacific sites in the distribution of Insecticide Treated Bed nets (ITN) which led to a significant malaria transmission reduction (Kaneko, 2010).

The Community Directed Intervention strategy recruits Community Directed Distributors (CDD) from within the community to administer the drugs. CDD's who participated

efficiently made themselves readily available to other community directed interventions given that there was no attrition between officials and themselves (Emukah et al., 2008a).

2.5 Ivermectin and Onchocerciasis control

The current and sole drug for onchocerciasis treatment is ivermectin which has been approved for distribution by the World Health Organization and is being provided for free by Merck and Co. Inc. to endemic countries (Vieira et al., 2007). It has contributed in abundance to relieving suffering onchocerciasis endemic areas worldwide and is considered to be one of the most successful public health interventions ever done (Crump et al., 2012).

Ivermectin is known to be an avermectin compound which belongs to the macrocyclic lactones class of endectocides derived from the bacterium *Streptomyces avermitilis*. The process through which ivermectin kills microfilariae is entirely not known, however the drug interferes with glutamate gated ion channels that normally will affect parasite contractility and release immunomodulatory molecules by the parasite (Antwi-Berko, 2014).

The administration of ivermectin is usually given at a dose of 150 to 200 µg/kg body weight. This recommended dose of 150µg/kg does not kill neither does it sterilizes permanently adult worms but has been established to stem the effectiveness of female worms to produce microfilariae (Osei-Atweneboana et al., 2007).

The distribution of ivermectin includes all persons aged 5 years and above. It excludes pregnant women and those breastfeeding a child not up to one week old. A high toleration is generally associated with ivermectin; however there seem to be some few

adverse effects associated with it which is likely to appear 1 to 2 days after treatment. These adverse effects normally correspond with the microfilarial load level of an individual.

Despite the emergence of a successful mass administration and high coverage, it is recorded that this infection keeps on being prevalent extending the elimination period if adherence to ivermectin is not taken seriously (Endale et al., 2015).

2.6 Current Status of Onchocerciasis in Ghana

It is estimated that about 3.4 million people in Ghana are at risk of onchocerciasis. The disease is prevalent in 3,204 communities in 66 districts and 9 regions. The only region that is not endemic with onchocerciasis is the Greater Accra Region. About 247 of the communities in the Brong-Ahafo and Ashanti Regions have been marked as Special Intervention Zones (SIZ) due to the hyper-endemic nature of these areas (Taylor et al., 2009)

SIZ zones within the two regions encompass the Pru River basin with a population of about 85,000, and a prevalence of 7.8%, the Oti River basin and its tributaries in Togo with a population of about 185,000 and a prevalence of 21.7% (Antwi-Berko, 2014).

After the Onchocerciasis Control Program (OCP) ended and the creation of the SIZ program, Ghana has put a lot of emphasis on intervention through the use of ivermectin in areas marked as onchocerciasis transmission hot zones. These onchocerciasis transmission hot zones in Ghana include the Pru River area in the Ashanti Region, The Pra area in the Central Region, The Black Volta Basin in the Brong-Ahafo Region, the

Oti and Asukawkaw River basins in the Volta Region. These areas are marked as high priority zones for ivermectin mass administration (Antwi-berko, 2014)

2.7 The Distribution of Ivermectin in Ghana

Ivermectin remains the only drug supplied in Ghana for onchocerciasis control. Mobile teams were initially used for the distribution which started in 1987. By 1988, an adoption was made with the Community Directed Treatment with Ivermectin (CDTI) and has since then been the only system of ivermectin distribution (Antwi-Berko, 2014). Ivermectin treatment as well started in lymphatic filariasis and onchocerciasis co-endemic areas in 2001 and has gone through a steady rise to cover about 61 endemic districts by 2005. An estimated 3.4 million people were treated through the Community Directed Treatment with Ivermectin strategy from 2002 to 2007. This represented a rise in coverage from 48.4% to 79.1%.

By 2010, 1,727,250 people had been treated in about 3,265 hyper endemic communities (Bush, Simon; Ngorok, 2011). Data from the Ghana National Onchocerciasis Control Program (GNOCP) as well shows that there has been a major improvement in both geographic and therapeutic coverage from 2006 to the first round of ivermectin administration in 2009 (APOC, 2010).

From 2006, the control of onchocerciasis has been implemented and sustained in consonance with the Neglected Tropical Diseases Control Program (NTDCP). A 5 year plan was drawn to integrate the delivery of preventive chemotherapy in 5 targeted Neglected Tropical Diseases (NTDs) which includes onchocerciasis. Its implementation

started in 2007 on a pilot basis in 5 regions; Northern Region, Upper East Region, Upper West Region, Western Region and Brong Ahafo Region.

The community directed mass drug administration included Lymphatic Filariasis (LF), Schistosomiasis and Vitamin A distribution. By 2007 the NTDCP was able to deliver over 25.5 million ivermectin tablets and over 8 million albendazole tablets for LF to endemic regions around Ghana (APOC, 2010).

A lot of efforts have been put in to enhance an effective ivermectin distribution through the CDTI. In view of this and given the high prevalence of onchocerciasis in Abekwai, the adherence levels of the community members toward ivermctin treatment is important.

2.8 Poor adherence to Ivermectin

After ivermectin was discovered to be efficacious and was going to be distributed by Merck & Co until onchocerciasis is eliminated, the problem laid in ways to maximize the distribution and adherence to it. Coverage has been reported to be high (80% and above), yet the prevalence of the disease in endemic areas especially Sub-saharan Africa still persist (APOC, 2010).

A study conducted in Cameroon, Nigeria and Tanzania on their attitudes and behaviors with respect to men and women suggested that relationships prescribed by culture influenced the ways in which men and women adhere to ivermectin (Clemmons et al., 2002)

Another study in Tanzania by Lakwo and Gasarasi revealed that inadequate knowledge on the cause, signs and symptoms of onchocerciasis, local beliefs and lifestyle of alcoholism contributed to non-adherence of ivermectin (Lakwo & Gasarasi, 2006). They

suggested that lots of educational campaigns should be made available to promote a better understanding on onchocerciasis and ivermectin treatment.

In recent times, not adhering to ivermectin includes a lack of an all-inclusive understanding of onchocerciasis, fears associated with taking ivermectin, a distrust of the methods that defines the dose, a not so flexible drug distribution method, an insufficient information communication from Community Directed Distributers and a scarcity of educational health materials for continuous use (York, Kabole, Mrisho, Berry, & Schmidt, 2015).

A lot of efforts are consistently being put in place to encourage adherence to ivermectin. Finding out the adherence levels of specific areas promotes the level of intensity attempts will be made to ensure a high prevalence.

