

## SOCIO-ECONOMIC IMPACT OF ONCHOCERCIASIS WITH PARTICULAR REFERENCE TO FEMALES AND CHILDREN: A REVIEW

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### ABSTRACT

*The socio-economic impact of onchocerciasis (river blindness) on humans is reviewed with special reference to females and children. The results of many studies reveal that onchocerciasis is usually a serious threat to public health and an impediment to socio-economic development in areas with high intensity and high endemicity of the disease. In such places, blindness and serious visual impairment are common, and mortality among the blind may be four times as high as among non-blind persons of the same age in the same community. As a result of debilitation and blindness, the infected person is unable to maintain for long any type of productive activity. Inhabitants of fertile river valleys move to the less fertile upland country. Many young men migrate to urban areas, reducing the productivity of the community and disrupting family life. Employees classified as having a severe Onchocercal Skin Disease (OSD) earned 15 % less in daily wages than those not infected. People with Onchocercal Skin Disease are stigmatized in their communities. OSD limits the range of social involvement and can affect sexual life of affected individuals. With reference to women and children, young females with OSD suffer stigmatization more than young men. This affects their age of marriage and the kind of partners they marry, limiting them to already married men, divorced men, elderly men, childless men, etc. Severe itching that often accompanies OSD may reduce the period lactating mothers breastfeed their babies. Children, particularly females, from households headed by individuals with onchocerciasis, especially blindness and OSD are more at risk of being school dropouts. Academic performance of school children with visual impairment is adversely affected. To reduce these effects, there is need for intense public enlightenment to augment the efforts of World Health Organization (WHO) in combating the disease using mass treatment with ivermectin (Mectizan).*

**Keywords:** Onchocerciasis, Onchocercal skin disease, Stigmatization, Visual impairment

### INTRODUCTION

Onchocerciasis is a parasitic disease caused by infection with the filarial nematode, *Onchocerca volvulus*. The adult worms (macrofilariae) lodge in palpable nodules under the skin of infected humans, although they can also be found free in subcutaneous tissue (Nnochiri, 1964; Samba, 1994). The microfilariae are found in the intercellular fluid, including that of the eye, and their death and subsequent disintegration result in inflammatory reactions. If microfilarial load is high following a prolonged period of exposure to massive infection, this may lead to serious visual impairment including blindness. In addition, the microfilariae give rise to intensely itching rashes, to wrinkling, thickening and depigmentation of the skin, to lymphadenitis resulting in hanging groins and elephantiasis of the genitals and to general debilitation, including loss of weight (Samba, 1994).

Onchocerciasis is transmitted by different species of *Simulium* (blackfly) in different parts of the world where the disease is endemic. In West Africa, the disease is transmitted by *Simulium damnosum* complex, which is made up of about 26 cytospecies some of which are *S. damnosum s. s.*, *S. sirbanum* found in Sudan and Guinea savannas, *S. squamosum* and *S. sanctipauli* in the forest zone (Dunbar and Vajime, 1972; Dunbar, 1976). These flies breed mainly in fast flowing streams and rivers. Species of *Simulium neavei* complex are the main vectors of

onchocerciasis in East and Central Africa and include *S. neavei s.s.*, *S. woodi*, *S. nyalalandicum*, *S. hightoni*, *S. goinyi* and *S. ovazzae*. These flies breed mainly in rivers and streams in highland areas of East and Central Africa and live in obligate phoresy with freshwater crabs of the genus *Potomonautes*, prawns of the families Atyidae and Palaemonidae and nymphs of mayflies (Crosskey, 1990). In Central and South America, the main vector is *Simulium ochraceum*. Others include *S. simplicicolor*, *S. metallicum*, *S. callidum*, *S. sanguineum* and *S. guianense* (Lacey and Charlwood, 1980).

Onchocerciasis is a disease of the warm tropical environment in which the flies that carry it live under conditions favourable for their development all year round (Crosskey, 1990). In Africa, the disease has been described as a disease of the future because as the development of the hinterlands proceed, particularly as dams and water projects increase, it will cease to be a disease affecting only small, isolated, poverty stricken and primitive communities in the bush and will become more and more a threat to sophisticated development personnel and other such workers (Duke, 1972).

The disease is endemic in much of tropical Africa and parts of Central and South America and Yemen. Almost all (96%) of the estimated 122.9 million at risk of the disease globally live in sub-Saharan Africa and 17.5 million of the estimated 17.7 million who are infected live in Africa (WHO, 1995a; Gemade *et al.*, 1998). The worst affected area is the

savanna zone of West Africa especially in the Volta River basin comprising parts of Benin, Ghana, Mali, Niger and Togo and the whole of Burkina Faso, where there may be up to 15% blindness rate in some endemic villages. At least 70,000 people are blind in these areas (WHO, 1980; Nwoke, 1990).

