



Epidemiological analysis of the environmental health impact of annual ivermectin mass drug administration on clinical manifestation of onchocerciasis

Nkeiru A. Kamalu¹, Jacinta A. Opara^{2,*}, E. Emukah³ and M. N. Orji⁴

¹Department of Animal and Environmental Biology, Imo State University, Owerri, Nigeria

²Department of Biological and Environmental Sciences, Kampala International University, Kampala, Uganda

³The Carter Centre South-East Integrated Programs, Owerri, Nigeria

⁴Department of Biological Sciences, Anambra State University, Uli, Nigeria

*E-mail address: jaopara@yahoo.com

ABSTRACT

Epidemiological studies on the impact of onchocerciasis control in some parts of Imo State, Nigeria was undertaken between 2008 and 2012 to determine the impact of annual ivermectin mass drug administration on clinical manifestation of Onchocerciasis. The survey took place in the nine villages of Okigwe local government area, which have base line data at Carter Center Imo/Abia project. Permission to carry out this survey was obtained from Ministry of Health as well as informed consent was obtained from the individual volunteers. Skin snip for microfilaria (mf), community microfilaria load (cmfl), physical examination, visual screening, were carried out among 960 volunteers comprising of 511 males and 499 females from age group 5-62+ in the sampled villages in accordance with the epidemiological evaluation of onchocerciasis protocol. The results shows 63.7% reduction against 47.2% nodule prevalence in 1995 to 14.3% nodule prevalence in 2012 ($p < 0.001$). Similarly there is 36.3% reduction rate of mf prevalence from 51.8% mf rate to 33.0% in 2012 after 15 years of mass drug administration ($p < 0.005$). CMFL is generally low among the sampled villages 0.90 mf per milligram ($p < 0.001$). An Onchocercal symptom was found among individuals in the sampled villages 47.2%. Also mf prevalence was rare in age group 5-15(17%), subsequently increased with age and highest in age group 56-62+ (26%). However, because microfilaria (mf) was found

among the subjects, is suggestive of its potential continued transmission and therefore Onchocerciasis is not yet eliminated.

Keywords: Onchocerciasis; microfilaria; ivermectin; nodule prevalence; drug administration; manifestation

1. INTRODUCTION

Onchocerciasis commonly called River Blindness is a chronic, neglected Tropical Disease (NTD) caused by a filarial worm known as *Onchocerca volvulus*. The parasite is a nematode that belongs to the family filariidae. The adult worms live in sub cutaneous nodules where the viviparous female produces millions of embryos known as microfilaria, which circulate in the skin. Transmission of onchocerciasis from man to man is through repeated bites by infected female black flies of the genus *Simulium damnosum*.

In Nigeria and other West African countries, the microfilariae are predominantly found in the lymphatic channels of the skin around the pelvic region and upper arm (Nwoke, 1987). There are at least 26 cytospecies of black flies which are widely distributed in the savanna and rainforest areas of West and Central Africa (Dunbar, 1976, cited by Iwuala 1998). The common cytotypes are *Simulium damnosum* and *Simulium naevi* (Bassey 1992; Iwuala 1998). The disease is essentially a chronic process characterized by episodes of acute manifestations each of which probably leads to some tissue damage.

The cumulative effects of these processes over the years result in disfiguring lesions of skin, lymph nodes, visual impairment and eventually blindness. Severe skin disease (Onchodermatitis) is one of the sequels of infection with onchocerciasis and its consequence makes this non fatal disease, a psychologically very devastating disease (WHO 1995b; TDR 2005). The disease is a clinical syndrome partly or entirely characterized by dermatologic, Ophthalmologic, Lymphatic and sometimes systemic manifestations.

Onchocerciasis is one of the leading causes of blindness in the tropical world. The distribution of the disease depends on the presence of an efficient vector. The immature stages of the vector develop in fast flowing and well oxygenated rivers. As a result, black fly which is the vector of Onchocerciasis is common near fast flowing river courses. Also based on the fact that blindness is a major manifestation of the disease, Onchocerciasis is commonly called river blindness. No wonder then many villagers in endemic communities still implicate their enemies and gods of the rivers as the cause of their infection (Nwoke, 1987). Local treatments are therefore misdirected towards consulting the oracle and appeasing the gods (Nwoke, et al 1987). Nwoke, (1990) noted that *Simulium damnosum* complex is widely distributed in the tropical Africa and made up of several sibling species, many of which are important vectors.

The climate of the study area Okigwe Local Government Area, Imo State, Nigeria favors the breeding of *simulium* because of the many months of rain and other geographical factors which create suitable vegetation and habitats for the adult pest, as well as dispersal. During the rainy season, there is increased dissolved oxygen in the water, accompanied by increased nutrients and these encourage pre-emergent developmental stages as well as the emergence of adult flies from the pupae with consequent increase in the adult biting population. Black flies are therefore wet season breeders (Nwoke, 1992). However, their human biting activities and population are limited, if not hindered during the dry months of

November to February. Onchocerciasis is endemic in parts of Sub-Sahara Africa, the Arabian Peninsula and South America (WHO, 1987). Of all the countries in the world, Nigeria has the greatest number of persons with onchocerciasis, accounting for over 33% of the global prevalence (WHO, 1987; Edungbola, 1991). In Nigeria there are currently about 7million infected people with over 120,000 cases of blindness, while 40 million people are living at the risk of infection in endemic areas (WHO, 1987; GRBP 1998).

Clinical Presentation/Manifestations of Onchocerciasis

The clinical manifestation of onchocerciasis is primarily due to the dead microfilariae. The frequency and severity of the symptoms are closely correlated with the number of microfilaria, which depends on the number of adult filarial worms. This, in turn is governed by the number of infective larvae received by the subject and therefore by the number of bites received from infected black flies in relation to the length of time spent in an endemic area (WHO, 2002; TDR, 2005). Clinical onchocerciasis manifests itself only after an accumulation of infections over several years. It may have multiple manifestations and the Symptomatology is extremely variable from one region to another (WHO, 2002). The clinical presentation of onchocerciasis occur as a result of tissue damage and reaction following absorption of toxins released by dead microfilaria worms, live microfilaria cause no reaction (Bassey, 1992). Dead microfilaria herald a complex array of a skin disease, lymphatic complications, ocular lesions and systemic manifestation which are aptly described as the most common and classical symptoms of onchocerciasis (WHO, 1976). Also severities of clinical manifestation are directly related to the load of microfilaria (Bjorn, 1989; Bassey, 1992). Most of the tissue changes in onchocerciasis that contribute to the development of various clinical manifestations appear to be associated with the death of microfilariae rather than related directly to the presence of adult worms. However, adult worms become lodged in the subcutaneous tissues to form the characteristics Onchocercal nodules (Murdoch, 2003; Nwoke, 2011).

