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Does the relationship of Community Drug Distributors to the individuals they treat with Ivermectin affect distribution success in Cameroon and Uganda, 2004-2005

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B.A., Emory University,
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Abstract

Does the relationship of Community Drug Distributors to the individuals they treat with Ivermectin affect distribution success in Cameroon and Uganda, 2004-2005

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Background: Onchocerciasis, also known as river blindness, has been targeted for elimination because humans are the only reservoir, and ivermectin treatment is cost effective and readily available. Ivermectin control programs are often evaluated at the country level and little is known about the community drug distributors (CDDs) themselves. The kinship enhanced community drug distribution program was developed to address the issue of sustainability. The long-term sustainability of the programs depends on the CDDs because ultimately they are responsible for distributing ivermectin to their communities at high coverage levels for many years.

Objectives: This thesis explores how delivering ivermectin to kinship groups effects treatment coverage in Cameroon and Uganda and whether or not the effect has been the same in males and females. This paper will fill in the knowledge gaps by determining whether a CDD is more likely to reach the 90% distribution target if over 50% of the people he or she distributed ivermectin to were related to the CDD. Additionally, this thesis will look at whether there are differences between Cameroon and Uganda and males and females.

Methods: Surveys from 1,636 CDDs in Cameroon and Uganda were analyzed using a multivariable regression model was used that considered treatment coverage as the outcome variable. The model was a logistic model to determine whether a CDD delivering ivermectin to his or her kinship group is associated with 90% treatment coverage for an individual distributor. The model also looked to see if the factors are the same or different in Cameroon and Uganda.

Results: After controlling for country, sex, number of households distributed, supervision, age, significant effect modification was found between country and relationship. There was also significant effect modification between sex and relationship. The significant interaction terms indicate that the effect of relationship to the outcome is different depending on whether the CDD is in Uganda or Cameroon and different depending on whether the CDD is male or female.

Conclusion: There is a difference on the effect of distributing to a majority kin that depends on whether the CDD is from Cameroon or Uganda and male or female.

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Table of Contents

Literature Review

Introduction

Onchocerciasis, also known as river blindness, has been targeted for elimination because humans are the only reservoir, treatment is cost effective and readily available and there exists political will and effective programs to combat the disease. There are several factors to consider when developing an onchocerciasis control program: the epidemiology of the disease, the vector, the life cycle of the parasite, treatment, environment and the programmatic approaches available to international organizations and governments. The African Program for Onchocerciasis control has made community directed treatment with ivermectin the backbone of its elimination programs since the early 1990s.

The Carter Center, based in Atlanta, Georgia, has implemented a kinship approach to community ivermectin distribution in Uganda since 2000 and in Cameroon since 2004. The Carter Center aims for ivermectin distributors to reach 90% of their target coverage goal each year for at least 15 years to achieve the African Program for Onchocerciasis Control goal of elimination of the disease as a public health issue. In order to make drug distribution more effective, more knowledge is needed about the relationship of distributing ivermectin primarily to kinship group. Additionally, more research is needed to determine whether there is a difference in success based on gender, country.

Ivermectin control programs are often evaluated at the country level and little is known about the community drug distributors (CDDs) themselves. The long-term sustainability of the programs depends on the CDDs because ultimately they are

responsible for distributing ivermectin to their communities at high coverage levels for many years. The kinship enhanced community drug distribution program was developed to address the issue of sustainability. In theory, the kinship CDTI approach reduces the workload of the CDD and increases their incentive to succeed because they are distributing to family members. This thesis will look at how distributing to kin affects CDD success rates and whether there is a difference in effect between Cameroon and Uganda and males and females. This knowledge can impact public health by influencing how future ivermectin distribution programs are designed and how distributors are selected.

Disease Background

Epidemiology of Onchocerciasis

Onchocerciasis, also known as "river blindness," is caused by *Onchocerca volvulus*, a microfilarial worm that is spread to humans through the bite of infected black flies of the genus *Simulium*. Onchocerciasis is endemic in 34 countries – 26 in Africa, 6 in Latin America and 2 in the Arabian Peninsula - and has infected an estimated 18 million people worldwide (1). Currently, there are an estimated 120 million people living in endemic areas near fast flowing rivers, the breeding sites of the black flies. Over 99 percent of people who suffer from onchocerciasis live in the 26 endemic African countries (2). In areas that are classified as hyperendemic, infection rates can approach 100% and cause blindness in 10% of those infected (3). The disease is characterized by fibrous nodules on the surface of the skin where adult filarial worms live and discharge microfilariae that spread all over the body.

Humans are the only host for onchocerciasis, which presents differently depending on where it is contracted. In Africa, there is a distinction between forest-strain and savannah-strain onchocerciasis. The forest-strain, which is common in rain forest and coastal regions of Africa, rarely causes blindness but causes a severe reaction on the skin. The savannah strain presents a higher risk of blindness and has been shown to affect up to 50% of adults in endemic communities(4). That there are two distinct types of onchocerciasis was proven in the late 1980s through DNA testing of worm samples from villages that showed savannah and forest disease patterns (4).

The primary determinants of the epidemiology of onchocerciasis are exposure to the vector and the gradual buildup of microfilarial loads. Communities located near breeding sites of the *Simulium* black fly are usually hyper-endemic, which is defined as skin snip positive in over 60% of samples. The prevalence of onchocercal skin disease and disability decreases as the distance from the breeding site increases (5). It is not clear whether sex affects susceptibility to onchocerciasis – there are some studies that show females have increased immunity to the parasite and it is generally thought that boys and men are more susceptible to infection. There have been other situations where females were found to have the same and in some cases, higher infection rates as males (5). In West Africa, the sowda type of onchocerciasis, characterized by hyperpigmentation of the skin, is seen more often in women than men (2). The epidemiological pattern of onchocerciasis is mostly determined by vector species, the environment and human behavior.

Uganda

Onchocerciasis has a long history in Uganda. The two primary vectors that spread the parasite, *S. neavei* and *S. damnosum,* were discovered in Uganda in 1903 and 1915 respectively and onchocerciasis was first recorded in the country in 1933 (6). In 2009, an estimated 1.36 to 1.5 million people were infected with onchocerciasis with 85% of the transmission caused by the *S. neavei* black fly (6-8). The distribution of onchocerciasis is dependent on the distribution of the vectors, which are found in 27 districts primarily in the far east and west of the country (6). In Uganda, onchocerciasis is mostly forest type, affecting the skin rather than causing blindness (6).

Cameroon

Onchocerciasis is found throughout Cameroon with 9,419 communities and 5,798,818 people residing in either meso or hyperendemic areas in 2006 (9).

Vector

Onchocerciasis is spread to humans through the bite of an infected female blackfly, which, in turn, was infected with the microfilarial parasites by previously feeding on an infected human. The *Simulium* genus of black flies takes their blood meals from humans. There are several sibling species of black flies from the genus *Simulium* that have been identified as obligatory vectors of onchocerciasis (2). Using fly morphology and chromosome branding patterns and gene sequencing, six species have been identified as the vectors responsible for onchocerciasis in West Africa: *Simulium damnosum, Simulium sirbanum,* which are found mostly in savannah areas, *Simulium sanctipuli, Simulium leonense,* which are generally in transition areas and *Simulium yahense* and *Simulium squamosum*, which are primarily responsible for the forest strains.

In Eastern and Central Africa, *Simulium neavei* is the vector primarily responsible for spreading onchocerciasis, infecting an estimated 6.5 million people (3). In western Uganda, the *S. neavei* is the vector is the primary vector for the parasite and in Cameroon, *S. damnosum* is the most common infectious vector.

Physically, the black flies are small and stout with mouths designed to tear human skin while feeding. Adults typically have a flight range of 12-18 kilometers, but the *S. damnosum* has been recorded having a range of over 400 kilometers (5). Therefore, the *S. damnosum* species, because of its longer flight range has the capacity to spread the microfilariae over a greater distance and in both savannah and forest settings. The *S. neavei,* which is found in Uganda, has a shorter range and are confined to smaller areas (5).