In Nigeria, onchocerciasis is widespread and a cause of blindness in most rural communities. Of all the countries of the world, Nigeria has the greatest number of persons with onchocerciasis (Edungbola, 1991). Visual impairment due to onchocercal eye disease can be demonstrated in about 30% of children aged 5 years who live in hyper-endemic communities in Nigeria; 35% of males and 27% of females in such communities are visually impaired at the age of 30 years (Gemade and Utsalo, 1990; Gemade *et al.*, 1998). The number of Nigerians living in high-risk areas (demarcated by river systems with villages that had  $\geq 19\%$  prevalence) and who therefore require urgent Mectizan treatment was estimated at about 13 million (Gemade *et al.*, 1998).

Blindness and impaired vision are the most dangerous disabilities associated with the disease and are seen more among endemic communities living around the foci of transmission. Onchocercal blindness is more common in the savanna bio-climatic zone than in the rain forest zone with sclerosing keratitis standing out as the ocular lesion with the highest prevalence. Males are more affected than their female counterparts, with sex differentials observed to be most marked in the savanna (Nwoke and Ikonne, 1993).

Onchocerciasis is often associated with changes in the skin. Itching and scratching are the most important early manifestations of onchocercal dermatitis and may affect any part of the body. Alteration in skin pigmentation also occurs early in the disease and may affect any part of the body. Papular rash may develop at any time on any part of the body and is usually associated with severe itching, which leads to scratching, bleeding and ulceration with secondary infection. Sowda is a severe form of onchocercal dermatitis first described in Yemen. Those affected have intensely itchy, dark and thickened skin, with papular rash and enlarged, soft, non-tender, regional lymph nodes. Sowda is usually localized and typically involves one leg but more generalized form may involve both legs or any part of the body. Other forms of onchocercal dermatitis are known as lizard skin and leopard skin. In long-standing onchocercal dermatitis, the skin generally becomes atrophic, fragile, wrinkled and inelastic and areas of it, often the shins, develop the classical spotting depigmentation of leopard skin (Hagan, 1998).

Presence of palpable nodules is another evidence of onchocerciasis in a person. Nodules tend to be more numerous and widely distributed in the rainforest than in the savanna but numbers of microfilariae in the skin are higher in the savanna. Skin depigmentation, lymphadenopathy and hanging groin are more frequent in the rainforest than in the

savanna but severe skin atrophy is more common in the savanna (Anderson *et al.*, 1974; Hagan, 1998).

The classical method of determining the prevalence and intensity of onchocerciasis is by the demonstration and counting of microfilariae in biopsies obtained by skin snipping. Although very specific, this technique is inadequate for detecting early, light or prepatent infections and is becoming increasingly unacceptable to the populations investigated due to different reasons, one of which is the awareness of the potential risk of secondary infections especially with HIV (Boatin *et al.*, 1998).

The future challenges for diagnostics in onchocerciasis lie in developing an optimal test, which is highly sensitive, highly specific, easy to carry out, cheap and acceptable to the populations studied. In the present era of widespread use of Mectizan, such a test should be capable of predicting the return of microfilariae in treated individuals. Serological test 0-150 PCR and DEC patch test appear to have prospects of meeting most of these challenges (Boatin *et al.*, 1998).

In view of the limitations of skin snip method and immunodiagnosis, there has been a search for an alternative rapid assessment method. Edungbola *et al.*, (1993) reported that the rate of leopard skin (LS) and palpable nodules showed significant variation with the microfilarial rates. The prevalence rates of these clinical features increase with increase in the community microfilarial rate.

The Rapid Assessment Method (RAM), based on nodule palpation and leopard skin, is a standardized epidemiological procedure with proven reliability. The RAM is simple, rapid, non-invasive, cheap, applicable and practicable over a wide range of ecological conditions, reliable regardless of the severity and duration of the infection, non-technical, acceptable to villagers, with absence of risk of other infections, and good for impact monitoring and evaluation. It is useful in preliminary screening for detailed prospecting of onchocerciasis endemicity (Edungbola *et al.*, 1993; Withworth and Gemade, 1999).

Control of onchocerciasis involves the control of the vector by means of insecticides used against *Simulium* larvae in the watercourses where they breed, and use of drug against the parasite in man. The drug of choice for treatment of onchocerciasis is ivermectin (Mectizan), which is effective against microfilariae and drastically reduces the microfilarial loads and the risk of developing ocular lesion (Awadzi *et al.*, 1989; Remme *et al.*, 1989) and Onchocercal Skin Disease (Brieger *et al.*, 1998). In West Africa, the World Health Organization's Onchocerciasis Control Programme (OCP) has been so successful in reducing the prevalence of onchocercal blindness in the savanna areas within its region of operation that this condition is no longer of public health significance in such areas (WHO, 1991).