Onchocercal skin disease (Onchodermatitis) begins when microfilaria degenerates in the dermis. This is accompanied by inflammation, with degranulation of eosinophills granules on the cuticle of the microfilarial (Nwoke, 2011). Some individuals with onchocerciasis may have clinically normal skin while others have intense pruritis and disfigured lesions due to different individual immunological reactions (Person, 1984; Nwoke, 2011). The Onchocercal skin disease include pruritis, Onchodermatitis, papulo-macular rashes, urticaria, oedema, excoriations, pustules⁷, crusts, scaling of the skin as a lizard skin, (premature ageing of the skin),leopard skin (depigmentation of the shins), lichenification, pachyderma, atrophy (which may be focal, regional, or generalized) and the appearance of subcutaneous nodules (Onchocercmata) – (Nelson, 1970; Pearson, 1984; Emukah, 2004) .

Pruritis is one of the early symptoms of the skin problem in African (Buck, 1992). The itching may be so intense that stones and sharp objects have been reported used to scratch the itching. In Africa it occurs mainly on the trunks, buttocks and lower limbs (Nnochiri, 1975; Anosike, 1995; Emukah, 2004).

Following the pruritic papular rashes which may develop at any time on any part of the skin, they may be small and closely spaced or large and more widely separated, clear fluids and pus may be extruded. The distribution of these rashes also follows the pruritic areas in African (Buck, 1994). The skin is therefore intensely pruritic, thickened and darkened with rashes and the regional lymph nodes are large and tender.

Skin Lesions

As described by most authors skin rash is one of the major manifestations of onchocerciasis. This dermatological problem is more common in the forest onchocerciasis than the savannah form. The early form of skin problems begins with pruritis, which is as a result of a reaction of the body to the circulating toxins following the death of the microfilaria worms. The dead worms elicit chemical reactions with the resultant productions of histamin, slow reacting substance, eosinophilic reaction that produce itching. The itching, spans throughout the life cycle of the infection in the individual, leading to misery, loss of concentration and productivity of the individual (Mutambazi, 1998). In higher endemic communities people are seen scratching with stones, sharp objects and knife often inflicting injury, bleeding, resulting in secondary bacterial infection (Anosike,1975; Nnochiri, 1975; GRBP, 1998; Nwoke, 2011).

As a result of the eruption of papular rashes, which may affect one region or dermatome, in Africa it is the trucks, buttocks and lower limbs that are more affected. These papules may contain clear fluids or pus, may be small appearing in clusters or big and widely separated (Nnochiri, 1975).

The constant itching over these papular areas further leads to skin destruction giving rise to thickening, hyper pigmentation as in elephantoid or to dry scaling lizard skin (Nwoke,1990; GRBP,1998; Emukah, 2000). Chronic forms leads to hypo-pigmentation which is more marked in the African on shin area giving rise to what is commonly known as leopard skin. This condition is often a result of trauma, old age and is not diagnostic of onchocerciasis. These dermal changes lead to premature aging (Nnochiri, 1975; Nwoke et al, 1987; Taylor et al, 1990; WHO, 1995). According to Murdoch, (2002), the various forms of Onchocercal skin disease may be categorized using classification system based on clinical findings.

(a) Acute Papular Onchodermatitis (APOD)

APOD consists of acute small widely scattered pruritic or itchy papules which progress to vesicles and pustules in more severe cases. Erythema and Oedema of the skin may also be present affecting a single limb or area of the trunk or face. Oedema of a limb with papular eruption accented on that limb may be seen. APOD may also develop in an individual from a non-endemic area for onchocerciasis after visiting an endemic area. In this situation, oedema of a limb or area on the trunk may be seen on someone from a non-endemic area for onchocerciasis after visiting an endemic area and found alone or in association with a subtle, urticated papular eruption. This affects mainly shoulders, arms, trunk or elsewhere (Murdoch 2002).

(b) Lichenified Onchodermatitis (LOD)

LOD is common in certain geographical areas, such as the Yemen and Sudan, though it is also seen less frequently in other countries. Teenagers and young adults are typically affected. Lichenified onchodermatitis (LOD) is characterized by pruritis, raised, discrete papular nodules of plaques of thickened skin as well as hyper pigmentation. The skin of the affected area is noticeably darker than the surrounding skin. With increasing severity the plaques become more confluent. The distribution is usually asymmetrical and may involve one limb (sowda). It is a peculiar feature of onchocerciasis in Africa and Yemen.

The draining lymph nodes are often enlarged, in later stages the skin is grossly lichenified, but in some patients this may revert to a normal (though hyper pigmented) or atrophic skin over a number of years with or without treatment. Itching is very intense in the acute stage. Acute or chronic papular Onchodermatitis may co-exist with lichenified Onchodermatitis. The area most affected are one or both legs, sometimes elsewhere (Murdoch, 2002).

(c) Chronic Papular Onchodermatitis (CPOD)

In chronic papular onchodermatitis the skin lesions are scattered flat-topped papules which vary greatly in size (3-5 cm) and height above the skin surface (some lesions are almost macular, others are elevated up to 5mm). Itching occurs in some lesions but is not a constant feature. Post-inflammatory hyper pigmentation is characteristic. Individuals with this type of skin disease may also have acute lesions and other charges due to onchocerciasis. This affects mainly buttocks, waist area, shoulder or elsewhere (Murdoch, 2002).

(d) Atrophy (ATR)

In Atrophy, the skin appears excessively wrinkled and dry, usually without itching and there is loss of elasticity. Hairs may be lost and sweating in affected areas is reduced. In order to avoid confusion with senile atrophy, ATR is only scored as a significant abnormality in individuals aged less than 50 years. ATR makes young people look old and the skin of the old look lizard or elephant – like. Sometimes the skin may resemble “tissue paper”. Areas most affected are buttocks, less commonly limbs (Murdoch, 2002).