All the subspecies of *Simulium* flies lay their eggs on submerged rocks and vegetation found in fast flowing, highly oxygenated rivers and streams (3). Unlike other parasitic vectors, the black flies of the *Simulium* genus are not efficient transmitters of the parasites, though the efficiency varies by species (10). The efficiency of the flies for spreading the worms is determined by seasonality, ecology, and endemicity. Studies in Mali and Senegal, where *S. damnosum* is most common, have shown that transmission of the parasite is seasonal and mostly take place in the rainy season when the flies have repopulated breeding sites. In other areas, the black flies transmit onchocerciasis year round. In West Africa it has been shown that the highest onchocerciasis endemicity levels are in areas with seasonal rather than perennial transmission (11).

Transmission Cycle

The human strain, *O. Volvulus* has a five-stage lifecycle, involving one of the black fly species of the *Simulium* genus and humans, the only host for the parasite. The transmission cycle begins when a female black fly ingests microfilariae while taking a blood meal from an infected human. The microfilariae then penetrate the fly's gut and moves to the thoracic flight muscles where they grow and develop into stage three larvae. From there, the third stage larvae travel back to the black fly's mouth where they reenter another human during another blood meal (2).

Inside the human, the stage three larvae grow and develop into adult nematodes over the course of a year (1). Once the worms mature, they form visible fibrous nodules right below the skin known as an onchocercoma, which contain between 2 and 50 females and 1 to 10 males. The sizes of the nodules depend on the number of worms and the host immunological response, but are generally between 2 millimeters and 6 centimeters. The nodule is a response of the human immune system to the female worm continuously releasing foreign proteins. Infected humans typically have between 1 and 60 females that grow to be between 30 and 80 centimeters long and live in the nodules for 10 to 15 years. During their lifetime the female are fertilized by the males, which then release 1000-3000 microfilariae per day during its entire lifetime. An infected person with one dozen fertilized females can have 100 to 150 million microfilariae, which travel around the body, right below the skin, unharmed by the host immune system. The microfilariae live for 1 to 1.5 years and travel around the body in sufficient numbers to ensure being ingested by feeding black flies, restarting the cycle (2).

Symptoms

People infected with the parasite experience usually experience symptoms with the gradual buildup and death of microfilarial worms. When the microfilariae die in the skin, the body's immune response leads to severe itching, rash and dermal lesions (known as onchocercal skin disease or OSD). As the travelling microfilariae reach the eye and the cornea and the load in the eye increases, it eventually leads to visual impairment or blindness (12).

Annually, as many as 500,000 people experience secondary visual impairment and 270,000 people become blind as a result of being infected by the parasite(1). Visual impairment and blindness were the main concern of programs first developed with the goal of controlling and ultimately eliminating onchocerciasis. It was not until the early 1990s that the effects of onchocercal skin disease on society were understood.

In addition to visual impairment and blindness, the itching has a caused by onchocercal skin disease has a large impact in the quality of life of an onchocerca patient. The skin is the principal organ affected by onchocerciasis. Constant and severe itching accounts for 60 percent of the DALYs lost as it makes working, schooling and socializing difficult. Surveys of onchocercal patients showed that the severe itching caused by the parasites lead to severe scratching which often leaves people with open wounds. A study in Nigeria showed that because of the social consequences, adolescent girls considered the lesions caused by onchocerciasis to be their most important health problem (4). Chronic onchocercal skin disease can lead to extended fibrosis, keratosis and changes in skin pigmentation. Hyperpigmentation or the blackening of the skin in some patients is

called aswad or sowda. The long term effects of the parasite can lead to permanently wrinkled skin and loss of elasticity (2).

In addition to the physical characteristics of onchocerciasis, there is the added issue of stigmatization and associated adverse effects on livelihood and development. One study showed that children from households that are headed by an onchocercal patient are twice as likely to drop out of school (13). In sections of West Africa people have fled their homes and fertile river valleys, which has severely affected agricultural production in the area and had a socioeconomic impact. Worldwide, in 2003, onchocerciasis was responsible for 1.49 million lost disability adjusted life-years (14).

Diagnosis and Community Prevalence

Once someone is infected there are several different ways to diagnose onchocerciasis, none of which provides a reliable gold standard. The challenge of diagnosis is important for determining which areas are endemic and require programmatic intervention. Once an area has been chosen for drug distribution, diagnosis is critical to evaluating the effectiveness of the program.

The closest to a gold standard diagnosis test that exists is the “skin snip” test that uses a sclerocorneal biopsy punch to obtain a tissue specimen by elevating a small cone of skin (3 mm in diameter) with a needle and shaving it off with a scalpel. The tissue is incubated in normal saline at room temperature for 24 hours to allow the microfilariae to emerge, where they can be seen under a microscope (15). Because of the time that it takes for the female worms to mature, become fertilized and produce microfilariae, the test is not sufficiently sensitive in areas of low endemicity. There are newer biochemical skin snip tests such as the PCR, ELISAs, EIAs and antigen surveys that are still being

evaluated. Another drawback to the skin snip test is that it is slow and difficult to use in the field. Recently, new antibody-based, rapid diagnostic tests that look at blood obtained from a finger-prick, are less expensive and easier to use in the field. There are also promising urine antigen detection dipstick assays being developed which have been shown to be 100% sensitive and specific in highly endemic areas (1).

The issue of diagnosis becomes more complicated when deciding where to implement an onchocerciasis control program. When deciding, it becomes necessary to quickly and reliably determine the percentage of the population that has been infected with onchocerciasis. Rather than look at infection at the individual level, many programs look at the community microfilarial load (CMFL) as the preferred epidemiological index of endemicity(4). In 1991 the WHO defined the level of endemicity of onchocerciasis necessary to implement a control program to be CMFL of 5 microfilariae per skin snip or a community prevalence of greater than 40% infected with microfilariae (16).

The skin snip method is difficult, intrusive and requires technical knowledge, making it difficult to implement over a wide area (4). The World Health Organization, UNICEF, UNDP and World Bank developed and introduced the technique of rapid epidemiological assessment called Rapid Epidemiological Mapping of Onchocerciasis (REMO) in the early 1990s. Rapid epidemiological assessment is used in programs today and relies on the nodule prevalence of a village. A study in 1992 found that nodule palpitation is a viable alternative method to identify communities that need intervention programs (17). Further studies concluded that the prevalence of palpable nodules was associated with the microfilarial prevalence of the community filarial load. This simple, non-intrusive test had a sensitivity of 92% and a specificity of 100% in correctly

identifying communities in need of urgent intervention with ivermectin mass treatment. The technique of using nodule prevalence can be used as a substitute to the skin snip test in hyperendemic areas where *S. neavei* is the principal vector (18). Nodule prevalence in adult males is a good indicator for community prevalence, having been reliably shown to be about half the community prevalence of microfilariae. Therefore, the cut-off point for identifying hyperendemic villages was set at 20% nodule prevalence in adult males over 20 that have lived in the community over 10 years (4) (16). The 20% nodule prevalence translates to roughly a 40% community microfilariae rate, which is the WHO cutoff for ivermectin intervention.

Rapid epidemiological mapping of onchocerciasis, which is used in all the African Program for Onchocerciasis Control countries to define endemic areas, uses a technique where a sample representing 2–4% of communities in a targeted area, is assessed for the presence of onchocerciasis by looking nodule prevalence in 50 adults per community. The adults are at least 20 years old and have been resident in the community for at least 10 years. If greater than 20% of adults have nodules, mass treatment is required In communities where the nodule rate is less than 20% clinic-based treatment is used. This information is then used to create REMO maps in endemic countries, which use a three-color scheme to inform different treatment and programmatic strategies. In the red zones, onchocerciasis is highly endemic and constitutes a significant public health problem. The REMO method provides estimates of the burden of disease (16).