Onchocerciasis is a widespread filarial disease that produces grave socio-economic consequences. The disease affects the productivity, social and sexual lives of sufferers due to blindness

and other debilitating effects (Nwoke, 1990). WHO (1980) reported that onchocerciasis is a major cause of blindness in parts of Africa and is a serious obstacle to socio-economic development.

According to Kale (1998), the greatest burdens related to human onchocerciasis are the result of the eye and skin lesions and severe itching produced by the microfilariae. He also said that the skin lesions are a major socio-economic burden in terms of disability-adjusted life-years (DALY).

The present paper reviews the effects of onchocerciasis on different aspects of socio-economic lives of those suffering from the disease with particular reference to effects on females and children. This will give a general picture of the severity of the socio-economic consequences of onchocerciasis. It will also form baseline information that will help those involved in the fight against onchocerciasis to have a better focus and a greater determination.

## MATERIALS AND METHODS

A comprehensive search was made from the Internet, various journal articles and textbooks of reports on the socio-economic effects of onchocerciasis in various parts of the world. Such articles were assembled and studied.

## RESULTS

**Symptoms of Onchocerciasis Related to Socio-Economic Effects:** From the materials reviewed, many symptoms of onchocerciasis relating to the socio-economic consequences of the disease were highlighted by the various authors. Some of these symptoms are given in Table 1.

Using WHO 1995b report on the importance of Onchocercal Skin Disease (which is a multi-centre study carried out in 8 centres in 5 countries of Africa: Nigeria, Cameroon, Ghana, Tanzania and Uganda), among the reported symptoms, itching was rated as the most troubling symptom by persons affected by Reactive Onchocercal Skin Disease and Depigmentation, both of which constitute Onchocercal Skin Disease. This is shown in Tables 2 and 3a.

The non-affected also rated itching as the most troubling symptom of Onchocercal Skin Disease followed by appearance as shown in Table 3b.

**Some Psychosocial Effects of Onchocerciasis on Infected Persons:** Some psychological and social effects of onchocerciasis on infected persons are given in Table 4.

**Economic Effects of Onchocerciasis:** Onchocerciasis has been shown to have serious economic consequences. Some of the economic effects are shown in Table 5.

**Specific Socio-economic Effects of Onchocerciasis on Females and Children:** Some of the socio-economic effects of onchocerciasis are

particularly cruel against children and females. Table 6 shows these effects.

In considering the overall marital status in relation to onchocercal infection, Ukpai and Ezeji, (2003), reported that among a population of examined females in Okigwe, Imo State, singles that were up to marriageable age had the highest percentage of infection indicating that such girls are avoided by males thus reducing their marriage prospects. This is shown in Table 7.

## DISCUSSION

**Symptoms related to Psychosocial Effects of Onchocerciasis:** Various symptoms of onchocerciasis were reported to lead to psychosocial and economic consequences in infected persons. Some of these symptoms include itching, Onchocercal Skin Disease, palpable nodules, insomnia, fatigue, Musculo-Skeletal pain, headache, visual impairment and blindness, hanging groins and elephantiasis of the genitals among others. Among all these, itching was reported to be the most troublesome symptom with the most profound socio-economic consequences. Appearance (OSD) was also rated very high. Visual impairment and blindness are particularly important in affecting farming (Workneh *et al.*, 1993; Kim *et al.*, 1997, Ubachukwu and Anya, 2001) and academic performance (Ubachukwu and Anya, 2003).

**Socio-economic Effects of Onchocerciasis:** The socio-economic liabilities as a result of onchocerciasis are enormous. The blackfly vectors of *Onchocerca volvulus* are a serious nuisance in the endemic communities because of the resultant skin lesions from their bites. Susceptible persons may be uncomfortable for weeks with an almost unbearable pruritus and scratching. In many individuals, this persists throughout the whole course of the infection. Sometimes, the itching and scratching may be so severe as to cause insomnia (Nwoke *et al.*, 1987).

The various skin changes associated with onchocerciasis such as rashes, hypopigmentation and scaling, oedema and depigmentation have distressing effects on the lifestyle of the infected individuals (Nwoke, 1986; Nwoke *et al.*, 1987), sometimes constituting destitutes (Nwoke, 1990). The presence of hanging groin and elephantiasis of the genitalia commonly seen in adult males and genital distortion seen in females nearly always results in the infected individual's unwillingness towards a free interaction within his or her locality. In infected individuals with the pendulous sacs, sexual life is greatly affected if not completely hindered (Nwoke, 1986; 1990; Nwoke *et al.*, 1987).

A study on perception and social implication of onchocerciasis in Edo State, Nigeria, showed that attitude of non-affected towards the affected is partially discriminatory and suspicious. The affected are socially withdrawn due to frustration of their health condition (Wagbatsoma and Okojie, 2004). Similar results have also been obtained in other parts of the country (e. g. Amazigo and Obikeze, 1991; Ubachukwu, 2001a and b).