CHAPTER THREE

3.0 METHODS

3.1 Study Area

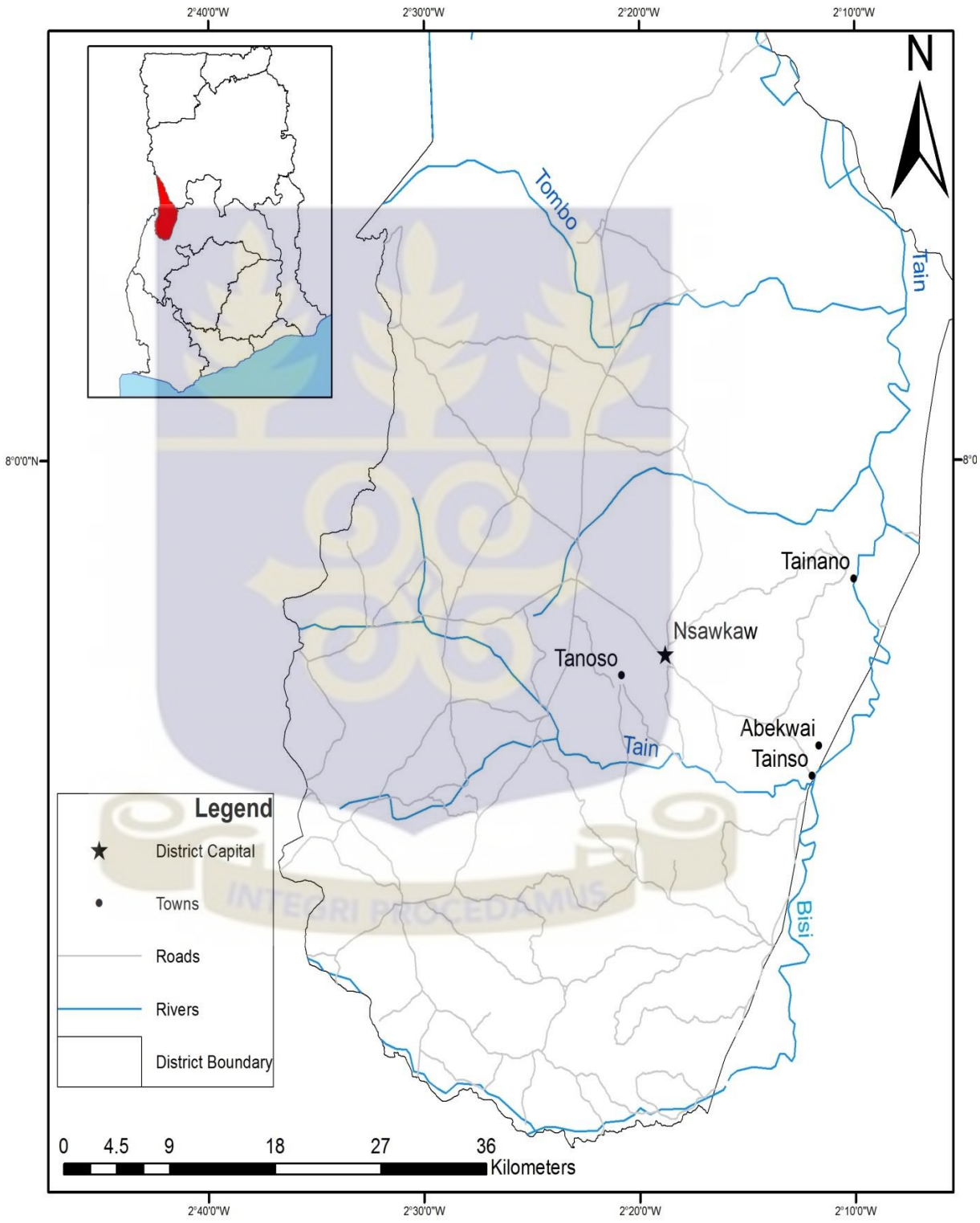
The Tain district is one of the newly created districts in the Brong-Ahafo Region. The district lies within latitudes 7.50º and 8.45° North and longitudes 2.52°West and 0.28° East covering a land area of 4,125 square kilometers. The district shares common boundaries with Wenchi Municipality to the East, Jaman North to the West, Sunyani Municipality to the South and Berekum Municipality to the South West. It is also bounded by the Bole District of the Northern Region to the North East and La Cote d'Ivoire to the North West. Nsawkaw, the district capital is 28.97 kilometers from Wenchi, the capital of Wenchi Municipality from which Tain was carved out. According to the 2010 Population and Housing census, it has a population of 88,104 (Tawiah, 2015). The Tain River is Major River in the district.

Agriculture is the major occupation with 80.8% engaging in it. Forest reserves in Tain include Sawsaw, Yaya and Bawa which serve as good watershed. The different vegetation zones favor the cultivation of a variety of crops including cereals, tubers and vegetables and animal rearing. Given the indication that a high vegetative cover is found in the protective and productive forest, it influences high soil fertility and aids human activities in terms of agriculture. Forest areas are also favorable for onchocerciasis transmission. It is worthy to note that since majority of the population engages in some form of agriculture, it indicates their total exposure to blackflies since agriculture is

predominantly an outdoor activity. Their nearness to the fertile forest areas and rivers makes their exposure worse.

The Tain District has been designated as an onchocerciasis endemic area (NTD, Unpublished 2015). In view of this the district undertakes biannual treatment using the Community Directed Treatment strategy for onchocerciasis control leading to possible elimination. Irrespective of the biannual treatment, it recorded a prevalence rate (Abekwai) of up to 11.8% in selected sentinel communities (NTD, Unpublished 2015).

Figure 3: Map of Tain District



3.2 Study design

A population based cross-sectional study was undertaken in Abekwai, an onchocerciasis endemic community in the Tain district of the Brong Ahafo Region during which data were collected from community members (18 years and above) using a structured questionnaire. Simple random sampling of the community members was done until the sample size was attained. Factors likely to influence adherence was elicited from the community members. Data were also collected on the number of eligible people in the community who received ivermectin during the 2015 treatment period from the District Health Directorate using the treatment registers.

3.3 Study Variables

Dependent variable: Drug intake

Independent variables: age, sex, education, religion, occupation, knowledge on onchocerciasis, knowledge on risk factors, ivermectin distribution awareness, reasons for receiving the drug, reasons for not receiving the drug, reasons for swallowing or not swallowing the drug, perceived side effects, ways of distribution and of supply.

3.4 Study Population

The study population was made up of all residents of Abekwai eighteen years and older. Data on these people were collected individually.