Treatment

The drugs available to treat onchocerciasis have had an enormous impact on programing approached to controlling the disease. Prior to the discovery of ivermectin,

the treatment options were diethylcarbamazine (DEC) and suramin. Though DEC is effective in killing the microfilariae, patients were often hypersensitive to the drug, leading to violent and dangerous side effects. Suramin is a highly toxic drug, which would occasionally kill the patient. Because of the toxicity of the drugs, both need to be administered by doctors and are expensive (19). Onchocerciasis control programs could not rely on these drugs as part of their programming and as a result they centered on aerial spraying of insecticide to kill the larvae of the black flies.

Ivermectin was discovered in n 1979 at the Kitasato Institute in Japan, in partnership with the pharmaceutical company Merck, Sharpe and Dohme. It was approved for veterinary use in 1981 and human use in 1988. Since 1988 it has been the central component to onchocerciasis elimination programs (20). Ivermectin is a semisynthetic avermectin and was isolated from a fermentation broth of *Streptomyces avermectinius,* which was found in soil near a golf course in Japan, the only place in the world that avermectin has ever been found (19, 20). The drug has been effective across a wide range of parasites and ticks and in addition to being used to treat onchocerciasis, ivermectin is widely used in agriculture and livestock (19).

Ivermectin works by inhibiting the nerve and muscle cells of the nematode causing paralysis in the worm (20). The drug only kills the microfilariae and it has been shown that each treatment sterilized up to 30% of the adult, female worms, but does not kill them (11). The microfilariae that are not killed immediately to migrate deeper into deeper dermal layer and into subcutaneous fat, connective tissue and lymph nodes where they can be attacked and killed by the bodies own immune system. The drug prevents the microfilariae from being released by the female, keeping them in utero where they

eventually die. This effect prevents the female from producing new microfilariae for a period of a few months and ultimately reduces the overall reproductive capacity of the adult worms (21). Ivermectin works quickly, reducing the dermal microfilariae load to almost zero within eight days. Additionally, when a patient is given the drug, there is a slight increase in the number of microfilariae in the eye, which is followed by a gradual reduction to almost zero in 6 months with no damage to the eye (19).

The ivermectin distribution strategies are affected by how the drug works. Mathematical modeling and studies have shown dermal microfilarial loads are generally reduced by 98% two weeks after treatment and remain at a low level for a year. During that year, after about 3-4 months, about 70% of adult female worms begin producing microfilariae again but at 35% of their original production (21). Since only a small percentage of the adult females are sterilized, mass treatment of the entire endemic community over the lifetime of the adult females is needed. Once ivermectin was shown to be safe and approved for human use, it became necessary to determine how often and for how long people in endemic areas should be given the drug.

A number of trials in hyperendemic areas were carried out in the early 1990s to figure out the best way to use ivermectin to control and possibly eliminate onchocerciasis. Early studies showed that the drug would have to be given for the entire lifetime of the adult worms since ivermectin only kills the microfilariae. Ivermectin halts transmission of onchocerciasis by killing the microfilariae and preventing the vector from ingesting infective microfilariae and spreading the parasite. A review article of early studies showed that a single treatment once a year was sufficient to keep the microfilarial load low enough to interrupt transmission of onchocerciasis. Ivermectin was also found

to be most effective when given just before the breeding period of the vectors (22). At the time the Carter Center became involved in ivermectin distribution in 1996, the prevailing strategy was to distribute the drug in hyperendemic areas once a year until onchocerciasis was eliminated. Merck, the company that produces ivermectin, began donating the drug in 1987 with the purpose of treating and eliminating onchocerciasis. Ivermectin, along with the donation by Merck, shifted the focus of onchocerciasis control programs from vector larvicide to drug distribution. Different mathematical models have shown that continued treatment can eliminate onchocerciasis in hyper and meso endemic areas in between 12 and 35 years depending on the intensity of the program and drug coverage achieved (22, 23).

Onchocerciasis Control Programs in Africa

Programs before Ivermectin

The Onchocerciasis Control Program (OCP), a joint program of the WHO, UNDP, FAO and World Bank, began in 1974 and focused on West Africa. From 1974 until 1987, when ivermectin was approved for human use, the program was exclusively a vector control program that relied on aerial larviciding (24). The program would use helicopters and small planes for weekly aerial spraying of seven larvicides that they would rotate to prevent resistance. The spraying targeted the breeding sites of the black fly vectors and the program would also include ground larviciding wherever it was possible.

The aim of the OCP was to continue the program for 20 years – the maximum presumed lifetime of the female worms, in order to achieve complete interruption of vector transmission (25). The OCP was a highly successful program, but larviciding

became a secondary focus when ivermectin was approved for use in humans in 1987. The program persisted in West Africa until 2002, where it was used concurrently with drug distribution programs (25).

Ivermectin Distribution Programs

Ivermectin changed the programmatic approach to onchocerciasis control and elimination. Merck, the pharmaceutical company that produces ivermectin, pledged to donate the drug until the parasite ceases to be a public health problem. The principle drug distribution program in Africa has been the African Program for Onchocerciasis Control. APOC began in 1995; the program works in 19 endemic countries throughout Africa and has the goal of eliminating onchocerciasis as a disease of public health importance by providing endemic communities with effective and sustainable annual dosage of ivermectin for 12-15 years. APOC uses Rapid Epidemiological Mapping of Onchocerciasis (REMO) to define high-risk areas. High-risk areas are defined as communities with nodule prevalence greater than 40%. Once a community is identified, ivermectin is distributed to the community through community directed treatment with ivermectin (CDTI). CDTI is a distribution method used to empower the community and allow communities the power to make decisions about the distribution of the drug. The idea behind CDTI is that empowered communities will continue the program after funding ends. CDTI hopes to achieve at least 65% distribution of ivermectin throughout the entire endemic community (25, 26). People in the villages that weigh less than 15kg, or are less than 90cm tall, are in poor health, pregnant or women nursing infants less than one week old are not eligible for treatment in the mass treatment program (27).

The African Program for Onchocerciasis Control is not run by one organization, but rather is a partnership between the ministries of health, donors, NGOs, the World Bank, the World Health Organization and Merck &Co. (25). The Carter Center is one of the APOC partners and began distributing Ivermectin in 1996 under the Global 2000 River Blindness program. After five years of programming, the Carter Center was working in 10 of the 18 endemic districts in Uganda and in 2 of the 10 endemic provinces in Cameroon. The program uses the recommended rapid epidemiological mapping for onchocerciasis to identify areas that have nodule prevalence of onchocerciasis of over 20%. After the REMO is complete, the program surveys villages with a convenience sample of 30-50 adults who are examined using nodule palpitation. The results are plotted in a geographic information system, which is used to define the endemic zones that surround endemic villages. Any community that falls within that zone is considered to be at risk and offered CDTI. Samples from 50 adults that have lived in the each of the communities that falls within the zone are taken and examined through nodule palpitation and skin biopsy. If one sample is positive then the village is recommended for the program (27).

Once communities are identified as candidates for mass treatment, an annual treatment objective (13) is determined. In each country there are two annual treatment objectives – the ATO (arv), or annual treatment objective – at risk villages, is defined as the number of at risk villages that the program determines it can reach during the year. The ATO (earp), or annual treatment objective for eligible at risk population, is defined as the number of people living in the communities at risk that can receive ivermectin. The ultimate treatment goal (UTG) is the sum of all the eligible at-risk population in all the

eligible at-risk communities. Full geographic coverage (TX (arv)) is reached when the program was able to distribute ivermectin to all the at risk villages. Full coverage occurs when TX(earp), ATO (earp) and UTG are all equal. The Carter Center reassesses and adjusts the ATO and UTG every year (27).