(e) Depigmentation (DPM)

Depigmentation (DPM) is often described a “leopard skin” (LS). Patches of complete pigment loss are seen with island or “spots” of normally pigmented skin centered on the hair follicles. It is rarely itchy and is flat or slightly depressed. Sometimes the skin is fully not depigmented and is seen as yellow-brown areas on black skin. Such lesions may represent early or incomplete or early depigmentation. This affects skins, less commonly lateral groins, lower abdomen (Murdoch, 2002).

(F) Palpable Onchocercal Nodules.

These are the house of adult worms in the body. They are firm subcutaneous nodules overlying bony prominences. The nodules consist of adult filarial worms surrounded by fibrous tissue. It is with these nodules that the female worms reside to produce the microfilaria worms (Murdoch, 2002). Nodules are either subcutaneous or dermal when easily palpated as firm, mobile tumors or fixed by the dermis, periosteum or fascia. However, most nodules may be deeply sited when they are not palpable. The presences of nodules have a very strong correlation to the identification of microfilaria in the skin. The nodules contain live female worms enclosed with a stroma containing a mixture of inflammatory cells such as macrophages, eosinophills etc. others may contain dead worms or blast formed upon the dead worms or a mixture of both live and dead worms.

The prevalence of onchocerciasis and the rapidity of community diagnosis are based on nodules. The WHO sponsored rapid epidemiological mapping of onchocerciasis worldwide is based on nodules (Nnochiri, 1975; GRBP, 1998; Emukah, 2002).

In Africa the preferred sites are the iliac crest, trochanter, coccyx, lateral chest wall/ribs and lower limbs, knee, ankle etc (Nnochiri, 1925; Pearson, 1984). Each nodule may contain one or more adult female worms (Bassey, 1992; GRBP, 1998; Nwoke, 2009).

Lymphatic Complications Due to Onchocerciasis

Lymphatic complications of human onchocerciasis are grouped into hanging groin, scrotal and penile elephantiasis and genital deformation. Patients with lymphatic involvement in onchocerciasis have progression of changes in their lymph nodes. Antigens released from microfilariae lead to the deposition of immune complexes in the tissue (Nwoke 2011). They are as a result of heavy infestation and infiltration of the lymphatic channels with microfilaria worms giving rise to oedema, stretching of the skin (Nnochiri 1975). The perfidious sack contains inguinal or femoral nodes (Histocytic hyperplasia) and may hang down as low as the knee, therefore, they become fibrotic (Follicular atrophy and fibrosis). This lymphatic change is followed by obstruction of the lymph flow- a condition causing hanging groin and elephantiasis of the genitalia in both sexes. These clinical features are seen in endemic areas in Central African Republic, Chad, Cameroon, Ethiopia, Nigeria and Zaire (Anosike, 1995; GRBP, 1998, Nwoke, 2011). Another feature of lymphatic involvement is the development of hydrocele in both male and female giving rise to ambiguous genitalia especially in women with clitoral hydrocele (GRBP, 1998).

Systemic Complications Due To Onchocerciasis

Systemic onchocerciasis is also associated with certain pathogens such as low body weight, low birth weight of new born babies, dwarfism and so on (WHO, 1987). There have been reports of secondary amenorrhea due to onchocerciasis (Anosike, et al 1975).

Generalized body aches and pains, backache and joint pains, musculo-skeletal pains, epilepsy and dwarfism - associated with signs of pituitary deficiency (Nakadama syndrome) have all been reported as systemic effects of onchocerciasis (Murdoch, 2002). The systemic effect of onchocerciasis are not well understood and may include the localization of the microfilariae in tissues other than the skin layer or lymph glands in organs (liver, spleen, pancreas), in other body fluid systems (tears, joint and vaginal fluids) in the blood (microfilaraemia) in the urine (microfilaruria), as well as the occurrence of blood eosinophilia (Anosike et al, 1975).

Eye Lesions/Ocular Complications of Onchocerciasis

The eye lesions are the most serious consequences of onchocerciasis. They result from the invasion of different parts of the eye by the microfilariae. Although they tend to be bilateral, they are not necessarily symmetrical (WHO 1989).

The clinical eye lesions encompass almost every tissue from the conjunctiva, to the optic nerve. Conjunctivitis, keratitis, uveitis, iridocyclitis, papillitis, neuritis, macula atrophy and degeneration and inflammation of optic nerve (neuritis) have been reported. Also associated glaucoma have been aptly linked with onchocerciasis, these lesions alone or combination results in partial or total blindness and thus the worst consequence of onchocerciasis. River blindness is one of the major causes of blindness in sub-saharan Africa especially the endemic savanna belt (GRBP, 1998). In the eye, as elsewhere in the body, living microfilariae stimulate very little inflammatory response. In untreated patients, a few

microfilariae die at each given time and stimulate a limited inflammatory response. With time, many microfilariae die and cause cumulative local inflammatory lesions and scarring. Because the eye depends on optical clarity for its normal function, even minor scarring can cause significant visual impairment (Nwoke, 2011). The other pathological sequence consists of Anterior chamber disease consisting of corneal (Keratitis) and iris (iritis and possibly secondary glaucoma and cataract) disease.

(1) Posterior disease develops in the form of chore retinal and optic nerve disease (Bassey, 1992; Buck, 1994; Nwoke, 2011).

Two types of Keratitis are reported; punctuate and sclerosing keratitis.

Punctuate keratitis:- occurs when the death of a microfilaria, small infiltrations forms around the punctuate, resulting in “fluffy” opacity causing punctuate keratitis. This is a temporary opacity, which normally disappears without residue (Nwoke, 2011).

Sclerosing Keratitis:- these happens when there are presences of large number of dead microfilariae on the cornea. These begins when there is lower part of the cornea (Nwoke, 2011).

Chronic Iritis:- when the anterior chamber of the eye is invaded by microfilariae their death here causes chronic iritis, it is one of the most frequently occurring pathogenomic signs of ocular lesions.