**Table 1: Symptoms of onchocerciasis related to socio-economic effects**

Symptom	Study Area	Reference
Itching	Jos, Nigeria	Nwoke, 1986; Nwoke <i>et al.</i> , 1987;
	Nigeria, Cameroon, Ghana, Tanzania and Uganda	WHO, 1995; Hagan, 1998
	Ethiopia	Kim <i>et al.</i> , 1997
	Enugu State, Nigeria	Ubachukwu, 2001a; 2001b
	Anambra State, Nigeria	Eneanya and Nwaorgu, 2001; Ukpai and Ezeji, 2003
Onchocercal Skin Disease (OSD)	Jos, Nigeria	Nwoke, 1986; Nwoke <i>et al.</i> , 1987;
	Nigeria, Cameroon, Ghana, Tanzania and Uganda	WHO, 1995; Hagan, 1998
	Enugu State, Nigeria	Ubachukwu, 2001b
	Anambra State, Nigeria	Eneanya and Nwaorgu, 2001; Ukpai and Ezeji, 2003
	Imo State, Nigeria	Ukpai and Ezeji, 2003
Palpable nodules	Jos, Nigeria	Nwoke, 1986; Nwoke <i>et al.</i> , 1987;
	Nigeria, Cameroon, Ghana, Tanzania, and Uganda	WHO, 1995; Hagan, 1998
	Enugu State, Nigeria	Ubachukwu and Anya, 2001
	Anambra State, Nigeria	Eneanya and Nwaorgu, 2001; Ukpai and Ezeji, 2003
	Imo State, Nigeria	Ukpai and Ezeji, 2003
Insomnia	Review work	Nwoke, 1990
	Nig., Cam., Ghana, Tanzania and Uganda	WHO, 1995; Hagan, 1998
	Africa	APOC, 2006
Fatigue	Nig., Cam., Ghana, Tanzania and Uganda	WHO, 1995; Hagan, 1998
Musculo- Skeletal Pain	Imo State, Nigeria	Ukpai and Ezeji, 2003
Headache	Anambra State, Nigeria	Eneanya and Nwaorgu, 2001
Visual impairment and blindness	Review work	Nwoke, 1990
	OCP area of West Africa	Samba, 1994
	Ethiopia	Kim <i>et al.</i> , 1997
	Enugu State, Nigeria	Ubachukwu and Anya 2003
	Africa	APOC, 2006
Hanging groins and elephantiasis of the genitals	Jos, Nigeria	Nwoke, 1986; Nwoke <i>et al.</i> , 1987
	Review work	Nwoke, 1990
	OCP area of West Africa	Samba, 1994.
Reduced fertility/ Complete infertility	West Africa	Okungu, 2000

**Table 2: Frequency of symptoms rated most troubling by persons affected by Reactive Skin Disease (%)**

Symptom	Awka N=60	Calabar N=53	Cameroon N=55	Enugu N=33	Ghana N=65	Ibadan N=17	Tanzania N=37	Uganda N=83
Itching	80.0	71.7	65.5	40.6	53.8	64.7	48.6	45.8
Appearance	11.7	9.4	12.7	3.1	16.9	17.6	5.4	9.6
Insomnia	0.0	1.9	7.5	0.0	3.1	0.0	0.0	0.0
Backache	0.0	0.0	1.8	6.3	0.0	5.9	33.3	6.0
Joint Pain	3.3	3.8	3.6	12.5	1.5	0.0	5.4	2.4
Fatigue	0.0	5.7	0.0	0.0	1.5	0.0	2.7	1.2
Headache	0.0	1.9	0.0	0.0	3.1	0.0	0.0	2.4
Others	5.0	5.7	5.5	31.3	16.9	11.8	24.3	31.3

(After WHO, 1995b)

**Table 3a: Frequency of symptoms rated most troubling by persons affected by Depigmentation (%)**

Symptom	Awka N=40	Calabar N=33	Cameroon N=42	Enugu N=31	Ghana N=28	Ibadan N=49	Tanzania N=15	Uganda N=15
Itching	45.0	51.5	57.1	12.9	46.4	36.7	33.3	40.0
Appearance	2.5	9.1	4.8	0.0	25.0	14.3	6.7	0.0
Insomnia	2.5	0.0	2.4	0.0	0.0	0.0	0.0	0.0
Backache	0.0	9.1	0.0	12.9	0.0	24.5	13.3	6.7
Joint Pain	30.0	15.2	4.8	25.8	0.0	4.1	6.7	20.0

Fatigue	0.0	3.0	7.1	0.0	0.0	2.0	6.7	0.0
Headache	0.0	0.0	4.8	6.5	0.0	2.0	13.3	0.0
Others	20.0	6.1	16.7	38.7	7.1	16.3	13.3	33.3

