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Onchocerciasis (River Blindness) in Africa

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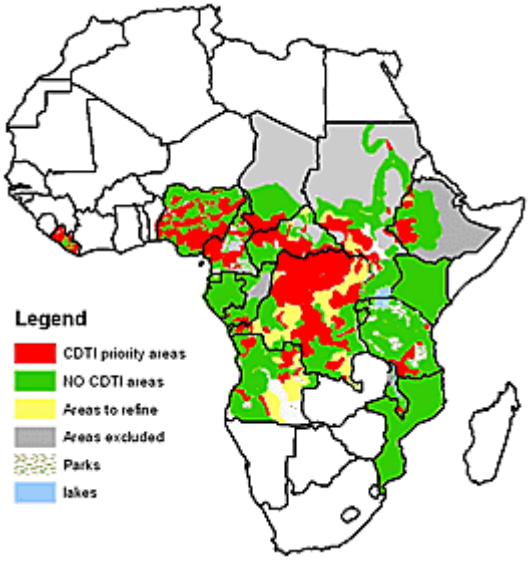
Definition of the Problem

Onchocerciasis is an eye and skin disease caused by the parasitic worm Onchocerca volvulus (WHO, 2016a). This disease is the 2nd leading infectious cause of blindness according to the World Health Organization (WHO) (USAID's, 2014). However, this parasite does not always cause blindness. Most cases are characterized by intense itching and disfigured skin. Skin disfiguration usually occurs due to uncontrollable itching to the point where the skin becomes raw and bloody (Silver, 2016). This itching is due to the death of microfilariae in the skin, which releases toxins. Repeated exposure to the parasite can cause irreversible blindness and leopard or lizard skin (WHO,2016). Approximately 99% of all onchocerciasis cases in the world occur in Africa, with 91% living in sub-Saharan Africa (WHO, 2016b). WHO has estimated that from 1995-2008 26 million people were infected, 265,000 have gone blind, and that 746,000 people are visually impaired due to onchocerciasis (USAID, 2014).



(WHO, 2016a)

The Background

In the 1970's, onchocerciasis was so widespread in some African river communities that up to half of all adults were blinded, and many fled the fertile river valleys. The socio-economic impact of this migration was so severe that it prompted the creation of the Onchocerciasis Control Programme (OCP) (Global, 2015). In 1974, the Onchocerciasis Control Programme (OCP) was formally launched. It was aimed to stop onchocerciasis from being a public health problem (Akande, 2003). During its peak, it covered 30 million people in 11 countries. Through air-borne spraying of insecticides, it reduced the black fly population drastically along with the use of a drug called invermectin (aka Mectizan) to treat the infected population.

The first pharmaceutical treatments used were diethylcarbamazine (DEC) and suramin. However, treatment with these two drugs can create serious side effects, including blindness in patients with advanced onchocercal eye disease and renal failure in the case of suramin, making them unattractive treatment options, especially for wide-scale use at a community level (Gustavsen et al., 2011).
The current treatment for onchocerciasis was founded in 1988. A United States based multinational pharmaceutical firm known as Merck, offered to donate the medication called Mectizan (Akande,

2003). Mectizan (aka invermectin) paralyses and kills the microfilariae that causes the itching, fever, arthritis, lymphadenopathy, and edema.

In 1995, the African Programme for Onchocerciasis Control (APOC) was founded by a group of nongovernmental organizations, governments, and United Nations agencies, with the World Health Organization overseeing it. The APOC partnership, which also includes the Carter Center, gave out 500 million invermectin treatments between 1995 and 2010 (Landau, 2013).

Interventions

There are a few different interventions dealing with onchocerciasis in Africa.

Mectizan (Ivermectin) Donation Program
The Mectizan Donation Program (MDP) developed by Merck has been providing free treatments to any organization that demonstrates need and the ability to distribute the drugs efficiently since 1985 (USAID's, 2014). Mectizan (ivermectin) is a versatile drug that was first developed as a veterinary treatment for various roundworm parasites, but has since proven effective at treating Onchocerca volvulus and the parasite responsible for elephantiasis (Silver, 2016). Mectizan is currently the only treatment for onchocerciasis. All other methods of killing the parasite are toxic to humans (USAID's, 2014). It prevents the transmission of O. volvulus by killing the microfilariae (larval stage) of the parasite that are circulating in the body and still in the adult female. This reduces the abundance of microfilariae forming nodules in the skin and the production of new ones (USAID's, 2014). A single dose of 150-200 mg/kg 1 time a year can reduce microfilarial density to near zero after one month, and maintain this low level for 12 months (Mectizan, 2016).This treatment is required for 10-15 years to ensure all adults and microfilariae are dead (USAID's, 2014). Initially treatment with Mectizan was not accepted by the communities in sub-Saharan Africa due to its adverse reactions including intensified itching (Silver, 2016). The increased itching is caused by the microfilariae dying and releasing toxins in the sub-cutaneous nodules they inhabit. Other documented reactions to mectizan include fever, rash, joint/muscle pain, rapid heartbeat, and painful tender glands. The reactions usually subside 2-3 months after the treatment (Landau, 2013). After the positive effects of the treatment became known in the African villages, infected individuals were willing to take mectizan (Silver, 2016).