Cataract: - this happens when microfilariae penetrate the lens and die there (Nwoke, 2011).

Posterior ocular lesions: - occur as a natural part of the disease. However, they are commonly observed to be in association with the anterior lesions (Nwoke, 2011).

Onchocercal blindness is a gradual process but may be accelerated with treatment especially with diethylcarbamazine – DEC (Aziz, 1989).

Generally, there are four characteristic eye lesions, in the anterior segment of the eye, sclerosing keratitis (which makes the cornea opaque) and iridocyclitis (an inflammation of the iris and the cilia body), and in the posterior segment, chorioretinitis and optic atrophy. Any of these lesions, which generally coexist at different levels of severity, may cause blindness (WHO, 1998).

Since onchocerciasis is an accumulative disease the ocular complications appear only after a certain number of years: the higher the rate of transmission, the earlier they occur. In certain hyperendemic areas blindness appears between the ages of 30 and 39 years (WHO, 1989; GRBP, 2002). Ocular lesions involve the whole eye, eventually leading to blindness (Bassey, 1992). Microfilaria worms have been reported to invade all the ocular tissue and cause wide spread inflammatory response when they die. The severity of inflammation depends on the microfilariae load (Aziz 1987. Bassey 1992, Cupp 1995).

Corneal scarring from long standing sclerosing keratitis has been reported (Bassey 1992, Buck, 1994). Chronic uveitis has also been reported leading to seclusion of the pupil and secondary glaucoma (Bassey, 1992). However, other earlier reports have not associated onchocerciasis with glaucoma (Bjorn, 1989), suggesting this as another area of future research, but work done in Okigwe Imo State by River Blindness foundation (GRBP, 1995) show relationship and high prevalence of glaucoma among onchocerciasis patients. It is further reported that Onchocercal uveitis leads to slight degree of pupil’s distortion.

Sometimes the pupil is somewhat dilated and reacts poorly to direct light (Buck, 1994). Virtually all the segments of the eye are affected by onchocerciasis. The microfilaria has been demonstrated by slit lamp in the retina of the eye (Cupp, 1995). The severity of the eye lesions depends on the number of microfilaria worms reaching the eye and also dying there.

2. MATERIALS AND METHOD

Study Area

Okigwe Local Government Area is one of the 27 LGA making up Imo State of Nigeria. It is located in the Northern part of Imo State with an estimated area of about 5,100 square kilometers. There are one hundred and fifteen (115) villages in Okigwe, and these villages have been receiving Ivermectin since 1995 (Global 2000). The climate is typical of a tropical rainforest region with moderate rainfall, rich vegetation, high temperature and humidity. There are many fast flowing streams because of its hilly nature which favor the breeding and development of black flies, the vector of onchocerciasis. Okigwe LGA is densely populated with Ibo ethnic group as their major race. The people are mainly farmers, fishermen, and petty traders. They are mostly living in villages and their houses are predominantly made with mud walls and thatched roofs. The study villages were mainly selected based on hyper-endemicity with onchocerciasis, the estimated infected population size ranged between 1,570 and 1,875 according to the data record of 1999-2011 treatment register obtain from Carter Center.

Study Population

The sample population for this research work consisted of 960 volunteers 511 males and 449 females taken from the nine villages in accordance with the age of persons eligible to take the drugs Ivermectin. The age bracket considered was between 5 years and 62+ and both males and females were used for this research. This age range was chosen because people less than 5 years of age are not allowed to take the drug Ivermectin because of side effect. The pregnant women and lactating mothers during the time of visit were excluded from the research because they belong to the exclusion criteria.

Sample Size

- ❖ The sample size was determined according to Krejcie (1970). Using a sample size calculation with the margin of error put at 10%. Nine villages were selected by a stratified simple random sampling. Using the sample size calculation with the margin of Error put at 10%, the sample size that will be studied will be calculated with the formula

$$\frac{P(100 - P)}{(SE)^2} = \frac{90(100 - 90)}{10^2} = 9$$

Therefore from each village a minimum of 42-50 persons will be interviewed, making the total minimum population to be $N = 42 \times 9 = 378$ persons or $N = 45 \times 9 = 405$ persons.

These 9 villages represent a proportion of 607 hyper endemic villages out of the total number of 1, 647 endemic villages in 16 Local Government Areas that are hyper or meso endemic and are currently receiving support from APOC/WHO/ CDTI.

Data Collection

The study was a cross-sectional survey and experimental research. All the data collected in these nine villages were based on the standardized data collections such as stratified simple random sampling tools diagnosed for this study by WHO. Ethical approval for the study was received from Imo State Ministry of Health also medical scientists and field attendants assisted in the sample collection.

Clinical Examination

Minimum of 100 volunteers individual in each villages were examined comprising children and adults both females and males. The age bracket considered was in accordance with age of persons eligible to take the drug ivermectin from 5 years and 62+. Parasitological examination was carried out by two techniques; skin snipping and microscopy (Ukaga and Nwoke 2007) on 960 volunteer's individuals.

The examination include palpation for mobile subcutaneous lumps on the skin of the individuals for identification for onchocercal nodules, or Onchocercal skin changes such as skin dermatitis, leopard skin, lizard skin, elephant skin, skin folds (hanging groin), musculo-skeletal pains and non-ocular complications of onchocerciasis manifestation. Each person was examined privately in a well illuminated place for clinical signs and symptoms of Onchocerciasis.

Blood free skin snips were taken from the volunteers using 5ml syringes and needles with scalpel blade. These involve the use of disposable materials like the use of sterile sharp blade and a sterile sharp needle held in a loop holder. A new loop holder and needle for one person alone. The needle is for lifting up the skin while a very small piece will be cut off with a sterile surgical scalpel. The skin snip is taken from the left and the right of the iliac crest. Each skin biopsy was placed in a microtiter plate (flat bottom containing 96 wells), containing some drops of normal saline and incubated for 12- 24hrs at room temperature. Microfilariae that emerged from each anatomical site were observed with the aid of a high powered microscope at 40x. A standard format was used to record the observation. All the records were entered into the individual clinical and parasitological form. Also any specimen that could not be examined after 24hrs was preserved by adding a drop of 10% formalin into each microtiter well.