Inclusion criteria:

1. Age, 18 years and above

2. Willingness to participate after going through consenting and agreeing to sign or thumb print the consent form.

Exclusion criteria:

1. Community members under eighteen years
2. Mothers who were lactating during the drug distribution period
3. Persons who were severely ill during the drug distribution period

3.5 Sample size determination

In order to get an appropriate representative sample, the formula for measuring a proportion was used since the overall purpose of this study was to account for the proportion of adherence. The formula is

$$\text{Sample size} = \frac{Z_{1-\frac{\alpha}{2}}^{2}\ p(1-p)}{d^2}$$

A confidence level of 95% which is equal to 1.96 on the standard normal table was used for Z, p was represented by the level of non-adherence and was taken to be 19.2% based on a similar study by (Endale et al. 2015). Attaining the proportion of non-adherence was then calculated and subtracted from 100 to get the adherence proportion. q is (1-p) and the level of precision of 5%. A total of 238.3 was attained from the calculation. 10% non-responsiveness was added to make 261.8. It was therefore expected that about 262 participants will be adequate for this study to obtain meaningful results.

3.6 Sampling method

A simple random sampling procedure was used where every community member was given an equal chance to participate. Each participant was entirely selected by chance from the very first compound in Abekwai and had an equal chance of participating as we moved from compound to compound. Community members were recruited and asked questions in isolation until the sample size was attained.

3.7 Data collection tools and procedure

Questionnaires were administered to every recruited participant 18 years and above. Data that was collected included knowledge of onchocerciasis, ivermectin treatment, some demographic characteristics such as age, sex and occupation of each participant, whether he/she was visited by a drug distributor during the last MDA session, whether the participant received the drug and whether the participant actually adhered to the drug by swallowing it.

Field observation is always an integral part of field data collection. It was therefore used to complement the questionnaire as to what exactly the case was. Proximity to the rivers and how often they were patronized for all purposes was accounted for to indicate a profound understanding and dynamics of ivermectin treatment.

3.8 Quality control

Data was taken with the registers of the Community Directed distributers to confirm some of the responses or otherwise. Data was also collected at a time that most of the community members were available that was in the mornings and evenings since most

are farmers and fishermen. The data was also coded and checked with Stata version 13 for outliers.

3.9 Pre-test

Pretesting of the questionnaires was done at Tainso a nearby community in the district to check the reliability of the questions and to find out whether they can really measure the uptake level of ivermectin before it was finally administered.

3.10 Data processing and analysis

Data analyses was made using Stata version 13. Descriptive statistics such as frequencies, percentages and proportions of those who received the drugs and those who swallowed them was determined. Individual level factors that affected receipt and swallow of ivermectin was also determined using proportions of those who adhered to ivermectin and was highlighted. Final proportions were measured using percentages of participants who received and who swallowed ivermectin. Chi square was used to determine the significance of the individual level factors in relation to adherence to ivermectin.

3.11 Ethical Issues

The study proposal was submitted to the Ghana Health Service Ethical Review Committee for review and approval before commencement of the study (GHS-ERC 76/02/16). Permission was also sought from the Tain district assembly, the Tain district health directorate and the Chief of Abekwai before the study was carried out. Written informed consent was obtained from each person in their local language before the administration of the questionnaire once they met the inclusion criteria which included the following;

3.11.1 Potential Risk

There was not any foreseen risk to participating in this study. There was however some discomfort associated with disclosing personal information to an unknown person.

3.11.2 Possible Benefits

There was not any direct benefit for participating in the study to any volunteer. Volunteers were however contributing to influencing a deeper method towards finding a sustainable solution to ensure an overall ivermectin adherence for elimination of onchocerciasis.

3.11.3 Privacy/Confidentiality

All information gathered in relation to the volunteer's participation was kept confidential and was not revealed to anyone. Identities will not be revealed in reports or publications that will result from the study while the data, both in hard copy and digital format, collected were kept for the purpose of analyses only.

3.11.4 Voluntary withdrawal

The decision of each volunteer in this study to participate was entirely voluntary. He/she was allowed to ask as many questions as possible until a better understanding was achieved. A volunteer was also allowed to withdraw participation at any time as he/she wished without the need for any explanation.

3.11.5 Compensation

There was not any form of payment to the volunteer. He/she was made to understand that agreeing to respond to the questionnaire would rather be contributing to an enhanced way of reducing the prevalence of onchocerciasis.

3.11.6 Consenting process

For every volunteer, he or she was taken through the consenting process that is, what the study was about and what we sort to achieve, the benefits of the study to the community and nation as well as the potential risk involved. He/she was also made aware that it was entirely voluntary and thus can decide to stop at any time in the process. To prove consent, every volunteer was made to either sign or thumb print the consent form before the questionnaire was administered.

3.11.7 Data storage and usage

It was explained to every volunteer that all the information obtained would be stored in files and put under lock and key. At the end of the study any personal identifying information would also be destroyed and would not be identified easily by anybody else.

3.11.8 Conflict of Interest

There was not any conflict of interest since the community is onchocerciasis prone. The community members after explanation found reason to partake in the study.

CHAPTER FOUR

4.0 RESULTS.

4.1 Background characteristics of the study participants.

A total of 251 people participated in the study; this was made up of 46.2% (116/251) males and 53.8% (135/251) females [Table 1]. The mean age of the participants was 37.6 years (SD 14.3; range 18-75 years). Most of the participants were aged 20-29 years (31.5%, 79/251) with majority of them without formal education (59.8%, 150/251) while only 1 person was educated to the tertiary level (0.40%, 1/251). Farming was the predominant occupation (92.0%, 231/251) with 74.9% (188/251) of the people being married.

