CASE 6
Controlling Onchocerciasis in Sub-Saharan Africa

Geographic Area: Sub-Saharan Africa

Health Condition: In 11 west African countries in 1974, nearly 2.5 million of the area's 30 million inhabitants were infected with onchocerciasis, and approximately 100,000 were blind. The remaining 19 endemic countries in central and east Africa were home to 60 million people at risk of the disease.

Global Importance of the Health Condition Today: Onchocerciasis, or "river blindness," afflicts approximately 18 million people worldwide, with well over 99 percent of its victims in sub-Saharan Africa. Today, an estimated 270,000 people are blind due to onchocerciasis and nearly 500,000 are visually impaired.

Intervention or Program: The Onchocerciasis Control Program (OCP) was launched in 1974 in 11 west African countries. Weekly aerial spraying helped control the disease-spreading blackflies in the fast-moving waterways in the region, eventually halting the disease's transmission. In 1995, a second program called the African Programme for Onchocerciasis Control (APOC) was established to control the disease in 19 central and east African countries. Through a broad international partnership and the participation of the local communities, APOC has distributed more than 67 million doses of Mectizan®—a drug that treats the disease's symptoms with just one annual dose.

Cost and Cost-Effectiveness: OCP operated with an annual cost of less than $1 per protected person. Total commitments from 22 donors during the 28-year project amounted to $560 million. The annual return on investment (due mainly to increased agricultural output) was calculated to be 20 percent, and it is estimated that $3.7 billion will be generated from improved labor and agricultural productivity.

Impact: OCP achieved impressive success between 1974 and 2002: Transmission was halted in 11 west African countries, 600,000 cases of blindness were prevented, and 18 million children born in the OCP area are now free from the risk of river blindness. About 25 million hectares of arable land—enough to feed an additional 17 million people—is now safe for resettlement, thanks to the program. APOC is expanding this success to central and east Africa, where 40,000 cases of blindness are expected to be prevented each year.

At the headquarters of the World Bank, the WHO, the Carter Center, and the multinational pharmaceutical firm Merck, visitors see a distinctive statue of a child leading a blind man—a reminder to staff and passersby of the part each organization played in the control of one of Africa's most devastating diseases.

The Onchocerciasis Control Program (OCP) has earned its place as one of the signal achievements of international public health, demonstrating the power of collaboration across countries and agencies, the importance of long-term funding, and the benefits of public-private partnership to bring pharmaceutical innovation into use in scaled-up programs in poor countries.

The first draft of this case was prepared by Jane Seymour.

The Disease

Onchocerciasis, or "river blindness," is a pernicious disease that afflicts approximately 18 million people worldwide, with well over 99 percent of its victims residing in sub-Saharan Africa. Primarily a rural disease, onchocerciasis disproportionately burdens the inhabitants of some of the world's poorest and most remote areas in Africa. Small, isolated foci also exist in Latin America and Yemen. In the most endemic areas, more than one-third of the adult population is blind, and infection often approaches 90 percent (Benton et al. 2002).

The disease is caused by a worm called *Onchocerca volvulus,* which enters its human victim through the bite of an infected blackfly. The flies breed in fast-moving waters in fertile riverside regions, where in some cases residents can be bitten as many as 10,000 times a day. Once inside a human, the tiny worm grows to an average of one to two feet in length and each year produces millions of microscopic offspring called microfilarie. These tiny worms are so abundant that a simple snip of the skin can expose hundreds of writhing worms. The constant movement of the microfilarie through the infected person's skin causes a wide range of debilitating symptoms, including disabling and torturous itching, skin lesions, rashes, muscle pain, and weakness and, in its most severe cases, blindness. Today, an estimated 270,000 people are blind due to onchocerciasis, and nearly 500,000 are severely visually impaired (Hoerauf et al. 2003).

Beyond the debilitating health burden, onchocerciasis also inflicts tremendous social and economic damage on individuals and entire communities. Self-esteem and concentration suffer, and the disease reduces marriage prospects for both women and men. Infected individuals often earn less money as a result of decreased productivity and spend a large portion of their income on extra health costs (Kim et al. 1997). Stigma adds many other noneconomic costs as well.