Visual Screening

A gross examination of the eye was also conducted with a magnifying lens and pen touch by an optometrist who classified any ocular impairment in the anterior segment into itching, redness, anterior uveitis; punctuate opacity, sclerosing keratitis and blindness. The individuals were asked to stand at a distance of about six meters from the optometrist and were asked to read the alphabet on the smelly chart/board, to tell how many fingers were shown to them by the optometrist, alternating between one, two or three finger (Emukah et al, 2004). The individuals were allowed to use both eyes. Poor visions or visual impairment was

defined as three failures to properly indentify the correct number of finger and unable to read the alphabet on the chart shown by the optometrist.

Musculo-skeletal pain were noted and their associated with micro filarial load investigated. The criteria used to assign subjects as musculo-skeletal pains (MSP) patients included report of chronic backache, waste pain, muscle pain, chest pain, and hip pain (Pearson 1988, Nwoke 1992, Ukaga 1997).

3. RESULTS AND ANALYSIS

3. 1. Results of Baseline Rapid Assessments 1994/95 (REMO)

Table 1 shows the assessment of sampled villages 1994/95 based on WHO/APOC guideline using nodules prevalence. Out of the nine villages sampled six villages were classified as hyper endemic, that is villages with nodule prevalence rates greater than 39%, while three villages were classified as meso- endemic, that is villages with onchocercal nodule rates between 20-39%.

Table 1. Baseline Rapid Assessment Result 1994 (REMO).

S/No	Villages	No Sampled	Prev.% Nodules	Prev.% leopard skin	Endemicity Level
1	Aku	50	52	9	Hyper
2	Amano	50	55	19	Hyper
3	Amuro	50	46	17	Hyper
4	Ezeogii	50	54	30	Hyper
5	Ihube	50	52	9	Hyper
6	Umulolo	50	55	19	Hyper
7	Umudiaba	50	37	30	Meso
8	Amachara	50	37	30	Meso
9	Umuokpara	50	37	30	Meso

Table 2 shows the comparative analysis base on REMO 1995 and present analysis on nodules and LS in the sampled villages. Base on REMO 1995 in the nine sampled villages nodules prevalence was (47.2%) and LS (42.9%), compared with the present analysis/ studies in same villages, nodules prevalence was (14.3%) and LS (13.8%). This indicates reduction on nodules and leopard skin in the present analysis; however no village were classified as hyper or meso-endemic village base on WHO/APOC guideline using nodules prevalence.

Table 2. Comparative analysis base on REMO 1995 and present analysis on nodules and leopard skin.

	REMO 1995			Present analysis		
	No sampled	Nodules %	LS%	No sampled	Nodules %	LS %
Aku	50	52	9	100	13	9
Amano	50	55	19	100	14	14
Amuro	50	46	17	100	20	12
Ezeogii	50	54	30	100	15	13
Ihube	50	52	9	100	12	20
Umulolo	50	55	19	100	19	16
Umudiaba	50	37	30	120	17	17
Amachara	50	37	30	120	14	14
Umuokpara	50	37	30	120	13	17
Total	450	47.2	42.9	960	14.3	13.8

3. 2. Prevalence of the Different Manifestations of Onchocerciasis

Clinical Manifestations

Table 3 shows the common onchocercal symptoms of onchocerciasis observed during the clinical investigation by palpation of individuals in the sampled villages. Out of 960 individuals examined, 453 (47.2%) showed symptoms; 136(30%) had MSP, 76(17%) had poor vision, 70 (15%) had mobile nodules, 90 (20%) had leopard skin, 68 (15%) had lizard/elephant skin, 13(3%) had hanging groin. Village most infected with the symptoms were Umulolo with infection/symptoms rate of 63% followed by Amachara with infection/symptoms rate of 58.3%. The least infected village was Aku 32%, applying the test statistic at 0.05 level of significance, the identified symptoms among village members are significantly different.

Table 3. Clinical Manifestation of Onchocerciasis among village members.

S/No	Villages	No examined	MSP		POOR VISION		NODULES		LEOPARD SKIN		LIZARD SKIN		HANGING GROIN		No infected	%
			No.	%	No.	%	No.	%	No.	%	No.	%	No.	%		
1	Aku	100	15	47	3	9	4	13	7	22	3	9	0	0	32	32
2	Amano	100	16	44	5	14	5	14	5	14	5	14	0	0	36	36

3	Amuro	100	14	28	8	16	10	20	12	24	6	12	0	0	50	50
4	Ezeogii	100	16	34	10	21	7	15	8	17	6	13	0	0	47	47
5	Ihube	100	16	33	7	14	6	12	10	20	10	20	0	0	49	49
6	Umulolo	100	16	25	12	19	12	19	13	21	10	16	0	0	63	63
7	Umudiaba	120	15	25	10	17	10	17	10	17	10	17	5	8	60	50
8	Amachara	120	15	21	15	21	10	14	15	21	10	14	5	7	70	58.3
9	Umuokpara	120	13	28	6	13	6	13	10	22	8	17	3	7	46	38.3
	Total	960	136	30	76	17	70	15	90	20	68	15	13	3	453	47.2

Table 4 shows the onchocercal clinical features among age groups and gender during the period of examination. In all the sampled communities, males and females from age group 05 – 62+ were examined, the result shows that 136 (14%) had MSP, 76 (8%) had poor vision, 70 (7%) had nodules, 90 (9%) had leopard skin, 68 (7%) had lizard skin, 13 (1%) had hanging groin. At the age group 05 -15 there were no presence of onchocercal symptoms observed in both males and females, from age group 26 – above onchocercal clinical features were observed and the clinical features was peaked at age group 56 -62+.

Table 4. Onchocercal Clinical Features among age groups and gender.