Kinship Enhanced CDTI

A community-directed ivermectin program puts the control of the distribution in the hands of the community. The community uses meetings to assign roles and responsibilities for the program and they decide how, when and where the ivermectin will be distributed. The community also decides who will distribute the treatment and what support the distributors will receive. This method has worked well for APOC and is responsible for over 75 million distributed treatments per year (28). Though the CDTI program has been successful, it has not maintained annual coverage of 90%, there have been high rates of attrition among distributors, low levels of women distributors, and demand for financial payments (29). In order to combat these issues, the Carter Center transitioned to a traditional kinship system for implementation of CDTI in Uganda in the year 2000. The kinship enhance CDTI has community members identify kinship zones within their communities. Kinship is defined as blood relationships, which includes extended family and allows women to enter through marriage (29). Kinship and kinship groups in rural sub-Saharan Africa may own land and be associated with a specific geographic area within a community, which is known as a kinship zone.

The kinship structure has been shown to be a reliable method to provide services and health education. A study in Uganda in 2000 by the Carter Center compared treatment coverage attained, performance on decision-making and ownership and

community distributor performance in villages using the traditional CDTI method and villages using the kinship enhanced CDTI (29). The communities that used the kinship enhanced CDTIs defined the number and sizes of each kinship zone. After the zones were defined, the members of each kinship zone chose their own ivermectin distributors, the methods of treatment, the location of training centers and how to conduct education programs. Once the distributors were chosen, they were instructed to give ivermectin only inside their kinship zone, which is different from the traditional CDTI where distributors are instructed to distribute the drug to all community members (29). The study results showed that the communities that used kinship enhanced CDTI had higher treatment coverage with lower workloads for distributors. The distributors were also more likely to be women, more likely to have been chosen by their community members, fewer decisions made by community leaders and more likely to be involved in other health related activities within their communities (29, 30). The Carter Center has embraced the kinship enhanced CDTI for their ivermectin programs in Cameroon and Uganda and has made a push to increase the number of distributors that focus on their kinship zones.

Part of the success of the program is thought to be because the CDDs are distributing to kin within the kinship zones. In a study looking at distributors who achieved 90% treatment coverage in Cameroon and Uganda, 36.4% of those distributors worked in their kinship zones in Cameroon and 70% of those distributors worked within their kinship zone in Uganda (31). In the six years following the introduction of kinship enhanced CDTI in Uganda, the Carter Center has seen sustained treatment coverage of over 90% of the eligible population (30). It was found that among all CDTI activities

(including kinship and classic CDTI), whether a distributor reaches 90% treatment coverage is affected by the number of additional community health activities the distributor performs. Treatment coverage is the most reliable indicator of distributor success. APOC has a distribution goal of at least 65% annually for 15 years to eliminate onchocerciasis as a public health problem; the Carter Center aims for full coverage, which is defined as treatment coverage of over 90% of the UTG in their programs (32, 33).

A significant number of distributors in both countries are involved in additional health activities. This tends to affect the ability to reach 90% treatment coverage more in Cameroon than in Uganda. If a distributor's only health function in a community is to provide mass treatment, then they are more likely to achieve 90% coverage; coverage was reduced with each additional health responsibility added (31). Additionally, in Uganda, compared to Cameroon, a significantly higher percentage of the distributors that reached 90% treatment coverage worked within one km of their homes, were selected by their community, worked in kinship zones, completed their distribution within a week and had to distribute to fewer than 20 households (31).

Other studies have shown that in Uganda, community participation in decision-making had a positive influence on treatment coverage, though males are most often the decision-makers in the communities and females tend to be excluded (32). In classic CDTI, only a small percentage of women are distributors. Female community drug distributors have been shown to remember training topics at higher rates than male distributors and were less likely to distribute the drug door to door than male distributors. Females were also less likely to receive community support through in-kind or financial

incentive, with 55.6% reporting no support from their communities. In spite of these setbacks, in Uganda, female distributors on average have higher treatment coverage compared to male distributors and just as willing to continue serving as ivermectin distributors (32). Community support has been shown to be a poor predictor of treatment coverage. One study showed that communities in APOC countries that provided no incentives reached on average 72% treatment coverage, followed by 70% treatment coverage in communities that provided in-kind support and 66% treatment coverage in communities that provided cash incentives (13). Additionally, distributors that work in kinship groups often have to travel smaller distances to distribute the drug. People in kinship groups often walk less than 1km from their home to distribute the drug where in traditional CDTI most distributors walk more than 1km (31).

The purpose of this thesis is to explore how delivering ivermectin to kinship groups effects treatment coverage in Cameroon and Uganda and whether or not the effect has been the same in males and females. Onchocerciasis is still a major public health problem in Cameroon and Uganda, and Community Directed Treatment with Ivermectin is the distribution method of choice of the African Program for Onchocerciasis Control. The Carter Center has argued that a kinship enhanced CDTI program model may be more effective and sustainable method of distributing ivermectin in endemic community. This paper will fill in the knowledge gaps by determining whether a CDD is more likely to reach the 90% distribution target if over 50% of the people he or she distributed ivermectin to were related to the CDD. Additionally, this thesis will look at whether there are differences between Cameroon and Uganda and males and females.

Because of the many years that ivermectin needs to be distributed for elimination programs to be successful, there were many challenges with CDTI programs concerning sustainability. The kinship enhanced CDTI program was developed to address the challenge of sustainability. However, the actors involved, from the CDDs themselves to the effects of different countries and gender are not understood. The purpose of this study is to see whether the kinship enhanced CDTI program model is a valid method to achieve sustained distribution.

Methods

Data

The data was provided by the Carter Center, based in Atlanta, Georgia. The Carter Center collected the data as part of their monitoring of their CDTI area in Cameroon and Uganda between 2004 and 2005. In Cameroon, the data was collected in the West and North provinces and cover 2.1 million people in the program. In Uganda, the data come from 11 districts: Adjumani, Apac, Gulu, Kabale, Kanungu, Kasese, Kisoro, Mbale, Moyo, Nebbi and Sironko, which cover 1.56 million people. The study populations in both countries are mostly rural and at the time of the study both countries had ≤20% nodule and ≤40%microfilardermia rates (13). In Cameroon, 8 of the 23 program districts and in Uganda 5 of the 11 program districts were randomly chosen both years to participate in the surveys. Only distributors (CDDs) from the randomly selected districts and communities were surveyed and interviewed. The surveys were conducted through face-to-face interviews and covered demographic information (gender, age, marital status etc.), selection and training (location, distance, and schedule), distribution and success rates, health education, supervision, reporting and support. The data from Cameroon 2004-2005 was combined with Uganda 2004-2005 data. This study was exempted by the Emory IRB because it does not meet the definition of a study involving human subjects.

Software and Data Analysis Plan

Data was analyzed in SAS version 9.3. A multivariable regression model was used that considered treatment coverage as the outcome variable. The model was a logistic model to determine whether a CDD delivering ivermectin to his or her kinship

group is associated with 90% treatment coverage for an individual distributor. Further analysis will look to see if the factors are the same or different in Cameroon and Uganda.

Establishing Initial Model

The dataset from the surveys conducted in Cameroon and Uganda included a sample size of 1,636 CDDs and 105 variables. The variables included information about the demographic composition of the CDDs, their selection and training, their distribution and success rates, their health education, supervision, reporting and support, which considered how the distributors received the drugs. Initial screening, based on the literature review and knowledge of the program, eliminated any variable that did not have a direct effect on a CDD's ability to distribute ivermectin. This method eliminated variables dealt with the selection process, reporting of side effects, detailed community information and support. The hierarchical backwards elimination modeling strategy approach described by Kleinbaum and Klein (34)was used to establish the best model to determine whether or not a CDD delivering ivermectin primarily to his or her kinship group is associated with 90% treatment coverage for an individual distributor.