On a community level, the disease has served as a barrier to economic growth; fear of the disease has led to the abandonment of more than 250,000 square kilometers of fertile land, at an estimated loss of $30 million (Akande 2003). In the words of Dr. Ebrahim Samba, OCP's director from 1980 to 1994, "Onchocerciasis therefore is a disease of human beings and also of the land. It directly retards development and aggravates poverty."

The disease is spread when a new blackfly bites an infected person and then bites another person, thus repeating the infection cycle. Various control attempts by colonial and ex-colonial entomologists during the middle of the 20th century achieved mixed results overall. In nearly every case, lasting results could not be achieved because the blackflies cover long distances and cross national boundaries, rendering unilateral control efforts largely ineffective.

Combating the Disease: The Onchocerciasis Control Program

The seeds of the first regional OCP were planted in the small-scale control efforts of the 1950s and 1960s and codified at an international conference held in Tunisia in July 1968 (Hopkins and Richards 1997). The conference concluded that the disease would be controlled if it could be addressed on a sufficiently large scale. WHO and former British and French colonial staff all contributed heavily to the preparation of a regional control plan. Several donors showed mild interest, but none was able to commit alone to what was expected to be a 20-year program covering at least seven countries.

A unifying and catalyzing element fortuitously materialized during World Bank President Robert McNamara's visit to west Africa in 1972. McNamara was touring the region mainly because of a long drought then underway. While visiting the rural areas of Upper Volta (now Burkina Faso), he witnessed the devastation caused by onchocerciasis. After seeing large numbers of children leading blind adults, and after traveling to some communities where nearly all the adults were blind, McNamara decided to spearhead an international effort to control the disease and committed his own institution to a financing role (Benton et al. 2002).

The OCP was launched in 1974 under the leadership of the WHO, the World Bank, the Food and Agriculture Organization (FAO), and the United Nations Development Program (UNDP). Financing and donor support were mobilized through the World Bank from a wide range of donor countries.

While the program was expected to last at least 20 years (because of the time needed to break the life cycle of the worm), its administrative and financial agreements were broken into six-year phases, allowing for both firm commitment and flexibility. This long-term commitment of donors has proved crucial to the program's success.

OCP, the first large-scale health program ever sponsored by the World Bank, set out to eliminate the disease first in seven—and eventually in 11—west African countries.[1] The primary intervention was vector control of the disease-spreading blackflies, with the goal of ultimately stopping the disease's transmission. Helicopters facilitated the weekly spraying of larvicide during rainy seasons on the areas most heavily populated by blackflies. The aerial treatment, as well as hand spraying of breeding grounds, persisted even through civil and regional conflicts and coups. Detailed mapping of the 12,000 miles of remote rivers and epidemiological mapping of onchocerciasis prevalence facilitated these efforts. In the late 1980s, the program also began administering a drug option, ivermectin, to treat the disease. Furthermore, a significant research budget was built into the program to respond to emerging challenges and problems and to investigate effective prevention and treatment options.

Striking Success in West Africa

The OCP's success in controlling onchocerciasis in west Africa has been remarkable. At the start of the program in 1974, nearly 2.5 million of the program area's 30 million inhabitants were infected, and approximately 100,000 were blind. Today, transmission of the disease has been virtually halted, and some 1.5 million people who once were infected with the disease no longer bear any symptoms. It is estimated that 600,000 cases of blindness have been prevented, and 18 million children born in the OCP area are now free from the risk of river blindness.

The economic impact has also been impressive. An estimated 25 million hectares of arable land—enough to feed an additional 17 million people—is now safe for resettlement (APOC 2003). In Burkina Faso, for example, 15 percent of the country's land that had been deserted because of the disease has been completely reclaimed, and its new residents now enjoy a thriving agricultural economy (OPEC Fund 2002).