Age Groups	SEX	No. Sampled	MSP	POOR VISION	NODULES	LEOPARD SKIN	LIZARD SKIN	HANGING GROIN
05-15	M	112	0(0%)	0(0)	0(0%)	0(0%)	0(0%)	0(0%)
	F	95	0(0%)	0(0)	0(0%)	0(0%)	0(0%)	0(0%)
16 – 25	M	32	0(0%)	1(3%)	0(0%)	0(0%)	0(0%)	0(0%)
	F	31	0(0%)	1(3%)	0(0%)	0(0%)	0(0%)	0(0%)

26 – 35	M	83	12 (14%)	7(8%)	5(6%)	11(13%)	5(6%)	0(0%)
	F	75	8(11%)	6(8%)	6(8%)	9(12%)	6(8%)	0(0%)
36 – 45	M	102	16 (16%)	11 (11%)	12 (12%)	11 (11%)	11 (11%)	1(1%)
	F	89	11 (12%)	8(9%)	8(9%)	11 (12%)	7(8%)	0(0%)
46 – 55	M	103	21 (20%)	11 (11%)	12 (12%)	13 (13%)	7(7%)	4(4%)
	F	87	18 (21%)	9(10%)	6(7%)	10 (11%)	10 (11%)	1(1%)
56 - 62+	M	79	23 (29%)	12 (15%)	11(14%)	13 (16%)	11 (14%)	5(6%)
	F	72	27 (38%)	10 (14%)	10 (14%)	10 (14%)	11 (15%)	2(3%)
All		960	136 (14%)	76 (8%)	70 (7%)	90 (9%)	68 (7%)	13 (1%)

Table 5 shows the overall prevalence of microfilaria in the sampled villages. In all the villages, 960 individuals were examined by skin snipping, 170(18%) were positive with microfilaria (mf) of *Onchocerca volvulus*, which varied in the different villages. The highest intensity was obtained in Umulolo 30(30%mf) and the least was in Umuokpara 10(8%).

Table 5. Overall prevalence of MF in sampled villages in Okigwe LGA, Imo State (n = 960)

S/No.		No Examined	No. mf +ve	% mf +ve
1	Aku	100	18	18
2	Amano	100	17	17

3	Amuro	100	23	23
4	Ezeogii	100	23	23
5	Ihube	100	19	19
6	Umulolo	100	30	30
7	Umudiaba	120	12	10
8	Amachara	120	18	15
9	Umuokpara	120	10	8
	Total	960	170	18

Skin mf

Table 6 shows the overall prevalence of mf infection in the sampled villages according to gender. The highest infection was obtained among male 94 (18.4%). In all the nine sampled villages, 511 males and 449 females were examined by skin snipping, 94 (18.4%) males were infected with mf, and 74 (16.9%) females were infected with microfilariae of *Onchocerca volvulus*. The highest infection was obtained among male 94 (18.4%). There was significant difference between the proportion of infected males (18.4%) and females (16.9%) $p>0.005$.

Table 6. Overall prevalence of mf in the sampled villages according to gender.

S/No.	Village	Sample		No. mf + ve		% mf + ve	
		M	F	M	F	M	F
1	Aku	51	49	11	7	21.6	14.3
2	Amano	64	36	11	6	17.2	16.7
3	Amuro	49	51	10	13	20.4	25.5
4	Ezeogii	49	51	13	10	26.5	19.6
5	Ihube	55	45	10	9	18.2	20.0
6	Umulolo	54	46	17	13	31.5	28.3
7	Umudiaba	66	54	9	3	13.6	5.6
8	Amachara	59	61	7	11	11.9	18.0
9	Umuokpara	64	56	6	4	9.4	7.1
	Total	511	449	94	76	18.4	16.9

The bar chart shows the overall prevalence of infected individuals with mf in the sampled villages by age and gender. In the villages, males and females from 05-62+ were examined by skin snipping, the result shows that in age group 05-15 males has more mf 8.0% than females 6.3%, age group 16-25 females has more mf 16.1% than males 12.5%, age group 26-35 females has more mf 25.3% than males 20.5%, age group 36-45 males has more mf 22.5% than females 18%, age group 46-55 males has more mf 17.5% than males 16.1% age group 56-62+ males has more mf 29.1% than females 22.2%. The result was also expressed in table 7 for a fast appreciation of the data (Fig. 1).