During the variable specification stage, the outcome variable was defined as success or failure and determines whether or not the CDD distributed ivermectin to 90% of their target population (achieving 90% or more was coded as 1 and under 90% was coded 0). The exposure is the relationship of the CDD to the people they distributed ivermectin to. If the proportion of people that the CDD delivered ivermectin to was 50% kin or greater, the relationship was coded as 1. If the proportion of people that the CDD delivered ivermectin to was below 50% kin, the relationship was coded 0.

The C variables, the initial variables that need to be considered for possible control, were chosen based on the study goal and the literature review. These variables included country (coded 1 for Cameroon and 0 for Uganda), the sex of the CDD, which was defined as male (coded 1) or female (coded 0) and supervision of the CDD, which was defined as supervised (coded 1) or unsupervised (coded 0). Country and sex of the CDD were considered potential confounders because they are both related to exposure and outcome. Another potential confounder was the total number of households where the drug was distributed, which is also related to both exposure and outcome, and was categorized as fewer than 10 households (coded 4), 10-20 households (coded 3), 20-30 households (coded 2) or over 30 households (1). A continuous variable for the age of the CDD was not considered a potential confounder but was included for precision reasons.

The potential confounders, i.e., Vs from an EVW model defined in Kleinbaum and Klein (34), were chosen from the above C variables and were determined by the study goal, using a directed acyclic graph based on theory and program design. Each of the five C variables were included in the model as V variables. The effect modifiers (35) included in the initial model were chosen by considering interactions that were considered programmatically relevant. These included interactions between the exposure (relationship) and separately to country, sex, supervision, and the number of households.

The initial model includes the exposure variable (relationship), five potential confounders (i.e., V variables) and four interaction terms between the exposure and covariates (i.e., E*W variables).

Initial Model: Target (outcome) $= \alpha + \beta_1$ (Relationship) $+ \gamma_1$ (Country) $+ \gamma_2$ (Sex) $+ \gamma_3$ (Age) $+ \gamma_4$ (Number of Households) $+ \gamma_5$ (Supervision) $+ \delta_{11}$ (Relationship*Country) +

δ_{12} (Relationship*Sex) + δ_{14} (Relationship*Number of Households) + δ_{15} (Relationship*Supervision) + ε

Collinearity Assessment

Prior to a determination of the significance of the interaction terms in the model, a collinearity assessment was completed using the SAS 9.3 macro created at Emory University and updated in 2011. In order to determine whether or not there were collinearity problems between variables, the SAS macro was run on a logistic model with all the variables from the initial model included. If the resulting condition index of the model was over 30, then the variance decomposition proportions (VDPs) were considered. In order to conclude that a collinearity problem existed in the model it was determined a priori that two variables, not including the intercept, with VDPs over 0.50 would need to exist.

Assessing Interaction

After the initial model was defined and the test for collinearity was completed, a chunk test was used to determine whether the interaction model was statistically different from a model that did not include the interaction terms. The chunk test is a likelihood ratio test that produced a chi-square statistic. Since four interaction terms were being tested, the test had four degrees of freedom. The null hypothesis for the chunk test is that the interaction model is equivalent to the no interaction model. The alternative hypothesis is that the models are different.

Following the chunk test, a hierarchical backwards elimination approach was used to determine which interaction terms were statistically significant and would therefore remain in the model. A logistic regression using SAS's proc logistic procedure

was run including all the variables that remained after the collinearity assessment. The variable with the highest p-value was removed sequentially from the model. The test determined the significance of the EV terms at α=.05 level. The process was repeated until all the interaction variables that remained in the model were significant while keeping the exposure variable, confounders and the lower order terms for any interaction variables. The model that remains after the interaction assessment is the "gold standard model."

Confounding

After assessing which interaction terms were significant and would therefore remain in the model, an all-possible-subsets strategy was used to assess whether any of the remaining confounding variables could be removed from the gold standard model. All possible models that contained the lower order terms not contained in the interaction variables were considered. In order to determine whether a variable could be removed from the gold standard model, the odds ratio for the exposure variable (relationship) for each possible model was compared to the odds ratio for the gold standard model. If the odds ratio for the exposure variable of a smaller model fell within 10% of the odds ratio for the exposure variable of the gold standard model, it was concluded that the models were equivalent and the model with fewer terms was preferred. After identifying the preferred models, precision was considered for choosing the final model.

Results

Demographic Results

The study population consisted of survey results from 1,636 randomly sampled community drug distributors from Cameroon and Uganda in 2004 and 2005 (Table 1). Of the 1,636 CDDs, 50% (n=814) met the goal of 90% distribution of ivermectin to the target population. Additionally, 1,069 (65%) of the CDDs surveys were from Uganda and 35% were from Cameroon. 1,056 (64.5%) of the CDDs were males and 35.5% of the respondents were females. 1,397 (85%) of respondents were married at the time of the survey. Of the total, 814 (49.7%) of the CDDs responded in 2004 and 50.3% responded in 2005. The population age was normally distributed with a mean of 37 and a standard deviation of 10.6 years. In Uganda, the mean age of the CDDs was 35 years with a standard deviation of 9.3 years and in Cameroon the mean age 39 years with a standard deviation of 11.4 years. Fewer than half (35%, N=579) of the CDDs had to walk greater than one kilometer to distribute ivermectin to the community. The vast majority, 94%, of the CDDs lived within the zone that they distributed ivermectin, and 65% of the CDDs did not distribute the drug outside of their distribution zone. The surveys also showed that 1,387 (85%) of the CDDs were supervised and 35% of supervisors lived in the same distribution zone as the CDD. The number of times a CDD was supervised ranged from one time (15% of the population) to more than 4 times (9% of the population). The majority of CDDs were experienced distributors with 83% of them responding that they had distributed ivermectin to their community for over 2 years. 1,312 (80%) of CDDs were also involved in other health activities in their communities.

Collinearity

After running the SAS macro for testing collinearity, no collinearity problems were discovered. The condition index of the initial model was 27.12, which was below our cut-point of 30. Therefore it was concluded that there were no collinearity problems.

Interaction

The results of the chunk test produced a chi-square statistic of 8.78 with four degrees of freedom. The -2 Log L of the interaction model was 1289.43. The -2 Log L of the no-interaction model was 1298.20. Subtracting 1289.43from 1298.20 resulted in a chi-square statistic of 8.78 with four degrees of freedom, which corresponds to a p-value of 0.066, which is statistically non-significant. A backwards elimination method was used to eliminate two insignificant interaction terms. Using this process, the two interaction terms between the exposure and number of households and exposure and supervision were removed from the model. The gold standard model is:

Target (outcome) $= \alpha + \beta_1$ (Relationship) $+ \gamma_1$ (County) $+ \gamma_2$ (Sex) $+ \gamma_3$ (Age) $+ \gamma_4$ (Number of Households) $+ \gamma_5$ (Supervision) $+ \delta_{11}$ (Relationship*Country) $+ \delta_{12}$ (Relationship*Sex) $+ \varepsilon$

Confounding

Because the variables country and sex were part of higher order interaction terms, the only variables considered for removal were supervision, and number of households. It was determined that supervision and number of households visited needed to remain in the model to improve the validity of the estimate, therefore no variables were removed from the model and the “gold standard” model was chosen as the final model.

Final Model

After creating an initial model, which established the E, V and W variables based on the literature and the directed acyclic graph, collinearity, interaction was tested and confounding was assessed. The final model is the gold standard model defined as:

Target (outcome) = $\alpha + \beta_1$ (Relationship) + γ_1 (County) + γ_2 (Sex) + γ_3 (Age) + γ_4 (Number of Households) + γ_5 (Supervision) + δ_{11} (Relationship*Country) + δ_{12} (Relationship*Sex) + ε

The regression coefficients for the final model are summarized in table two.