(Wong, 2013)

WHO Programs
The World Health Organization (WHO) has developed numerous organizations dedicated to the elimination of onchocerciasis throughout the world (USAID's, 2014). The African Programme for Onchocerciasis Control (APOC) is the only one currently acting in sub-Saharan Africa. This program was launched in 1995 with the goal of controlling onchocerciasis in the endemic areas of Africa. The main strategy for this control was to establish self-sustaining community-directed mectizan treatments (WHO, 2016b). In 2009, this goal

switched from control to elimination of onchocerciasis with mectizan treatments and environmentally safe vector control methods. By 2014, more than 112 million people throughout 22 African countries were treated with mectizan (WHO, 2016b). The WHO hopes to have onchocerciasis under control in all treated areas by 2020 (The End Fund, 2016).

Helen Keller International
Helen Keller International is an organization working with MDP and African governments to distribute mectizan across Africa. This organization also helps train community health workers in affected areas. The goal of this education program is to increase risk awareness, as well as increase knowledge of the effectiveness of treatment programs available to citizens (Helen, 2014).

The Carter Center
The Carter Center works with national ministries of health in both Latin American and Africa to help eliminate onchocerciasis through distribution of mectizan (Carter, 2016). By donating more than 200 million treatments, the center has helped to achieve official elimination status of onchocerciasis in Colombia, Ecuador, and Mexico, and has stopped transmission in 15/17 original foci in Uganda, as well as other areas of sub-Saharan Africa. The center also is working to provide health education in conjunction with mectizan treatments to eliminate onchocerciasis in Africa (Carter, 2016).

Insecticide Treatments
Onchocerciasis was controlled using insecticides distributed by airplanes and helicopters from 1974-2002. Since 1989, mectizan treatments were used to supplement this vector control method (WHO, 2016b). However, these insecticides were not environmentally friendly. Currently, biodegradable insecticide treatments are being implemented in areas of Uganda that have shown a positive effect. This biodegradable insecticide, called Abate, is applied directly to the fast flowing rivers to prevent the development of black fly larvae in order to reduce the vector population. However, insecticide treatments are not effective by themselves. Simulium species of black flies from untreated areas will fly to treated areas and infect humans with O. volvulus (Landau, 2013).

The Impact

In 2011 more than 1 billion treatments had been approved cumulatively by the Mectizan Donation Program for the treatment of onchocerciasis, and in 2012 The Mectizan Donation Program celebrated 25 years of partnerships and progress toward the elimination of onchocerciasis (Merck, 2016).

The original Onchocerciasis Control Programme (OCP) eliminated onchocerciasis as a public health problem. The OCP, a joint effort of the World Health Organization (WHO), the World Bank, the United Nations Development Programme, and the UN Food and Agriculture Organization, was considered to be a success, and came to an end in 2002. Although, there is continued monitoring that is being done which ensures onchocerciasis cannot reinvade the area of the OCP (Akande, 2003).

Global preventative efforts are currently concentrated in population-based prophylactic treatment through programs such as the African Programme for Onchocerciasis Control (APOC) and OCP. Community-wide ivermectin administration and black fly control have been the main focus of these programs, which have been successful. These measures have resulted in an estimated 35 million people no longer being at risk for infection, two million infected people who have been appropriately treated, and over 200,000 people in whom blindness has been prevented. The APOC has reduced the rate of river blindness by 73% since its inception (Global, 2015). While these programs have been

highly effective in some highly endemic areas, more than three decades of annual treatment are still needed in order to effectively control this preventable disease (Pham, 2015).

Costs and Benefits

Onchocerciasis causes an inability to maintain the fertile land, so there is a mass migration to less fertile areas to live. In the 1970's, the economic losses surrounding this was approximately $30 million (End Fund, 2016). Those that have been cured of the disease have permanent skin deformities that limit their daily life. They are stigmatized in their communities especially the young women which affects their age of marriage and what kind of partners they marry. Men experience the negative affects through 15% lower wages than those who haven't been affected (Ubachukwu, 2006). Even beyond the stigmatization associated with skin deformities, individuals infected with onchocerciasis experience detrimental financial effects due to blindness or impaired vision.

Using the current APOC strategy in all infected countries would allow for savings of $1.5 billion to $1.6 billion over 2013–2045. In endemic African regions, total financial and economic costs over the period 2013–2045 would be $4.3 billion to simply control the disease but eradication of the disease would cost only $2.7 billion (Kim, 2015). The elimination and eradication of onchocerciasis are predicted to allow substantial cost-savings in the long run.

Lessons Learned

We learned several things about onchoceriasis throughout the course of this project. Some of these things include:

1**. Continued donation of ivermectin** is essential to the eradication of River Blindness. The unlimited donation of ivermectin that is given to all affected countries has proven to be the most effective method of stopping onchocerciasis. Several Central American countries have completely eradicated the disease through this program. For Africa to eradicate river blindness the donation of ivermectin must continue (Carter, 2016).

2. **Compared to other diseases onchocerciasis is easily eradicated**. Onchocerciasis can be eradicated if people take one pill a few times a year for about 20 years. Compared to diseases like tuberculosis and human immunodeficiency virus (HIV) that have yet to be eradicated from any country this is easy.

3. **It is possible to eradicate the disease.** Colombia, Mexico, Guatemala, and Ecuador have halted river blindness transmission through health education and semiannual distribution of Mectizan. Columbia, Ecuador, and Mexico have received World Health Organization verification of eliminating river blindness. Guatemala has eliminated transmission and has filed its request for verification.

4. **Onchocerciasis is cheaper to eradicate than to treat.** Using the current APOC strategy in all infected countries would allow for savings of $1.5 billion to $1.6 billion over 2013–2045 in comparison with just trying to treat the people infected with onchocerciasis (Kim, 2015).

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