(After WHO, 1995b)

**Table 3b: Most troubling symptom according to non-affected (% of respondents)**

Symptom	Reactive Skin		Depigmentation	
	Male	Female	Male	Female
Itching	50.7	53.2	33.0	37.2
Appearance	24.0	25.4	32.1	24.0
Can't say	6.0	8.1	12.8	20.9

(After WHO, 1995b)

**Table 4: Psychological Effects of Onchocerciasis**

Effect	Study Area	Reference
Low effect of self esteem	Nigeria, Cameroon, Ghana, Tanzania and Uganda Anambra State, Nigeria	WHO, 1995; Hagan, 1998 Eneanya and Nwaorgu, 2001
Stigmatization of infected persons and their families	Ette, Enugu State, Nigeria Nigeria, Cameroon, Ghana, Tanzania and Uganda Anambra State, Nigeria Enugu State, Nigeria Imo State, Nigeria Edo State, Nigeria Africa	Amazigo and Obikeze, 1991 WHO, 1995; Hagan, 1998 Eneanya and Nwaorgu, 2001 Ubachukwu, 2001a and b Ukpai and Ezeji, 2003 Wagbatsoma and Okojie, 2004 APOC, 2006
Dampens marriage prospects	West Africa Anambra State, Nigeria Enugu State, Nigeria Imo State, Nigeria Africa	Okungu, 2000 Eneanya and Nwaorgu, 2001 Ubachukwu, 2001a and b Ukpai and Ezeji, 2003 APOC, 2006
Hinders breastfeeding	Review paper Anambra State, Nigeria	Amazigo, 1994 Eneanya and Nwaorgu, 2001

**Table 5: Economic effects of onchocerciasis**

Effects	Nature of Effects	Study Area	Reference
Effects on productivity	Itching, musculo-skeletal pain and severe fatigue interfere with productive ventures e.g. a. Farm work b. Academic performance	Nig, Cam, Ghana, Tanzania and Uganda Nig, Ethiopia, Sudan Ethiopia Ethiopia Review work Enugu state, Nig, Enugu state, Nig,	WHO, 1995, WHO, 1997, Workneh <i>et al.</i> , 1993, Kim <i>et al.</i> , 1997 Benton, 1998 Ubachukwu and Anya, 2001 Ubachukwu and Anya, 2003
Effects on education	Children especially females of infected parents drop from school	Nig, Ethiopia, Sudan Review work	WHO, 1997 Benton, 1998
Direct costs	More money spent on health issues	Nig, Ethiopia, Sudan Review work	WHO, 1997 Benton, 1998
Indirect costs	More time spent on seeking health-care and less time spent on household activities	Nig, Ethiopia, Sudan Review work	WHO, 1997 Benton, 1998
Reduced labour supply	Through death Thru blindness Reduced efficiency Loss of potential working days	Review work Review work Review work Review work	Nwoke, 1990 Nwoke, 1990 Nwoke, 1990 Nwoke, 1990
Depopulation	Emigration leading to depopulation of infected areas and over population of less fertile uninfected areas disruption of family life.	Review work Review work Review work Review work Hawal valley, Nigeria	Hamon and Kartman 1973 Vajime, 1982 Nwoke, 1990 Kale, 1998 Bradley, 1976
Demographic	Uneven distribution	Hawal valley, Nigeria	Bradley, 1976

imbalance	of the population by age and sex	Review work	Vajime, 1982
Hinder effective sully of land	Fertile lands are abandoned	Review work	Nwoke, 1990

**Table 6: Socio-economic effects of onchocerciasis on children and females**

Effects	Study Area	Reference
Children, especially girls, drop out of school to care for the blind.	Nigeria, Ethiopia and Sudan Review work	WHO, 1997 Benton, 1998.
Academic performance of children is hindered	Enugu State, Nigeria Africa	Ubachukwu and Anya 2003 APOC, 2006.
Social discrimination against adolescent girls with rashes diminishing their marriage prospects	Nigeria, Cameroon, Ghana, Tanzania and Uganda Ette, Enugu State Review paper West Africa Enugu State, Nigeria Imo State, Nigeria Africa	WHO, 1995, Hagan, 1998 Amazigo and Obikeze, 1991 Amazigo, 1994 Okungu, 2000 Ubachukwu, 2001a, 2001b Ukpai and Ezeji, 2003 APOC, 2006
Hinders stability of marriage Social discrimination against families of girls with rashes	West Africa Ette, Enugu State Nigeria, Cameroon, Ghana, Tanzania and Uganda	Okungu, 2000 Amazigo and Obikeze, 1991 WHO, 1995; Hagan, 1998
Reduces duration of breastfeeding	Review work	Amazigo, 1994