4.2 Receipt and intake of Ivermectin.

Out of the 251 respondents, 94.02% (236/251) received ivermectin, 44.9% (106/236) males and 55.1% (130/236) females with similar proportions of males (91.4%, 106/116) and females (96.3%,130/135) receiving the drug. The 20-29 age group had the lowest receipt 89.9% (71/79) of ivermectin as compared to the other age groups though they recorded the highest number of drugs received 30.1% (71/236) [Tables 1 & 2]. A much higher number of farmers 91.5% (216/236) also received ivermectin due to the fact that most of the community members are farmers but then they recorded the lowest receipt 93.5% (216/231) as compared to the other occupations. The Christians recorded the lowest receipt 92.7% (139/150) of ivermectin than any other religious sect in the community. 18.6% (44/236) of respondents who received ivermectin had no religious status. Participants who were divorced received the lowest 83.3% (5/6) as compared to

the participants who were single 88.4% (38/43) and the rest of the relationship status [Tables 1 & 2]. A chi2 test showed that there was no significant associated between any of the socio-demographic variables against receipt and intake of ivermectin. Out of the 236 participants who received ivermectin, 86.9% (205/236) swallowed it, out of which 46.3% (95/205) of them were males and 53.7% (110/205) were females [Table 2]. There was no difference between males and females who swallowed ivermectin (81.9%; 95/116) and (81.5%; 110/135) respectively. The 20-29 year group had a higher percentage uptake 27.8% (57/205) as compared to the other year groups but more of them refused to swallow the drug 27.8% (22/79) as compared to the other year groups [Tables 1 & 2]. The 70+ year group recorded a 100% (3/3) uptake. 12.5% (27/216) of the farmers received ivermectin but refused to swallow while 18.8%(16/85) participants educated to the JHS level received and refused to swallow as compared to participants with no formal education 10.1%(14/139). Muslims and traditional worshipers recorded a 100% uptake against receiving ivermectin, leaving the Christians accounting for 14.6% (25/171) of them who received refused to swallow. Participants married had a higher refusal of drug intake 8.9% (16/179) as compared to other relationship status though they received [Table 2].

Table 1: Socio-demographic characteristics of respondents (N=251).

Variables	Category	Frequency (%)
Sex	Male	116(46.2)
	Female	135(53.8)
Age	<19	17(6.8)
	20-29	79(31.5)
	30-39	51(20.3)
	40-49	46(18.3)
	50-59	40(15.9)
	60-69	15(6.0)
	70>	3(1.2)
Occupation	Farming	231(92.0)
	Trade/business	9(3.6)
	Official employee	1(0.4)
	Other	10(4.0)
Educational Level	No education	150(59.8)
	Primary/JHS	89(35.5)
	SHS	10(4.0)
	Tertiary	1(0.4)
	Other	1(0.4)
Religion	Christian	179(78.5)
	Muslim	11(4.4)
	Tradition	15(6.0)
	No religion	46(18.3)
Relationship Status	Single	43(17.1)
	Married	188(74.9)
	Divorced/separated	6(2.4)
	In a relationship but not married	8(3.2)
	Widowed	6(2.4)

Table 2: Socio-demographic characteristics of respondents who received and swallowed ivermectin during the last treatment round.

Variables N=251	Drug recipient N=236(%)	Drug swallowed N=205(%)	Did Not Swallow N=31(%)
Sex			
Male	106(44.9)	95(46.3)	11(35.5)
Female	130(55.1)	110(53.7)	20(64.5)
Age	17(7.2)	14(6.8)	3(9.7)
<19	71(30.1)	57(27.8)	14(45.1)
20-29	47(19.9)	43(21.0)	4(12.9)
30-39	45(19.1)	39(19.0)	6(19.4)
40-49	38(16.1)	37(18.0)	1(3.2)
50-59	15(6.4)	12(5.9)	3(9.7)
60-69	3(1.3)	3(1.5)	0(0)
70>			
Occupation			
farming	216(91.5)	189(92.2)	27(87.1)
trade/business	9(3.8)	6(3.0)	3(9.7)
official employee	1(0.4)	1(0.5)	0(0)
other	10(4.2)	9(4.4)	1(3.2)
Educational level	139(58.9)	125(61.0)	14(45.2)
no education	85(36.0)	69(33.7)	16(51.6)
primary/JHS	10(4.2)	9(4.4)	1(3.2)
SHS	1(0.4)	1(0.5)	0(0)
tertiary	1(0.4)	1(0.5)	0(0)
other			
Religion			
Christian	171(72.5)	146(71.2)	25(80.6)
Muslim	8(3.4)	8(3.9)	0(0)
Tradition	13(5.5)	13(6.3)	0(0)
No religion	44(18.6)	38(18.5)	6(19.4)
Relationship status			
single	38(16.1)	29(14.1)	9(29.0)
married	179(75.4)	163(79.5)	16(51.6)
divorced/separated	5(2.1)	3(1.5)	2(6.5)
in a relationship but not married	8(3.9)	5(2.4)	3(9.7)
widowed	6(2.5)	5(2.4)	1(3.2)

4.3 Behavioral and service related factors.

Enquiries where made from respondents about their knowledge levels of onchocerciasis, the vector (blackfly) responsible for transmission, mode of transmission (blackfly bite) and whether they itched when bitten by blackflies. 94.8% (P<0.001) of the respondents who ever heard of onchocerciasis adhered while 97.8% (P<0.001) of those who knew the vector that transmits, 98.6% (P<0.001) of those who knew the mode of transmission and 97.5% (P<0.001) of those who normally itch when bitten adhered to ivermectin [Table 3]. Enquiries were further made on the knowledge of (at least one) signs or symptoms of onchocerciasis, whether it is a serious disease and whether it is common in their village. 2.7% of those who did not know at least one sign or symptom, 2.3% of respondents who knew onchocerciasis to be a serious disease and 1.6% of respondents who knew onchocerciasis to be a common disease in the village did not take ivermectin. A chi square test showed all of these were significant, P<0.001. The risk perception of respondents indicated that 83.7% (210/251) knew they were at risk while 98.1% (206/210) of them adhered to ivermectin leaving 1.9% (4/210). Out of the 41 respondents who did not know they were at risk, 73.2% (30/41) of them adhered, leaving 26.8% (11/41). It was also found out that only 2.0% (5/251) of the respondents did not know any CDD in the village, however they all received the drug. Also, respondents who ever attended a village durbar on CDTI adhered 5.2% (96.4%-91.2%) more than those who never attended any. The difference was however not statistically significant (P>0.05). Responses were also sort from respondents on their perception on the performance of CDD's, importance of CDTI and on the CDTI program to cure onchocerciasis against their level of uptake. 85.3% (214/251) respondents perceived the performance to be good, of them, 85.8%

(205/214) adhered to ivermectin. With the perceived importance of CDTI, 96.8% (243/251) of them considered it to be very important. Only 37.5% (3/8) saw it to be an obligation and adhered. Of those who perceived that CDTI could cure onchocerciasis, 2.4% (6/251) said it was not possible, 33.3% (2/6) still adhered though. A chi square test proved significance $P<0.001$. A respondent who knew a person who stopped or skipped treatment was not significantly related to whether he/she took ivermectin, $P>0.05$.

Table 3: Adherence rate versus behavioral and service related factors among study participants.