The program, which formally concluded in December 2002, was extremely cost-effective and had a yearly cost of less than $1 per protected person. Total commitments from 22 donors during the 28-year project amounted to $560 million. The World Bank calculated the annual return on investment (attributable mainly to increased agricultural output) to be 20 percent, and it is estimated that $3.7 billion will be generated from improved labor and agricultural productivity (Hopkins and Richards 1997).

A Medical Breakthrough: Mectizan® Is Discovered

While OCP was proving its success in controlling onchocerciasis in the 11 designated west African countries during the 1970s and 1980s, the disease remained endemic in 19 central and east African countries[2] not covered by the program. Controlling the disease was considerably more difficult and expensive in these countries, because aerial spraying—the only control option available at the time—was considered neither feasible nor cost-effective given the area's longer distances and thick forests (APOC 2003).

An important scientific breakthrough brought new hope to these 60 million people at risk in the region. In 1978, a veterinary researcher at Merck & Co., Inc., Dr. William Campbell, discovered that the new antiparasitic agent he had developed to treat gastrointestinal worms in horses was also effective against the family of worms responsible for onchocerciasis. Clinical trials in Africa sponsored by Merck and the WHO demonstrated that with just one dose, Mectizan® (ivermectin) could relieve debilitating symptoms of river blindness and effectively paralyze the tiny

1. Benin, Burkina Faso, Côte d'Ivoire, Ghana, Guinea, Guinea-Bissau, Mali, Niger, Senegal, Sierra Leone, and Togo.

2. Angola, Burundi, Cameroon, Central African Republic, Chad, Democratic Republic of the Congo, Republic of Congo, Equatorial Guinea, Ethiopia, Gabon, Kenya, Liberia, Malawi, Mozambique, Nigeria, Rwanda, Sudan, Tanzania, and Uganda.

worms for up to a full year (Merck 2003). Dr. Kenneth Brown, one of the developers of the drug, explained the significance of this new one-dose medicine: "Most drugs for the treatment of tropical diseases have to be given in multiple doses over days, weeks, even years. The ability to treat and control an important disease, such as river blindness, with a single dose each year is nothing short of spectacular."

Getting the Drugs to Africa: Merck Donates Mectizan®

The fight against river blindness now had a powerful new weapon. The great challenge facing Merck and the public health community, however, was to resolve how those most in need of the drug—and also the least able to pay—could access this life-saving medicine. Even at a discounted price of just $1 a treatment, it was clear that the drug would be out of reach to the developing countries where onchocerciasis was endemic.

Merck was eager to donate Mectizan®, but the company's initial attempts to find a partner organization to manage the drug's distribution were unsuccessful. After neither the WHO nor the US Agency for International Development accepted Merck's offer, the company turned to Dr. William Foege, then executive director at the Carter Center. Foege, a veteran of the smallpox eradication effort, agreed to lead the donation program at the Task Force for Child Survival and Development, an affiliate of Emory University, only when Merck pledged that its donation would be long-term. In 1987, Ray Vagelos, then CEO of Merck, made the historic announcement that his company would donate Mectizan® to anyone who needed it, for as long as it was needed—marking the launch of the world's longest ongoing medical donation program, the Merck Mectizan® Donation Program, and one of the largest public-private partnerships ever created (Merck 2003).

Dr. Foege explained that the program's goal was to "reach as many people with Mectizan® as possible, and to make the rules reasonable but not too difficult" (personal communication, June 2004). The Mectizan® expert committee—a group of experts in tropical medicine, epidemiology, and public health—was established to lay the rules for how the drug would be used and who would receive it. The committee set up an annual application process through which requests for Mectizan® would be granted based on the applicant's capacity to distribute the drug for at least three years. The ministries of health had to approve the applications, which were submitted mostly by international nongovernmental organizations (NGOs), medical mission groups, foundations, and the ministries of health themselves (Dull and Meredith 1998).