**Table 7: Overall marital status related infection**

Marital Status	No. examined	No. infected	% of infection
Not up to the age of marriage	22	9	40.90
Single but up to marriageable age	120	73	60.83
Married	110	54	49.10
Separated	44	17	38.60
Divorced	43	12	27.90
Widowed	61	42	60.80

(After Ukpai and Ezeji, 2003)

Onchocercal Skin Disease can have major adverse psychological and socio-economic effects (WHO, 1995b; Murdoch *et al.*, 2002). Results from a multi-country study by the Pan-African Group on Onchocercal Skin Disease (WHO, 1995b) showed that OSD limits the range of social involvement of affected persons. Affected individuals reported that manifestation of onchocerciasis impair their ability to work and interact socially, and also affect other facets of their lives resulting in loss of sleep, inadequate sexual performance, weakness, worry, pains and embarrassment. Affected individuals feel ashamed of themselves, worry a lot over their skin condition, fear that the disease might kill them and experience low morale.

While society feels sorry for and pities those who suffer from the skin condition, they also avoid, despise and make fun of them. Affected people are stereotyped as weak, emotionally dull and cold and as unable to perform their duties, let alone, feed themselves. They are considered dangerous and dirty, are avoided for fear that they might pass on their disease to others. People would not elect them to positions of leadership. Oncho-affected individuals have poor self-image, suffer lack of confidence and are not willing to accept positions of leadership,

thinking they might embarrass the people they would represent (WHO, 1995b).

Onchocerciasis rarely leads to death but when it does, it cuts off the individual's supply of labour years in the future. As a result of debilitation and blindness, the infected person is unable to maintain for long any type of productive activity. Because onchocercal blindness is mostly found among the working age groups, such permanent disability withdraws the affected individual's supply of labour years requiring vision (Nwoke, 1990). The blind people are usually poverty-stricken and have a lower life expectancy than normal people (Vajime, 1982). Mortality among the blind may be four times as high as among non-blind persons of the same age in the same community (Samba, 1994). Blindness in 20 % of the adult males reduces farming capacity below survival level (Hamon and Kartman, 1973).

Nwoke (1990) reported that onchocerciasis affects the effective supply of labour in three ways:

- i) as a cause of death, it removes the individual's supply of labour years in the future
- ii) as a result of permanent disability through blindness and serious visual impairment, onchocerciasis withdraws

- the individual's supply of labour years to activities requiring vision and
- iii) partial visual impairment and/or non-disabling manifestation may also reduce the efficiency of labour days worked. Also as a result of so many people suffering from onchocercal blindness, there is loss of a huge number of potential working days.

Kim *et al.* (1997) reported that the human toll of the disease is devastating due to high numbers of blind people and constant itching which affects productivity. Infected persons have difficulty attending to their jobs. Infected persons with OSD were reported to be 15% less productive than those not infected. This was because they earned 15% less in daily wages than those not infected. Workneh *et al.* (1993) and WHO (1995b) also reported that non-ocular onchocerciasis has a negative impact on work productivity.

According to Ubachukwu and Anya (2001), the most disturbing aspects of onchocerciasis are impaired vision and blindness. Blindness hinders a person permanently from agricultural activities and makes such a person an economic liability. Blindness leads to loss of income for the family because most of the time, the blind person is the breadwinner of the family. In addition, the blind becomes a socio-economic burden to the other members of the family, as he/she needs to be cared for instead of caring for others. Serious visual impairment, on the other hand, does not lead to complete disability (morbidity) from farm work as blindness but reduces the working efficiency of such a person (Ubachukwu, 2001a; Ubachukwu and Anya, 2001). In addition, they reported that the presence of a large number of nodules, especially around the hip, to a large extent, hinders the farmer from farm work. Nwoke (1986) and Nwoke *et al.* (1987) also reported that the itching and rashes associated with onchocerciasis cause serious scratching, which can be so severe as cause loss of sleep and even necessitate complete absenteeism from work.

Onchocerciasis, therefore, leads to both morbidity and debility resulting in complete loss of productive years and reduction in labour input (work time) and labour output or efficiency (amount of work per unit time) respectively. The bites of *Simulium* in the farms also reduce the time a farmer effectively puts into farm work (Ubachukwu and Anya, 2001).

The skin lesions of onchocerciasis have recently been shown to be a major socio-economic burden in terms of disability-adjusted life-years (DALY) (Kale, 1998). Computation of disability-adjusted life-years lost because of onchocerciasis shows that the total burden of human onchocerciasis in Africa is about 884,000 DALY lost annually. The estimate of DALY lost per year because of itching is greater than that lost from ocular manifestations of the disease. DALY is computed as the sum of years of life lost because of early mortality and years lived with disability because of a given disease (Benton, 1998).