Odds ratio estimates

After controlling for country, sex, number of households distributed, supervision, age, significant effect modification was found between country and relationship (Table 2). Additionally, there was significant effect modification between sex and relationship. The significant interaction terms indicate that the effect of relationship to the outcome is different depending on whether the CDD is in Uganda or Cameroon and different depending on whether the CDD is male or female (Table 3). The difference in outcome between sexes is also seen within both countries - the effect of relationship on the outcome also differs whether the CDD is male or female in both Uganda and Cameroon. Table three shows that a male community drug distributor from Uganda who distributed to over 50% kin was 1.98 (CI 1.24, 3.19) times more likely to achieve the 90% distribution target than a male CDD from Uganda who distributed to under 50% kin (p-value 0.004). The effect of distributing to kin is not the same for female CDDs in Uganda. A female community drug distributor from Uganda who distributed to over

50% kin was 1.07 (CI 0.65, 1.75) times more likely to achieve the 90% distribution target than a female CDD from Uganda who distributed to under 50% kin (p-value 0.80).

The results in Cameroon are not consistent with the results from Uganda. Unlike Uganda, CDDs in Cameroon did not see any improvement in results when distributing ivermectin to a majority kin. In fact, both male and female CDDs performance decreased when distributing to majority kin. The results are consistent across sex, though the magnitude of effect differs. A male community drug distributor from Cameroon who distributed to over 50% kin was 0.92 (CI 0.59, 1.44) times as likely to achieve the 90% distribution target than a male CDD from Cameroon who distributed to under 50% kin (p-value 0.72). Like Uganda, female CDDs did not perform as well as male CDDs. A female community drug distributor from Cameroon who distributed to over 50% kin was 0.49 (CI 0.26, 0.94) times as likely to achieve the 90% distribution target than a female CDD from Cameroon who distributed to under 50% kin (p-value 0.03).

The only significant effects of gender or country on relationship at the 5% level are with Cameroonian female CDDs (p-value 0.03) and Ugandan male CDDs (p-value 0.004). For Cameroonian males and Ugandan females, the effects of gender and country on relationship are not significant (p-values 0.72 and 0.80 respectively).

Discussion

Ivermectin distribution programs have always been difficult because to achieve progress towards the elimination of onchocerciasis, extremely high coverage rates need to be sustained in communities for many years. The Carter Center attempted to address the issue of sustainability with Kinship enhanced CDTI where the CDDs were responsible for distributing ivermectin mostly among members of their kinship groups. This study aimed to determine whether that kinship model was achieving its goal of increasing coverage and if the results were the same across Cameroon and Uganda, two countries with endemic onchocerciasis and a long history with ivermectin distribution programs. Both countries have also adopted the Kinship enhanced CDTI approach to ivermectin distribution.

The data from 2004 and 2005 show that there is significant effect modification between relationship and country and relationship and gender. The effect of relationship (whether or not a CDD is related to over 50% of the people he or she distributed to) is different depending on whether or not the CDD is Ugandan or Cameroonian and it is different whether the CDD is male or female.

These results indicate that though the structure of the program is supposed to be the same, the program execution is different in each country and the results are different across sex. In both countries, the CDD's relationship to the people he or she is distributing effects males and females differently. Ugandan CDDs who distributed to over 50% kin were likely to showed improved performance where in Cameroon, CDDs who distribute to majority kin showed decreased performance. This indicates that the

kinship enhanced distribution program model functions according to plan more in Uganda than Cameroon. This difference could be due to a number of reasons and merits further studies and evaluation of the programs.

One of the main goals of the kinship-enhanced program is to get more women CDDs involved. Though the program has been successful in recruiting female CDDs, during the period of this study, female CDDs are not as successful as male CDDs in the program. The program as designed and implemented in 2004-2005 was achieving its goal of high distribution rates for Ugandan male CDDS. For females in Uganda, more study is needed to determine if over time the increase in success is significant.

The program in Cameroon for 2004-2005 was not performing as designed. CDDs that distributed to majority kin were not performing as well as the traditional CDTI model and were less likely to achieve the 90% distribution goal. The performance of female CDDs in Cameroon was far below the expectations of the program and more study is needed to determine why female CDD performance in Cameroon was so different than anywhere else.

Future Directions

More studies are needed to understand what the specific program differences are possibly causing the differences between countries and between males and females. Future studies can focus on differences in how CDDs in both countries are trained and whether males and females are trained differently. Workload, both within the program and outside of it, should also be assessed.

Strengths

This thesis adds to public health knowledge because it looks at whether the relationship of the CDD to the people he or she distributes to effects the success rate. Ivermectin distribution programs must sustain high distribution levels for many years to be successful. The kinship enhanced CDTI aims to address sustainability by putting control of the program into the hands of communities and increasing the desire of CDDs to succeed by having them distribute ivermectin to kinship groups. The program idea and design is the same in all the implementing countries, but this thesis shows that the results are not the same across countries or within countries. This is the first paper to compare the kinship program across two implementing countries and shows that the program was not being implemented the same way in both countries.

Limitations

The main limitation of this paper is that there is a small probability that some of the data points are correlated. Though the sample is random, it draws from the same population; therefore there is a possibility that a few CDDs were randomly selected both years. Because the data is de-identified there was no way to determine whether the same CDD was chosen both years. Additionally, the CDD sample population was considered sufficiently large that the probability of selecting the same CDD for the two years was small enough that the analysis would not be compromised.

Another limitation for this thesis is that it compares the data at the country level. Though differences between Uganda and Cameroon were found, a possible next step would be to compare the results within the country, between districts. It is possible that there are major differences in CDD performance between districts.

The data for this thesis was collected between 2004 and 2005. At that point, the CDDs in Uganda had been working to distribute to kin for four years and the program in Cameroon had started more recently. This is limitation for this thesis as the CDDs in Uganda had more time to implement the program. Future studies should control for how long the program had been implemented in the country. Additional longitudinal studies can also show the effects of distributing to majority kin over time.

Overall Conclusion

Overall, there is a difference on the effect of distributing to a majority kin that depends on whether the CDD is from Cameroon or Uganda and male or female. A CDD in Uganda who distributes to a majority kin is more likely to improve his or her performance when distributing to a majority kin, whereas a CDD from Cameroon is less likely to reach the 90% distribution target if distributing ivermectin to a majority kin. Males in Uganda are two times as likely to succeed if distributing to kin and female CDDs in Cameroon are half as likely to succeed when distributing to a majority kin. The effects of distributing to a majority kin are not significant for male CDDs from Cameroon or female CDDS from Uganda.

More study is needed to assess why female CDD performance is different than their male counterparts. The difference is seen in both countries. Though the kinship program is increasing the number of female CDDs, their lack of achieving the 90% target distribution when distributing to kin is worrying. More study is needed to understand why this is happening in order to improve the program or to determine if there is something about female CDDs from Cameroon distributing to kin that adversely affects performance.

There have been few studies that explore the factors that make CDDs successful distributors. Ivermectin programs rely on CDDs to distribute ivermectin at high rates for a long time for onchocerciasis elimination to be feasible. This thesis shows that on the country level, the kinship enhanced CDTI program is not the same in Cameroon and Uganda and that male and female CDDs perform differently when distributing to kin. In Uganda, the program improves performance, significantly for males CDDS. In Cameroon, the kinship program inhibits performance, especially amongst the female CDDs. The differences in performance could be because the program was operating for a few years longer in Uganda, therefore the CDDs were more experienced. Future studies could look at the start of the Ugandan kinship program to determine if the first years had results like Cameroon. If that is the case, then maybe what we are seeing in Cameroon is a program in its infancy that needs time to improve.

This thesis is a snapshot of a long and complicated program. The data only looks at data from 2004 and 2005. It is possible that as the kinship program continues developed in the two countries the results across the countries would even out. Further studies should determine if program performance changes year to year and whether individual performance changes over time. Also, more studies are needed to see if there are differences within countries.