On the ground, the NGOs' task of reaching millions of residents of remote villages in east and central African countries with the drug was daunting: Public health systems were either weak or nonexistent in these countries, health workers were in short supply, and combating onchocerciasis was not then a public health priority. Two important factors aided the NGO effort: more than $30 million in grants from the River Blindness Foundation (Drameh et al. 2002) and the effectiveness of Mectizan® in combating many troublesome parasites. Because the drug reduces itching and is nearly 100 percent effective in treating round worms and whipworms, improvement in quality of life is observable almost immediately after taking Mectizan®. As a result, despite the fact that the drug must be taken for nearly 20 years to effectively kill the worm, Mectizan® proved popular, and uptake across endemic villages was fast.

The Mectizan® Donation Program far exceeded its initial goal of 6 million treatments in six years. Since 1988, the program has provided approximately 300 million treatments at an estimated value of $1.50 per dose (Akande 2003). Merck recently reconfirmed its commitment to indefinite donation of the drug and extended its pledge to also treat lymphatic filariasis.

Two important economic factors have encouraged the company's altruism: US tax benefits that reduce the net cost of the program and Mectizan®'s successful performance in the animal health market (Coyne and Berk 2001). In 1984, Mectizan® was the highest selling animal product and ranked as Merck's second best selling drug in 1987 (Erik Eckholm, "River Blindness: Conquering an Ancient Scourge," *The New York Times Magazine*, January 8, 1989).

Reaching the 19 Remaining Countries: APOC Is Launched

By 1995, however, onchocerciasis still persisted in 19 endemic countries not covered by the OCP. To meet the scale of the problem there, it was clear that more resources were needed to support the efforts of the organizations working on the ground and that a more cost-effective, affordable, and sustainable approach than the clinic-based ivermectin delivery was necessary (Sékétéli et al. 2002).

Building on the work of the NGOs in central and east Africa, a new program was launched in 1995 with the goal of "eliminating onchocerciasis as a disease of public health and socio-economic importance throughout Africa." The African Programme for Onchocerciasis Control (APOC) was designed as a 15-year partnership under the leadership of the World Bank, WHO, UNDP, and FAO, which would build on the success of the OCP and extend its reach to the remaining 19 endemic countries in Africa. The program aims to treat 75 million people per year by 2010, eventually scaling up to about 90 million treatments annually; to prevent 43,000 cases of blindness annually; to protect the OCP area from reinvasion; and to make an estimated 7.5 million additional years of productive adult labor available for the region's developing countries (OPEC Fund 2002).

APOC involves the participation of a wide range of organizations and groups, many of which were also involved in the OCP, including the same four sponsoring agencies, the governments of 19 developing countries, 27 donor countries, more than 30 NGOs, Merck, and more than 80,000 rural African communities. The primary role of the program is to build the capacity of the NGOs and the ministries of health to deliver drugs and to increase the efficiency and sustainability of ivermectin distribution at the local level. Unlike the OCP, which involved very limited local participation, APOC is not a vertical program but rather is integrated within the national health systems of the participating African countries (APOC 2003).

Because the donor-funded program is scheduled to end in 2010, and effectively killing the worm requires annual drug treatment for at least 15 to 20 years, APOC has placed a strong emphasis on long-term sustainability. To achieve the program's goal of developing a self-sustainable, fully African-owned and -managed program by 2010, APOC has pioneered a system of Community-Directed Treatment with Ivermectin (ComDT). Through this framework, many tens of thousands of communities effectively organize and manage the local ivermectin treatment, taking full responsibility for drug distribution and thus increasing the chances for the long-term sustainability of the program after donor funding ends (Amazigo et al. 2002). The communities select the community-directed distributor, and the distribution efforts are adapted to the local culture and conditions. Community volunteers receive training and supervision from the national public health systems and from the program's NGO partners.

The ComDT system has demonstrated its value not only as a cost-effective intervention but also as a successful framework for delivering treatment with high coverage rates to remote populations. In 2000, the WHO estimated that the ComDT network achieved an average treatment coverage rate of 74 percent, exceeding the minimum 65 percent rate necessary for the program's success (Benton et al. 2002). A further indicator of the strong prospects for the program's long-term sustainability is the increasing rates of coverage in subsequent rounds of treatment, a trend that illustrates the popularity of the drug and the success of both the education campaigns and the locally run distribution system (APOC 2003).