There are reports that low population densities and desertion of many fertile river valleys in the savanna zone of West Africa are mainly due to onchocerciasis (Budden, 1956; Bradley, 1976, Nwoke, 1990). These reports were also supported by Hamon and Kartman (1973) who reported that fertile lands become deserted while less fertile uplands become overcrowded. Highlighting this observation, Kale (1998) reported that although the major manifestations of the disease show geographical variation, they are often sufficiently severe to prevent human use of the often very fertile land close to the rivers in which the vectors breed.

Serious economic and social setbacks result from distorted distribution of population due to depopulation. If emigration is not checked, onchocerciasis free lands can become increasingly overused and possibly ruined beyond recovery. Demographic imbalance also results, marked by uneven distribution of the population by age and sex because men afflicted by onchocercal blindness desert the villages while women and children stay back. This jeopardizes family life and the division of labour (Bradley, 1976). Emigrants impose demands upon other territories that are often agriculturally less fertile, consequently resulting in constant population maladjustment (Nwoke, 1990). Due to the habitual migration of disabled people from endemic areas to urban centres to beg for alms, it is often a common social trend to see chains of blind adults being led to markets or around cities by children with good sight (Nwoke, 1990).

Hamon and Kartman (1973) summarized the socio-economic effects of onchocerciasis as follows:

1. blindness lowers farming capacity seriously
2. fertile lands become deserted while less fertile uplands become overcrowded
3. fishing in infested water is reduced
4. labour forces engaged in development activities e.g. building of dams, are protected at great cost.

Some studies have shown that onchocerciasis imposes both direct and indirect costs on people suffering from the disease. Preliminary results of multi-country study (WHO, 1997; Benton, 1998) show that on the average, an individual who has a severe manifestation of OSD spends almost \$20 more per annum on health-related expenditures than an uninfected individual. Given the low level of income in the study countries (Nigeria, Ethiopia and Sudan), these extra costs can represent as much as 15 % of the annual income of an infected individual. The study also shows that there are substantial 'time costs' of infection, those with severe OSD spending more time seeking health care and spending less time in household activities.

Other reported effects of onchocerciasis include male sterility (Hughes, 1954 cited by Budden, 1956) and habitual abortion (Ikejiani, 1954). Ikejiani (1954) reported two cases of habitual abortion involving onchocerciasis patients in Nigeria. According to him, after treatment with hetrazan, these women produced children without difficulty.

**Socioeconomic Impact of Onchocerciasis on Females and Children:** According to Amazigo (2004) in a paper titled 'Women's Health and Tropical Diseases: A focus on Africa', women constitute a significant percentage of the total population in Africa and to achieve better global health condition, a focus on African women is thus necessary. Infections are confined to the world's poverty belt of the tropics and subtropics largely in sub-Saharan Africa. Low-income levels are associated with debilitating disease patterns. According to this report, of all geographical regions, Africa has the highest tropical diseases morbidity and mortality ratios. Historical changes in economic and agricultural roles of men and women leave women with the major responsibility for subsistence farming and family welfare. Consequently, adolescent and adult females in Africa now make the greatest contribution to agricultural production. These changes in roles have increased exposure of females to infective bites of flies, which transmit tropical diseases and increase their role in the transmission of diseases (Amazigo, 2004). It is, therefore, not surprising that females suffer a lot of socio-economic consequences of one of the tropical diseases with severe public health and socio-economic importance- human onchocerciasis.

A review of some of the ways onchocerciasis affects females and children socially, psychologically and economically is hereby documented. In a recent review paper, Amazigo (2004) reported that certain health conditions and problems associated with the highly prevalent tropical infectious diseases are shared by males and females at almost equal prevalent rates but they have each particularly serious consequences for females because of their reproductive functions. These problems result in increased risk during pregnancy and childbirth. Some tropical infections (e.g. onchocerciasis) that cause gross disfigurement are particularly cruel for adolescent females and women because of their effects on marriage prospects, education and self-esteem (e.g. Amazigo and Obikeze, 1991; WHO, 1995b; 1997; Amazigo, 2004).

Children especially girls are forced to drop out of school in order to care for the blind. The result of a multi-country study (WHO, 1997; Benton, 1998) indicates that (i) the risk of children becoming non-attendees (school dropouts) is twice as high if the head of their household has OSD than if the head is uninfected, (ii) severe OSD in heads of households is more likely to have a detrimental impact on the attendance in school of female children than of male.

Studies on the effects of onchocerciasis on school academic performance in a standard examination (Junior Secondary School Certificate Examination, JSSCE) in Nigeria (Ubachukwu and Anya, 2003) show that visual impairment has profound negative effect on school performance. The result of the regression analysis between performance and various manifestations of onchocerciasis shows a strong inverse correlation ( $r \sim -0.72$ ) between performance and visual impairment. In school, constant distraction caused by unrelenting itching impairs any educational achievements,

especially among girls who already suffer from gender-based inequalities of opportunity (APOC, 2006).