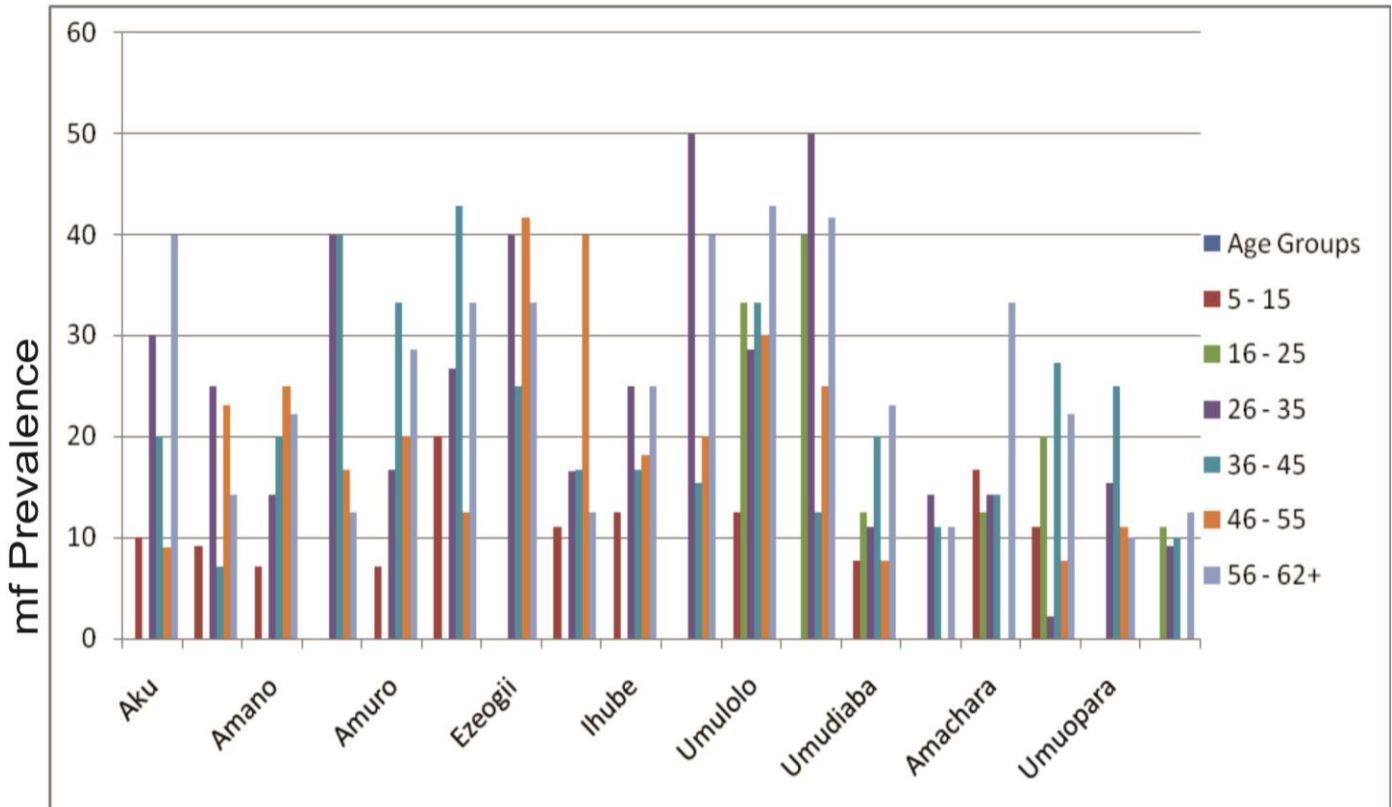


Fig. 1. Bar Chart showing the overall prevalence of infected individuals with mf in the sampled villages by age and gender

Table 8 shows Community Microfilaria Load in the sampled villages, after 13 years of ivermectin distribution, that the CMFL in most of the villages is below 0 except Amuro 1.32 and Umulolo 1.33, while the range mean is generally 0.90, which shows significantly low and base on onchosim model the disease boarding in most of the villages is low, this means that the probability of the black flies biting and transmitting the disease is very low.

Table 8. Community Microfilaria Load (CMFL) of 9 Villages in Okigwe LGA.

S/No	Village	Mf Count				Mf			Weight	CMFL	P-value
		N	L	R	Total	L	R	TOTAL			
1	Aku	100	9	4	13	8.1	6.1	14.2	0.92	P<0.001	
2	Amano	100	8	3	11	7.5	8	15.5	0.71	P<0.001	
3	Amuro	100	6	3	9	0.1	3.3	6.8	1.32	P<0.001	
4	Ezeogii	100	7	2	9	4	6	10	0.90	P<0.001	
5	Ihube	100	7	1	8	6	5.1	11.1	0.72	P<0.001	
6	Umulolo	100	5	3	8	4	2	6	1.33	P<0.001	
7	Amachara	120	0	0	0	1.2	0.1	1.3	0.00	P>0.05	
8	Umudiaba	120	0	0	0	0.8	0.7	1.5	0.00	P>0.05	
9	Umuokpara	120	0	0	0	0.5	0.6	1.1	0.00	P>0.05	
	TOTAL	960	42	16	58	32.2	31.9	64.1	0.90	P<0.001	

4. DISCUSSION

Assessing the Baseline Data and Impact of Ivermectin

The study area Okigwe is hyper endemic for onchocerciasis which is shown from the baseline information as outlined in table 1: APOC/WHO, REMO of 2003 classified these areas as in Red CDTI zone (Nwoke et al 1995, Emukah 2004).

The definitive diagnosis of onchocerciasis is by demonstration of mf in the skin snips. Because there was no base line mf prevalence, data in some of the villages studied were not possible to compare between mf prevalence in 1994/95 with mf in 2012. However from studies done in the past, in this area Okigwe LGA, there was reported decline in onchocerciasis prevalence following Ivermectin distribution (Dozie et al 2005, Nwoke 1995, Emukah 2004).

The prevalence of clinical signs of onchocerciasis was low in the studied communities compared with baseline information in 1994; this low prevalence is a good testimony of the impact of annual Ivermectin treatment in the studied villages and is similar to the findings of (Nwoke 1995, Dozie 2005, Emukah 2004).

Ivermectin treatment from the study has shown beneficial impact to individuals who are receiving the drug. The lower prevalence and intensity of infection obtained in the study when compared with pre-treatment with Ivermectin is attributed to on-going control activities in the

sampled villages with Ivermectin executed through the Community Directed Treatment with Ivermectin (CDTI) strategy.

The gender-related prevalence was high in males than in females, which is an indication of males been more exposed to the vectors of the disease either through involvement in some occupational activities or by living in close proximity to the breeding sites. Similar observations have been made in previous studies in the forest zone (Nwoke et al 1994, Abanobi et al, 1999) which showed higher infestation rates in males than females. In this study it was also observed that onchocercal mf prevalence increased with age, and this agrees with previous reports of (Anosike and Onwuliri (1995); Anosike et al (2001); Dozie and Nwoke (2002) that the prevalence and intensity of infection increased with advancing age and is due to a continues build up of infection acquired early in life.

However, there is presence of mobile nodules and MF among age group 5-15 indicating continued transmission of onchocerciasis which signifies failure of CDTI to control onchocerciasis. Information obtained from Carter Center (Global 2000) which is in charge of river blindness revealed that in Okigwe LGA, there has been continues onchocerciasis control programme for over 18years, and the disease is still prevalent. This is not an encouraging development.

In this study no case of blindness was recorded except poor vision. The respondents, who presented with poor vision, reported not able to see properly and some gave up their petty trading like sewing, weaving and hair plaiting due to visual impairment. According to (WHO,1976) visual impairment incapacitates a large segment of the community and make them an economic burden.

The prevalence of poor vision in this study was low 76(8%), this was as a result of ivermectin treatment in the study villages (Dozie 2005, Emukah 2004).

Informal discussion with the adult males and females in the sampled community reveal that the respondents affected by the troublesome itching experienced general fatigue and distraction at work and consequently result to low productivity; while those in school, their education suffered due to distraction in class caused by constant itching.

5. CONCLUSION

Human Onchocerciasis is one of the Neglected Tropical Diseases (NTD) which has been one of the major challenges facing Nigeria and other developing countries. The launching of WHO, African Programme for Onchocerciasis Control (APOC) in 1995 and the establishment of self-sustaining Community Directed Treatment with ivermectin (CDTI) in Nigeria and most other endemic African countries has shown that treatment with ivermectin has a significant impact on the microfilarial load of *Onchocerca volvulus*. In conclusion therefore treatment with ivermectin has a significant impact on the microfilarial load of ivermectin after more than 15 years shows there is hope that there will be total elimination of Onchocerciasis in the study area because many villages are having zero prevalence.