Variables (N=251)	**Category(No.)(%)**	**Receipt of ivermectin**		**p-value**
		Received(%)	Did not receive(%)	
Heard of onchocerciasis	Heard(249)(99.2)	236(94.8)	13(5.2)	0.001
	Never heard(2)(0.8)	0(0.0)	2(100)	
Know the vector(blackfly) for transmission	Know(230)(91.6)	225(97.8)	5(2.2)	0.001
	Don't know(21)(8.4)	11(52.4)	10(47.6)	
Know mode of transmission(blackfly bite)	Know(216)86.1)	213(98.6)	3(1.4)	0.001
	Don't know(35)(13.9)	23(65.7)	12(34.3)	
Itch when bitten by blackflies	Scratch(235)(93.6)	229(97.5)	6(2.6)	0.001
	Don't scratch(16)(6.4)	7(43.7)	9(56.3)	
Know signs and symptoms(at least one)	Know(221)(88.0)	215(97.3)	6(2.7)	0.001
	Don't know(30)(12.0)	21(70.0)	9(30.0)	
Onchocerciasis a serious disease	Serious(217)(86.5)	212(97.0)	5(2.3)	0.001
	Not serious(34)(13.5)	24(70.6)	10(29.4)	
Onchocerciasis common in village	Common(186)(74.1)	183(98.4)	3(1.6)	0.001
	Not common(65)(25.9)	53(81.5)	12(18.5)	
Risk perception of onchocerciasis	At risk(210)(83.7)	206(98.1)	4(1.9)	0.001
	Not at risk(41)(16.3)	30(73.2)	11(26.8)	
Know any CDD in village	Know(240)(98.0)	231(96.2)	9(3.8)	0.001
	Don't know(5)(2)	5(100)	0(0.00)	
Know how CDD's are recruited	Know(24)(9.6)	24(100)	0(0.0)	0.2
	Don't know(227)(90.4)	212(93.4)	15(6.6)	
Attend any village durbar on CDTI	Attended(137)(54.6)	132(96.4)	5(3.6)	0.1
	Never attended(114)(45.4)	104(91.2)	10(8.8)	
Perceived performance of CDD's	Good(214)(85.3)	205(95.8)	9(4.2)	0.001
	Poor(37)(14.7)	31(83.8)	6(16.2)	
Perceived importance of CDTI	Very important(243)(96.8	233(95.5)	10(4.1)	0.001
	An obligation(8)(3.2)	3(37.5)	5(62.5)	
Perception on CDTI program	possible(245)(97.6)	234(95.5)	11(4.5)	0.001
	Not possible(6)(2.4)	2(33.3)	4(66.7)	
Know a person who stopped treatment	Know(43)(17.3)	42(97.7)	1(2.3)	0.3
	Don't know(208)(82.7)	194(93.3)	14(6.7)	
Perceived reason for stopping treatment	Effect of drug(21)(48.3)	21(100)	0(0.0)	0.3
	Not available(7)(16.3)	6(85.7)	1(14.3)	
	Others(15)(34.9)	15(100)	0(0.0)	

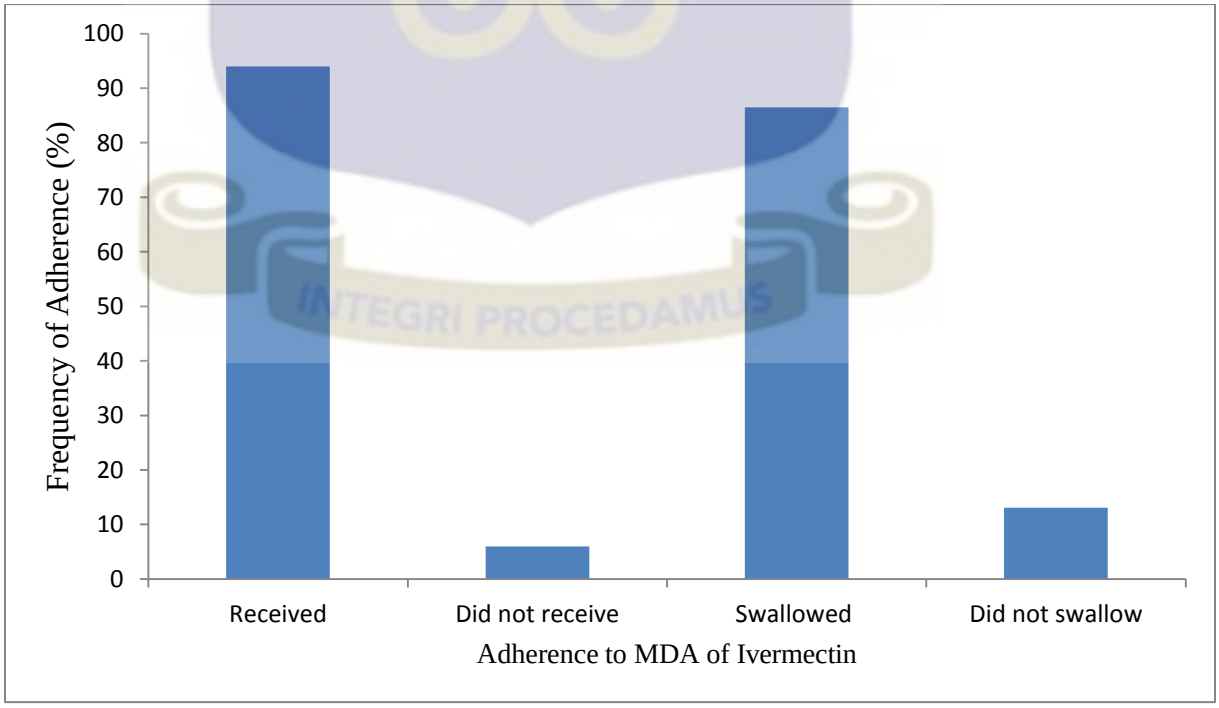
4.4: Rate of CDTI adherence.

During the most recent treatment round (2015), 94% (236/251) of the respondents received ivermectin. The remaining 15 (10 males and 5 females) eligible respondents did not receive [Table 4]. Majority of the respondents who did not receive ivermectin (53.3%; 8/15) were between the ages of 20 and 29. Out of the 236 respondents who received ivermectin, 86.9% (205/236) of them swallowed, leaving 13.1% (31/236) of them [Table 4 & Figure 4] (11 males and 20 females) [Table 2]. Majority of those who did not swallow the drug 45.1% (14/31) were under 19 [Table 2]. The most common reason the respondents mentioned for not receiving or swallowing ivermectin was that the CDD did not come to their houses 63%(29/46) followed by other reasons such as illness and pregnancy accounting for 13%(6/46). As far as the place of ivermectin receipt is concerned, 97.4% (230/236) responded that they received ivermectin from the CCD's house.