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Tables

Table 1: Demographic characteristics of community drug distributors in Cameroon and Uganda, 2004-2005

	Distributed to greater than 50% Kin (N=971)	**Distributed to fewer than 50% Kin (N=665)**
Distributed to 90% of target		
Yes (N, %)	536 (55%)	278 (42%)
No (N, %)	435 (45%)	387 (58%)
Country		
Cameroon (N, %)	206 (21%)	361 (54%)
Uganda (N, %)	765 (79%)	304 (46%)
Year		
2004 (N, %)	525 (54%)	289 (43%)
2005 (N, %)	446 (46%)	376 (57%)
Gender		
Male (N, %)	636 (65%)	420 (63%)
Female (N, %)	334 (35%)	243 (37%)
Number of Households delivered to		
Less than 10 (N, %)	124 (13%)	67 (10%)
10 to 20 (N, %)	266 (27%)	120 (18%)
21 to 30 (N, %)	173 (18%)	78 (12%)
Greater than 30 (N, %)	385 (40%)	381 (57%)
Supervised		
Yes (N, %)	867 (89%)	520 (78%)
No (N, %)	97 (10%)	125 (19%)
Years Distributing Ivermectin		
Less than 1 year (N, %)	46 (5%)	56 (8%)
One year (N, %)	95 (10%)	61 (9%)
Two Years (N, %)	230 (24%)	118 (18%)
Three Years (N, %)	192 (20%)	109 (16%)
More than three years (N, %)	400 (41%)	316 (48%)
Delivered outside of zone		
Yes (N, %)	349 (36%)	248 (37%)
No (N, %)	616 (63%)	405 (61%)

Time to Complete		
One week or less (N, %)	531 (55%)	249 (37%)
Greater than a week (N, %)	428 (44%)	407 (61%)
CDD involvement in other activities		
Yes (N, %)	792 (82%)	520 (78%)
No (N, %)	167 (17%)	123 (18%)
Marital Status		
Single (N, %)	85 (9%)	82 (12%)
Married (N, %)	856 (88%)	541 (81%)
Widowed (N, %)	25 (3%)	31 (5%)
Separated/Divorced (N, %)	3 (0%)	4 (1%)
Number of times supervised		
Once (N, %)	171 (18%)	78 (12%)
Twice (N, %)	332 (34%)	204 (31%)
Three times (N, %)	205 (21%)	108 (16%)
Four times (N, %)	84 (9%)	61 (9%)
More than 4 times (N, %)	79 (8%)	70 (11%)

Table 2: Regression coefficients and confidence intervals for variables in the final model and by country with significant p-values in bold.

	Regression Coefficient (β)	**95% Confidence Limits**	**P-Value**
Intercept	-0.868	(-1.66, -0.77)	**0.03**
Relationship	0.064	(-0.43, 0.56)	0.8
Country	-1.035	(-1.49, -0.58)	**<0.0001**
Gender	-0.422	(-0.86, 0.02)	0.06
Age	0.022	(0.01, 0.04)	**0.001**
Number of Households	0.077	(-0.06, 0.21)	0.26
Supervision	0.368	(-0.02, 0.76)	0.07
Relationship x Country	-0.771	(-1.37, -0.17)	**0.01**
Relationship x Gender	0.624	(0.04, 1.21)	**0.04**

Table 3a: Odds ratios for the effect of relationship in strata for country and sex

	Uganda	**Cameroon**
Male	1.98	0.92
Female	1.07	0.49

Table 3b: 95% Confidence Intervals for the odds ratio for the effect of relationship in strata for country and sex

	Uganda	**Cameroon**
Male	(1.24, 3.19)	(0.59, 1.44)
Female	(0.65, 1.75)	(0.26, 0.94)

Appendix

EMORY UNIVERSITY | Institutional Review Board

IRB Exemption

December 9, 2011
Lisandro Torre
Rollins School of Public Health
Global Health Institute
1602 Fishburne Drive
Atlanta, GA 30322

RE: Determination: No IRB Review Required
IRB00054331; *Evaluating the association between the size of a kinship group and effective drug distribution for the Carter Center's Onchocerciasis Elimination program in Cameroon and Uganda, 2004-2007*

PI: Torre

Dear Mr. Torre:

Thank you for requesting a determination from our office about the above-referenced project. Based on our review of the materials you provided, we have determined that it does not require IRB review because it does not meet the definition of a study involving "human subjects," nor does it meet the definition of "clinical investigation" as set forth in Emory policies and procedures and federal rules, if applicable. Specifically, in this project, you will use survey data collected from CDDs in Uganda and Cameroon from 2004 to 2007. These data will have no identifiers linked to any individual upon presentation to your study team.

HHS regulations define *human subject* at 45 CFR 46.102(f) as follows:

Human subject means a living individual about whom an investigator (whether professional or student) conducting research obtains

(1) data through intervention or interaction with the individual, or
(2) identifiable private information.

This determination could be affected by substantive changes in the study design, subject populations, or identifiability of data. If the project changes in any substantive way, please contact our office for clarification.

Thank you for consulting the IRB.

Sincerely,

Sam Roberts, CIP
Research Protocol Analyst
This letter has been digitally signed

Community Drug Distributor Survey

Face-to-face interviews of persons who were selected to distribute ivermectin on factors that are related or appear to enhance community participation and sustainability of community directed treatment with ivermectin (CDTI) mprogram during 2004.

This questionnaire is intended for distributors in randomly selected communities.(Only the last treatment exercise of 2004 is considered.
(Please tick the appropriate answer in the box).

{ID} #

{IDNUM}: ####

1. {Province}/State/Zone: _____

2. {District}/Woreda/LGA: _____

3. Sub-County ({Heal}th {Area}/Health Facility): _____

4. {Parish} /Kebele/Village: _____

5.{Name} of the {CDD}/CDHW: _____

6. {Community}: _____

7. Name of Kinship/Neighbourhood {ZONE}: _____

8.{Targ}et {pop}ulation for the zone: ####

9.{Child}ren Below 5years in the zone: ##

10.{Elig}ible {pop}ulation in the zone: ####

11.{No}.{treat}ed: ####

12. {Tot}al {pop}ulation of the community: ####

13. {Elig}ible population in the {com}munity: ####

14. % {Cov}erage of {el}igible {pop}ulation: ###.#

A: Personal Information

15. Gender:

[ ] 1. Male
[ ] 2. Female

{GENDER} #

16. How old are you {HWOLD}? ###

17. What is your marital status?

[ ] 1.Single
[ ] 2.Married
[ ] 3.Widow
[ ] 4.Widower
[ ] 5.Divorced/Separated

{MARSTATUS} #

B: Selection and Training

18. Who selected you as a CDHW (CDD)

[ ] 1. Individual community members and leaders in a general meeting at the zonal level
[ ] 2. Local council leaders/Chairman only
[ ] 3. The community-directed health supervisor (CDHS) /Community Supervisors
[ ] 4. I volunteered to help my people
[ ] 5. {Others18} (specify) _____

{WHSELYOU} #

19. In which place were you selected?

[ ] 1. community center in my kinship/ neighbourhood zone
[ ] 2. community center outside this kinship/ neighbourhood zone
[ ] 3. Outside my community
[ ] 4. Health unit/facility
[ ] 5. {others19} (specify) _____

{PLYOUSEL} #

20. How far was the selection center from your home?
[ ] 1. within 0.5km
[ ] 2. 0.5 to 1 km
[ ] 3. more than 1 km

{HWFARSEL} #

21. Were you trained on how to distribute ivermectin?

[ ] 1. Yes (If no, go to No.24)
[ ] 2. No

{YRTRAINED} #

22. If yes, who trained you?

[ ] 1. The Community health supervisor
[ ] 2. The District Onchocerciasis Coordinator
[ ] 3. Health workers at the health unit
[ ] 4. {Others22} (specify) _____

{WHTRAINYR} #

23. How far was the training centre from your home?

[ ] 1. within 0.5km
[ ] 2. 0.5 to 1 km
[ ] 3. more than 1km.