Recommendations

This study has confirmed the existence of clinical manifestation of onchocerciasis in some part of Okigwe LGA of Imo State Nigeria. There is need for effective control and

elimination of onchocerciasis to a level that is no longer a public health problem. Therefore the following recommendations were made:

- That Okigwe LGA and Imo state in general should immediately increase the no of CDDs working in each village and possibly select them using the kindred system.
- That Okigwe LGA should embark on extensive community mobilization, awareness and health education to ensure effective CDTI.
- The Okigwe LGA onchocerciasis control coordinator should ensure that the freely donated Ivermectin is delivered to the endemic villages

References

- [1] Chavasse D.C., Post R.J. Lemoh P.A., Whitworth J.A.G, (1992). The effect of repeated doses of ivermectin on adult female *Onchocerca volvulus* in Sierra Leone. *Trop. Med. Parasit.* 43: 256-262.
- [2] Crosskey R.W., Crosskey M.E., (1959). A quantitative survey of Onchocerciasis in persons under twenty years of age in an endemic area in Northern Nigeria. *Ann. Trop. Med. Parasit.* 53: 10-24.
- [3] Cupp E.W. Bernardo M.J., et al. (1995). The effects of ivermectin on Transmission of *Onchocerca volvulus* science No 3: 13-5.
- [4] Duke B.O., Zea-Flores G., Castro J., Cupp E.W., Munoz B., (1992). Effects of three month doses of ivermectin on adult *Onchocerciasis volvulus*. *Ann. J. Trop. Med. Hyg.* 46(2): 189-194.
- [5] Duke B.O.L, Zea-Flores G., Castro J., Cupp E.W., Munoz B., (1990). Effects of Multiple monthly doses of ivermectin on adult *Onchocerca volvulus*. *Ann. J. Trop. Med. Hyg.* 43(6): 90-142.
- [6] Emukah. E. et al; (2004). A longitudinal study of impact of repeated mass Ivermectin treatment on clinical manifestations of Onchocerciasis in Imo State, Nigeria: *Annl. J. Trop. Med. Hyg.* 70(5): 556-561.
- [7] Epidemiology of human Onchocerciasis on the Jos Plateau Nigeria II season relatives' abundance and ineffective biting pattern of *Simulium damnosum* complex *Nigerian Journal of parasitology*, 7(1) (1986).
- [8] Fuglsang, H. (1983). "Leopard skin" and Onchocerciasis. *Trans. of Roy. Soc. Trop. Med. Hyg.* 77: 881.
- [9] Goa K.L. Mc Tavish D. Clissold S.P. (1991). Ivermectin-A review of its antifilarial activity, pharmacokinetic properties and clinical efficacy in onchocerciasis. *Drugs. grading system of the cutaneous changes in onchocerciasis. British Journal of Dermatology* 129: 250-269.
- [10] Habbaema J.D.F. (1995). Irreversible effects of ivermectin on adult parasites in Onchocerciasis patients in the Onchocerciasis control programme in West Africa. *J. Inf. Dis* 172: 204-210.

- [11] J. D. Smith; *Animal Parasitology* 3rd edition (1976) pg. 423-436. Merck Sharp Dohme and Co. Inc. USA: Hope for patients suffering from Onchocerciasis a vision for Tomorrow MSD 1991.
- [12] Merck Sharp Dohme and Co. INC. USA: STROMECTION, (Ivermectin) MSD 1996.
- [13] Murdoch M.E., Hay R.J. Mackenzie C.D.A, (1993): Clinical Classification and
- [14] Nwoke B.E.B (1992). Musculo-skeletal pain (MSP) in Onchocerciasis. A potential in the rapid low cost epidemiological survey and in the assessment impact of mectizan treatment in a community, *angewante parasitol.* (Germany) 33: 133-138.
- [15] Nwoke B.E.B, (1994). Rapid Epidemiology Mapping of Onchocerciasis (REMO) in South-eastern Zone of NOCP Nigeria. *Technical Report National Onchocerciasis control Programme (NOCP) Federal Ministry of Health, Lagos Nigeria, P.122.*
- [16] Nwoke, B.E.B. and Dozie, I.N.S (2001). Operational Research and its success in Onchocerciasis control in Nigeria. *The Nig Journal of parasitology*, 22 (1&2): 3-10.
- [17] Nwoke, BEB Onwuliri, COE and Iwuala, MOE (1986a). Studies on the field
- [18] Plaisier A.P., Alley, E.S, Boatin B.A., Van Oartmarssen ,Remme H., De Vlas S.J., Bonneux, L., (1995). Irreversible effects of ivermectin on adult parasites in onchocerciasis patients in the onchocerciasis control programme in West Africa. *J. Inf. Dis.* 172: 204-10.
- [19] Schulz-key H. (1988). The collagenase technique; how to isolate and examine adult onchocerca volvulus for the evaluation of drug effects. *Trop Med. Parasit.* 39: 423-440.
- [20] Taylor H.R. Semba, R.D, Newland H.S. (1987). Ivermectin Treatment of patient with severe ocular Onchocerciasis. *AM. J. Trop. Med. Hyg.* 1987: 494-500.
- [21] Taylor H.R., Pacque M., Munoz B. Green B.M., (1990). Impact of mass treatment of Onchocerciasis with ivermectin on the transmission of infection. *Sci.* 250: 116-118.
- [22] Ukaga C.N. Onchocerciasis Musculo Skeletal pains in women. *Africa Health* March 1997, Vol. 19 No. 3: 16. WHO publication. 126 p.
- [23] World Health Organization (1976). Epidemiology of onchocerciasis. Report of WHO expert committee. Technical Report series: 542.
- [24] World Health Organization (1989). Report of a meeting of the TDR/OCP/OCTsubcommittee for monitoring of community trials of ivermectin. Geneva: WHO, Publication no. TDR/OCP/ OCT/ IVERMECTIN/89.3.
- [25] World Health Organization (1990). Drugs used in parasitic diseases. Geneva:

(Received 28 July 2016; accepted 16 August 2016)