Table 4: CDTI's level of adherence within the study participants in Abekwei.

Variable	category	Frequency (%)
Receipt of ivermectin during the last treatment round(N=251)	Received	236(94.0)
	Did not receive	15(6.0)
Swallowed ivermectin during the last treatment round(N=236)	Swallowed	205(86.9)
	Did not swallow	31(13.1)
Reason for not receiving or swallowing(N=46)	Absent	5(10.9)
	Side effects	1(2.2)
	Not informed	5(10.9)
	CDD did not come to my house	29(63.0)
	Others (pregnancy, illness, etc.)	6(13.0)
Place of Ivermectin receipt(N=236)	CDD came to my house	6(2.6)
	CDD's house	230(97.4)

Figure 4: Adherence to Ivermectin in Abekwai during the 2015 last treatment round.



CHAPTER FIVE

5.0 DISCUSSION

This study was undertaken in Abekwai in the Tain district of the Brong-Ahafo Region of Ghana because data from the neglected tropical disease office in Ghana for 2015 on selected sentinel sites revealed that it had the highest crude prevalence (11.8%) of Onchocerciasis (NTD Ghana, Unpublished data). The objective was therefore to check the level of adherence to ivermectin by the community members using the treatment round – 2015. Earlier studies have established that infection can be eliminated and transmission interrupted through the use of ivermectin alone (Okeibunor et al., 2011).

The current study has established that, during the 2015 treatment round, 94% of the community members received ivermectin however, 86.9% swallowed it. Side effects of the drug and low level of knowledge about the seriousness of onchocerciasis especially among the younger age groups accounted for why some of the people did not swallow the drug even though they received them from the distributors. A sustained treatment coverage of 90% and over is however required for elimination of the disease as a public health problem to be achieved (Endale et al., 2015). In this way sustained effort is to be put in to ensure that at least all the people who receive the drug from the distributors swallow. This will help achieve a higher level therapeutic coverage leading to elimination.

Though more females received ivermectin than males in the 2015 treatment round, it came out interestingly that the proportion of those who swallowed the drug was similar

among the sexes. Pregnancy related issues and severe illness at the time of the drug distribution prevented a significant proportion of the people from taking the drug.

Adherence to a medication especially one that does not immediately manifest its effect becomes an issue especially if it has to be taken periodically as a preventive strategy. Effective education and persuasion will have to be done in infected foci periodically to maintain a higher adherence. Also measures to keep a high uptake including direct observed treatment (Ho et al., 2009) has been proven to be very effective and thus should be practiced relentlessly.

The introduction of ivermectin and incorporation of its distribution in the Onchocerciasis Control Program in the early 1990's further dwindled the disease manifestation (Crump et al., 2012) making people who were born around that time and in later years free from experiencing onchocerciasis disease manifestation. This study proofs this observation in the sense that the percentage of respondents who received ivermectin and the percentage of those who swallowed it were lower within the younger age especially the 20 to 29 years group than the older ones. They being young and energetic could be the reason why they are highly unstable subjecting themselves to travels on a regular bases (Endale et al., 2015).

The level of the perceived seriousness of onchocerciasis and of the perceived risk of not taking ivermectin for that matter had a high influence on receipt and intake of ivermectin. People who considered themselves of being at a higher risk took the drug relating it to the ripple effects and the suffering they will have to undergo in the event that they do not take the drug (Okeibunor et al., 2011).

This study has demonstrated that the level of knowledge of the signs and symptoms of onchocerciasis affects the intake of ivermectin. The proportion of respondents who knew at least one sign or symptom adhered to ivermectin more than those who had no idea of any sign or symptom. A similar study in Nigeria revealed that about half of the respondents did not know any sign or symptom of onchocerciasis (Ib, Onwujekw, Uzochukw, Ajub, & Okonkw, 2015) with the level of adherence being very low among that group. Intensive education was advised to be carried out to improve intake of the drug. As the World Health Organization has set the ambitious target of eliminating onchocerciasis between 2020 and 2025 (Stolk, Walker, Coffeng, Basáñez, & De Vlas, 2015) using the community directed distribution of ivermectin approach, there will be the need for durbars and other meetings to be carried out on a regular bases especially for the younger age groups to make them understand their level of risk and exposure paths they might become to the rest of the community.

A study in Ethiopia assessed that a predictor of ivermectin uptake had to do with the risk perception of being infected taking into consideration the level of commonness onchocerciasis is perceived to be (Yirga, Deribe, Woldemichael, Wondafrash, & Kassahun, 2010). This study revealed that a higher proportion of respondents adhered to ivermectin due to the fact that they believed onchocerciasis was common in their community. Those who did not believe the disease was common proved to be reluctant by recording lower uptake levels giving rise to a needed improved information strategy for action.

Majority of the respondents went to the CDD's house for ivermectin which should not have been the case. The CDD has the responsibility of doing a house to house

administration of the drug and possibly observing its swallow (Emukah et al., 2008b). Absenteeism due to farming activities and illness accounted for not going to the CDD's house coupled with their level of perceived performance and lack of motivation. A study conducted in North Western Ethiopia showed that CDD's were not motivating community members enough and also needed to be motivated so that distribution would become a smooth process (Weldegebreal, Medhin, Weldegebriel, & Legesse, 2014).

The study however revealed that most of the respondents knew the CDD and so they willingly went for ivermectin hence the high record of receipt as against a relatively lower uptake making the direct observed treatment method, an effective treatment strategy defeated. Once the CDD was from the community, they obliged despite the fact that the results showed that a majority of them did not know how the CDD was recruited.

The effective distribution and uptake of ivermectin appears not to only work for onchocerciasis but for other diseases such as soil transmitted helminthiases, lymphatic filariasis etc. (Krotneva et al., 2015) as such, every means possible to achieve maximum desired coverage for onchocerciasis elimination should not be relaxed.

The key issues identified in this study indicate also that a high uptake level of ivermectin is needed to be able to achieve elimination within the target period. This study was an independent one by independent investigators from outside the program implementers. The main limitation of the study was that responses were made on recollection of an event and therefore there might have been some recall bias.

CHAPTER SIX

6.0 CONCLUSION AND RECOMMENDATION

6.1 Conclusion

In conclusion, though an appreciable number of community members in Abekwai received and swallowed ivermectin (86.9%; 205/236), some people did not (18.3%, 46/251). Accounting for this level of non-adherence boils down to the fact that some community members did not see the need to swallow ivermectin. This implies that infected people within the community may serve as sources of continuous transmission to others if regular mop-ups are not made. Respondents 30 years and below accounted for the greater proportion of non-adherence in this study. It was also revealed that community members rather went to the distributors' house for the drug which should not be the case.