APOC's Success in Central and East Africa

More than 67 million doses of Mectizan® were distributed through APOC in 2000 alone (Sékétéli et al. 2002). The WHO estimates that the program prevents approximately 40,000 cases of blindness each year. As the program extends its coverage, the benefits are expected to magnify. These include an 80 percent reduction in the incidence of optic nerve disease, a 50 percent reduction in severe itching, and a 45 percent reduction in visual deterioration for those with atrophied optic nerves (Sékétéli et al.

2002). By the time the program is phased out at the end of the decade, it is hoped that nearly half a million people's sight will have been saved (Benton 1998).

Furthermore, the impact of the successful ComDT system extends beyond the treatment and prevention of river blindness. The system offers a valuable entry point for other community-directed health interventions in neglected communities with little or no access to traditional health services and a vehicle for strengthening the overall health system in developing countries (Amazigo et al. 2002). In the Central African Republic, for example, ComDT has provided a stimulus for expanded primary health care, where the coordinators of the Mectizan® distribution program are often the only health workers to reach every village (Hopkins 1998). Suggestions for health interventions that could utilize the ComDT framework include vitamin A, azythromycin (an antibiotic that treats trachoma), albendazole (for prevention of lymphatic filariasis), and even vaccines and HIV/AIDS drugs.

The Cost

APOC bears a total price tag of $180 million. Donor funding accounts for 75 percent of this figure, while African governments and NGOs contribute the remaining 25 percent (APOC 2003). Donations have kept the program's costs low; Merck donates the drugs and covers the shipping cost. Because the World Bank and the WHO waive all administrative fees, 100 percent of donor funds reach country operations without the usual overhead costs. Taking into consideration only the donor funding, then, the cost of APOC coverage each year is just 11 cents per person.

A preliminary analysis prepared by the World Bank demonstrated that the economic rate of return for the program is 17 percent for 1996 through 2017 (Benton 1998). This rate is comparable to Bank projects in the most productive sectors, such as industry, transportation, and agriculture. It is estimated that the program will add 27 healthy life days per dollar invested (Benton 1998).

Elements of Success

Dr. Ebrahim Samba, winner of the 1992 Africa Prize for his contribution to the control of onchocerciasis, has described several elements of the program's success (Akande 2003):

- **a shared vision.** "Among the elements that contributed to success was, number one, a real shared vision, by the beneficiaries at the highest level and the non-African partners." The shared vision among regional African governments was especially important because controlling the disease in the region represented a public good, and preventing the disease from crossing national boundaries required a coordinated, comprehensive regional effort.

- **long-term commitments.** "Many programs in Africa last three to five years," Dr. Samba explained. Such short-term efforts are a "waste of time" because "this is the time one requires to study the situation, install, and start. One needs more time to get going, consolidate, and evaluate." The donor commitments of a minimum of 20 years, most of which lasted 30 years, combined with the commitment from Merck to donate Mectizan® indefinitely, are an essential element of the effort's long-term success.

- **power of partnership.** The effective engagement of a wide range of organizations in the control effort—from private companies to multilateral institutions to local NGOs—allowed for a cost-effective, efficient intervention rooted in improved resource allocation and a wide range of expertise.

- **local ownership and participation.** The success of the ComDT framework in instilling ownership among the local communities is another distinguishing feature of the program. "No matter how generous foreign friends may be, the development of Africa will forever rest with Africa," Dr. Samba asserted. "African counterparts must therefore be trained technically and attitudinally to take over." Furthermore, every OCP director from 1980 until

the program's end in 2002 were African, and 99 percent of OCP personnel were African.

"A Health Program with a Development Outcome"

In the final year of its operations in 2002, Robert McNamara described the success of the OCP he helped pioneer: "[OCP] has been an enormously effective program: a health program with a development outcome; it has empowered rural communities to banish this burden and thrive." Dr. Samba further expounded this message, "It proves it can be done—effective aid programs deliver lasting results. African member-states contributed in cash and kind, and donors have been steadfast in their support. This was achieved through hard work, transparency, and accountability."

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