There are reports of social discrimination against people with onchocerciasis especially rashes (Amazigo and Obikeze, 1991; Amazigo, 1994; WHO, 1995b; Okungu, 2000; Ubachukwu, 2001a and b; APOC, 2006). The results of these studies show that there is serious social discrimination against people with Onchocercal Skin Disease. This discrimination is more serious against adolescent girls and young women than men, diminishing their marriage prospects. This is reflected in the fact that the infected adolescent girls do not get married as early as their uninfected counterparts because men tend to avoid them. These infected girls are also limited in their choice of marriage partners to men that are elderly, divorced, widowed, childless, disabled etc. Even if they are married, their skin condition affects the stability of their marriage and therefore jeopardizes their future happiness (Okungu, 2000). They are therefore subjected to perpetual unhappiness and frustration in life. According to Okungu's (2000) report, "many mothers agreed that onchodermatitis affects the marriage chances of a young woman because a man wants a pretty girl for marriage. Moreover, it is commonly believed in West Africa that whatever has happened to a mother can happen to a child, so the disease can be transmitted to offspring at birth". The belief that the disease can be transmitted from one person to the other including from mother to child during pregnancy/birth is widespread and underlies most of the discriminatory attitudes observed in most communities (Amazigo, 1993; Okungu, 2000; Ubachukwu, 2001a; 2004a) These infected girls also rarely appear in public gatherings due to shame and whenever they do, they try to cover the rashes on their bodies as much as possible with their wears, although this is very inconveniencing. The families of such girls are also discriminated against. They are usually looked down upon (Amazigo and Obikeze, 1991; WHO, 1995b).

In women with onchocercal itching, the duration of breastfeeding was reported to be reduced by more than 9 months for 25% of the infected women who breastfed infants after the onset of disease condition (Amazigo, 1994).

**Summary and Recommendations:** The greatest burdens related to human onchocerciasis are the results of the eye and skin lesions and severe itching produced by the microfilariae (Kale, 1998). Onchocerciasis affects the productivity, social and sexual lives of infected persons due to blindness and other debilitating effects (Nwoke, 1990), and is a major obstacle to socio-economic development (WHO, 1980). The skin lesions of onchocerciasis have recently been shown to be a major socio-economic burden in terms of disability-adjusted life years (Kale, 1998).

Onchocerciasis rarely leads to death (Nwoke, 1990), although it has been reported that mortality among the blind may be four times as high as among non-blind persons of the same age in the



same community (Samba, 1994). Blindness lowers productivity of infected persons and makes them both social and economic burdens (Ubachukwu and Anya, 2001). Even the academic performance of children is seriously affected by visual impairment (Ubachukwu and Anya, 2003). Children, especially girls, are forced to drop out of school in order to care for the blind (WHO, 1997; Benton, 1998). People with onchocercal dermatitis are socially discriminated against. This discrimination is worse for adolescent girls than for young men, to the extent that the marriage prospects of these girls are adversely affected (Amazigo and Obikeze, 1991; WHO, 1995b; Ubachukwu, 2001a, 2001b). This greater discrimination against girls is based on the belief in the communities that the "wealth of a man is his beauty", so if a man has rashes but has wealth, it does not matter much (Ubachukwu, 2001a; 2001b) and also that "whatever happens to a mother will happen to a child so the disease can be transmitted to the offspring at birth" (Okungu, 2000; APOC, 2006).

To combat onchocerciasis, there is need to improve people's attitude towards the disease and improve disease awareness through appropriate health education, which will encourage the acceptance of ivermectin as adequate treatment and compliance to the treatment regimen to reduce morbidity and promote self-esteem (Wagbatsoma and Okojie, 2004; Ubachukwu, 2004a, 2004b). Stigma and other findings show that suffering arising from non-blinding onchocerciasis also requires efforts of control programmes (WHO, 1995b). Different control programmes have been launched in different parts of the world e.g. the World Health's Onchocerciasis Control Programme in West Africa (OCP), (Samba, 1994), the African Programme for Onchocerciasis Control (APOC), (WHO, 1996; Benton, 1998) and the Onchocerciasis Eradication Programme of the Americas (OEPA), (WHO, 1996; Ety'ale, 1998). These control programmes are supported by world bodies such as World Health Organization, World Bank, United Nations Development Programme, Food and Agricultural Organization, Pan American Health Organization and different non-governmental development organizations (NGDO). However, the need for elimination of onchocerciasis is far from being met. There is still need for more commitment on the part of the world bodies and the NGDO and for more NGDO and public-spirited individuals to get involved in efforts to eliminate onchocerciasis as a public health and socio-economic burden and save the lives of infected individuals especially children and adolescent girls from the psychological and socio-economic consequences of onchocerciasis.

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