Individual level factors such as the knowledge level of onchocerciasis, the vector that transmits it and the mode of transmission significantly affected the level of ivermectin uptake. Knowledge of the signs and symptoms, knowledge of the level of its seriousness and how common it is in the community also significantly contributed to the uptake of ivermectin. The risk perception of being infected with onchocerciasis by the community members influenced a higher uptake against those who did not see themselves as being at risk. However, the community members' knowledge on how CDDs were recruited and the attendance of durbars was not significantly related to ivermectin uptake as well as their knowledge of persons who stopped treatment and their perceived reasons for stopping treatment did not show any significance.

6.2 Recommendations

To the Community Directed Distributors

1. The community directed distributors should be encouraged to do house-to-house distribution as planned for the programme as well as to practice direct observed treatment as much as they can instead of the community members rather going to the houses of the distributors for the drugs as revealed in this study.

To the district health directorate

1. Mop-ups drug distribution should be encouraged and supervised effectively to cover up community members who missed treatment within treatment rounds as a result of travel or illness.
2. The study revealed that more respondents received ivermectin than swallowed; the need for direct observation by the distributors is required.

Further studies

1. This study only focused on one portion, which is community members adhering to ivermectin. Further studies is need to be made on all other stake holders (District assemblies, Health directorates, CDD's, Tropical Neglected Disease office) involved in the distribution of ivermectin to come out holistically with the problems that affect the distribution of ivermectin and find lasting solutions to achieve elimination.

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APPENDICE
CONSENT FORM

TOPIC: Adherence to Community Directed Treatment with Ivermectin for Onchocerciasis Elimination in Abekwai in the Tain District Ghana.

PRINCIPAL INVESTIGATOR: Jeffrey Gabriel Sumboh

ADDRESS: School of Public Health, College of Health Science, University of Ghana, P.O. Box , Legon, Accra, Ghana. Telephone: 0242230413.

INTRODUCTION: Ivermectin distribution has been going on in this community for some years now through the Community Directed Treatment with Ivermectin (CDTI) strategy. The aim of this treatment is the reduce onchocerciasis transmission and if possible eliminate it. We want to know your views on onchocerciasis and your thoughts on ivermectin administration. We will also like to know how often you adhere to ivermectin and whether it is necessary to take it or not.

PROCEDURE: We will like to invite you to participate in an interview which aims to assess your experiences and expectations on onchocerciasis and ivermectin treatment. This interview will last between 20 and 30 minutes.

POSSIBLE RISK AND DISCOMFORTS: There are no known risks to you personally if you agree to participate in this study. There might be some discomfort associated with disclosing personal information and other personal questions.

POSSIBLE BENEFITS: We cannot guarantee you any personal benefits from participating in this study. You will be contributing in influencing policy towards finding sustainable solutions to ensure an overall ivermectin adherence to eliminate onchocerciasis in the least possible time.

CONFIDENTIALITY: We assure you that all the information that we obtain will be stored in files and put under lock and key. At the end of the study any personal identifying information will

be destroyed. Your name will not be easily identifiable by anybody else. All information related to your participation will be kept confidential and will not be revealed to anyone. Your identity will also not be revealed in any reports or publications resulting from the study. The data, both in hard copy and digital format, collected will be kept for the purpose of analyses only.

VOLUNTARY PARTICIPATION: Your decision to participate in this study is entirely voluntary. You can talk to any one you feel comfortable with to help you understand better. You can also ask many questions as you want until you understand better. You are not under any obligation to participate and you also have the right to refuse this invitation. If at any point in time during the study you take the decision not to participate any further, you are free to do so immediately without any further discussion and it will have no consequences to you.

DURATION OF PARTICIPATION AND RESPONSIBILITIES: Your participation in the study will be for only one day and your role is to provide us with appropriate responses to some questions and as truthful to as possible.

ADDITIONAL INFORMATION: If you will like to receive more information, please feel free to contact the principal investigator on 0242230413 or through jsumboh@gmail.com. To get more information about your rights as a participant, you can also contact the Ghana Health Service Ethics Review Committee on 0507041225 or 0243235225.

VOLUNTEER AGREEMENT

The above document has described the benefits, risks and procedures for the research titled "Adherence to Community Directed Treatment with Ivermectin for Onchocerciasis Elimination in Abekwai in the Tain district Ghana" has been read and explained to me. I have been given an opportunity to ask any questions about the research and have been answered to my satisfaction.

I agree to participate as a volunteer.

_____ _____

Date Name and signature or mark of volunteer

If volunteers cannot read the form themselves, a witness must sign here:

I was present while the benefits, risks and procedures were read to the volunteer. All questions were answered and the volunteer has agreed to take part in the research.

_____ _____

Date Name and signature of witness

I certify that the nature and purpose, the potential benefits, and possible risks associated with participating in this research have been explained to the above individual.

_____ _____

Date Name Signature of Person Who Obtained Consent

DEPARTMENT OF EPIDEMIOLOGY AND DISEASE CONTROL
SCHOOL OF PUBLIC HEALTH
UNIVERSITY OF GHANA

QUESTIONNAIRE

This research instrument is designed to collect data from community members in Abekwai in the Tain District of Ghana for a study on Adherence to Community Directed Treatment with Ivermectin for Onchocerciasis Elimination.

TIME INTERVIEW STARTS | | | | |

QUESTIONNAIRE NUMBER | | | | |

DATE OF INTERVIEW

DAY		MONTH		YEAR			
				2	0	1	

🗣 **INTERVIEWER:**

We are interviewing community members to get a better understanding on what they think about Onchocerciasis and Ivermectin treatment.

Your participation in the study as said earlier on is completely voluntary. We would also like to assure you that all information collected in the course of the study will remain confidential.

Thanks a lot for your participation. In case you have any questions, please let us know.

Please also ask when you have a problem understanding a question.