{TNCENTRE} #

C: Distribution

24. For how long have you been distributing ivermectin?

[ ] 1. less than one year
[ ] 2. One year
[ ] 3. two years
[ ] 4. three years
[ ] 5. more than 3 years

{HWLONG} #

25. Did you distribute ivermectin last year (2003)?

[ ] 1.Yes

[ ] 2. No

{DSTIVER} #

26. If no to No. 25, why?

[ ] 1. I was not yet selected
[ ] 2. I was sick
[ ] 3. I was away
[ ] 4. {Others26} (specify) _____

{NOWHY} #

27. Did you distribute ivermectin this year (2004)?

[ ] 1. Yes
[ ] 2. No (If no, go to no.34)

{YRDSTVER} #

28. Do you live in the kinship/ neighbourhood zone where you distributed ivermectin?

[ ] 1. Yes
[ ] 2. No

{LVZONE} #

29. Did you help to distribute ivermectin in zones outside your own kinship/ neighbourhood zone?

[ ] 1. Yes
[ ] 2. No

{HPDSTVER} #

30. If you distributed ivermectin, how many households did you distribute ivermectin to this year (2004)?

[ ] 1. less than 10
[ ] 2. 10 to 20
[ ] 3. 21 to 30
[ ] 4. more than 30

{MNHOLDS} #

31. What distance did you walk when you were distributing ivermectin this year (2004)?

[ ] 1. within 0.5km
[ ] 2. 0.5 to 1 km
[ ] 3. more than 1 km

{WTDSTWK} #

32. How long did it take you to complete treatment this year (2004)?

[ ] 1. 1 to 3 days
[ ] 2. 4 to 7 days
[ ] 3. 2 weeks
[ ] 4. more than 3 weeks

{HLTKCOMP} #

33. What relationship do you have with the people you treated?

[ ] 1. Majority are relatives by blood and marriage
[ ] 2. Very few are relatives by blood and marriage
[ ] 3. About half of them are relatives
[ ] 4. Just neighbours and non relatives

{RELTX} #

34. If no to No.27, why didn't you distribute ivermectin this year (2004)?

[ ] 1. I was busy with other duties.
[ ] 2. I was sick.
[ ] 3. This is hard work, I decided that I should not do it.
[ ] 4. Not informed
[ ] 5. {Others34} (specify) _____

{WHYNTDST} #

35. If no to No.27, what other CDTI activities were you involved in?

[ ] 1. I health educated community members

[ ] 2. I mobilized community members
[ ] 3. I advocated for the CDTI programme
[ ] 4. I urged community members to go for treatment
[ ] 5. {Others35} (specify) _____

{WTOTHACTIV} #

36. Are you involved in other health and developmental activities besides CDTI (e.g. health education, mobilization, census update, reporting etc)?

[ ] 1. Yes
[ ] 2. No

{INVOTACT} #

37. If yes, how many health or development activities are you involved including river blindness?

[ ] 1. Only one health or development activities
[ ] 2. Two health or development activities
[ ] 3. Three health or development activities
[ ] 4. Four health or development activities
[ ] 5. More than four health or development activities

{HMHDACT} #

38. What other health and developmental activities are you involved in?

[ ] 1. {Water} and {san}itation <Y>
[ ] 2. {Com}munity {bas}ed {he}alth care <Y>
[ ] 3. {Immuniz}ation <Y>
[ ] 4. {Family pl}anning <Y>
[ ] 5. {AIDs contr}ol campaign <Y>
[ ] 6. Midwifery/{Trad}itional {bir}th {at}tendant <Y>
[ ] 7. {TB contr}ol <Y>
[ ] 8. {Malar}ia {cont}rol <Y>
[ ] 9. Supply of {Vit}amin {A} tablets <Y>
[ ]10. {Spring pro}tection <Y>
[ ]11. {Construct}ion of schools/Dispensaries/Roads <Y>
[ ]13. {Afforest}ation/Agricultural extension services <Y>
[ ]14. {Lymph}atic {fil}ariasis <Y>
[ ]15. {Schisto}somiasis control <Y>

[ ]16. {Other38} specify _____
[ ]16. Others (specify) _____

D: Health education.

39. Did you give health education to your community members before the last treatment (2004)?

[ ] 1. Yes
[ ] 2. No

{GVHELEDU} #

40. From which place was health education given before the last treatment (2004)?

[ ] 1. within my kinship/ neighbourhood zone
[ ] 2. within the community but outside the kinship / neighbourhood zone
[ ] 3. outside the community.
[ ] 5. {Others40} (specify) _____

{HEGVLSTTX} #

41. Who were the other people involved in giving health education to the community members?

[ ] 1. {Com}munity directed {heal}th {sup}ervisors (CDHS) <Y>
[ ] 2. Local council leaders/{comm}unity {lead}ers <Y>
[ ] 3. Other {distr}ibutors in this {kin}ship/ neighbourhood zone <Y>
[ ] 4. {Other dist}ributors outside this kinship/ neighbourhood zone<Y>
[ ] 5. {Others41} (specify) _____

E: Supervision

42. Were you supervised during this year's treatment?

[ ] 1. Yes
[ ] 2. No

{YRSUPTX} #

43. If yes, who supervised you?

[ ] 1. Community supervisor
[ ] 2. Health worker
[ ] 3. Community leader
[ ] 4. {Others43} (specify) _____

{WHOSUPYR} #

44. How many times were you supervised during this year's (2004) distribution?

[ ] 1. Once
[ ] 2. Twice
[ ] 3. Thrice
[ ] 4. Four times
[ ] 5. More than four times

{MNTMSUPYR}#

45. What sex is your community-directed health supervisor?

[ ] 1. Female
[ ] 2. Male

{SEXSUPRV} #

46. Where does your community-directed health supervisor live?

[ ] 1. Within my kinship/ neighbourhood zone
[ ] 2. Within my community but outside my kinship/ neighbourhood zone
[ ] 3. Outside my community
[ ] 4. Outside my parish/Kebele/Village
[ ] 5. {Others46} (specify) _____

{CDHSLV} #

F: Reporting

47. Are there some people you treated who got side effects?

[ ] 1. Yes
[ ] 2. No (If no, go to No. 49)

{SDEFFECT} #

48. If yes, how did you manage these side effects?

[ ] 1. Referred to the health unit within the community
[ ] 2. Referred to the Supervisor
[ ] 3. I told them that they will disappear within a few days
[ ] 4. {Others48} specify _____

{MNSIDEFF} #

G: Support

49. Who brought ivermectin to your kinship/ neighbourhood zone?

[ ] 1. Supervisor
[ ] 2. Community members
[ ] 3. Health assistant
[ ] 4. District Onchocerciasis coordinator
[ ] 5. Local council/community leader
[ ] 6. Myself
[ ] 7. Fellow distributor
[ ] 8. I do not know
[ ] 9. {Others49} (specify) _____

{WHOBRIV} #

50. Did the rest of the community members help in mobilization for CDTI activities?

[ ] 1. Yes
[ ] 2. No

{RSTCOMHP} #

51. What other support would you like to get from community members in Order to serve them well?

[ ] 1. {Get lunch} during distribution <Y>
[ ] 2. {Get} some {money} <Y>
[ ] 3. {Sensit}izing other {com}munity members <Y>
[ ] 4. {Cooper}ation from {com}munity members <Y>
[ ] 5. {Mobiliz}ation <Y>
[ ] 6 {Com}munity to {prov}ide {trans}port <Y>
[ ] 7. {Nothing} <Y>
[ ] 8. {Others51} (specify) _____

52. Will you continue distributing ivermectin next year in your community?

[ ] 1. Yes
[ ] 2. No
{CONTDST} #

53. If no, why?

[ ] 1. I Will be leaving this zone as Iam getting married outside
[ ] 2. I can't continue with this work, It is too much involving.
[ ] 3. There is no pay
[ ] 4. Iam going to look for a job far from here.
[ ] 5. {Others53} specify _____

{NOCONTWHY} #

THANK YOU FOR YOUR CONTRIBUTION TO THIS PROGRAMME