DEMOGRAPHICS

No.	Question	Response	Code
1	Age		.....
2	Sex	Male Female	0 1
3	Education	No formal education Primary/JHS SHS Tertiary Other, specify_____	0 1 2 3 96
4	Religion	Christian Muslim Traditional	0 1 2

		No religion Other, specify_____	3 96
5	Main occupation	Farming Fishing Farming + Fishing Trade/Business Official employee Casual labor Other, specify_____	0 1 2 3 4 5 96
6	Relationship status	Single Married Divorced/separated In a relationship but not married Widowed	0 1 2 3 4
7	Place of residence	Rural Peri-Urban Urban	0 1 2
8	Family size		

SECTION B: KNOWLEDGE OF ONCHOCERCIASIS

9	Do you know or have you ever heard of	Yes	0

	onchocerciasis?	No	1
10	Do you know the vector that transmits onchocerciasis?	Yes No	0 1
11	Do you know how the transmission takes place?	Yes No	0 1
12	Do you normally scratch when bitten by the blackflies?	Yes No	0 1
13	Are the bites from the blackflies painful?	Yes No	0 1
14	Do you know any sign and symptom of Onchocerciasis?	Yes No	0 1
15	Do you know onchocerciasis to be a serious disease?	Yes No	0 1
16	Do you know onchocerciasis to be common in this community?	Yes No	0 1
17	Do you think you are at risk of being infected with onchocerciasis?	Yes No	0 1
SECTION C: ADHERENCE TO IVERMECTIN			
18	Are you aware ivermectin is distributed in this community?	Yes No	0 1

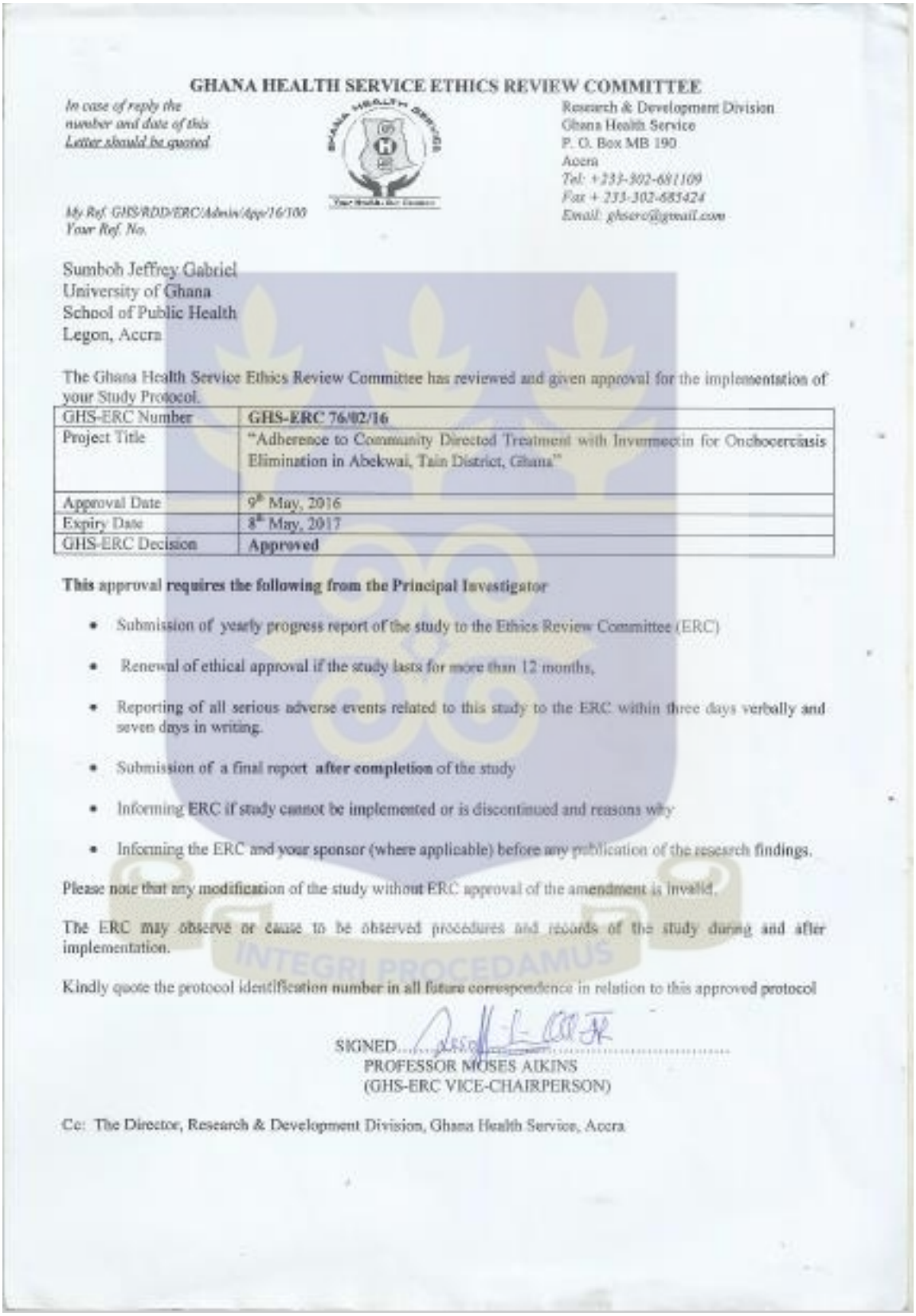
19	Did you receive ivermectin during the last treatment round?	Yes No	0 1
20	If Yes, did you swallow it in front of the CDD?	Yes No NA	0 1 88
21	If no, What was the reason?	Absent Sides effects Not being informed CDD didn't come to house Don't believe in free things We do not have a CDD Tired of swallowing the drug Drug not effective Other, Specify _____ HA	0 1 2 3 4 5 6 7 96 88
22	From where did you collect ivermectin?	CDD came to my house I went to CDD's House From the community centre N/A	0 1 2 88
23	Do you know any CDD personally?	Yes No N/A	0 1 88
24	Are you aware how CDD's are recruited?	Yes No	0 1

25	Have you ever attended any durbar on onchocerciasis or CDTI?	Yes No	0 1
26	How will you rate the performance of CDDs?	Good Poor	0 1
27	How important do you think CDTI is?	Very important An obligation	0 1
28	Do you think ivermectin treatment can control onchocerciasis?	Yes No	0 1
29	Do you know someone who has stopped taking ivermectin?	Yes No	0 1
30	If Yes, What was the reason?	Effect of drug Not always available Other, Specify _____ NA	0 1 2 88

Name of interviewer: …… Sign……

TIME INTERVIEW ENDS | | | | |

Ethical Clearance Approval from GHS



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/16/100
Your Ref. No.

Research & Development Division
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Fax + 233-302-685424
Email: ghserc@gmail.com

Sumboh Jeffrey Gabriel
University of Ghana
School of Public Health
Legon, Accra

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

GHS-ERC Number	**GHS-ERC 76/02/16**
Project Title	"Adherence to Community Directed Treatment with Invermectin for Onchocerciasis Elimination in Abekwai, Tain District, Ghana"
Approval Date	9th May, 2016
Expiry Date	8th May, 2017
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.....
PROFESSOR MOSES AIKINS
(GHS-ERC VICE-CHAIRPERSON)

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